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USEFUL MINERALS OF THE
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COMPILED BY

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AND SAMUEL SANFORD

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USEFUL MINERALS OF THE UNITED STATES.

Compiled by FRANK C. SCHRADER, RALPH W. STONE, and SAMUEL SANFORD.

INTRODUCTION.

The volumes of the Geological Survey's annual report entitled "Mineral Resources of the United States" for 1882 and 1887 contain lists of the useful minerals of the United States. No similar list was published by the Survey in the succeeding quarter of a century or more until 1914. During that period, however, the mineral resources of the United States were enormously developed, the value of the total production having increased from \$500,000,000 to over \$2,000,000,000, and the investigations made by the United States Geological Survey and the State geological surveys added greatly to the knowledge of the natural resources of the country.

Many changes in the mineral industry other than increase in production have taken place. Aluminum was not made in the United States in 1887, so that the deposits of bauxite, now the source of material that maintains a great industry, were untouched and were not included in the Survey's lists. Twenty-five years ago the annual imports of Portland cement were four times the domestic production, and the total quantity consumed was about 1,250,000 barrels. The production of natural rock cement was five times the combined production and imports of Portland cement. To-day the Portland cement industry is distributed generally over the United States, and the annual production amounts to more than 86,000,000 barrels. The production of natural rock cement and the imports of foreign cement are so small as to be negligible. These are only examples of notable changes in the mineral production of the United States and of correlated changes in the appraised value of some of the mineral deposits.

The timeliness of the Survey's list of useful minerals¹ issued in 1914 is indicated by the fact that the edition of 6,000 copies became exhausted in less than a year and that nearly 2,000 applications were made for additional copies. The rapidly growing demand for information regarding our mineral reserves has led to the publication

¹ Sanford, Samuel, and Stone, R. W., Useful minerals of the United States: U. S. Geol. Survey Bull. 585, 1914.

of the present list, which includes much more information than the one last published.

This bulletin may be regarded as a thoroughly revised edition of Bulletin 585, greatly enlarged and brought up to date. The work of revision has been done by F. C. Schrader. Besides giving several thousand new localities of mineral deposits and adding more than 160 mineral names to the glossary, it includes considerable added information concerning certain minerals, especially uranium and vanadium minerals in the high plateau region of the West. The present bulletin, like the earlier work, gives concisely the location, by States and counties, of the principal deposits of useful minerals and includes a glossary showing the composition and character of each mineral and the location of its principal deposits. It gives also the principal uses of each mineral, a feature not appearing in the earlier bulletin. As a mineral directory it will be useful to scientific bureaus and educational institutions that deal with the numerous inquiries of the general public concerning what may be called commercial mineralogy, as well as to the prospector, miner, manufacturer, business man, and student of economic conditions.

In this list, as in the earlier lists, it has not been deemed necessary to make the references very detailed. A general statement may give a clearer and more comprehensive view of the occurrence than a minute and specific enumeration of the known deposits; indeed, to state all the localities at which some minerals are found would make the lists too bulky for convenient reference, and they would be useful principally to the professional mineralogist rather than to the miner or manufacturer or the student of economic conditions. The principal localities at which most of the minerals are found are clearly indicated, but the more extensive deposits of some others, such as clay, coal, and iron ore, are mentioned only in general terms. One material difference will be found between this list and the earlier lists. The form of the earlier lists was twofold, the substances "mined" and "not mined" in each State being grouped separately, whereas this list indicates, as to many but not all deposits, whether they are, have been, or are not mined or worked.

The material in this bulletin is in two distinct parts. The first part consists of lists of the occurrence of minerals by States in alphabetic order. Under each State the minerals found there are also given in alphabetic order. The second part is a glossary of nearly 600 names of minerals. Each name or its definition is followed by a list of the States in which the mineral occurs. The glossary is therefore virtually an index to the first part. In connection with the localities given the reader may find it helpful to refer to Geological Survey Bulletin 507, "The mining districts of the western United States," and to the chapter entitled "Mineral products of the United

States" in Mineral Resources of the United States for 1912 and later years. Details of occurrence, development, utilization, and market conditions are given in the annual volumes of Mineral Resources and in the bulletins and other publications of the Survey.

The intention has been to present here a list of localities at which minerals occur in sufficient quantity to be of present or possible future value, but the existing literature is very defective in statements of the quantities available at many localities. At some of the localities listed, therefore, the mineral may occur in quantities so small that it is of scientific interest only, or if it was once abundant it may have been completely exhausted by mining or quarrying. Deposits of minerals that are widely distributed, such as quartz and calcite, have been omitted, except those that by reason of some unusual feature, such as occurrence in fine crystals, in very pure form, or in remarkably large quantity, are of especial interest or value. Some minerals, such as the copper ores of Pennsylvania, are included in the list not because they occur in sufficient quantity to warrant mining for their usual products, but because they furnish excellent museum specimens. Some mineral aggregates, such as clay, granite, limestone, sand, and sandstone, are included because they constitute a very considerable part of the mineral production of the country.

As the data in this book have been compiled from many sources other than its own publications the Geological Survey can not vouch for the correctness of all the statements made about occurrences of minerals.

Much valuable material has been drawn, some of it without change, except for abbreviation, from the following State mineralogic reports, especially from those of Arkansas, California, Colorado, New Mexico, Oregon, South Dakota, Tennessee, and Texas; to list all the literature consulted would be impracticable.

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Jones, F. A., New Mexico mines and minerals, World's Fair edition, 1904.

Genth, F. A., Minerals of North Carolina: U. S. Geol. Survey Bull. 74, 1891.

Shannon, C. W., Mineral resources of Oklahoma and statistics of production from 1901 to 1914: Oklahoma Geol. Survey Bull. 22, pt. 2, 1914.

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Scott, Samuel, Map of the Black Hills of South Dakota and Wyoming, with full descriptions of mineral resources, etc., Philadelphia, E. P. Noll & Co., 1897.

Ziegler, Victor, The minerals of the Black Hills: South Dakota School of Mines Bull. 10, 1914.

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Phillips, W. B., The mineral resources of Texas: Univ. Texas Bull. 365, Sci. Ser. 29, 1914.

Among other mineralogic works consulted may be mentioned Gems and precious stones of North America, by G. F. Kunz; Minerals of economic value, by E. S. Simpson, Western Australia Geol. Survey Bull. 19; A list of Canadian mineral occurrences, by R. A. A. Johnston, Canada Geol. Survey Dept. Mines Mem. 74, Geol. Ser. 61.

This list does not record discoveries or developments later than January 1, 1916. Any corrections of errors or any information concerning deposits not listed will be gratefully received by the authors and may be incorporated in a later edition of the bulletin.

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ALABAMA.

Alum. *See* Halloysite.

Aluminum. *See* Bauxite and Halloysite.

Asbestos. Tallapoosa County, with corundum deposits near Dudleyville; not found in commercial quantity or quality.

Asphalt. Colbert County, small quantity has been shipped from near Leighton; has been obtained also from Russellville and Moulton valleys.

Barite (heavy spar). Very pure and white in residual clays at following localities: Bibb County, Pratts Ferry; Calhoun County, near Tampa; Clay County, T. 20 S., R. 7 E.; Jefferson County, at Elyton; Lee County, at Chewacla lime works; St. Clair County, at Greensport; Shelby County, near Whiting station and Calera; Talladega County, in several places.

Bauxite. Cherokee County, mined near Rock Run; known also in Dekalb County, and occurs southward along narrow belt from Georgia State line near Rock Run to Jacksonville, Calhoun County.

Beryl. Coosa County; crystals suitable for gems have been found near Rockford and Hissop.

Brown iron ore. *See* Limonite.

Cement material (Portland). Portland cement manufactured near Demopolis, Leeds, Ragland, and St. Stephens. Mississippian and Pennsylvanian shales and residual clays, Ordovician and Mississippian limestones abundant in northern Alabama; Cretaceous and Tertiary limestones in southern Alabama.

Chalcopyrite (copper pyrites). Clay County, with pyrite in T. 21 S., R. 6 E., and near Ashland. Cleburne County, with pyrite in mica schist at Wood's mines and Smith's mines. Tallapoosa County, in T. 23 N., R. 22 E. Occurs at many localities in Clay, Coosa, Randolph, and Talladega counties and has been mined at some places.

Chalk. Soft, argillaceous, quarried in Dallas County, at Selma; Green County, at Eutaw; Marengo County, at Demopolis; Sumter County, at Epes; and other localities.

Chert. Calhoun County, at Anniston and Jacksonville; Jefferson County, extensive quarries near Birmingham and Bessemer; Talladega County, several quarries. Used for road metal.

Clay (brick). Pits at one or more places in 38 counties, notably Calhoun and Tuscaloosa counties. Value of brick reported in 1914, \$1,500,000.

Clay (fire). Mined at the following places: Bibb County, at Ashby, Bibbville and Woodstock; Blount County, at Lehigh, burns buff; Calhoun County, Peaceburg, Oxford, coarse, sandy near Anniston and at Oxanna; Cherokee County, Rock Run; Colbert County, at Pegram, black, gritty, burning white; Dekalb County, at Fort Payne, Kaolin, and Valley Head, coarse, sandy; Jefferson County, Ensley, at Littleton, Mabel, and Hoagland mines; Marion County, white at Pearces Mills; Russell County, at Girard; Tuscaloosa County, at Hulls station. Also in Choctaw, Clarke, Conecuh, Fayette, and Tishomingo counties.

Clay (flint). Abundant in many localities in Choctaw, Clarke, Conecuh, Monroe, and Washington counties.

Clay (kaolin or china). In weathered portion of coarse-grained granite veins in Piedmont Province from alteration of feldspar. In Calhoun County, near Jacksonville. Cherokee County, suitable material, not worked, occurs as soft white clay at Rock Run. Cleburne County, Stone Hill. Colbert County, good white ware clay in Pegram. Coosa County, at Socapatoy. Dekalb County, white, fine sandy at Fort Payne, pits work-

ing in pure white clay at Eureka mine, 4 miles northeast of Valley Head. Etowah County, white, good ball clay at Gadsden. Marion County, white, fine grained at Chalk Bluff; hard, porous, gritty, adapted to highest grade ware, at Pearces Mills. Randolph County, Louisa. Talladega County, hard white micaceous clay, suitable for white tile or earthenware at Kymulga. Also found in Bibb, Chilton, Clay, Elmore, Fayette, Franklin, Lee, Macon, and Tallapoosa counties.

Clay (porcelain). Dekalb County, dug near Valley Head. Hard, white, close to halloysite, used for chinaware.

Clay (pottery). Autauga County, at Edgewood, smooth, plastic, and sandy; Baldwin County, at Marlow, on Fish River; Barbour County, formerly mined for red crockery at Mineral Springs; Cherokee County, at Rock Run; Dekalb County, at Rodenton; Elmore County, at McLean pottery, burns bluish; Lamar County, at Fernbank, Bedford, and Silligent; Marion County, 10 miles southeast of Hamilton, at Chalk Bluff, reddish, fine grained, and burns red; Marshall County, Arab; Pickens County, at Roberts Mill, Coal Fire Creek; St. Clair County, Jugtown; Tuscaloosa County, Vances station. Also in Bibb, Blount, Calhoun, Fayette, Franklin, and Lauderdale counties.

Coal (bituminous). Three fields: Cahaba, Coosa, and Warrior; coals all of Pottsville (Carboniferous) age.

Cahaba field.—Bibb, Shelby, St. Clair, and Jefferson counties, about 290 square miles, 40 coal beds, half of them workable, some only locally; mined at Acton, Aldrich, Blocton, Coalmont, Garnsey, Glen Carbon, Hargrove, Henryellen, Margaret, Marvel, Maylene, Piper, Sanie, and elsewhere; excellent domestic and steam coals.

Coosa field.—Shelby and St. Clair counties, about 300 square miles; 20 beds, mostly of small area; mined at Coal City and Ragland.

Warrior field.—Jefferson, Tuscaloosa, and Walker counties, and southern end of Blount County, 7,800 square miles. Four groups of beds—Black Creek, Brookwood, Mary Lee, and Pratt coal groups. Black Creek coal group mined at Bradford, Coaldale, Empire, Indio, Kimberly, Seloca, Warrior, Wigan, and elsewhere. Brookwood coal group mined at Brookwood, Kellerman, and Searles. Mary Lee coal group mined at Abernant, Adger, Bessie, Davis Creek, Johns, Lewisburg, Littleton, Mulga, New-castle, Sayre, Sayreton, Sumter, and Yolande, extensively throughout Walker County. Pratt coal group mined at Pratt mines west of Birmingham, Blossburg, Brookside, Cardiff, and Mineral Springs.

Coal (lignite). Occurs in Tertiary sedimentary strata of southern and southwestern parts of State at Horse Creek, and at many places eastward in Barbour, Choctaw, Clarke, Marengo, Monroe, Pike, Wilcox, and other counties. Also in Cretaceous, mostly as lignitized trunks, in Greene, Pickens, and other counties. Some of the Tertiary lignites have recently been tested, with satisfactory results, in the clarifying of sugar, and also at the University of Alabama, in gas producer and gas engine.

Copper. Along eastern flank of Talladega Mountain from Chilton County to Georgia State line, small production. *See also* Chalcopyrite, Covellite, and Melaconite.

Corundum (emery). Found in various places in gold region, including Coosa County, near Mount Olive and Hanover; Tallapoosa County, near Alexander City and Dudleyville. No deposits of commercial value.

Covellite (indigo copper). Clay County, small quantities with pyrite in sec. 24, T. 19 S., R. 7 E.

Diatomaceous earth (tripolite). At many localities in Recent and Tertiary formations, including swamp deposits near Mobile and Montgomery.

Diopside. Calhoun County, at Piedmont.

Dolomite. See Marble.

Feldspar. Coosa County, mined and prospected near Hissop.

Flagstone. Yellow sandstones of Red Mountain, Bucksville to Georgia State line; sandstones of Pennsylvanian series ("Coal Measures") at Plank Shoals on North River. Thin-bedded limestone in Mississippian and Ordovician rocks. Gneisses and mica schists of metamorphic region. Quarries at Tallassee Falls, in Elmore County.

Galena. Calhoun County, occurs 5 miles west of Jacksonville, was worked during Civil War. Madison County, near New Market. Marshall County, near Guntersville.

Gas. See Natural gas.

Gneiss. See Granite.

Gold. In metamorphic rocks, Chilton, Clay, Cleburne, Coosa, Elmore, Randolph, Talladega, and Tallapoosa counties; for most part, free milling and associated with limonite, resulting from oxidation of pyrite; below water level both free and with pyrite. Chilton County, Blue and Rock creeks. Clay County, Idaho district. Cleburne County, Arbacoochee, Chulafinnee, Kemp Mountain. Coosa County, Rockford and Parsons mines. Elmore County, on Peru Branch. Randolph County, Goldberg, Pinetucky district. Talladega County, near Waldo. Tallapoosa County, Goldville; Hog Mountain district (cyanide plant), 12 miles northeast of Alexander, with iron sulphides, bismuth, arsenic, and tellurium; Silver Hill. Placer mining in Clay, Cleburne, Randolph, and Talladega counties.

Granite. Not much quarried, but occurs in great quantities in Chambers, Chilton, Clay, Cleburne, Coosa, Elmore, Lee, Randolph, and Tallapoosa counties. Quarried in Coosa County about Rockford, and in Randolph County at Wedowee. Thick-bedded gneisses quarried in Chambers County at Milltown; Coosa County, Bradford and Rockford; Lee County, Auburn; Macon County, Notasulga; Randolph County, Blakes Ferry; Tallapoosa County, Tallassee.

Graphite (plumbago). Chilton County, flake graphite mined along Mountain Creek. Clay County, at Ashland, Quenelda, and Stockdale. Coosa County, near Rockford and Goodwater. Randolph County, formerly mined at Christiana. Tallapoosa County, at Blue Hill and Gregory Hill.

Gypsum. Choctaw, Clarke, and Dallas counties, found in small quantities; not of commercial importance.

Halite. See Salt.

Halloysite. Dekalb County, mined at Sulphur Springs for pottery. Jackson County, found near Stevenson. Shelby County, near Calera.

Hematite (Clinton, dyestone, fossil, oolitic, red iron ore). Most important iron ore of State; 1 to 5 beds. Greatest mining district, Jefferson County between Bessemer and Birmingham; also mined in Blount County at Village Springs; Cherokee County, Gaylesville and Round Mountain; Dekalb County, Fort Payne and Valley Head; Etowah County, Attalla and Gadsden; St. Clair County, Springville. Formerly mined in Shelby County at Columbiana, and in Tuscaloosa County south and east of Dudley; occurs also in Bibb, Clay, Coosa, Jackson, Marshall, Talladega, and Tallapoosa counties, and in other places.

Hematite (gray iron ore). Talladega County, with variable proportions of magnetite in narrow belt; mined at Emauhee and Mesabi; ore of two types, quartzitic and slaty.

Iron. *See* Hematite, Limonite, Magnetite, Pyrite, and Pyrrhotite.

Kaolin. *See* Clay.

Lead. *See* Galena.

Limestone (building stone). Quarried in Blount County, near Blount Springs and Bangor; Calhoun County, at Anniston; Franklin County, at Rockwood. Used in construction of locks on Tennessee River, and at Greenport and other sites on Coosa River. Quarried also in Etowah County at Lagarde, and in Bibb, Colbert, Dekalb, Jefferson, Marshall, Shelby, St. Clair, and Talladega counties.

Limestone (crushed stone). Quarried for macadam, riprap, in Blount County at Chepultepec; Clarke County, Coffeetown; Etowah County, Lagarde; Franklin County, Rockwood and Darlington; Jackson County, Bridgeport; Jefferson County, Gate City; Madison County, Huntsville; Morgan County, Guntersville; Tuscaloosa County, Dowdle between Vance and Bibbville; Washington County, St. Stephens.

Limestone (lime). Quarried and burned in Blount County near Chepultepec; Calhoun County, Anniston; Colbert County, Dennis kilns; Dekalb County, Fort Payne; Etowah County, Rock Springs; Jackson County, Bridgeport; Lee County, Chewacla kilns; Morgan County, New Decatur; Shelby County, about Calera, Keystone, Longview, Newala, Saginaw, and elsewhere; Tuscaloosa County, Dowdle between Vance and Bibbville. *See also* Chalk, Flagstone, and Lithographic stone.

Limonite. Mined in Bibb and Tuscaloosa counties near Woodstock; Blount County, near Champion; Calhoun County, near Anniston, Jacksonville, Piedmont; Cherokee County, Baker Hill, Bluffton, Langdon City; Franklin County, Russellville; Jefferson County, Birmingham district. Principal ore used in Colbert, Lamar, and Marion counties. Occurs also in Clay, Cleburne, Coosa, and other counties, as gossan of pyritiferous ore; also in concretionary masses.

Lithographic stone. Jackson County, formerly quarried on small scale.

Magnetite (gray iron ore). Chambers County, occurs with hematite near Fredonia and Oak Bowery; Clay County, near Kennedys and Millerville; Coosa County, T. 24 N., R. 20 E.; Randolph County, Wedowee; Talladega County, Emauhee, Mesabi, Ogdens Mill, and Pope Mountain.

Manganese ore. Manganiferous limonite mined in Bibb County at Woodstock; Calhoun County, near Anniston. *See also* Manganite, Psilomelane, and Pyrolusite.

Manganite. Blount and Etowah counties, occurs in Murphrees Valley; Cherokee County, near Piedmont; Cleburne County, in residual clays near Borden Springs.

Marble (crystalline). Crystalline or statuary along west border of metamorphic rocks from northwest part of Coosa County, through Talladega County into Calhoun County, one-fourth mile wide, 60 miles long; Talladega County, best stone; pure white and white clouded marble near Sylacauga and at Carrara near Talladega. Crystalline dolomite found along east foot of Talladega Mountain range in Chilton and Coosa counties; in Clay County, near Elder post office; and in Lee County in Chewacla quarry, near Opelika.

Marble (noncrystalline). Variegated marble has been quarried in Shelby County, southeast of Calera; in Bibb County, near Pratt Ferry. Marble has been taken also in Colbert County at Dickinson, and in Shelby County, south of Shelby Springs. It occurs also in Franklin, Lauderdale, Lawrence, Madison, and other counties in the northern part of the State. Quarried near Birmingham for flux.

Marl (greensand). Occurs in Autauga, Barbour, Bullock, Butler, Choctaw, Clarke, Coffee, Conecuh, Crenshaw, Elmore, Greene, Hale, Macon, Marengo, Monroe, Perry, Pickens, Pike, Russell, and Wilcox counties.

Marl (shell). Occurs in Butler, Clarke, and Monroe counties.

Melaconite (black copper, black oxide of copper). Cleburne County, was mined with other copper ores at Woods' copper mine.

Mica (muscovite). Chilton County, mined in T. 22 N., R. 16 E.; Clay County, in T. 20 S., R. 6 E., mined around Pyriton, 2 miles northeast of Pyriton, near Bowden, and 2 miles south of Lineville. Cleburne County, prospected near Micaville. Coosa County, prospected near Hissop. Lee County, prospected near Opelika and Auburn. Randolph County, mined at Wedowee, near Pinetucky, Micaville, Milner, Foster Bridge, and McInnish Ferry. Tallapoosa County, mined 6 miles northeast of Dadeville.

Millstone. Madison County, "Millstone grit" of the Pennsylvanian series ("Coal Measures") quarried for millstones at many points on sides of anticlinal valleys, as near Huntsville. Marion County, ferruginous conglomerate (probably from "Lafayette" formation) quarried and used; Butler, Choctaw, Clarke, Crenshaw, Monroe, Pike, and Wilcox counties, as buhrstone.

Mineral paint. See Barite and Ocher.

Natural gas. Occurs in scattered wells in Franklin County, near Russellville; Madison County, at Huntsville and Hazelgreen; Walker County, Jasper; Winston County, Haleyville. Largest well in State near Fayette, Fayette County; yielded 4,500,000 cubic feet a day. Natural gas also issues in small quantities from many salt wells in Baldwin, Clarke, Mobile, and Washington counties.

Niter. Obtained in limestone caves, principally in Tennessee River valley, for making gunpowder during Civil War.

Ocher. Red ocher mined in Etowah County, at Attalla, and found at many other places. Yellow ocher, mined in Autauga County and in Elmore County, at Coosada station. Found also in Fayette, Marion, and Tuscaloosa counties.

Oil. See Petroleum.

Oil shale. See Shale.

Petroleum. Shows of oil in wells in northwestern part of State but no producing wells.

Phosphate rock. Dark and light rock phosphate extends several miles into State from Tennessee along Elk River. In Limestone County, small quantity mined 1 mile west of Veto. Phosphatic greensand, with phosphate nodules, at base of Selma chalk, through or near Eutaw, Greensboro, Hamburg, Marion, Montgomery, Prattville, and Selma.

Potash. See Marl and Niter.

Psilomelane (manganese hydrate). Found in several localities in Bibb, Blount, Calhoun, Cherokee, Cleburne, and Tuscaloosa counties.

Pyrite. Clay County, formerly mined and shipped from near Pyriton for sulphuric acid. Cleburne County at Smith's and Wood's copper mines. Limestone County, abundant at Elkmont. Occurs with copper ores also. Randolph County, small quantity at Pinetucky mine; carries gold; also at other gold mines.

Pyrolusite (manganese dioxide). Occurs in Blount and Etowah counties, in Murphrees Valley; in Bibb and Tuscaloosa counties; in Cherokee County, north and northwest of Piedmont, and in Cleburne County, in residual clay near Borden.

- Pyrrhotite.** Cleburne County, was mined at Wood's copper mine near Stonehill. Tallapoosa County (auriferous), at Hog Mountain.
- Quartz.** Friable quartz rock in Chambers, Chilton, Lee, Macon, Randolph, Tallapoosa, and other counties. Fine silica from cherty limestone in Tennessee Valley, may be suited for glass sand; not used.
- Quartz (sand).** Monroe County, near Claiborne.
- Road metal.** *See* Chert and Limestone.
- Salt.** Made from waters of salt wells in Clarke and Washington counties during Civil War.
- Sand (building).** Dug in Calhoun County, at Anniston; Clarke County, Jackson; Dallas County, Plantersville; Elmore County, Coosada, Grandview, and Jones; Escambia County, Pollard; Etowah County, Alabama City and Gadsden; Jefferson County, Irondale and Truesville; Montgomery County, Montgomery.
- Sand (glass).** Glass sand from crushed sandstone in Jefferson County, at Gate City, carries 99 per cent SiO_2 ; also in Etowah County, at Gadsden.
- Sand (molding).** Dug in Clarke County, at Jackson; Elmore County, at Coosada, Grandview, and Jones; Etowah County, at Alabama City and Gadsden; Jefferson County, at Truesville; St. Clair County, at Cooks Springs.
- Sandstone.** Quarries: Calhoun County, at Anniston; Colbert County, Cherokee; Cullman County, Cullman; Tuscaloosa County, Tuscaloosa; Walker County, Jasper, and elsewhere. Fayette County, rough stone; Jefferson County, flagstone of "Rockwood" formation used at Birmingham.
- Shale.** For jetties and ballast, quarried $2\frac{1}{2}$ miles east of Berry and at Ledule. Quarried for making brick in Blount County, at Lehigh; Jefferson County, at Alton, Coaldale, Graves, Lovick, and Shale; Marion County, at Bexar, Glen Allen, and Pearces Mills.
- Shale (oil).** Devonian; underlies northern third of the State.
- Sienna.** Cherokee County, found at Oxford.
- Silver.** Recovered in refining gold in three deep mines and three placers.
- Slate.** Promising beds of slate occur in Calhoun County, near Anniston; in Clay County, T. 19 S., R. 7 E.; in Shelby County at Buxahatchee Creek; in Talladega County, T. 21 S., R. 3 E.; also in Chilton, Cleburne, and Coosa counties. Not worked anywhere since the Civil War.
- Soapstone.** Greenish schistose rock mined in Chambers County, at Oak Bowery for lining kilns, near Dudleyville for hearthstones, T. 22 N., R. 25 E., for headstones. Old excavations in Coosa, Lee, and Tallapoosa counties.
- Sphalerite (zinc blende).** Cleburne County, near Wood's copper mine.
- Sulphur.** *See* Pyrite and Pyrrhotite.
- Tripoli (rottenstone).** Largest deposits in Calhoun, Lauderdale, and Talladega counties. Shipments have been made from Talladega County.
- Tripolite.** *See* Diatomaceous earth.
- Wavellite.** St. Clair County, important deposits 5 miles northeast of Coal City, on Coosa River, undeveloped.
- Zinc.** *See* Sphalerite.

ARIZONA.

- Agate.** In the Kaibab limestone of the Aubrey group in the northern part of the State, and in the lavas of the Tucson range of mountains. Santa Cruz County, in Santa Rita Mountains in basaltic andesite.
- Aikinite.** Pima County, in Roadside mine in Roskrige Range 28 miles west of Tucson (reported).
- Alabandite.** Cochise County, abundant in the Lucky Cuss mine at Tombstone.
- Alabaster.** Occurs in Superstition Mountains; near Pueblo Viejo; near Sulphur Springs; in Gila Range, and elsewhere.
- Alunite.** Santa Cruz County, Palmetto district in Three R mines, 5 miles south of Patagonia, in granite porphyry.
- Amethyst.** Mohave County, 6 miles southwest of Kingman in the McConico district.
- Andradite.** *See* Garnet.
- Anglesite** (sulphate of lead). Cochise County, Tombstone district; Gila County, at Lost Gulch mine, near Globe; Maricopa County, west of Morristown, in Montezuma lead mine. Mohave County, in Mineral Park. Pinal County, in Mammoth mine, Shultz. Santa Cruz County, Mowry mine. Yavapai County, in ores of Bradshaw Mountains, common in silver veins. Yuma County, in Castle Dome Mountains.
- Antimony ores.** *See* Bindheimite, Bournonite, Dyscrasite, Jamesonite, Polybasite, and Stibnite.
- Argentite** (silver glance). Maricopa County, Red Rover mine. Mohave County, in pre-Cambrian granite gneiss in Chloride, Mineral Park, and Stockton Hill districts. Pinal County, at Silver King. Pima County, Helvetia district, in Exile and King claims, Henrietta prospect, Blue Jay mine, and other properties; Empire district, Total Wreck and other mines. Santa Cruz County, Tyndall district, Elephant Head group, Salero, Alto, Eureka, Ivanhoe, Empress of India, Montezuma, and other mines; Wrightson district, Augusta, Happy Jack, and other mines; Red Rock district, La Plata and Meadow Valley mines; Harshaw district, January, Blue Eagle, World's Fair, Flux, Hardshell, American, and other mines. Yavapai County, in ores of Bradshaw Mountains, Monte Cristo mine near Constellation.
- Arsenic.** Santa Cruz County, Patagonia district, Duquesne-Washington camp in Double Standard mine; 50 pounds or more was found in reniform masses, some of several pounds each. *See also* Arsenopyrite.
- Arsenopyrite** (mispickel, arsenical pyrite). Maricopa County, in Mazatzal Mountains, Sun Flower district, associated with cinnabar. Mohave County, in pre-Cambrian granite gneiss in Chloride and Mineral Park districts; Minnesota-Connor, Windy Point, and Queen Bee mines; carries gold and silver; not mined for arsenic. Yavapai County, in veins of Bradshaw Mountains; carries gold and some silver at McCabe mine.
- Asbestos** (chrysotile). Coconino County, associated with serpentine in limestone at Grand View and Bass Camp, Grand Canyon. Gila County, mined on Ash Creek, 35 miles northeast of Globe, and in massive serpentine, 20 miles west of Globe. The Arizona asbestos is practically free from iron and consequently more suitable for the manufacture of electrical insulating products than is that of the Canadian deposits or other deposits found elsewhere in the United States.
- Azurite.** Cochise County, was abundant at Copper Queen mine, Bisbee district. The finest specimens of azurite in many museums have come from this mine. Gila and Pinal counties, rare in Globe district. Greenlee

County, large masses in Longfellow, Manganese Blue, and Shannon mines. Pima County, Helvetia district, Old Dick, Isle Royal, Heavyweight, Copper Duke, Bulldozer, Cuprite, and other mines; Empire district, California and Verde Queen mines; in Old Baldy district, Florida mine; Tyndall district, Bradford, Tia Juana, Montezuma, and other mines; Wrightson district, Castle Butte and other mines; Harshaw district, Dewey prospect; Palmetto district, Isabella mine; Patagonia district, Winifred mine and most of the mines in the Duquesne-Washington camp; Nogales district, Lion mine. Yavapai County, in ores of Bradshaw Mountains.

Azurmalachite. Cochise County, blue azurite and green malachite, an ornamental stone in copper mines of Bisbee district. Mohave County, as impregnation of porphyry at John Kay mine, Mineral Park.

Barite. Maricopa County, in White Tank Mountains and in Eagle Tail Mountains. Pima County, near Silver Bell, associated with fluor spar, occurs in large masses in the Quijotoa district; is also common as a gangue mineral in mines in the Santa Rita Mountains. Pinal County, in Silver King mine; Salt River Valley east of Phoenix. Santa Cruz County, common in gangue mineral in World's Fair and many other mines.

Basalt. Basalt suitable for road metal occurs in many places and in large quantity, covering many square miles. Notable areas are present in Coconino County, in the region of the San Francisco Mountains, and in Mohave County, in the Black Mountains or River Range, especially in the southern or Black Mesa portion.

Bindheimite. Santa Cruz County, Patagonia district, Mowry mine.

Bismuth. Gila County, in Mazatzal Mountains, associated with quicksilver minerals. Maricopa County, in McDonnell Mountains; Vulture district, Cleopatra mine; San Domingo placers, where it is known by the Mexicans as copaleo; southeast of Granite Reef Dam; Salt River Valley. Mohave County, in Aquarius Cliffs, 30 miles south of Hackberry and 30 miles east of Yucca. Yavapai County, in Humbug Creek placers; Minnehaha Flats. *See* Bismuthinite, Bismutite, and Tetradymite.

Bismuthinite. Mohave County, in Aquarius Cliffs, 30 miles south of Hackberry and 30 miles east of Yucca, apparently in small quantities. Yavapai County, in prospects on Connor & Lawler's claims, Eureka district, 45 miles west of Prescott, in quartz veins probably of pegmatitic origin, with wolframite, specular hematite, fluorite, muscovite, and a little chalcopryrite.

Bismutite. Yavapai County, in prospects on Connor & Lawler's claims, Eureka district, 45 miles west of Prescott, in quartz veins probably of pegmatitic origin, with wolframite, specular hematite, fluorite, muscovite, and a little chalcopryrite.

Bornite (peacock ore). Cochise County, at Bisbee in Copper Queen and Calumet and Arizona mines; small quantity in quartz veins in Whetstone Mountains. Maricopa County, in south side Harqua Hala Mountains. Mohave County, at Altata and Pinkham mines, Chloride district. Pima County, Santa Catalina Mountains, Leatherwood mine; a little in Mammoth mine; Iron Mask mine in Old Baldy district. Pinal County, Silver King mine; Magna mine near Superior. Santa Cruz County, Austine mine, Carrie Nation mine; Tyndall district, Montezuma and Connecticut mines; Wrightson district, American Boy mine; Harshaw district, Blue Eagle mine, Elevation group, and other properties; Palmetto district, Three R mine; Patagonia district, O'Mara mine, Line Boy mine, and most

of the mines in the Duquesne-Washington camp; San Cayetano district, Wise prospect. Yavapai County, common in copper veins; in ores of Bradshaw Mountains carries free gold; Jerome, United Verde mine. Yuma County, at Cunningham Pass north of Wenden.

Bournonite. Yavapai County, at the Boggs mine in the Big Bug district.

Brochantite. Cochise County, small quantities commonly associated with malachite in Bisbee district; also with cuprite in Copper Queen and in Calumet and Arizona mines. Greenlee County, common with malachite in Clifton-Morenci district; mined at Shannon, Metcalf, Copper Mountain, and Montezuma mines. Mohave County, Bentley district. Yavapai County, United Verde mine, Jerome.

Bromine. *See* Bromyrite and Embolite.

Bromyrite. Santa Cruz County, Tyndall district, Rosario mine; Wrightson district, Walker mine.

Brongniardite. Associated with other argentiferous ores.

Brown iron ore. *See* Limonite.

Cacholong. *See* Opal.

Calcite. Mohave County. Beautiful white and amber-colored specimens of the variety known as dogtooth spar are said to occur in abundance on the north side of the Grand Canyon of the Colorado.

Caliche. Mohave County, near Chloride, formerly used for flux, and at other places. Pima County, in the Tucson region underlying the Tucson Plain. The alluvial slopes at the base of the Santa Rita Range near Helvetia and other places.

Carnotite. Navajo Reservation.

Catlinite. Yavapai County, near Jerome Junction. Ornaments made of it are found in ancient ruins in different parts of Arizona.

Celestite. Maricopa County, occurs at Gila Bend, and 14 miles south of there.

Cement material. Occurs in many places, as at Flagstaff and near Phoenix. Utilized at Roosevelt Dam. Pima and Santa Cruz counties, abundant, seemingly suitable limestone and shale, mostly Carboniferous, occur in or near the Santa Rita and other mountains and the Canelo Hills. It is also probable that much of the tuff in Santa Cruz County may be suitable.

Cerargyrite (horn silver, chloride of silver). Cochise County, Commonwealth mine, Pearce. Gila County, Black Warrior district. Maricopa County, Red Rover mine. Mohave County, in pre-Cambrian granite gneiss in Chloride, Cerbat, and Stockton Hill districts; mined at Distaff mine, Chloride district, and in Union Pass (San Francisco) district. Pinal county, Silver King mine. Pima County: Helvetia district, Henrietta prospect; Empire district, Total Wreck, Verde Queen, and Red Cloud mines; Greaterville district, Hancock mine; Old Baldy district, Florida mine. Santa Cruz County: Tyndall district, common in many rich vein croppings, Toluachi group, Rosario, Ivanhoe, and many other mines; Red Rock district, La Plata, Meadow Valley, Hardshell, and Hermosa mines; Harshaw district, American mine; Palmetto district, Palmetto mine; San Cayetano district, Wise prospect. Yavapai County: Bradshaw Mountains district, common in Black Warrior and Peck mines; Big Blue and Monte Cristo mines near Constellation; also in Cerro Colorado district.

Cerium metals. *See* Gadolinite.

Cerussite (lead carbonate). Cochise County, impure sandy form in Hendricks Gulch, Bisbee district. Gila County, Red Cloud mine. Greenlee County, mined for gold at Hormeyer mine, Morenci. Mohave County, in Mineral Park district, Tyler mine. Pima County: Helvetia district, Pauline mine;

Empire district, Total Wreck, Jerome No. 2, and California mines; Greaterville district, containing silver and gold in Anderson prospect and in Greaterville placer deposits. Pinal County, Haley claims, 2½ miles east of Ray. Santa Cruz County: Tyndall district, Montosa, Ivanhoe, and other mines; Harshaw district, Trench, Flux, Hardshell, and other mines; Palmetto district, Three R, Isabella, and Palmetto mines; Patagonia district, Mowry, Morning Glory, and Holland mines; Nogales district, Dura mine.

Chalcantite (blue vitriol). Greenlee County, small quantities mined at Copper Mountain, Clifton-Morenci district. Yavapai County, considerable quantity formerly in United Verde mine, Jerome district.

Chalcedony. Apache and Navajo counties, abundant in petrified wood associated with jasper in the petrified forests near Adamana. Some has been cut for ornamental work. Greenlee County, in limestone in Clifton-Morenci district; also loose on Shannon Mountain. Mohave County, gray, white, and purplish on western slope of River Range and other localities. Santa Cruz County, Grosvenor Hills. Yuma County, east of Parker, near milepost 87, on Atchison, Topeka & Santa Fe Railway. *See also* Chrysoprase.

Chalcocite (copper glance). Common below oxidized zone in most copper mines of the State. Cochise County, formerly most important sulphide near Bisbee; in Copper Queen, Calumet, Arizona, and other mines, but chalcopyrite has succeeded it at greater depth; abundant in massive form in Shattuck mine, Bisbee. Gila and Pinal counties, the essential constituent of the disseminated ores in schist and porphyry at Ray and Miami; in the Old Dominion mine, near Globe; with bornite forms rich ore of Queen mine at Superior. Greenlee County, principal copper mineral in Clifton district; in Ryerson and other mines. Maricopa County, in Vulture district. Mohave County, in Chloride and Bentley districts. Pima County, Cababi district, Cobriza mine; Helvetia district, Copper World and Black Horse mines and Narragansett claim; Old Baldy district, Star Pointer mine. Santa Cruz County, Tyndall district; Tia Juana, Alto, Montezuma, Ivanhoe, Bradford, and other mines; Wrightson district, American Boy, Augusta, and Anaconda mines; Harshaw district, World's Fair mine; Elevation and Buffalo groups; Palmetto district, Three R and Sonoita mines and Gladstone prospect; Patagonia district, Four Metals mine, and some mines in the Duquesne-Washington camp; San Cayetano district, Wise prospect. Yavapai County, in copper-silver veins of Bradshaw Mountains. Yuma County, in Ellsworth district and in prospects at Cinnabar, 8 miles southwest of Quartzsite.

Chalcopyrite (copper pyrites). Found in nearly all the copper mines of the State. Cochise County, in massive form in Bisbee district, mined at Copper Queen, Calumet, Arizona, and other mines. Gila and Pinal counties, abundant with specularite in Gibson mine as vein in schist, Globe district; with pyrite in veinlets and in disseminated form in so-called "primary ore" of mines at Miami and Ray; in mines about Dudleyville and near Mineral Creek, Ripley district. Greenlee County, small proportion in copper ore bodies in Clifton-Morenci district. Maricopa County, associated with galena and pyrite in Vulture mine near Wickenburg; in Big Horn Mountains 32 miles southwest of Wickenburg, in mines of United States Gold & Copper Co. Mohave County, primary ore of Chloride district, in Pay Roll and Redemption mines; primary ore, Mineral Park district, in Keystone, Windy Point, and other mines; Cer-

bat district, in Cerbat and Alpha mines; Stockton Hill district, in Banner group and Treasure Hill mines. Pima County, Helvetia, Empire, and Silver Bell districts, important copper ore at Twin Buttes, Old Boot, and Rosemont mines; in Catalina Mountains, at Leatherwood mine, associated with bornite; Helvetia district, Copper World, Black Horse, Leader, Isle Royal, Heavyweight, Black Eagle, Omega, Tiptop, Ridley, Cuprite, New York, and Pauline mines, and Eclipse group and Henrietta prospect; Empire district, California mine; Old Baldy district, Jackson, Iron Mask, and Lucky Ledge mines, and Upper and Great Eastern groups. Santa Cruz County, in Tyndall district at American Boy mine, Carrie Nation, Elephant Head group, Treasure Vault, Montosa, Cottonwood Canyon, Rhode Island, Connecticut, Tia Juana, Salero, Alto, Joplin, Toluachi group, Arizona-Pittsburgh, Bland, Eureka, Viceroy, Victor, Ivanhoe, and other mines; Wrightson district, Sweet, Blackcap, American Boy, Augusta, and other mines; Red Rock district, New York (Jensen) mine; Harshaw district, Humboldt, Blue Eagle, Flux, and American mines, Invincible prospect, Aztec and Elevation groups; Palmetto district, Three R and Isabella mines; Patagonia district, Morning Glory, Endless Chain, Omara, National, Big Lead, Golden Rose, Bennett, Buena Vista, Gladstone, and Four Metals mines, and in the Duquesne-Washington camp, Pride of the West, Bonanza, Holland, Belmont, Silver Bell, Empire, New York, Tibbetts, Benton, and Line Boy mines; Nogales district, Dura and Columbia mines; San Cayetano district, Tubutana mine. Yavapai County, in ores of Bradshaw Mountains and United Verde mine, Jerome district; auriferous and argentiferous.

Chert. Mohave and Yuma counties, found as pebbles in the streams and as irregular nodules and other forms in the limestone, especially the Kaibab limestone of the Aubrey group, in the Grand Canyon region.

Chromium. *See* Crocoite.

Chrysocolla (silicate of copper). Cochise County, Bisbee district, Calumet and Arizona mines, 3 miles north of Dragoon; not abundant. Coconino County, in sandstone of White Mesa of Navajo Indian Reservation. Gila and Pinal counties, formerly a more important ore than at present; in Globe district, abundant in Live Oak, Keystone, Black Warrior, Geneva, and Black Copper mines. Graham County, common, but not important, in Clifton-Morenci district. Mohave County, Bently district. Pima County, Helvetia district, Copper Duke and Bulldozer mines and Peach prospect. Santa Cruz County, Tyndall district, Montosa, Montezuma and Bradford mines; Wrightson district, Castle Butte mine; Harshaw district, Dewey prospect and some mines in the Duquesne-Washington camp. Yavapai County, in Bradshaw Mountains district, common in outcrops of copper veins; not important.

Chrysolite. *See* Olivine.

Chrysoprase (blue-green chalcedony). Gila County, "blue chrysoprase," copper-stained chalcedony at Live Oak and Keystone mines, near Miami. Mohave County, true chrysoprase in Weaver district and elsewhere on west slope of River Range.

Chrysotile. *See* Asbestos.

Cinnabar. Gila County, reported on Deer Creek at Rye, and in the Mazatzal Mountains. Maricopa County, in the Mazatzal Mountains on the north-eastern boundary between Maricopa and Gila counties in the Sunflower district. Yavapai County, Copper Basin district, reported at Skull Valley. Yuma County, sparsely distributed in veins at Cinnabar, 14 miles from Ehrenberg; has been mined on small scale, and the ore is said to average $1\frac{1}{2}$ per cent of mercury.

- Clay** (brick). Cochise County, clay made into common and front brick at Benson, Douglas, and Naco. Coconino County, at Williams and Flagstaff. Gila County, at Rosemont. Maricopa County, at Alhambra and Tampa. Navajo County, at Snow Flake. Pima and Santa Cruz counties, clay suitable for adobe occurs in almost all the valleys and some along Santa Cruz River is said to make fine red brick; apparently much of the shale that occurs in the Paleozoic formations in or near the Santa Rita and Patagonia and other mountains is also suitable for making good brick clay. Pima County, at Tucson. Pinal County, at Florence. Santa Cruz County, at Nogales. Yavapai County, at Columbia and Mayer and near Prescott.
- Clay** (fire, graphitic). Cochise County, mined in extensive deposits in Whetstone Mountains, near Benson; burns white; used for lining converters and also for manufacture of pressed brick; occurs also at Bisbee.
- Clay** (kaolin or china). Gila County, occurs at Globe. Greenlee County, not uncommon at Copper Queen, Morenci, and Metcalf, Clifton-Morenci district; as veinlets in quartz in Humboldt, Ryerson, and other mines; mined at Longfellow mine for converter lining. Maricopa County, near Wickenburg, near Cave Creek, and on Lime Creek. Pinal County, in Vekol mines. Yavapai County, near Skull Valley. Yuma County, southwest of Salome.
- Clay** (pottery). Cochise County, in San Pedro Valley, northwest of Benson, reported of good quality.
- Coal** (bituminous). Pinal County, Deer Creek field, at the eastern end of the county, 35 miles southeast of Globe, and east of Winkelman; area 30 square miles; two workable beds, 24 to 30 inches; block, coking.
- Coal** (subbituminous). Apache, Coconino, and Navajo counties, Black Mesa field, in Moqui and Navajo Indian reservations; area approximately 5,920 square miles; coal in two main groups of beds, appears to be in thin benches alternating with layers of shale and bone.
- Cobaltite**. Pima County, Cababi district. Yavapai County, near Cherry Creek station and near Jerome.
- Copper** (native). Cochise County, Bisbee district, with cuprite in Calumet & Arizona, Copper Queen, Shattuck, Holbrook, and other mines. Gila and Pinal counties, Globe district, in quartzite, Old Dominion mine. Greenlee County, with other copper ores in Metcalf mines, Clifton-Morenci district, not important. Pima County, Helvetia district, Palmetto mine; Old Baldy district, Upper and Great Eastern groups. Yavapai County, in ores of Bradshaw Mountains district; not important.
- Copper minerals**. Ores of copper are of chief importance in the following districts: Cochise County, Courtland, Dagoon, Huachuca, Johnson, and Warren (Bisbee); Coconino County, Francis, Grand Canyon, and Jacobs Lake; Gila County, Black Warrior, Christmas, Globe, Lost Gulch, Miami, and Pinto Creek; Graham and Greenlee counties, Bunker Hill, Clark, Greenlee (Metcalf), Morenci, and Lone Star; Maricopa County, San Domingo; Mohave County, Bentley and Hualpai; Pima County, Ajo, Amole, Helvetia, Old Baldy, Pima, Rincon, Santa Rosa, and Silver Bell; Pinal County, Bunker Hill, Mineral Creek, Mineral Hill, Pioneer, and Vekol; Santa Cruz County, Patagonia and Washington; Yavapai County, Agua Fria, Black Hills, Copper Basin, and White Picacho; Yuma County, Harcuvar, Planet, Plomosa, Swansea, and Vicksburg. *See also* Azurite, Azurmalachite, Bornite, Bournonite, Brochantite, Chalcantite, Chalcocite, Chalcopyrite, Chrysocolla, Covellite, Cuprite, Malachite, Melanconite, Stromeyerite, Tennantite, Tenorite, and Tetrahedrite.

- Coronadite** (manganite of lead). Greenlee County, Clifton-Morenci district, fairly abundant near Coronada vein, three-quarters of a mile west of Horseshoe; stated to contain some gold; has been mined.
- Covellite** (indigo copper, blue copper). Greenlee County, rare in Clifton-Morenci district, in Ryerson and Montezuma mines. Pinal County, La Coronado mine, Mineral Hill district. Santa Cruz County, Three R mine, Palmetto district.
- Crocoite** (chromate of lead, red lead). Maricopa County, in some of the mines of the Vulture district; occasionally met with in other lead ores; Montezuma lead mine west of Morristown. Pinal County, in Mammoth mine, associated with wulfenite and vanadinite. Yuma County, in Castle Dome Mountains.
- Cuprite** (red oxide of copper). Cochise County, abundant and important ore of Bisbee district, in Calumet & Arizona and Copper Queen mines. Gila and Pinal counties, in Continental and Buffalo mines, Globe district. Greenlee County, in Clifton, Morenci, and Metcalf mines. Pima County, in Helvetia district, Cuprite mine, Chicago prospect, Pilot and Sweet Bye and Bye claims; Old Baldy district, Florida mine. Santa Cruz County, Tyndall district, Montezuma mine; Harshaw district, Dewey prospect; Patagonia district, Winifred mine and some mines in the Duquesne-Washington camp; San Cayetano district, Tubutana mine. Yavapai County, Bradshaw Mountains district; not important.
- Cuprodescloizite**. Gila County, 4 miles north of Globe, at Camp Signal. Mohave County, on joints in copper ore; at Grand Gulch mine, Bentley district, and in most localities given for descloizite, which see.
- Cuproscheelite**. Maricopa County, near Cave Creek, 35 miles north of Phoenix, associated with cuprotungstite, molybdenite, azurite, malachite, and other copper and tungsten minerals.
- Cuprotungstite**. Maricopa County, near Cave Creek, 35 miles north of Phoenix. Pima County, southwestern part.
- Cyanite**. Yuma County, north of Yuma in stout crystals and associated with dumortierite.
- Descloizite** (vanadate of lead). Cochise County, Lucky Cuss mine, Tombstone, Castle Dome district; Mammoth mine in Catalina Mountains. Pima County, Old Yuma mine in Tucson Mountains. Maricopa County, in Old Horton mine, west of Agua Fria and north of Beardsley, associated with wulfenite; in Big Horn Mountains near old Pump mine. Pinal County, Dripping Spring Range, 4 miles east of Kelvin, with vanadinite and wulfenite. Yavapai County, on Gold Hill near Columbia, associated with several other lead minerals.
- Diatomaceous earth** (diatomite). Pinal County, 40 miles north of Benson, along east bank of San Pedro River above Mammoth, in beds more than 100 feet in thickness, snow-white in color; used locally for building. Yavapai County, near Reddington, Bradshaw district.
- Diopside**. Graham County, Clifton-Morenci district. Pinal County, reported near Riverside.
- Dufrenoyite** (arsenical lead ore). Mohave County, associated with other ores of lead, zinc, and silver; mined when argentiferous; Mineral Park.
- Dyscrasite** (antimonide of silver). Associated with other ores of lead and silver.
- Embolite** (chlorobromide of silver). Cochise County, especially abundant in Pearce district; occasionally found with other silver ores. Santa Cruz County, Tyndall district, Ivanhoe and Alto mines.

- Ferberite.** Maricopa County, mined at Cave Creek, 10 miles north of Defiance.
- Flint.** Mohave and Yuma counties, found as pebbles in the streams and as irregular nodules and other forms in the limestone especially the Kaibab limestone of the Aubrey group in the Grand Canyon region.
- Fluorspar (fluorite).** Cochise County, at Paradise, small quantity in quartz veins, 4 miles north of Dagoon; has been mined. Maricopa County, White Tank Mountains. Mohave County, gangue mineral of Black Mountains. Pima County, at Helvetia; at Red Rock and other mines in Silver Bell district in green cubes with barite, galena, and chalcopyrite. Pinal County, near Mammoth mine. Yavapai County, gangue mineral of Bradshaw Mountains district. Yuma County, in Castle Dome Mountains north of Yuma.
- Freieslebenite (antimonial sulphide of silver).** Yuma County, mined at Castle Dome; small quantities shipped. With other argentiferous ores.
- Fuller's earth.** Cochise County, reported near Benson.
- Gadolinite.** Mohave County, in Aquarius Cliffs in pegmatite, 30 miles south of Hackberry and near Kingman, about 6 miles west of Chin Lee Valley and 2 to 4 miles south of the Utah State line. Thousands of pounds have been gathered from drifting sand dunes by Indians and some fine gems have been obtained. Also with peridot here and elsewhere.
- Galena (argentiferous and some of it slightly auriferous).** Cochise, Gila (sparingly at Globe), Graham, Mohave, Pima, and Pinal counties (sparingly in Ray district). Greenlee County, in Metcalf ores of Clifton-Morenci district; in Copper King mine; carries considerable silver in Stevens group. Maricopa County, Montezuma lead mine west of Morristown, also in Vulture mine. Mohave County, Chloride district; mined at Tennessee, Elkhart, Hercules, and other mines; principal ore of Mineral Park district; mined at Tyler, Lady Bug, and Queen Bee mines; Cerbat district, Idaho and Alexander mines; Stockton Hill district. Pima County, Mammoth mine, argentiferous; Helvetia district, Silver Spur (old Frijole), and Ridley mines, near Helvetia; Pauline mine; Greaterville district, Enzenburg, Hancock, Royal Mountain, St. Louis, and Wisconsin mines, and Anderson prospect. Santa Cruz County, Tyndall district, Elephant Head group, Treasure Vault, Shea-O'Donnell, Montosa, Tia Juana, Wandering Jew, Josephine, Toluachi group, Arizona-Pittsburgh, Trenton, Eureka, Viceroy, Victor, and Ivanhoe mines; Wrightson district, Sweet, Blackcap, American Boy, Happy Jack, Anaconda; Harshaw district, World's Fair, Humboldt, January, Trench, Flux, Elevation group, Alta, Great Silver, Buffalo group, Blue Nose; Palmetto district, Three R, Isabella, Palmetto, and Sonoita mines; Patagonia district, Omara, National, Big Lead, and Golden Rose; in Duquesne-Washington camp, Holland, Empire, Pocahontas, and Tibbetts mines; Nogales district, Lion mine, Columbia mine. Yavapai County, common silver mineral of Bradshaw Mountains district; also carries gold; Senator and other mines; carries free gold, Humbug district, near Columbia. Yuma County in Castle Dome Mountains.
- Garnet.** Apache County, Navajo Reservation, gem pyrope ("Arizona ruby") in extreme northern part of the State, in Garnet Ridge field, an important collecting ground. Greenlee County, large masses on western slope of Modoc Point at Morenci, and on top of Shannon Mountain at Metcalf; massive garnet occurs in many of the mining districts; as yellowish to dark-brown andradite at Clifton. Pima County, in Twin Buttes and Silver

- Bell districts. Santa Cruz County, Patagonia district, at Duquesne-Washington camp. Yavapai County, common in schists of Bradshaw Mountains.
- Glauberite** (sulphate of soda and lime). Yavapai County, in Verde Valley, associated with thenardite, halite, mirabilite, and gypsum.
- Gold** (lode). Principal producers are as follows: Cochise County, Warren and Tombstone districts. Maricopa County, Vulture mine, one of the largest producers in the State; in association with galena, pyrite, and chalcopyrite. Mohave County, produced extensively at the Gold Road, Tom Reed, and many other mines in the Black Mountain range, from Tertiary quartz-calcite veins in Tertiary volcanic rocks. Pima County, Helvetia district, Helena mine, Blue Jay mine, Henrietta prospect; Greaterville district, St. Louis and Yuba mines; Old Baldy district, Iron Cliff prospect. Santa Cruz County, Tyndall district, Santa Rita and Bland mines; Wrightson district, Gringo mine; Harshaw district, Invincible prospect and Buffalo group; Palmetto district, Sonoita mine; Patagonia district, Big Lead mine and some mines of Duquesne-Washington camp; Nogales district, Dura and Lion mines. Yavapai County, Big Bug, Martinez, Tiger, and Verde districts. Yuma County, Kofa district.
- Gold** (placer). Pima, Yavapai, and Yuma counties are the largest producers. Other counties yielding appreciable quantities are Cochise, Coconino, Gila, Greenlee, Maricopa, and Santa Cruz. Maricopa County, at Relief mine, north of Peoria. Pima County at Greaterville, Madero Canyon, in Old Baldy district. Santa Cruz County, Harshaw district, on Sonoita Creek below Patagonia at mouth of Allen Canyon; Patagonia district, near Mowry in piedmont portion of Mowry Wash and adjacent drainages; Nogales district, 6 miles northeast of Nogales in Guebabi Canyon. Yavapai County, Congress mine, Rich Hill, at Canada del Oro, Catalina Mountains, and Weaver placers; dredges have been erected on Lynx Creek in the Walker district and in French Gulch, a small tributary of Hassayampa River.
- Granite**. Quarried in Cochise County, at Lee station; Gila County, at Globe; and Maricopa County, at Phoenix, building and monuments.
- Granite** (quartz diorite). Gila County, Pinal Range, not used. Yavapai County, Bradshaw Mountains, would make handsome building stone; used near Prescott for building and monuments.
- Granite porphyry**. Cochise County, Sacramento Hill in Bisbee district. Mohave County, Mineral Park, in Cerbat Range. Pima County, in Santa Rita Range, at Helvetia and elsewhere. Santa Cruz County, common in the Santa Rita and Patagonia mountains in the Tyndall, Palmetto, Patagonia, and Red Rock districts.
- Graphite**. Pure graphite has not been found. *See also* Clay, graphitic.
- Gypsum**. Cochise County, dug 5 miles east of Douglas; occurs near Land. Mohave County, on south side of Virgin River about 15 miles south of St. George, Utah. Navajo County, occurs in Fort Apache Reservation, at Woodruff and Snowflake, and has been quarried at Winslow. Pima County, occurs 9 miles northeast of Tucson near Alamo Spring and on east flank of Empire Mountains 8 miles south of Pantano. Pinal County, occurs at Feldman and reported on San Pedro River about 15 miles south of Mammoth. Yavapai County, Verde Valley, associated with thenardite, glauberite, and allied minerals. *See also* Alabaster and Halite.

Halite (common salt). Gila County, occurs in headwaters of Salt River and in Tonto Basin. Yavapai County, occurs in Verde Valley associated with glauberite, gypsum, mirabilite, and thenardite; used to a small extent for cattle; too impure for table use.

Hematite. Occurs in gossan of copper deposits at many localities in Santa Cruz County, at Pluto, Isabella, and other claims, and in Yuma County, at the Palmer & Wharton claim. Occurs as contact mineral in Cochise County in magnetite on croppings of Black Diamond copper mine, Dragoon; in Greenlee County, in the Clifton-Morenci district; and at Mangane Blue mine. Gila County, mined with copper ores in Globe district.

Hematite (specular, micaceous). Gila County, with chalcopyrite in Old Dominion, Superior, Boston, Gibson, and other mines of Globe district. Mohave County, common in Black Mountain and Cerbat ranges, Chloride district. Pinal County, occurs near Mammoth. Santa Cruz County, at Line Boy mine, near Duquesne; near Gross camp occurs in large beds; used for flux. Yavapai County, reported from Willcox and Briggs.

Hübnerite. Cochise County, in veins and placer deposits near Dragoon; the placers are mined; also found in Dos Cabezas district, about 14 miles south of Bowie. Mohave County, Owens, 40 miles southeast of Yucca. Pima County, in quartz veins cutting granite at Arivaca; mined. Santa Cruz County near Nogales. Yavapai County, Hot Springs in Humbug district; Eureka district, 45 miles northwest of Prescott, near Camp Wood, T. 15 N., R. 7 W. (unsurveyed); mined near head of Tule Creek, southwest of Tip Top.

Hyalite. *See* Opal.

Infusorial earth. *See* Diatomaceous earth.

Iron minerals. *See* Arsenopyrite, Hematite, Limonite, Magnetite, Pyrite, Pyrrhotite, and Siderite.

Jamesonite. Yavapai County, in ores of Bradshaw Mountains; carries free gold.

Jasper. Apache and Navajo counties, brilliant, red, orange to yellow, with chalcedony in petrified forests near Adamana; some has been cut for ornamental work. Gila County, near Deer Creek. Maricopa County, near Red Rover mine, red jasper. Mohave and Yuma counties, brilliant red, orange to yellow, with chalcedony in petrified forests. Mohave County, dark red and brown on west slope of River Range, 20 miles west of Mineral Park.

Kaolin. *See* Clay.

Lead minerals. *See* Algiesite, Brongniardite, Cerusite, Coronadite, Crocoite, Dufrenoyite, Galena, Jamesonite, Leadhillite, and Pyromorphite. Ores of lead are of chief importance in the following districts: Cochise County, California (Paradise); Graham County, Aravaipa; Mohave County, Cedar Valley and Stockton Hill; Pima County, Empire; Yuma County, Castle Dome and Silver.

Leadhillite. Pinal County, rare; occurs with other lead ores at Shultz.

Lenzite (wireless crystals). Mohave County, Cedar Valley district, in Waldron and Arizona Venture mines, in Deluge Wash, Wallapai Mountains, 56 miles south of Kingman.

Limestone. Cochise County, quarried for building or for lime burning at Lee station. Coconino County, at Flagstaff. Gila County, quarried during construction of dam at Roosevelt. Greenlee County, gray Modoc limestone quarried at Morenci. Mohave County, in the Grand Canyon region, in the Redwall formation but generally not pure. Pima County, formerly

quarried for flux and lime at Andrade ranch and the California mine, 6 miles southwest of Pantano. Limestone, also apparently suitable for building, occurs in places in the Empire, Whetstone, and Santa Rita mountains and their foothills or outlying buttes at Helvetia, Greaterville, and other localities. Santa Cruz County, abundant in the Canelo Hills east of Patagonia, and occurs in many places in the lower east and west slopes of the Santa Rita and Patagonia mountains, formerly quarried and burned for lime at the north end of the Canelo Hills, near Old Fort Crittenden, now quarried and burned for lime at Mowry. For general distribution in the Empire, Santa Rita, and Patagonia mountains and Canelo Hills, see United States Geological Survey Bulletin 582, Plate II. Yavapai County, occurs mainly in the Paleozoic formations at Wekon.

Limonite (brown hematite, brown iron ore). Cochise County, Copper Queen mine at Bisbee. Gila and Pinal counties, mined for contained copper in Old Dominion mine, Globe district. Greenlee County, abundant in Clifton-Morenci district, valuable as flux. Mohave County, common in Black Mountains and Cerbat Range, Chloride district. Pima County, coating quartz veins at McCleary prospects near Helvetia, at Old Baldy prospect. Yavapai County, in ores of Bradshaw Mountains.

Magnetite (magnetic iron ore). Cochise County, Black Diamond mine, Dragoon Range. Greenlee County, Clifton-Morenci district, mined for flux in Manganese Blue and Arizona Central mines. Pima County, in the Tucson Mountains and in the Santa Rita Mountains at Iron Mask and Jackson mines. Yavapai County, in ores of Bradshaw Mountains; carries free gold.

Malachite (green carbonate of copper). Cochise County, mined at Bisbee, Copper Queen, and other mines; wonderfully beautiful specimens have been obtained from the Copper Queen mine and placed in museums. Greenlee County, common in irregular deposits in limestone in Clifton-Morenci district; mined at Detroit, Manganese Blue, Longfellow, and Standard mines. Gila and Pinal counties, abundant in Globe district; associated with copper ores but not itself an important ore constituent. Mohave County, in granite gneiss, Mineral Park district. Pima County, Helvetia district, Old Dick, Isle Royal, Copper Duke, Bulldozer, and Cuprite mines; Empire district, Verde Queen and California mines; Old Baldy district, Florida, and Lucky Ledge mines. Santa Cruz County, Tyndall district, common in the rich vein croppings, Carrie Nation, Elephant Head Group, Montosa, Connecticut, Montezuma, and Bradford mines; Wrightson district, Castle Butte mine; Harshaw district, Sunnyside mine, Dewey prospect; Palmetto district, Jarilla mine; Patagonia district, National, Winifred, Duquesne-Washington mines; Nogales district, Dura and Lion mines; San Cayetano district, Tubutana mine. Yavapai County, in ores of Bradshaw Mountains.

Manganese. Cochise County, manganese oxide, principally pyrolusite and earthy black wad, with some psilomelane, is abundant in oxidized ores of certain mines of the Tombstone district. Ore mined for silver in these mines is principally pyrolusite and wad, with some psilomelane. *See also* Alabandite, Coronadite, Psilomelane, Pyrolusite, Rhodochrosite, and Wad.

Marble. Cochise County, medium-grained crystalline, pure white with pinkish tones, beautiful color, suitable for decorative purposes near Fort Bowie; white, pinkish or grayish white, also gray, dove-color, or blue, handsome decorative marble near Emigrant Canyon; coarsely crystalline, granular

white, excellent building stone near Whitetail Canyon. Pima County, black marble in Tucson Mountains. Pinal County, white statuary marble at northern end of Santa Catalina Mountains, near Condon mine. *See also* Onyx marble.

Melaconite (black oxide of copper). Of common occurrence in many mines with other ores of copper.

Mica (muscovite). Several deposits, none developed, value unknown. Occurs in Coconino and Mohave counties, on north side of Grand Canyon, and in Maricopa County, White Horse Tank Mountains, southwest of Phoenix, in Santa Estrella Mountains, and also south of Buckeye.

Mineral paint. Yuma County, 30 miles northeast from Quartzsite and at Bouse's well.

Mirabilite. Yavapai County, associated with thenardite, glauberite, and halite, Verde Valley.

Molybdenite. Cochise County, in the mines at Johnson, near Cochise. Gila County, in disseminated ores at Miami. Greenlee County, in copper ores of Clifton-Morenci district. Maricopa County, near Cane Creek, associated with tungsten minerals. Mohave County, primary ore of Chloride district in granite gneiss; in Hualpai Mountains, Maynard district, 26 miles east of Yucca in Leviathan and American molybdenum mines (mined), in Aquarius Cliffs. Pima County, in Madera Canyon, 10 miles southwest of Helvetia; in limestone and quartz at Leader and Ridley mines, Helvetia; in workable quantities only at Leader mine; with copper ores at Vail, near Silver Bell, in the Silver Bell district, northwest of Tucson. Pinal County, Shultz, in ores at Ray and Kelvin mines as original mineral. Santa Cruz County, mined in Bonanza mine at Duquesne, and in Santa Nino mine, 2½ miles west of Duquesne; occurs in Line Boy mine and in San Antonio Canyon south of Duquesne; with scheelite 4 miles southwest of Duquesne or 4½ miles southwest of Washington; sparingly in quartz monzonite at Providencia Canyon, 5 miles west of Washington. Yavapai County, in Copper Basin east of Skull Valley, associated with chalcopyrite, near head of Humbug Creek.

Molybdenum. *See* Molybdenite and Wulfenite.

Niter. Coconino County, in Walnut Canyon, 12 miles from Flagstaff.

Obsidian. Occurs in regions of Tertiary volcanic rocks; small quantities cut for jewelry.

Olivine (chrysolite, Job's tears). Apache County, beautiful green, yellowish-green, brownish-green, and brown gems are found 10 miles north of Fort Defiance, in the Navajo Indian Reservation; Coconino County, in some basalts of the San Francisco Mountains near Flagstaff; Gila County, in basaltic rocks near Tolkai, and Rice, in the San Carlos Indian Reservation.

Onyx marble. The most important locality in Arizona is in Yavapai County, near Mayer, in the Bradshaw Mountains, about 26 miles from Prescott; light green to white, weathering producing yellow and red banding, deposit three-quarters by one-half mile in area, maximum thickness 25 feet; decorative stone has been quarried and a little shipped. Occurs also in Maricopa County, at Cave Creek, 45 miles north of Phoenix; Pima County, at Greaterville, Kirkland Valley, and Oak Creek; Yavapai County, at Big Bug Creek.

Opal (cacholong and hyalite). Mohave County, in east slope of the Black Mountains, northwest of Kingman. * Pinal County, Picket Post. Santa

Cruz County, Grosvenor Hills, 2 miles southwest of Santa Cruz. Yavapai County, several localities.

Petrified wood. *See* Wood.

Pitchblende. *See* Uraninite.

Platinum. Maricopa County, in San Domingo placers; in placers along Gila River, associated with gold, opposite the old Riverside stage station. Yavapai County, occurs in black sands near Columbia.

Polybasite. Pinal County, fine specimens were found at Silver King mine; occasionally with other argentiferous ores.

Potash. *See* Alunite and Niter.

Proustite (light ruby silver). Occurs with other argentiferous ores at many places. Santa Cruz County, Tyndall district, Salero mine. Palmetto district, Sonoita mine.

Psilomelane (manganese ore). Cochise County, with pyrolusite and wad in Carboniferous limestone at Tombstone; mined for silver contents. Santa Cruz County, Mowry mine.

Pyrrargyrite (ruby silver). Mohave County, secondary ore of Chloride, Mineral Park, and Cerbat districts; large quantities were found in upper levels of Stockton Hill district; mined at Minnesota-Connor, Golden Star, and Paymaster mines. Yavapai County, in silver ores of Bradshaw Mountains.

Pyrite (iron sulphide). Common and widely distributed, generally in close association with copper sulphides. Cochise County, with copper ore of Bisbee, Copper Queen, Calumet and Arizona, and other mines. Gila and Pinal counties, abundant in unenriched parts of nearly all copper deposits near Globe, Miami, and Ray. Greenlee County, important ore of Clifton-Morenci district; large masses in Joy, Ryerson, Morenci, and other mines. Mohave County, primary ore of Chloride, Mineral Park, and Cerbat districts; mined at Tennessee, Schuylkill, Keystone, Windy Point, Vanderbilt, and Idaho mines; carries gold values. Pima County, important ore in Mammoth mine; also in Helvetia district, in Copper World, Black Horse, Leader, Isle Royal, Omega, Tiptop, and Ridley mines (mostly cupriferous); Empire district, in Copper Camp (cupriferous). Santa Cruz County, in granite at Providencia Canyon, 5 miles west of Washington; Tyndall district, Alto, Joplin, Arizona-Pittsburgh mines (all cupriferous); Wrightson district, American Boy mine; Red Rock district, New York (Jensen) mine; Harshaw district, January and Blue Eagle mines (cupriferous), Invincible prospect; Patagonia district, Morning Glory, Buena Vista, and Four Metals mines (cupriferous); in or near Duquesne-Washington camp, Holland, Empire, Pocahontas, Benton, and Line Boy mines; apparently mostly cupriferous; Nogales district, Dura mine; San Cayetano district, Tubutana mine and Wise prospect. Yavapai County, in ores of Bradshaw Mountains, carries free gold; also with chalcopyrite and sphalerite, mined at United Verde mine, Jerome district, for copper, gold, and silver.

Pyrolusite (black oxide of manganese). Cochise County, at Tombstone, mined for silver content only; formerly used for flux. Greenlee County, in Clifton-Morenci district, mined for flux. Santa Cruz County, Mowry mine. Yavapai County, secondary mineral in ores of Bradshaw Mountains; unimportant; not mined.

Pyromorphite (phosphate of lead). Occasionally found with other lead ores; occurs in Yuma County, at Iber-Plumosa mine, Bouse; reported in Pima

County, at Cerro Colorado mine, and in Santa Cruz County, at Constitution, Hardshell, and Trench mines.

Pyrope. *See* Garnet.

Pyrrhotite (magnetic pyrite). Yavapai County, in ores of Bradshaw Mountains; mined for gold.

Quartz. Cochise County, gold bearing; formerly mined near Douglas at Easter Sunday mine, for use as converter lining. Santa Cruz County, Patagonia district, southwest part Duquesne-Washington camp (large body). Yavapai County, Miller Bros. quarry.

Quartzite. Greenlee County, quarried for converter lining, near Metcalf, Clifton-Morenci district.

Quicksilver. *See* Cinnabar.

Radium. *See* Carnotite and Uraninite.

Rhodochrosite. Santa Cruz County, old French mine near Harshaw.

Rhyolite. Mohave County, near Kingman, in Black Mountains, Tom Reed and Gold Road district, Union Pass, and other places. Pima County, Santa Rita Mountains, 4 miles east of Helvetia, in Old Baldy district. Santa Cruz County, Santa Rita Mountains, in Old Baldy, Tyndall, and Wrightson districts; abundant in Patagonia Mountains a few miles south and southeast of Patagonia.

Road metal. *See* Basalt, Sand and gravel, and Caliche.

Salt. *See* Halite (common salt).

Sand (building). Widespread and abundant; reported dug for building in Cochise County, 18 miles west of Douglas, and in Mohave County, at Yucca. Pima County, in places along Santa Cruz River; Santa Cruz County, along Sonoita Creek and Santa Cruz River.

Sand and gravel. Generally abundant, for instance, in the southeastern part of Pima County, including the region about Tucson, deposits of unsorted Quaternary sand and gravel, suitable for road metal, concrete, and ballast, occupy more than half the area and occur in almost inexhaustible amount on the floors of the valleys and on the piedmont slopes of the Santa Rita and other ranges. In Santa Cruz County deposits occur in similar localities and in abundance.

Sandstone. Excellent quality in great abundance in many places; as red, brown, so-called blue, and white sandstone of good quality, in Grand Canyon region. Cochise County, quarried for flagging and rubble at Douglas. Coconino County, quarried at Flagstaff for building stone. Pima County, sandstone (chiefly Cretaceous), mostly in heavy, reddish beds, apparently suitable for building purposes, is abundant in the eastern part of the county in a broad area extending from Helvetia 15 miles eastward, beyond the Empire Mountains, and in the Whetstone Mountains on the east; in the east base of the Santa Rita Mountains, from Rosemont southward to Casa Blanca Canyon into Santa Cruz County. Santa Cruz County in the northeastern part, underlying the Babocomari Mesa country, as shown by exposures along the railroad from the vicinity of Old Fort Crittenden to a point beyond Elgin; southwest of Mowry, Montana Canyon, and south of Agua Caliente. Yavapai County, quarried for rough building at Kirkland and 2½ miles northwest of Prescott.

Scheelite. Cochise County, small quantity in quartz veins cutting granite about 4 miles north of Dragoon; with wolframite in granite in west slope of Whetstone Mountains, 12 miles west of Benson. Mohave County, 15

miles northeast of Yucca. Pinal County, Oracle; mined for gold and silver content at Maudina mine, Old Hat district, Santa Catalina Mountains. Santa Cruz County, small quantity mined as tungsten ore with wolframite, 3 miles southeast of Calabasas, at Reagan camp; occurs with molybdenite 4 miles southwest of Duquesne.

Serpentine. Cochise County, in Dos Cabezas Mountains. Greenlee County, pure yellow, translucent, west of Morenci; dark green, with magnetite, at Thompson mine.

Shale. Abundant in many parts of the State. Pima County, in northern part of Santa Rita Mountains and in Whetstone Mountains.

Siderite. Pima County, Old Baldy district, Iron Mask mine.

Silver. Large quantities produced generally with different proportions of gold, copper, and lead, at the following places: Cochise County, Tombstone, Herschell, Bunker Hill, Royal Guard, Calumet and Arizona, and Copper Queen mines. Gila County, Old Dominion, Arizona-Commercial, Warrior, Keystone, Globe Consolidated, and other mines. Greenlee County, Detroit, Arizona-Copper, Shannon, Silver King, Gold Bar, Capote, Silver Bonanza, and other mines. Mohave County, Grand Gulch, Bentley district; Gold Road, Tom Reed, and other mines, San Francisco district; Banner, Champion, and Tennessee, Wallapai district. Pima County, Pima and Silver Bell districts; Helvetia district, Henrietta mine; Empire district, Total Wreck mine and Copper camp; Greaterville district, Yuba and Bland mines. Santa Cruz County, Harshaw district, World's Fair (antimonial), Hardshell, Flux, Salero, and many other mines. Yavapai County, Big Bug, Martinez, Tiger, Verde, and Walker districts, in Monte Cristo mine near Constellation. Small quantities of silver are produced in Pinal, Santa Cruz, and Yuma counties. *See also* Argentite, Bromyrite, Brongniardite, Cerargyrite, Dyscrasite, Embolite, Freieslebenite, Polybasite, Pyrargyrite, and Stromeayerite.

Silver (native). Native silver in beautiful specimens has been found in Gila County in a placer 12 miles north of Globe; in Pinal County, at Silver King mine; in Yavapai County, at McMillanville, at the Tiger mine; and in other counties.

Slate. Maricopa County, fair grade of roofing slate, bluish gray, 6½ miles north of Phoenix; undeveloped.

Smithsonite (zinc carbonate). Greenlee County, in Shannon Mountain, Clifton-Morenci district. Pima County, Empire district, Jerome No. 2 mine. Santa Cruz County, Patagonia district, Holland mine; unimportant.

Specularite. *See* Hematite.

Sphalerite (zinc blende). Cochise County, Tombstone district. Greenlee County, accompanies copper ores in Clifton-Morenci district. Mohave County, occurs in Chloride district, Tennessee and Towne mines; Mineral Park district, Keystone mine; Cerbat district, Golconda (mined), Tub, Champion (mined), Vanderbilt, and Flores mines; Stockton Hill and Union Pass districts. Pima County, occurs with silver ores at Mammoth and many other mines and with copper ores at Ridley and other mines; occurs at the San Xavier or Twin Buttes district; Greaterville district, Enzenburg and St. Louis mines. Pinal County, Globe district, Bobtail mine, on north side of Mineral Creek. Santa Cruz County, occurs at many mines, including the Montana mine in the Oro Blanco district; Tyndall district, Shehey-O'Donnell mine, mined and shipped; Harshaw district, January, Flux, and American mines; Patagonia district, Morning

Glory mine, mined and shipped; Duquesne-Washington camp, Pride of the West, Bonanza, Holland, Belmont, and New York mines. Yavapai County, common in Bradshaw Mountains district; carries free gold at Crown King and other mines, and gold and silver at United Verde mine, Jerome district; has been produced by the Copper King mines in the Tiger district.

Stephanite. Santa Cruz County, Golden Rose mine.

Stibnite (sulphide of antimony). Mohave County, in Cerbat district, at Vanderbilt mine. Yavapai County, common in silver veins; in ores of Bradshaw Mountains carries free gold. Turkey Creek district, commercial deposit with 2-foot pay streak.

Stromeyerite. Pinal County, Silver King mine, with other cupriferous and argentiferous ores.

Strontium. *See* Celestite.

Tantalum. *See* Wolframite.

Tennantite. Santa Cruz County, Tyndall district, Toluachi mine.

Tenorite. Cochise County, unimportant copper ore; occurs in Lowell and Copper Queen mines, Bisbee, and elsewhere. Pima County, Helvetia district, Bulldozer mine. Santa Cruz County, Tyndall district, Alto mine; Harshaw district, Sunnyside and Blue Eagle mines.

Tetradymite (telluride of bismuth). Yavapai County, small quantity in Montgomery mine, at Minnehaha, and near Bradshaw City.

Tetrahedrite (gray copper). Pima County, Helvetia district, Silver Spur (old Frijole) mine; Greaterville district, Summit mine. Santa Cruz County, Tyndall district, Treasure Vault, Shehey-O'Donnell, Rhode Island, Alto, Wandering Jew, Toluachi group, and Eureka mines; Wrightson district, Blackcap, American Boy, Augusta, and Happy Jack mines; Harshaw district, World's Fair mine; Patagonia district, Endless Chain mine; San Cayetano district, Tubutana mine. Pinal County, Heintzelman and Silver King mines. Yavapai County, in ores of Bradshaw Mountains district; also in copper-silver veins.

Thenardite (verde salt). Yavapai County, Verde Valley, 3 miles southwest of Old Camp Verde, occurs in large beds with rock salt, glauberite, and mirabilite.

Tourmaline. Pinal County, in the Catalina Mountains near Oracle in granite. Gem material has not been found.

Travertine. Mohave County, abundant at the mouth of the Grand Canyon; also a few miles west of that locality there are extensive deposits, thought to be travertine, which cap Greggs Breccia and are in places 200 feet in thickness.

Tuff. Mohave County, at Kingman, fine grade. Pima County, near Tucson, used extensively for building. Santa Cruz County, at Nogales, used extensively for building, in lower east slope of San Cayetano Mountains, 5 miles north of Calabasas; in Grosvenor Hills 7 miles west of Patagonia may be quarried in thin slabs, suitable for building and paving, also at Harshaw used for building. Yavapai County, near Skull Valley and near Wickenburg; was used in building the State capitol at Phoenix.

Tungsten minerals. *See* Cuproscheelite, Cuprotungstite, Ferberite, Hübnerite, Scheelite, and Wolframite.

Turquoise. Cochise County, has been mined near Courtland, at Turquoise Mountain. Maricopa County, occurs 12 miles east of Morristown, reported. Mohave County, several mines worked near Mineral Park yield large quantities of gem material. Pinal County, 2 miles south of Kelvin, east side of Verde River, about 2 miles from Maricopa County line. Yavapai County, reported.

Uraninite. Santa Cruz County, Wrightson district, Happy Jack mine (reported).

Vanadinite. Occurs at numerous places associated with lead ore. Cochise County, near Fairbanks; Gila County, Globe district, at Lockwood claim, Clark & Stewart claims near Old Dominion mine; Mohave County, in the Eldorado and neighboring mines of the Gold Basin district; Pima County, Old Yuma mine, 14 miles northwest of Tucson; Pinal County, Mammoth mine at Shultz, Royal Dane claim, 7 miles southwest of Oracle, Black Prince mine, Pioneer district, and at Kelvin; Santa Cruz County, Mowry mine at Mowry; Yavapai County, near Silver Belt mine, Big Bug district; Yuma County, Red Cloud mine.

Vanadium ores. See Descloizite, Vanadinite, and Volborthite.

Verde salt. See Thenardite.

Volborthite (vanadate of copper). Occasionally found in other copper and lead ores.

Volcanic ash. See Tuff.

Wad (manganese ore). Cochise County, occurs at Tombstone; mined for silver content only.

Willemite (silicate of zinc). Greenlee County, small grayish crystals in Modoc open cut on Modoc Mountain, Clifton-Morenci district.

Wolframite (tungstate of iron and manganese). Cochise County, Dragoon Mountains, contain extensively worked deposits near Dragoon Summits; Whetstone Mountains, 12 miles south of Benson; Paradise. Gila County, Globe. Maricopa County, at Cave Creek, 30 miles north of Phoenix. Mohave County, 40 miles southeast of Kingman and 35 miles east of Yucca in Aquarius Cliffs. Pima County, with gold and quartz in Arivaca district. Pinal County, Powers Gulch, 18 miles west of Globe; mined. Santa Cruz County, 7 miles north of Nogales, at Reagan camp. Yavapai County, Tiptop district, Bradshaw Mountains, mined at Arex, in Eureka district, 45 miles west of Prescott, and at Canyon, Goodwin, and Hillside; in Humbug district, 38 miles north of Peoria, the material contains 1 per cent tantalum; occurs also at Hot Springs, 28 miles north of Peoria.

Wood, petrified. In eastern part of State, in Apache and Navajo counties, 6 miles south of Adamana and 12 miles southeast of Holbrook, on the Atchison, Topeka & Santa Fe Railway, is the Petrified Forest National Monument, including Chalcedony Park, where many square miles are in part covered and underlain with petrified logs, tree trunks, branches, and bright-colored fragments. Another notable area, the North Forest, lies 8 miles northwest of Adamana, in Navajo County. The finest specimens are found in the Holbrook-Adamana region, occurring in the Triassic "Red Beds." In Mohave and Yuma counties petrified wood is reported to be abundant in the Grand Canyon and the country extending southward along Colorado River to Yuma, but here it probably occurs chiefly as a constituent of alluvium transported by the river.

Wulfenite (molybdate of lead). Occasionally found with other lead ores. Cochise County, nearly always present with silver ores of Tombstone in small quantity. Coconino County, in canyon of Oak Creek, 25 miles south of Flagstaff. Occurs also in Gila County, at Troy. Maricopa County, in Phoenix mine above Cave Creek, and in Big Horn Mountains. Pima County, Old Yuma mine, 14 miles northwest of Tucson; Empire district, Total Wreck and Verde Queen mines. Pinal County, mined at Mammoth mine, Shultz; also on the Orizaba and other claims, 30 miles south of Casa Grande, associated with minor amounts of vanadinite. Santa Cruz County, 4 miles northeast of Patagonia. Yavapai County, Bradshaw Mountains, near Briggs and near Columbia. Yuma County, at Castle Dome.

Yttrium. *See* Gadolinite.

Zinc. Principal production of zinc in State is in Mohave County at Golconda and Tennessee mines; small quantities in Santa Cruz County in Patagonia and Tyndall districts. *See also* Smithsonite, Sphalerite, and Willemite.

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ARKANSAS.

Agate. Montgomery County, finely variegated; has been mined.

Aluminum. *See* Bauxite.

Antimony ore. *See* Stibnite.

Asphalt. Madison County. Pike County, in the Trinity sand, $2\frac{1}{2}$ miles southeast of Pike; has been used to a small extent. Polk County, as veins or fissure filling near west end of Fourche Mountain, north of Mena. Sevier County, east of De Queen (in the Trinity sand).

Azurite (blue carbonate of copper). Montgomery County, near Silver. Polk County, at Copper Queen and Silver World mines. Searcy County, copper mines at Tomahawk; not worked as ore. Sevier County, at antimony and silver mines.

Barite (heavy spar). Garland, Montgomery, Pike, Polk, Pulaski, Saline, and Sevier counties, in seams or pockets.

Bauxite. Pulaski and Saline counties, the principal producing area of the United States from 1904 to 1914, inclusive. The major part of the production comes from what is known as the Bauxite district, sometimes called the Bryant district, lying about 18 miles southwest of the city of Little Rock and covering an area of about 12 square miles in Bryant Township near Benton, in Saline County. The second and less important district is known as the Fourche Mountain district, lying immediately south of the city limits of Little Rock in Pulaski County and embracing an area somewhat larger than the Bauxite district. The two areas are about 14 miles apart.

Braunite (manganese ore). Independence, Izard, and Sharp counties, mined with psilomelane in Batesville district.

Brookite. Hot Springs County, abundant as good museum specimens in several places at Magnet Cove, with quartz.

Brown iron ore. *See* Limonite.

Cadmium. *See* Greenockite.

Calamine (zinc silicate). Boone County, in Almy mine. Lawrence County, in Bath and Koch mines. Marion County, in zinc mines of Sugar Orchard region and elsewhere; has been mined.

Celestite (strontium sulphate). Howard, Pike, and Sevier counties, as thin layer in Lower Cretaceous limestone (Trinity formation). In Pike County, at White.

Cement material (Portland). Limestone suitable for Portland cement occurs in many counties in northwestern part of the State. Little River County, large cement plant at White Cliffs, idle since 1903.

Cerussite (lead carbonate). Howard, Montgomery, Newton, and other counties, with galena and coating it in mines in northern Arkansas.

Chalcopyrite. Sevier County, in Davis mine 5 miles west of Gillham, and in other mines and prospects in western Arkansas.

Chalk. The Annona chalk of the Upper Cretaceous outcrops over a strip about half a mile wide, extending northeast and southwest from White Cliffs, Sevier County, through Howard, Hempstead, Nevada, and Clark counties, almost to Okolona. Formerly used in manufacture of Portland cement at White Cliffs.

Chert. Large deposits (Bigfork chert) in Saline, Pulaski, Garland, Montgomery, and Polk counties; mined for road building at Hot Springs, Garland County. Cherts belonging to the Mississippian series of the Carboniferous system and to the Ordovician system of rocks are widely distributed in all the counties north of the Boston Mountains.

Clay (ball or paper). Pike County.

Clay (brick). Arkansas County, common brick, made from red surface clay at Stuttgart. Ashley County, alluvial buckshot clay used for common brick at Hamburg. Benton County, pits in residual red clay used for common brick, at Bentonville, Rogers, and Siloam Springs. Boone County, at Harrison. Bradley County, at Warren. Carroll County, common brick made from residual clays at Berryville and Green Forest. Clark County, common brick made from alluvial clay at Arkadelphia and Gurdon; common brick, fire brick, and drintile from Tertiary clay at Whelen Springs. Clay County, common brick made from red clay on Crowleys Ridge, at Rector, Piggott, and Pratt. Cleburne County, alluvial clay used for common brick at Heber Springs. Cleveland County, pressed brick made at Kingsland. Columbia County, surface clays used for common brick at Magnolia and Waldo. Craighead County, common and pressed brick made from clays on Crowleys Ridge at Jonesboro. Cross County, loess and surface clay on Crowleys Ridge used near Wynne. Drew County, alluvial and leached buckshot clays used near Monticello for common brick. Faulkner County, buckshot clays used at Conway. Garland County, alluvial and residual clays, and Carboniferous shales used for common red brick at Hot Springs. Greene County, pressed and common brick made from reworked loess at Paragould and from loess at Gainesville. Hempstead County, surface clay used at Hope, Doyle, and Spring Hill. Hot Spring County, alluvial clay used for common and pressed brick at Malvern; white plastic for white front and paving at Malvern. Howard County, common brick clay, at Nashville. Independence County, red surface clay used for common brick, at Batesville. Jefferson County, alluvial and surface clays used at Pine Bluff and Redfield. Lawrence County, surface clay used for common brick at Walnut Ridge; yellow or reddish clay, at Black Rock; residual clay, at Imboden. Lee County, red brick from loess of Crowleys Ridge, at Marianna. Lincoln County, yellow surface clay used for common brick, at Palmyra. Lonoke County, at Lonoke and Cabot, red surface clays used for common brick. Miller County, Tertiary clays used at Texarkana for pressed and common brick. Mississippi County, yellow alluvial clay used for common brick and drintile at Blytheville. Monroe County, at Brinkley. Nevada County, at Emmet and Prescott, common brick and building tile. Phillips County, common brick made from mixture of surface clay and loess at Helena. Poinsett County, reworked or eroded loess used at Harrisburg for common brick and drintile. Polk County, common brick made from residual clay at Mena. Pope County, residual clay and shale used at Atkins. Prairie County, red surface clay used at Devall Bluff. Pulaski County, surface clay used for common brick at Little Rock. Randolph County, at Pocahontas, common and front brick. St. Francis County, brick clay and yellow loess on and near Crowleys Ridge, burns uniform red; used at Forrest City. Saline County, surface clays used at Benton. Searcy County, residual clays used for common brick at Marshall and Leslie. Sebastian County, Carboniferous shales used at Fort Smith and Mansfield for common and paving brick; alluvial clay near Fort Smith, burns bright red, soft brick, re-pressed for front brick, uniform good color. Sevier County, surface clay used for common brick near Delmar. Union County, red surface clay used at Felsenthal. Washington County, at Prairie Grove, common brick and drintile. White County, argillaceous shales of Round Mountain suitable for sewer pipe and pav-

ing brick; surface clay mined at Beebe, Searcy, and Judsonia for common brick. Woodruff County, surface clay used at Cotton Plant, common brick and drintile, made from buckshot clay at New Augusta. Yell County, alluvial and surface clay, mined at Dardanelle.

Clay (fire). Clark County, fire brick made from Tertiary clay at Whelen Springs. Crawford County, disintegrated Carboniferous shales in vicinity of Van Buren; makes good yellow ware; used to line kilns at Fayetteville. Hot Spring County, fire brick made at Malvern and Perla, from Tertiary clays. Ouachita County, at or near Lester, in September, 1914, the Camden Coal & Clay Co. began mining a high-grade clay which burns gray to reddish brown. The clay is used in place of imported German pottery clay for crucibles, tank blocks, and the like refractory vessels for glass works. Saline County, Tertiary clays used for fire brick at Benton. Occurs also in Conway, Dallas, Franklin, Garland, Hempstead, Johnson, Logan, Pike, Sebastian, White, and other counties.

Clay (kaolin). Dallas County, white kaolin of fair refractoriness outcrops in the Tertiary strata in the SE. $\frac{1}{4}$ sec. 10, T. 7 S., R. 17 W., and on Little Cypress Creek. Garland and Hot Spring counties. Lawrence County, at Black Rock and Annieville. Ouachita County, in large quantity, in Tertiary strata on Sandy Branch. Pike County, beds of variable color in the Upper Cretaceous (Bingen sand) outcrop at several places on Saline, Vaughn, and Clear creeks, near Delight. Pulaski County, white pisolitic kaolin in places in Fourche Mountain region; burns white and glazes well. Saline County, nearly white kaolin, residual from nephelite syenite, at Bauxite.

Clay (pottery). Ashley County, Tertiary clays suitable for common pottery near Hamburg. Bradley County, Tertiary clays at Banks, Alga Bluff, Crawfords Bluff; clay at Johnsonville formerly used. Calhoun County, supply on Champagnolle Creek, Moro Creek, and large streams. Clark County, Tertiary clays on Copeland Ridge and at Barringer mine near Whelen Springs. Clay County, Tertiary clays on Crowleys Ridge near Piggott and Greenway. Cleveland County, near New Edinburg, Mount Elba, and other places. Columbia County, near Mount Holly and Magnolia. In Conway and Crawford counties. Dallas County, Tertiary clays, abundant and of excellent quality along streams. In Drew County. Faulkner County, buckshot clays abundant over flood plains of streams. Franklin County, strong dark-red earthenware residual clays abundant. Garland County, residual clays from Paleozoic shales at Hot Springs and on Cedar Mountain, formerly used for pottery. In Grant County. Greene County, Tertiary clays on Crowleys Ridge at Gainesville, formerly used. Hempstead County, Tertiary clays used for jug ware, etc., at Spring Hill. Hot Spring County, at Perla switch, near Malvern, burns light-cream common pottery. Independence County, residual clays from Moorefield shale and Boone limestone near Sulphur Rock and Newark, formerly used. Jefferson County, White Bluff on Arkansas River. Johnson County, soft shale sagger clay in Felker mine, Coal Hill. Lafayette County, leached pottery clays along Red River. Logan County, Pennsylvanian clay abundant. Miller County, Tertiary clays used at Texarkana for jugs, churns, and jars; burns solid cream color. Montgomery County, alluvial clay along Ouachita River used for stoneware near Story. In Nevada County. Ouachita County, abundant along Ouachita Valley. Pulaski County, red and yellow surface clay used in Little Rock district for making flowerpots. Saline County, Tertiary clays used for jugs,

crocks, jars, art pottery, and other clay ware at potteries near Benton; burns solid cream color. Sebastian County, red and blue, has been mined in NE. $\frac{1}{4}$ sec. 20, T. 10 N., R. 26 W.; abundant at Fort Smith and elsewhere; light yellowish surface clay used at Comby's pottery. Union County, abundant. Yell County, Carboniferous shale formerly used in SE. $\frac{1}{4}$ sec. 12, T. 6 N., R. 21 W.

Coal. Arkansas coal ranges from bituminous to semianthracite; the coal-bearing rocks belong to Pennsylvanian series of the Carboniferous; three beds worked, Hartshorne, Charleston, and Paris; Hartshorne most important. Crawford County, Charleston coal, 9 to 18 inches on north side of river near Alma, semibituminous, mined; also mined on small scale about Charleston. Franklin County, Paris coal mined at Potato Hill; west of Potato Hill worked for local supply. Franklin and Johnson counties, Coal Hill, Denning district, Hartshorne coal, 1 to 5 feet thick, mined from Coal Hill to Denning, semibituminous. Johnson County, Spadra district, Hartshorne coal, 3 feet thick, mined near Spadra, anthracite; Philpot district, Charleston coal, 18 to 22 inches thick, mined at Ozark, semibituminous. Logan County, Paris seam, 2 to 3 feet thick, mined in vicinity of Paris, semibituminous. Pope County, Russellville district, Hartshorne coal, 40 to 46 inches thick in Shinn Basin, mined, semianthracite. Scott County, Hartshorne coal, 4 feet thick in Bates-Coal Dale district, mined near Bates. Sebastian County, Bonanza-Jenny Lind district, Hartshorne coal 3 to 6 feet thick; Greenwood-Huntington district, 2 to 6 feet thick. Charleston bed outcrops between Charleston and Fort Smith, mined near Central, 20 inches thick. Washington County, 14-inch bed in Morrow group (Pennsylvanian), mined at Baldwin. Yell County, Atoka coal $1\frac{1}{2}$ to 3 feet thick in vicinity of Dardanelle; has been mined. *See also Lignite.*

Copper ore. *See* Azurite, Chalcopyrite, and Malachite.

Diamond. Pike County, four peridotite masses near Murfreesboro; white, brown, and yellow stones; more than 2,000 have been found.

Dolomite. *See* Limestone.

Fluorspar. Garland County, at mouth of Gulpa Creek, near Lawrence, not mined.

Freibergite. Pulaski County, at Kellogg and McRae mines; Montgomery County, in Silver City region. Also occurs in Sevier County, not mined.

Fuller's earth. Area of about 3 square miles between Hot Springs and Benton; 2,563 tons produced in 1910. Only two plants operating in 1911—at Fairplay and Klondike—and only one in 1915, that of John Olsen at Klondike.

Galena. Has been mined in limited quantities in northern Arkansas fields, in Baxter, Benton, Carroll, Boone, Marion, Newton, Washington, and other counties. In western Arkansas it has been found sparingly and mined occasionally in Garland County, near Blakely Creek; Hot Spring County, at Point Cedar; Montgomery County, at Rubicon mine, near Virginia City, and at Minnesota, Montezuma, Walnut, and Waterloo mines; Pulaski County, Kellogg and McRae mines; Sevier County, at Bellah mine in Gulch shaft, New Discovery shaft, near Conboy, and elsewhere.

Gas. *See* Natural gas.

Gravel (road metal). Along Crowleys Ridge, in Clay, Greene, Craighead, Poinsett, Cross, and St. Francis counties. On and near the border of the highlands in Randolph, Lawrence, Independence, Jackson, White, Pulaski, Saline, Hot Spring, and Clark counties; and in Bradley, Cal-

houn, Dallas, Drew, Howard, Jefferson, Lafayette, Pike, and Sevier counties. These gravels consist almost entirely of chert, quartz, and novaculite pebbles, and range in age from Lower Cretaceous to Quaternary.

Greenockite. Marion and other counties; occurs with sphalerite.

Gypsum. Pike County, was mined at Tokio; extensive beds from 15 inches to 15 feet in thickness occur in the bank of Little Missouri River, T. 8 S., R. 25 W., and westward into Howard County.

Hydrozincite (zinc carbonate). In zinc and lead regions, Baxter, Lawrence, Marion, and Searcy counties.

Iron. See Limonite, Magnetite, and Pyrite.

Kaolin. See Clay.

Lead. See Cerusite and Galena.

Lignite. Beds, possibly of workable thickness, underlie parts of several counties south and southwest of Little Rock; workable beds near Camden, Ouachita County.

Limestone (building). Benton County, quarried at Monte Ne and Gravette; Boone County, at Alpena and Keener. Carroll County, limestone quarried at Eureka Springs. dolomite at Beaver. Independence County, oolitic limestone, ornamental, has been quarried at Batesville. Izard County, quarried at Guion. Lawrence County, quarried at Imboden, for building and crushed stone. Sharp County, at Williford. Washington County, at Johnson.

Limestone (hydraulic). Occurs in Saline County and many counties in northern part of State; not used.

Limestone (lime). Benton County, quarried and burned near Rogers, Anoca, Garfield, and Sulphur Springs. Independence County, at Batesville; oolitic limestone quarried at Pfeiffer, near Batesville. Izard County, at Guion and East Sylamore. Montgomery County, Cedar Glades. Stone County, east of Sylamore. Washington County, Farmington, Johnson, Elm Springs, Viney Grove, and elsewhere.

Limonite. Small quantity in nearly every county; has been mined near Berryville, Carroll County, and in Lawrence and Sharp counties.

Magnetite (magnetic iron ore). Hot Spring County, in loose fragments at Magnet Cove; not mined.

Malachite. Garland County, at Hot Springs, ledge several feet in thickness in stream bed on Cedar Street.

Manganese ore. See Braunitz, Psilomelane, Pyrolusite, and Wad.

Marble. The marble region includes Benton, Boone, Carroll, Marion, and parts of Baxter, Independence, Izard, Madison, Newton, Searcy, Stone, and Washington counties. The marbles and limestones belong to the Mississippian and Pennsylvanian series of the Carboniferous system and to the Ordovician and Silurian systems of rocks.

Marble (black). Fine black, suitable for ornamental work, at Jamestown, in southern part of Independence County, reported shipped; Marshall, Searcy County.

Marble (gray). Gray (Boone limestone), finest quality in Boone, Marion, Newton, and Searcy counties; coarsely crystalline; good polish.

Marble (onyx). Onyx marble in numerous caves and in limestone in northern Arkansas.

Marble (oolitic). Independence County, oolitic marble quarried near Batesville, for monuments.

- Marble** (St. Clair). Light gray to chocolate-brown, highly crystalline, 2 to 4 feet thick in irregular belt running across central part of northern Arkansas in east and west direction from Hickory Valley, Independence County, to Mount Hersey, Newton County; valuable building stone.
- Marble** (St. Joe). Widely distributed north of Boston Mountains. Length of marble outcrop in State is about 3,500 miles. Light pink to dark chocolate, spotted white, gray, or pea-green, varies in texture; in Buffalo River and Crooked Creek basins in Baxter, Benton, Boone, Carroll, Madison, Marion, Newton, Searcy, and Stone counties; Searcy County, small quarry worked for marble and lime at St. Joe.
- Marl**. Calcareous and shell marls in Clark, Greene, Hempstead, Howard, Jefferson, Lonoke, Pike, Howard, and St. Francis counties; gypseous marls in Greene and Pike counties; have been mined.
- Mica** (biotite). Garland County, at Potash, Sulphur Springs; not mined. Hot Spring County, Magnet Cove.
- Mineral paint**. *See* Ocher and Reddle.
- Natural gas**. In 1911 there were 110 productive wells in the State, all near Fort Smith. At the close of 1914 there were 99 productive wells, all near Fort Smith and Mansfield, in Sebastian County. Also found at Ozark, in Franklin County.
- Niter** (saltpeter). Occurs in niter earth of limestone caves of northern Arkansas, Marion and Newton counties; not mined.
- Novaculite**. White novaculite (the Arkansas novaculite) forms ridges in Hot Spring, Garland, Howard, Montgomery, Pike, Polk, Pulaski, and Saline counties. Garland County, quarried on North Mountain, Indian Mountain, and near Summit for whetstones and on North or Quarry Mountain for concrete. Commercially known as Arkansas stone and Washita stone. Formerly used by the Indians for stone implements. Hot Spring County, quarried at Butterfield for concrete.
- Ocher**. Clay County, irregular beds of yellow ocher in Tertiary, near Piggott; has been mined. *See also* Reddle.
- Octahedrite**. Hot Spring County, sparingly with brookite and rutile at Magnet Cove.
- Oilstone**. *See* Novaculite.
- Onyx marble**. In numerous caves and in limestone in northern counties.
- Pearls**. Lawrence, Prairie, and other counties. Quite extensively produced from the fresh-water mollusks of White River and its tributary, Black River.
- Phosphate rock**. Independence County, mined at Anderson and on Lafferty Creek, about 12 miles northwest of Batesville; occurs near Hickory Valley, 12 miles north of Batesville. Searcy County, Garvin tract, near St. Joe.
- Psilomelane** (manganese ore, with pyrolusite). In the manganese mines of Batesville district, Independence, Sharp, and Izard counties. Occurs with pyrolusite in novaculite in belt extending from Pulaski County, through Saline, Garland, Hot Spring, Pike, Montgomery, and Polk counties.
- Pyrite**. Hot Spring County, 2 miles west of Hot Springs, on south slope of West Mountain, probably suitable for sulphuric acid.
- Pyrolusite** (manganese ore). Important ore of manganese; in small quantities with psilomelane in Pulaski, Saline, Garland, Hot Spring, Pike, Montgomery, Polk counties; has been mined. Now mined near Little Rock, Pulaski County, and at Cushman, Independence County.

Quartz. Garland County, clear crystals in Blakely Mountains and many other localities. Hot Spring County, clear crystals at many localities; used for ornaments and lenses; smoky quartz in small quantities about Magnet Cove, used for jewelry. Madison County, clear limpid quality at Delaney. Montgomery County, crystals have been mined from Crystal Mountain sandstone (Ordovician) in the Crystal Mountains near Womble and Crystal Springs, used for ornaments and lenses; most of the crystals from Arkansas are from this county.

Rectorite. Garland County, deposits about a foot thick in association with Ordovician sandstones in sec. 27, T. 2 N., R. 19 W.

Reddle (red chalk). Abundant in many localities; probably useful in paint manufacture; not mined.

Road metal. *See* Chert, Gravel, Limestone, Marble, Novaculite, Sandstone, and Syenite.

Rutile. Hot Spring County, abundant in several places about Magnet Cove, commonly with brookite; not mined; good museum specimens. *See* Octahedrite.

Sand (building). Dug at many places: Boone County, Harrison; Clark County, Arkadelphia; Greene County, Paragould; Izard County, Guion; Jefferson County, Pine Bluff; Pulaski County, Little Rock; Saline County, Benton; Sebastian County, Fort Smith.

Sand (glass). Dug in Izard County, at Guion; Jefferson County, in small quantity at Pine Bluff; St. Peter sandstone along valley of White River from Batesville nearly to Fayetteville, probably will make excellent glass sand.

Sand (molding). Johnson County, brown sandy loam suitable for molding sand in vicinity of Coal Hill; Pulaski County, dug at Little Rock.

Sandstone (asphaltic). Polk County, on land of E. E. Follensbee.

Sandstone (building and crushed stone). Widely distributed in the Ouachita and Boston mountains, and in Arkansas Valley. Quarries are located at the following places: Benton County, Siloam Springs; Boone County, Alpena Pass; Carroll County, Carrollton; Cleburne County, Heber Springs; Conway County, Morrillton; Franklin County, Ozark; Garland County, Hot Springs; Independence County, Batesville; Izard County, Guion; Johnson County, Clarksville and Lomar; Perry County, Fourche (Bigelow) and Kenny; Polk County, Eagleton, near Mena; Pope County, Atkins; Pulaski County, Little Rock; Searcy County, Leslie; Sebastian County, Fort Smith and Greenwood; Washington County, Springdale and Fayetteville; White County, Bald Knob, Searcy, and Russell; Yell County, Dardanelle.

Silver. Garland County, with pyrite, fluorite, and chalcedony near Lawrence; Pulaski County, in galena, chalcopryite, and sphalerite, in Kellogg and McRae mines. Montgomery County, with lead ores near Silver. Sevier County, with lead ores in Otto mine, Antimony Bluff shaft and Stewart lode and mine near Antimony, May mine. Hot Spring County, with lead, zinc, and copper ores at Point Cedar. *See also* Freibergite.

Slate. Gray, black, green, and red slates along uplift west of Little Rock; slate area includes parts of Saline, Garland, Montgomery, and Polk counties. Garland County, worked in small way at several points near Hot Springs; not shipped at present. Montgomery County, dark red quarried for switchboards at Slatington. Polk County, several quarries; Missouri Mountain slate, red and green, suitable for laundry tubs, wainscoting, switchboards, extensively prospected near Board Camp Creek; slate,

blue to black, in Stanley shale, extensively prospected in southeastern part of county.

Smithsonite (zinc carbonate). Most valuable and next to sphalerite most abundant ore of zinc in Arkansas; "turkey fat," a cadmiferous variety of smithsonite, mined in small quantity.

Soapstone. *See* Talc.

Sphalerite (zinc blende). Most important and abundant zinc mineral in northern Arkansas. In mines in Boone, Newton, Marion, Baxter, Searcy, Sharp, Lawrence, Pulaski, Sevier, Saline, Montgomery, and Washington counties. Lawrence County, with calamine and smithsonite in Bath and Koch mines. Marion County, in limestone at Wood's mine. Pulaski County, Kellogg mines.

Stibnite (antimony sulphide). Sevier County, in Stewart mine, May mine, Convoy shaft, Gulch shaft, Antimony Bluff shaft, and Otto mine; was mined for silver in Bob Wolf mine; also found in Pike County.

Strontium. *See* Celestite.

Sunstone. Hot Spring County, pink or gray; occasionally found in Magnet Cove; cut for ornaments.

Syenite. Garland County, nephelite syenite at Potash Sulphur Springs. Pulaski County, nephelite syenite ("gray granite") outcrops over an area about a mile square and pulaskite ("blue granite") over an area of about 5 square miles in the Fourche Mountain region south of Little Rock. Nephelite syenite is quarried at west base of Allis Mountain, and pulaskite has been quarried on north slope of Fourche Mountain. Hot Spring County, elæolite syenite quarried at Diamond Jo quarry in Magnet Cove region; suitable for ornamental interior use. Saline County, occurs in large masses, light gray, pinkish, or buff; quarried.

Talc (soapstone). Pulaski County, at Wallis's soapstone quarry. Saline County, has been quarried between Little Rock and Hot Springs; no production in 1915.

Titanium. *See* Brookite, Octahedrite, and Rutile.

Tripoli (polishing powder). The porous siliceous residue resulting from decay of siliceous limestone occurs in zinc region. Montgomery County, T. 4 S., R. 26 W., reported good quality. Marion County, reported abundant at Lees Mountain; not used. Occurs as decomposed novaculite in Hot Spring, Garland, Howard, Montgomery, Pike, and Polk counties.

Variscite. Montgomery County, translucent and transparent, emerald to bluish green; not mined.

Vesuvianite. Hot Spring County, yellowish-green to olive-green crystals in Magnet Cove; not mined.

Wad (bog manganese). Izard County, north fork of White River. Marion County, about Dodd City; unimportant. Common but of no particular value in northern Arkansas.

Wavellite. Garland County, near Hot Springs. Hot Spring County, associated with the upper novaculite beds at Magnet Cove. Montgomery County, in Silver City region and neighboring districts.

Whetstone. *See* Novaculite.

Zinc. In plateau portion of Ozark uplift, including parts of Baxter, Boone, Lawrence, Marion, Newton, Searcy, Sharp, and Washington counties; in western Arkansas, including parts of Pulaski, Montgomery, and Sevier counties; mines scattered; deposits chiefly in Ordovician rocks. *See also* Calamine, Hydrozincite, Smithsonite, and Sphalerite.

CALIFORNIA.

- Agalmatolite** (pyrophyllite). San Diego County, near Encinitas.
- Agate** (moss). San Bernardino County, jaspery agate in San Bernardino Mountains; not mined.
- Alabaster**. Riverside County, in Palen Mountains. San Luis Obispo County, at Arroyo Grande. Santa Barbara County, has been mined at Point Sal; occurs in eastern part of county. *See* Gypsum.
- Altaite**. Calaveras County, with hessite and petzite at the Stanislaus mine, Nevada City, in bunches in the Ural vein, intergrown with native gold and associated with quartz pyrite and galena. Tuolumne County, occurred at the Golden Rule mine, near Tuttletown; also at Sawmill Flat.
- Aluminum**. *See* Bauxite and Halloysite.
- Alum salts**. *See* Kalinite.
- Alunite**. Mariposa County, Tres Cerritos Buttes, southwest of Indian Gulch.
- Alunogen**. Alameda County, Alma mine, Leona. Nevada County, Providence mine, Nevada City. San Luis Obispo County, near Paso Robles.
- Amalgam**. Mariposa County, gold amalgam; quoted by Dana.
- Amblygonite**. San Diego County, was mined at Stewart mine, near Pala.
- Amethyst**. Amador County, Volcano and Oleta and vicinity; Mono County, Bodie district.
- Anglesite**. Inyo County, found in oxidized zone of Cerro Gordo mines and at the Modoc mine. Mono County, Benton mine, with galena.
- Anhydrite**. Inyo County, at the Ygnacio and Cerro Gordo mines. Mono County, at the Mammoth mine, Mineral Hill, associated with barite. Orange County, in the Santa Ana Mountains, near Anaheim. Riverside County, Palen Mountains. San Bernardino County, at Searles Lake. Shasta County, Rising Star mine.
- Antimony**. Kern County, has been mined in San Emigdio Canyon, and near Havilah. Riverside County, occurs near Corona. Is obtained in anti-monial lead as a by-product in smelting gold-lead-silver ores of the State. *See also* Bournonite, Jamesonite, Stibiconite, and Stibnite.
- Apatite** (asparagus stone). Contra Costa County, found in brown masses in the schists north of Berkeley. San Bernardino County, east end of Kingston Range. San Diego County, Dos Cabezas mine, near Jacumba, not mined; in the gneiss at Dehesa, with dumortierite; tabular crystals of violet and pink colors occur at the old Mack mine near Rincon; at Victor mine, Rincon, pale dirty-green crystals occur; crystals are found on South Mountain and at Mesa Grande.
- Apophyllite** (fish-eye stone). Plumas County, white to gray at Buckeye mine near Orion Valley. San Francisco County, found rarely at Fort Point. San Mateo County, near La Honda. Santa Clara County, at New Almaden quicksilver mines, in large crystals associated with gyrolite and bituminous matter.
- Aquamarine**. *See* Beryl.
- Argentite**. The primary silver mineral in many of the silver districts, generally associated with other silver minerals. Alpine County, Silver Mountain district; small octahedral crystals have come from the Advance mine. Inyo County, common in some mines, especially at Cerro Gordo; massive and crystalline specimens have been found in the Oriental mine; Deep Spring mine. Kern County, crystals associated with native silver in the Silver King mine near Garlock; with tetrahedrite and pyrargyrite at the Amalie mine. Los Angeles County, Kelsey mine; San Gabriel Canyon,

associated with native silver, erythrite, smaltite, and annabergite; at Silverado with argentiferous galena. Mono County, sparingly in Bodie and Benton districts, with gold, tetrahedrite, sphalerite, chalcopyrite, and galena; in Sweetwater Range, north of Bridgeport, the mines contained argentite, with gold, cerargyrite, tetrahedrite, and native silver. Nevada County, in the Allison Ranch mine near Nevada City. San Bernardino County, produced by the silver districts but not in general abundant; New York Mountains, near Manvel, Old Imperial and Tip Top mines, and the Lava Beds districts have produced crystals; occurs with cerargyrite in the Calico and Barstow districts.

Arsenic. Concentrates sent to smelters from some of the Mother Lode mines contain much arsenopyrite. The arsenic in the ore is mostly oxidized, volatilized, and condensed in the fume chambers, where it accumulates.

Arsenolite. Alpine County, with enargite at Exchequer and Monitor mines. San Bernardino County, large masses occurred with gold at Amargosa mine.

Arsenopyrite. Amador County, New Hope mine, Quartz Mountain mines, and in the mines between Jackson and Mokelumne Hill. Calaveras County, near Angeles and in the mines along the Mother Lode, high in gold content. Eldorado County, Florence mine, near Placerville and near Georgetown. Kern County, mined for gold in Sunshine and La Crosse mines, southeast of Randsburg. Madera County, commonly associated with coarse gold, as at Gambetta mine; the Sumner, Confidence, Relief, and other old mines, near Kernville and Havilock, contained auriferous arsenopyrite. Madera County, in mines near Coulterville; danaite with erythrite was found in the Josephine mine, Bear Valley. Mono County, common in the Lundy district, carrying gold. Nevada County, in the Betsy mine, Grass Valley, and in the Meadow Lake district, with danaite. Placer County, common in Ophir gold-silver veins. Plumas County, in Pilot Hill gold mine, 6 miles northwest of Gibsonville. San Diego County, in the Julian district. Sierra County, Tightner mine, and in many mines of the Mother Lode; common in gold mines of East Lode; the chief gold-bearing mineral at Alleghany and containing a high percentage of gold; in the Golden King mine on Kanaka Creek it is said to have occurred with gold telluride. Tulare County, in the Mineral King district.

Asbestos (chrysotile). Reported through prospects from northwestern border of serpentine belt extending from Plumas County south through Sierra, Nevada, Placer, Amador, and Calaveras counties; was mined in Butte and Riverside counties, and near Auburn, Placer County. Inyo County, masses of the variety known as paligorskite, mountain leather, and mountain cork occur in the Swansea district and in Craigs Canyon on the east slope of the Inyo Mountains. Placer County, large masses occur at Wisconsin Hill and Arizona Flat. Shasta County, mined at Sims; a few tons were mined on Mears Creek, near Hazel Creek post office, in 1913. Trinity County, reported 15 miles northeast of Carrville. Tuolumne County, near Chinese Camp and Montezuma; the paligorskite or mountain cork variety at Sawmill Flat and on Table Mountain.

Asphalt. Considerable deposits of asphaltic sandstone in following counties: Kern County, in the McKittrick and Sunset oil fields. Los Angeles County, the most noted deposit in the State on the Rancho de la Brea. Mendocino County, near Point Arena. Monterey County, southeast of Metz, northeast of King City, west of San Ardo, and west

of Bradley. San Luis Obispo County, south of San Luis Obispo. Santa Barbara County, along the coast west and east of Santa Barbara, and in the Santa Maria district in the Casmalia Hills, on Graciosa Ridge, east of Sisquoc, and in the Purisima Hills. Santa Cruz County, north of Santa Cruz. Ventura County, in the Ojai Valley. Also numerous small deposits of maltha and asphalt scattered through the Coast ranges.

Aurichalcite. Inyo County, in Cerro Gordo mine, as plumose aggregates and long prismatic crystals associated with calamine and chrysocolla.

Axinite. Eldorado County, Cosumnes copper mines near Fairplay; thin-bladed masses of violet-colored axinite occur in veins near Glen Alpine. Inyo County, occurs in the Funeral Mountains and in the Owl Mountains and at several places in Death Valley. Riverside County, in quarry near Riverside. San Diego County, mined near Bonsall, associated with quartz, epidote, and laumontite.

Azurite (blue carbonate of copper). Calaveras County, at the old Hughes mine. Eldorado County, with other copper ores in Alabaster Cave mine near Newcastle. Inyo County, in Ubehebe district. Also in copper ores in Calaveras, Modoc, Mono, Monterey, San Bernardino, and Shasta counties.

Barite (heavy spar). Inyo County, occurs massive near Independence; at the Defiance mine with native sulphur; white massive at Bishops Creek, White Mountains; veins in the Alabama Range. Los Angeles County, occurs white near Azusa. Mariposa County, in veins in slate at El Portal; a large deposit occurs about 2 miles west of El Portal, which has produced much of the mineral mined in the State; undeveloped deposits also occur. San Bernardino County, common as a gangue mineral in the mines of the Bismark and Calico district near Barstow; in north end of Colorado River Indian Reservation, in the Whipple Mountains, 10 miles north of Parker, Ariz. (associated with calcite), in vertical fissure veins up to 3 feet in width in Tertiary or Quaternary basalt and associated sandstone; has not been prospected. San Mateo County, massive barite has been found on Permanente Creek. Santa Barbara County, white massive at Santa Maria. Trinity County, dark gray, occurs about 15 miles below Hay Fork.

Basalt. Abundant and widespread. Used extensively for road metal.

Bauxite. Riverside County, near Riverside; Yuba County, 2 miles southeast of Smartsville, white and red.

Benitoite. San Benito County, in southeastern part, 35 miles northwest of Coalinga; associated with serpentine.

Bentonite. Kern County, 4 miles north of Randsburg.

Berthierite. Tuolumne County, heavy ledges of dark ore, which appears to be an impure berthierite mixed with galena, pyrite, and quartz, occur in schists on the southeast slope of Mount Gibbs.

Beryl. Riverside County, fine yellow and green beryls at Coahuila, and rose crystals near Hemet. San Diego County, aquamarine variety mined intermittently at Pala, Rincon, Mesa Grande, and Ramona; yellow, green, and blue crystals occur in the Palomar Mountains 9 miles southeast of Pala. Tuolumne County, Jamestown (reported).

Bismuth. San Bernardino County, southeast of Banning, in veins; San Diego County, Pala, Rincon, in pegmatite.

Bismuthinite. Madera County, a constituent of the ores at the Minarettes. Mono County, at Oasis, with bismutite. Riverside County, at the Lost Horse mine.

- Bismutite.** Fresno County, occurred at the Second Sierra and Lot One mines. Inyo County, Big Pine Creek; Antelope Springs, Deep Spring Valley. Los Angeles County, white earthy bismutite has been found. Mono County, at Oasis. San Diego County, Pala, Rincon, as an alteration of bismuth in pegmatite.
- Bituminous rock.** Kern, Mendocino, Monterey, Santa Barbara, San Benito, Santa Cruz, San Luis Obispo, and Ventura counties. *See also* Asphalt.
- Bloedite.** San Luis Obispo County, in Soda Lake about 50 miles east of San Luis Obispo.
- Bloodstone.** San Bernardino County, south end of Brown Mountain; Death Valley region, cut for gems.
- Borax.** Has been produced from the waters of Borax and Hachinham lakes, in Lake County. Deposits of the marsh type were formerly extensively worked at numerous localities in Inyo, Kern, and San Bernardino counties. Deposits of the calcium borate mineral, colemanite, are now being worked in Ventura, Los Angeles, and Inyo counties, and similar deposits have formerly been worked in San Bernardino County. *See also* Colemanite and Ulexite.
- Bornite.** Calaveras County, at Campo Seco and Copperopolis. Del Norte County, with other copper ores in Low Divide district; common in the mines at head of Copper Creek. Eldorado County, mined at Cosumnes copper mine and Pioneer mine; occurs at Alabaster Cave and Pioneer mines, near Newhall; at Slug Gulch, with chalcopyrite and massive green epidote; at Georgetown, with massive garnet. Inyo County, in mines of the Inyo and Ubehebe districts. Los Angeles County, in the Meadow Valley district. Mono County, Tioga mine and Benton district. Nevada County, Mineral Hill, California mines. Plumas County, common form of copper ore in Lights Canyon, Genesee Valley, and Indian Valley, at the Shoofly and Peters mines. San Bernardino County, occurs at Tiptop mine, Lava Beds district. Santa Clara County, near Lexington. Shasta County, Bully Hill, Afterthought mines, Copper City, and Iron Mountain.
- Bournonite.** Inyo County, massive at Cerro Gordo mine.
- Braunite** (silico-oxide of manganese). Plumas County, Meadow Valley.
- Brea.** Kern, Los Angeles, and Ventura counties.
- Brochantite.** Calaveras County, at Copperopolis; Inyo County, Cerro Gordo mine.
- Brown iron ore** (limonite, brown hematite). Is present in every county. Alameda County, mixed with hematite is common as a gossan capping of the pyrite deposit at Leona Heights. Amador County, in concretions and earthy masses at Pine Grove, with hematite and magnetite at Volcano. Butte County, large blocks at Burns Creek; thick masses at the Monarch mine; cubes at Red Hill and Magalia. Calaveras County, common in mines southeast of Campo Seco, near Valley Spring, Esmeralda, and Murphy; massive and yellow ocher at the Eureka mine, near Valley Springs; the Detert deposit near Valley Springs was formerly worked. Inyo County, pseudomorphs after long prisms of stibnite from the Cerro Gordo mine. Mariposa County, fine large cubes have come from the Chowchilla Valley. Placer County, has been mined with magnetite; at Hotaling, iron-ore deposits 6 miles north of Auburn; occurs at Gold Run. Plumas County, massive in Lights Canyon and at Nelson Point. Riverside County, Eagle Mountain and near Dale. San Bernardino County, prospects in Cave Canyon area north of Scott station. San Luis Obispo

County, occurs in secs. 1 and 6, T. 31 S., Rs. 10 and 11 E.; brown banded masses have come from the Perfumo ranch. This deposit lies in the Los Osos Mountains interbedded with shales and sandstones of the Franciscan formation, and in Jurassic shale and limestone in Perfumo Canyon about 5 miles south of west from San Luis Obispo. Shasta County, with magnetite in numerous prospects, common as cappings of the pyrite deposits of the county; at Gossan, Iron Mountain, near Keswick; mined as iron flux for Bully Hill smelter; pseudomorphs after hedenbergite at Ydalpan; highly iridescent specimens have come from Copper City; excellent bronze stalactites occur at the Lost Confidence mine, Iron Mountain. Sonoma County, yellow ocher at the Occidental mine. Siskiyou County, occurs in sec. 10, T. 46 N., R. 10 W. Tulare County, common in the Mineral King district. Yolo County, in the sands at Capay.

Calamine. Inyo County, with willemite and smithsonite at the Ignacio, Cerro Gordo, and Indiana mines, and in Surprise Canyon. San Bernardino County, with smithsonite at the Cuticura mine near Paggett.

Calaverite. Calaveras County, Stanislaus and Melones mines. Eldorado County, with petzite in the Darling mine near Rock Creek, about 3 miles northeast of American Flat.

Calciovolborthite. San Bernardino County, Camp Signal, near Goffs.

Calcite. Alameda County, crystals in the chalcedony geodes on Berkeley Hills. Alpine County, fine groups of rhombohedrons have come from the Pennsylvania mine. Calaveras County, crystals occur near the Natural Bridge. Eldorado County, fine stalactites at Alabaster Cave; good crystals at the Cosumnes copper mine. Inyo County, fine crystal specimens at the Cerro Gordo and other mines. Los Angeles County, with colemanite at Lang. Mariposa County, good crystals in mines near Mariposa. Merced County, strontium-bearing at Delhi. Mono County, good crystals from the Bodie mine. Nevada County, common in the Grass Valley and Nevada City mines; fine scalenohedrons from the Pittsburg mine. Placer County, Ophir district, a verde antique variety was found about 16 miles east of Auburn. Riverside County, Crestmore, blue calcite is quarried for cement. San Benito County, in rocks adjoining the benitoite veins near the headwaters of San Benito River. San Mateo County, near San Pedro. Sonoma County, low rhombohedrons in geodes near Petaluma. Tuolumne County, fine crystals at the Keltz mine; large stalactites at the Crystal Palace Cave near Columbia. *See also* Limestone and Marble.

Caledonite. Inyo County, found in oxidized zone at Cerro Gordo mines.

Caliche. Common in deserts of southern California.

Californite. *See* Vesuvianite.

Cassiterite (tin ore, tin stone). Plumas County, stream tin in the bed of Middle Fork of Feather River, 3 miles above Big Bar. Riverside County, small occurrence in Cajalco mine, 7 miles southeast of Corona, with tourmaline in granodiorite, has been mined; the Temescal tin mine was situated a few miles southeast of South Riverside in the Santa Ana Mountains; the oxide occurred in a rudely semicircular area of granite, about 2 miles in diameter, as brownish masses and reddish-brown crystals in a vein of tourmaline and quartz; some layers of wood tin also occurred. San Diego County, found at Pala, of mineralogic importance only; small crystals were found associated with gem tourmaline, beryl, and stibiotantalite at Mesa Grande. Santa Clara County, fine large crystals occur in the eclogites of Calaveras Valley, in the quartzite and diorite of Oak Hill, near San Jose. Siskiyou County, in the gravels of Sawyers Bar. Trinity County, as stream tin, near Weaverville.

Celestite. Inyo County, with the colemanite of Death Valley. San Bernardino County, occurs near Silver Lake; also associated with the colemanite of Calico; reported as one of the minerals associated with borax at Searles Lake.

Cement material (Portland). Seven Portland cement companies are operating in the State at the following places: Contra Costa County, Cowell, using travertine and shaly clay. Kern County, Monolith, using limestone and clay. Napa County, Napa Junction, using two grades of limestone. Riverside County, Riverside, using limestone and clay. San Bernardino County, Colton, using marble, quarried in a large deposit of variegated marble at the Gem marble quarries in the Silver Mountain district, about 5 miles south of Oro Grande; also using gray limestone from Slover Mountain, near Colton, and clay from deposits $2\frac{1}{2}$ miles north of Amboy. Santa Cruz County, Davenport, using crystalline limestone, clay, and diatomaceous shale. Solano County, near Suisun, using travertine and clay.

The principal deposits of suitable material are in the following places: Contra Costa County, travertine from Mount Diablo to Pinole. Kern County, limestone at Tehachapi. Los Angeles County, shell limestone near Mission San Fernando. Orange County, shell limestone at San Fernando and on mesa toward Orange and toward San Juan. San Benito County, limestone west of Hollister. San Diego County, chalklike limestone near Pacific coast at Jamul. Santa Cruz County, limestone near the coast in vicinity of Santa Cruz associated with shale and clay. Shasta County, limestone in abundance in the copper-bearing district, east of Furnaceville, Brock Mountain, north of Lillienthals, near Kennett, and elsewhere. Solano County, travertine from Vallejo to Goodyear. Sonoma County, limestone reported 6 miles northeast of Geyserville on Little Sulphur Creek.

Cerargyrite (horn silver, silver chloride). Inyo County, abundant with argenterous galen \acute{a} , argentite, and copper minerals in the Argos and Coso ranges and to some extent in the Darwin and Cerro Gordo districts. Kern County, in the Amalie mine, with pyrrargyrite and native silver. Mono County, in the Blind Springs district near Benton; in the Bodie district and in the Sweetwater Range. Placer County, Gold Blossom, California, Mina Rica, and other mines in Ophir region. San Bernardino County, Calico district and Grapevine mine near Barstow; important, with embolite, cerusite, barite, pyrolusite, chrysocolla, malachite, and jasper; in the Silver Reef district, about 40 miles east of Victor; with argentite at the Bonanza King mine on Providence Mountain and in the Imperial mine in the Lava Beds district, about 40 miles from Lavi \acute{c} .

Cervantite. Inyo County, found massive at Lottie mine, Wild Rose district, and at St. Ignacio mine. Kern County, occurred with stibnite at San Emidio mine.

Chalcanthite (blue vitriol, sulphate of copper). Alameda County, Leona Heights. Amador County, common in the mines on Copper Hill. Calaveras County, common at Copperopolis, occurred at Quail Hill. Nevada County, at Sweetland. Shasta County, Peck, Copper City, and other mines; was mined. Trinity County, with copper and iron ores in New River district.

Chalcedony. Alameda County, common as geodes in the Berkeley Hills. Alpine County, red jasper is common in the Monitor district. Amador County, bluish chalcedony occurs at Volcano. Calaveras County, red, green, and

brown jasper occurs near Murphy, silicified wood at Angeles. Del Norte County, handsome varieties of agate, chalcedony, and jasper at Pebbly Beach, Crescent City. Fresno County, near Panoche. Humboldt County, at Big Lagoon, the beach pebbles are agate, chalcedony, jasper, prase, carnelian, etc. Inyo County, porcelain jasper in the Coso district. Kern County, blue chalcedony at Kane Springs; pale lilac-tinted chalcedony near Muroc station. Los Angeles County, Redondo, in lava near Acton, abundant in rhyolite in Jawbone Canyon. Marin County, agate and chalcedony occur in the beach pebbles at Bolinas; red jasper outcrops on Reed Ranch; spherulitic jasper, called "kinradite," occurs on the shores of Golden Gate and on the west shore of Sausalito. Napa County, common at the Manhattan cinnabar mine, Knoxville; red jasper occurs on Mount St. Helena. Nevada County, brown jasper occurs at Nevada City, moss agate near Indian Flat. Placer County, chalcedony, agate, jasper, carnelian, prase, etc., occur in the beach pebbles at Lake Tahoe. Chalcedony, at the Spanish mine, in gold veins in Ophir district. Plumas County, banded green and red jasper occurs in the slates and schists west of Meadow Valley. San Bernardino County, beautiful chalcedony containing vermilion-red cinnabar and resembling St. Stephen stone variety, in granite rocks near Ash Hill, 15 miles east of Indian Springs; lavender-blue chalcedony, 38 miles east of Johannesburg and 2 miles east of Leadpipe Spring. San Francisco County, San Francisco, red, green, and brown jasper, common in the serpentine; spherulitic jasper occurs near Lands End. San Mateo County, at Pescadero, fine specimens with agate, carnelian, jasper, etc., in the beach pebbles. Santa Barbara County, with agate in the beach pebbles. Siskiyou County, common in serpentine beds. Sonoma County, red jasper at Windsor. Tulare County, fine moss agate on Deer Creek; chrysoprase in the mountains east of Visalia, on Deer Creek and at Lindsay. Tuolumne County, yellow and brown jasper at Shaws Flat.

Chalcoite (copper glance). Alpine County, in Hope Valley with chalcopyrite and pyrite. Calaveras County, Penn Chemical Co. mines, Campo Seco, and Copperopolis. Del Norte County, Low Divide district, in the Copper Creek, Diamond Creek, and Crescent City mines. Inyo County, Bluejay and Sanger mines, Ubehebe district. Los Angeles County, in the mines at Soledad Pass. Madera County, at the old Buchanan mine. Mariposa County, Green Mountain mines. Plumas County, with bornite forms rich copper ore in the Genesee Valley and Lights Canyon districts, at Peters and Duncan mines, mined for gold and silver. San Bernardino County, as rich masses in some of the copper claims in the mountains in the eastern part of the county. San Diego County, at Potrero. Shasta County, Afterthought, Balaklala, Bully Hill, Copper City, and Mountain Copper mines. Tuolumne County, Oak Hill Copper mine and Whiskey Hill mines.

Chalcopyrite (copper pyrites). Calaveras County, the belt of schists in the western part of the county contains important deposits, and the mines at Copperopolis and Campo Seco are important producers of copper; Penn Chemical Co. mines west of Campo Seco, said to carry some gold in places, mined for gold and silver in "Foothill Copper Belt." Del Norte County, in the serpentine area in the northern portion of the county near Smith River and its tributaries with pyrite and pyrrhotite, Low Divide district, Diamond Creek, and Shelby Creek, and other places. Eldorado County, Alabaster Cave mine, with gold and silver, at Diamond Springs near Georgetown and at Pilot Hill. Fresno County,

Fresno copper mine and Copper King mine, and in the gold district in the northeast part of the county. Humboldt County, on the east slope of Horse Mountain, with chalcocite, native copper, and cuprite. Inyo County, Chloride Cliff prospects, near Darwin, on granite-limestone contact and in the Ubehebe Mountains with chalcocite. Kern County, in the gold mines near Dandoburg, Garlock, and Woody. Madera County, was mined at Buchanan mine, at the Ne Plus Ultra, and at other claims near Daulton. Marin County, between Mount Tamalpais and Bolinas Bay in the schists. Mariposa County, Green Mountain mines; old Pocahontas mine near Lewis, Copper Hill mines in Indian Gulch, old Beretta mines and others near Merced River, all contain massive chalcopyrite with auriferous pyrite. Merced County, Jose copper claims, sec. 4, T. 14 N., R. 9 E. Nevada County, California mine, gold and silver; Spenceville copper mine, Mineral Hill, Pine Hill, Zion Mountain, French Corral, North San Juan, Meadow Lake district. Placer County, 2 miles east of Valley View, was worked for gold; was also mined at Hotaling; occurs near Auburn, Valley View, and at Dairy Farm. Plumas County, good deposits with bornite and chalcocite in Genesee Valley near Fluornoy, in Indian Valley near Taylorsville, and in Moonlight and Lights canyons, 12 miles north of Taylorsville. Riverside County, Vulture Crag, 14 miles east of Capistrano, little gold; and in the Palen, McCoy, and other mountains in the eastern part of the county. San Benito County, Lewis Creek claim, 16 miles from King City. San Bernardino County, with oxidized copper ores in the Clark and the New York mountains, near Ivanpah, Manvel, Vontrigger, Sunrise, Needles on Mount Whipple, Monument Mountain, Turtle Mountain, Providence Mountains, and in the Lava Beds, Oro Grande, and Morrow districts. San Diego County, prospects 18 miles east of Encinitas and 12 miles northeast of Lakeside, in the Banna mines near Lakeside, and in the Julian district. San Luis Obispo County, near Cayucos, carries gold and silver. Shasta County, mined at Mountain Copper, Shasta King, Bully Hill, Balaklala, Yolinsky, Mammoth, Afterthought, and other mines in Shasta district. Sierra County, near Poker Flat, Sierra City, and in the Mohawk Valley. Siskiyou County, in the Richie mine and claims near Callahan; Blue Ledge mine, in Elliot district, carries gold and silver. Trinity County, Lambert claims, South Ford district; along New River, at the mouth of Rattlesnake Creek, and on the Cold Fork of Indian Valley Creek. Tulare County, Tule River, about 20 miles above Porterville; on Middle Fork of Tule River, a few miles east of Porterville and near Kearsarge Peak. Tuolumne County, was mined at Washington and other mines and occurs locally along the schist belt, extending across the county a few miles west of the Mother Lode.

Chiastolite. Madera County, fine specimens at Daulton. Mariposa County, Moores Hill, and on Chowchilla River. Riverside County, opaque pink at Coahuila.

Chromite (chromic iron ore). In much of the chromite of the State magnesium replaces the iron, forming magnesium chromite. The mineral is formed in serpentine rocks commonly as large boulder-like and irregular shaped masses. It is abundant in the serpentine areas and some tons of it are produced annually. It is also abundant in the black sands. Alameda County, 15 to 20 miles southeast of Livermore, has been mined at several mines; pockets of massive chromite occur in the serpentine about 7 miles northeast of Milton and at Mendenhall, about 16 miles south of

Livermore. Amador County, near Jackson and Mount Spring House. Butte County, in the black sands at Magalia, Oroville, Cherokee, Buchanan Hill, Lovelock, and Pentz. Calaveras County, has been mined at Valley Springs, and is found at Campo Seco and Murphy; in the concentrates at Forest Gulch. Colusa County, massive at Newville, in the black sands of Smith River on Gilbert Creek and at Crescent City. Del Norte County, found in Rattlesnake Mountain from Bald Hill to Klamath River; French Hill and Low Divide mines; good deposits on Rattlesnake Mountain, 20 miles east of Crescent City. Eldorado County, numerous deposits, some near Latrobe, near Colima, and at Shingle Springs. Fresno County, has been mined near Sentinel; found near Madero in masses coated with zaraitite; deposits occur in the southwest part of the county in the Mount Diablo Range and in the serpentine hills east of Fresno. Glenn County, at Black Diamond mine near Newville. Humboldt County, in the beach sands at Gold Bluff and the concentrates at Orleans and Trinidad. Lake County, in Jerusalem Valley, 8 miles east of Middletown and near Bradford. Los Angeles County, with magnetite near Langs station, Soledad Canyon. Marin County, $7\frac{1}{2}$ miles west of San Rafael, reported from Maillard ranch. Mendocino County, several localities in hills west of Russian River valley, found coated with green uvarovite garnet about 10 miles north of Willits; specimens have come from the vicinity of Ukiah. Monterey County, near San Benito River, common in small masses in the serpentine of the county. Napa County, in Pope and Chiles valleys east of St. Helena. Nevada County, near Nevada City, at Washington on Deer Creek, and Coyote Diggings, also near Indian Springs and in the concentrates at Rough and Ready, North Bloomfield and Relief Hill. Placer County, has been mined 2 miles east of Flagstaff Hill, 7 miles east of Iowa Hill, and near Alabaster Cave; in serpentine near Green Valley below Towle; in black sands of North Fork of American River of Blue Canyon at Lewis and at Michigan Bluff. Plumas County, 2 miles west of Spanish ranch and south of Clear Creek, near Meadow Valley, common at Rock Island Hill, La Porte, and in Meadow Valley as concentrates. Sacramento County, a prominent constituent of the black sands at Michigan Bar. San Benito County, at Emmet and Idria, massive specimens coated with zaraitite have come from the vicinity of Hollister. San Luis Obispo County, near San Luis Obispo, in Santa Lucia Mountains, near Santa Margarita, and elsewhere; mined in mountains southeast of St. Louis Valley on the slope of the Santa Lucia Range; occurs at the Montana mine, $4\frac{1}{2}$ miles northeast of San Luis Obispo, also at the head of Carpojero Creek and at La Panza. Santa Barbara County, near Santa Ynez. Santa Clara County, near Livermore, San Jose, and elsewhere. San Mateo County, common in the beach sands. Santa Clara County, in small masses in the serpentine near Los Gatos and near New Almaden. Shasta County, deposits have been worked to small extent on Shotgun Creek; occurs at French Gulch and in the black sands of Sacramento River. Sierra County, occurs along Goodyear Creek and at Howland Flat, near Downieville. Siskiyou County, is found in Forest Mountains and is mined at Chromite station and Dunsmuir; a good deposit occurs near Castella; common in the concentrates at Callahan, Grouse Creek, Happy Camp, on Scott River, Beaver Creek, and in Seiad Valley. Solano County, Fairfield. Sonoma County, occurs near Geysersville and Litton Springs, and has been mined at Cloverdale. Tehama County, was mined on north fork of Elder Creek. Trinity County, vicinity of Hayfork and north fork of Trinity River, in

the sands at Trinity Center. Tulare County, Deep Creek near Plano and Porterville. Tuolumne County, northwest of Mountain Pass, about 8 miles southwest of Sonora and elsewhere; masses have been found near Chinese Camp. Yuba County, in the black sands at Camptonville, on Yuba River, and on Indian Hill; found also in other counties, usually in serpentine areas.

Chromium. See Chromite.

Chrysocolla (hydrous silicate of copper). Amador County, common at Volcano. Eldorado County, with other copper ores at Cosumnes copper mine, sec. 25, T. 9 N., R. 12 E., reported to carry gold and silver. Fresno County, at the Ne Plus Ultra mine. Inyo County, found at Darwin and other places; common at the Cerro Gordo mines; occurs in pseudomorphs after limonite at the Aries mine. Los Angeles County, at the old Kelsey mine, San Gabriel Canyon. Mariposa County, John Dias mine, sec. 12, T. 6 S., R. 16 E., carries gold, shipped; in streaks near Mariposa. Mono County, Goleta mines on Copper Mountain, mined for gold and silver; common in Lundy and Benton districts, with quartzite at the Diana mine, Blind Springs district. Nevada County, common with the copper of Meadow Valley and also at Spencerville. Plumas County, with copper ores in Engels copper mine, Light Canyon, and in the Mohawk Valley. San Benito County, with chalcocite in natrolite at the benitoite locality. San Bernardino County, claims in Ord Mountain copper group, Hixon mine near Barnwell; common in the Calico and Bismark districts; massive at the Copper World mine, Clark Mountain. San Diego County, common in the Julian and Banner districts.

Chrysoprase. Tulare County, mined at Venice Hill, 10 miles east of Visalia; on Deer Creek, 8 miles southeast of Porterville, near Lindsay, at Stokes Mountain, and other localities. Used for jewelry and ornamental work.

Chrysotile. See Asbestos.

Cinnabar. California contains many cinnabar mines and prospects in Santa Clara and San Benito counties, among which are the New Almaden and New Idria mines, the most important in the United States. Colusa County, on both sides of Sulphur Creek, in sandstones and shales associated with sulphur, bitumen, and gold; has been mined at Manzanita, Elgin, Empire, and Wideawake mines. Contra Costa County, near Mount Diablo. Del Norte County, prospects on Diamond Creek, near northern boundary of county. Eldorado County, has been mined near Latrobe, at the Bernard or old Amador quicksilver mine. Fresno County, Mexican mine in northwest branch of Cantua Creek; also Providential group and in the Mercy mines, Little Panoche district, on the Diablo Range. Lake County, on the shore of Clear Lake, Abbott mine and Anderson prospects in Mayacmas district, the Great Western, near Middletown, and other mines were once famous producers. Mariposa County, occurs near Horseshoe Bend, and near Coulterville associated with gold. Monterey County, Cholame Parkfield mine, 6 miles from Parkfield, and at Table Mountain, 13 miles from Parkfield; Dutro mine, in the San Carpojo district. Napa County, Boston mine, Cathill mine at Oat Hill, Manhattan mine, and other places; deposits of the Pope Valley and Vallejo have also been important. Nevada County, at Grass Valley, associated with gold. Orange County, on San Joaquin ranch. San Benito County, Alpine mine, Cerro Benito mine, south of "Llanada," New Idria, Picacho, and Stayton mines. San Bernardino County, associated with chalcedony near Ash Hill, 15 miles east of Indian Springs. San Luis Obispo County, in the Santa Lucia Range, the productive mines are mainly in the Oceanic and Adelaide

districts. Santa Barbara County, was mined at Los Prietos mines; occurs also in the Santa Ynez Range and near Cachuma Creek. Santa Clara County, New Almaden mine and Guadalupe mines and others near Los Gatos. Shasta County, 30 miles northeast of Redding. Siskiyou County, near Oak Bar in northern part of county. Solano County, was mined at St. John mine. Sonoma County, Boston group, Cloverdale mine, Culver-Baer mine, and various other mines. Stanislaus County, Red Mountain on the border of Santa Clara County. Trinity County, the old Altoona and other claims in the northern part of the county near Carrville were once productive. Yolo County, New England, and Harrison mines, Knoxville district.

- Clay** (brick). Ninety-two operators reported a production of brick and other clay products in 1911 valued at \$4,915,866; yards at the following places: Alameda County, Alameda, East Oakland. Amador County, South Carbondale, near Jane. Butte County, Biggs. Contra Costa County, Antioch, Eckley, Point Richmond. Del Norte County, Elk Valley. Fresno County, Fresno and vicinity. Humboldt County, Eureka and Fortuna. Imperial County, Holtville and Inglewood. Kern County, Bakersfield and Kern. Kings County, Hanford. Lassen County, Susanville. Los Angeles County, Garvanza, Long Beach, Los Angeles, and elsewhere. Marin County, McNear and San Rafael. Mendocino County, Ukiah. Merced County, Merced. Monterey County, Salinas. Orange County, Fullerton, La Balsa, and Huntington Beach. Placer County, Lincoln. Riverside County, Corona and Hemet. Sacramento County, Sacramento and elsewhere. San Bernardino County, Redland and San Bernardino. San Diego County, San Diego. San Francisco County, San Francisco. San Joaquin County, Roberts Island, Carnegie, and on San Joaquin River. San Luis Obispo County, San Luis Obispo. San Mateo County, South San Francisco. Sonoma County, Glen Ellen and Hilton. Santa Barbara County, Santa Barbara and Santa Maria. Santa Clara County, San Jose, Pleasanton, Mountain View, and elsewhere. Shasta County, Anderson and Redding; Solano County, Vallejo. Stanislaus County, Modesto. Tulare County, Milo. Ventura County, Montalvo and Ventura.
- Clay** (fire). Amador County, Ione; Calaveras County; Los Angeles County, has been mined at Palates ranch. Orange County, mined at Gypsum switch. Placer County, at Lincoln. Riverside County, at Alberhill.
- Clay** (kaolin, plastic). Sonoma County; San Bernardino County, occurs near Calico; San Diego County, at Jamul.
- Clay** (pottery). Amador County, white clay mined northwest of Ione and about Carbondale. Eldorado County, has been mined at Michigan Bar. Los Angeles and Mercer counties. Placer County, at Lincoln.
- Clay** (sewer pipe). Amador, Placer, Riverside, and other counties; San Mateo County, South San Francisco.
- Clay** (tile, not drain). Los Angeles and Merced counties; San Diego County, near La Costa.
- Coal** (bituminous). Monterey County, has been mined in Stone Canyon, sec. 14, T. 22 S., R. 13 E., near middle of Mount Diablo Range. San Benito County, Trafton mine, sec. 21, T. 17 S., R. 10 E.
- Coal** (lignite). Alameda County, Corral Hollow, includes area on both sides of divide between Livermore and San Joaquin valleys; of Eocene age; has been mined. Amador County, Ione field, 4 miles northwest of Ione, underlies valley between Ione and Carbondale; of Miocene age; bed 6 to 24 feet thick; has been mined for local use. Monterey County, in eastern part in Priest Valley. Orange County, Santiago Canyon, small beds in

Trabuco Canyon mined for local use. Riverside County, Elsinore field, bed 3 to 10 feet thick, has been mined for local use. Trinity County, Hyampom Valley, T. 3 N., R. 6 E., bed 17 feet thick, not mined. Is found in small quantity in several other counties but not mined.

Cobalt. See Cobaltite and Erythrite.

Cobaltite. Placer County, in the Metallic mine, near Cisco with arsenopyrite, and about 4 miles northeast of Alta with chalcopyrite.

Colemanite (borate of lime). Inyo County, mined at Lila C. mine, Death Valley. Los Angeles County, Lang. Ventura County, Griffin. San Bernardino County, has been mined in Calico district, Lone Star, and other places.

Columbite. Fresno County, at the Reynolds mine, Kings River district. San Diego County, Little Three mine near Ramona, Victor mine, Rincon.

Copper minerals. Copper is the principal metal produced in the following districts: Alameda County, Alma (Leona Heights). Amador County in the old Newton mine. Calaveras County, Campo Seco and Copperopolis, Mokelumne Hill. Fresno County, east of Fresno City, Big Dry Creek, and Pollasky. Inyo County, Furnace Creek, Gold Belt, Harrisburg, and Ubehebe. Kern County, Rademacher and Woody. Madera County, Buchanan and Daulton. Mariposa County, in the Copper Queen mine, Green Mountain, White Rock. Mendocino County, at Red Mountain, 15 miles southeast of Ukiah, and in Lost Valley. Merced County, in Victor Bonanza mines. Nevada County, Spenceville. Placer County, near Auburn, New-castle, Valley View, and at Dairy Farm. Plumas County, Genesee Valley, in Indian Valley and Taylorsville and in Moonlight and Lights canyons, 12 miles north of Taylorsville. Riverside County, in McCoy Mountain district. San Bernardino County, Bullion, Dry Lake, Ivanpah, Kane Springs, Monument Park, Shadow Mountains, Signal, and Stedman. San Diego County, near Encinitas. San Luis Obispo County, at Tiptop mine, 10 miles north of San Luis Obispo, and on Chorro Creek. Shasta County, Afterthought, Bully Hill, Copper City mines, Kennett, Keswick Mountain copper mine, and Shasta King mine. Tehama County, Tom Head, on Elder Creek, and at White Bluff. Tulare County, Porterville. It is of subordinate importance in many other districts. See also Azurite, Bornite, Brochantite, Chalcantite, Chalcocite, Chalcopyrite, Chrysocolla, Cuprite, Enargite, Malachite, Stromeierite, and Tetrahedrite.

Copper (native). Occurs in Alameda County, Leona Heights. Del Norte County, Diamond Creek district. Eldorado County, Cosumnes mine. Humboldt County, Horse Mountain district; with other copper ores in Amador, Calaveras, Napa, Plumas, Riverside, San Bernardino, and Shasta counties. Some metallic copper has been found in most of the copper mines of the State, but no commercial deposits of the native metal are known. Most of the localities cited for chalcopyrite have yielded some native copper.

Corundum. Los Angeles County, in drift at San Francisquito Pass. San Bernardino County, crystals of ruby corundum occur in a corundum syenite in San Antonio Canyon, near Upland. Plumas County, near Meadow Valley, large crystals of a pale violet-blue shade occur in a dike rock on Spanish Peak. San Bernardino County, in syenite in western part of county.

Crocidolite. Lake County, near Lakeport, as blue fibrous veins in schist. Santa Clara County, occurs as bluish fibrous seams in metamorphic rock east of Hamilton.

Cubanite. San Luis Obispo County, a large mass was found on Santa Rosa Creek near San Simeon.

Cuprite (red oxide of copper). Alameda County, massive specimens near Livermore. Amador County, at Volcano. Calaveras County, mined in Copperopolis and Campo Seco, associated with chalcopyrite. Colusa County, at the old Candace and Union mines, and with chalcotrichite in the Lion mine. Del Norte County, in masses with native copper at the Pearl Copper mine; common in the Rockland district. Glenn County, at L'Homme. Humboldt County, Horse Mountain district. Kern County, Old San Emidio ranch. Mono County, massive at Eclipse, Kerrick, and Mammoth mines, near Lundy, with cerargyrite and chrysocolla; Copper Mountain. Napa County, near Calistoga and St. Helena, some with chalcotrichite. Nevada County, at Meadow Lake. San Bernardino County, Ord Mountain copper group. Shasta County, Bully Hill mine.

Cuprodescloizite. San Bernardino County, at Camp Signal.

Datolite. Inyo County, white massive datolite was associated with vesuvianite and garnet at the San Carlos mine. San Francisco County, occurs as glassy crystals and white veins in an old altered diabase dike in the serpentine at Fort Point.

Diabase. See Trap rock.

Diamond. Amador County, near Fiddletown, and Oleta, at Rancheria and near Volcano. Butte County, found at Cherokee Flat, about 9 miles north of Oroville. Eldorado County, in auriferous gravels at Forest Hill and Webber Hill, near Placerville on Webber Creek, in White Rock Canyon, and at Smiths Flat and White Rock. Fresno County, a few miles north of Coalinga. Nevada County, at French Corral and elsewhere. Siskiyou County, at Hamburg in placer gravels. Trinity County, in the sands of Trinity River and its tributaries.

Diatomaceous earth (infusorial earth, tripolite). Occurs abundantly in the Coast Ranges in the southern half of the State in Tertiary shales, where, mixed with clay, it composes formations several thousand feet thick. In places these shales consist almost wholly of diatom remains and are commercially valuable. Largest workings are near Lompoc, Santa Barbara County. Shales composed almost wholly of diatomaceous remains occur in southern San Luis Obispo County; in Monterey County, on both sides of Salinas Valley; in Kern, Kings, Fresno, Merced, and Stanislaus counties, on the west side of San Joaquin Valley. Small deposits occur in Amador County, in Ione Valley; Lake County, on Lost Spring ranch; Los Angeles County, at Santa Monica and on Santa Catalina Island; Mono County, near Bodie; Orange County, around Allison Creek south of El Toro; Placer County, at Dutch Flat; San Diego County, about 40 miles north of San Diego; San Joaquin County, on Staples ranch; San Luis Obispo County, near Port Harford, near Arroyo Grande, and near Edna; San Mateo County, at San Gregorio; Santa Barbara County, Lompoc, on south slope of Santa Ynez Mountains, and near Santa Barbara; Sonoma County, about 10 miles north of Petaluma; Tulare County, near Exeter.

Diopside. Pink diopside found near San Francisco, cut for gems. Eldorado County, occurs in limestone and serpentine near Mud Springs and at Cosumnes copper mine.

Dolomite. Nevada County, as veins in the serpentine at Nevada City. Santa Clara County, large specimens of drusy crystallizations and low, snow-white rhombohedrons in the New Almaden and Guadalupe quicksilver mines.

- Electrum.** Placer County, alloy of gold and silver intergrown with sulphides in Ophir mines.
- Embolite.** Inyo County, with cerargyrite in the Indiana mine, near Swansea. Mono County, with cerargyrite in the Minnie mine, Sweetwater Range. San Bernardino County, with cerargyrite in the Calico, Grapevine, and Silver Reef districts.
- Enargite.** Alpine County, occurred in large masses with massive pyrite in the Mogul district and was the chief copper mineral of the Morning Star and other neighboring mines.
- Enstatite.** Contra Costa County, massive in the Diablo Range in this and other counties to the south.
- Epidote.** Common in the State. Often found in aggregates of large crystals and columnar masses in veins with quartz and feldspar. Butte County, in gold washings at Cherokee. Calaveras County, large crystals found at Bald Point on Mokelumne River at Mokelumne Hill, and at Copperopolis. Contra Costa County, in the rocks on Mount Diablo and in the Diablo Range. Eldorado County, large crystals occurred in a coarse vein with orthoclase, bornite, and molybdenite, which were coated with axinite, at the old Cosumnes copper mine; minute prisms in quartz at Placerville. Inyo County, columnar specimens have come from the vicinity of Independence. Los Angeles County, occurs with bitumen and orthoclase at White Point and with labradorite at San Pedro. Madera County, common on the Minaret Mountains. Marin County, with lawsonite at Reed station. Mariposa County, massive at Hornitos, also near Coulterville and at Yosemite Cliff. On the south side of Mount Hoffman. Nevada County, common near Glen Alpine with violet axinite, at Meadow Lake. Placer County, near Newcastle. Plumas County, with garnet and quartz at Mount Herbert. San Bernardino County, common in the Monte Negro district. San Diego County, as a secondary mineral with black tourmaline at Rincon. Santa Clara County, in the eclogite (a metamorphic rock) of Calaveras Valley. Tulare County, common in the Mineral King district; large divergent columns at Eber Flat and at Three Rivers; also common in Fraser Valley. Tuolumne County, near Sonora. Yuba County, at Smartsville.
- Epsomite.** Alameda County, in pyrite mines of Leona Heights. Amador County, common in the mines on Copper Hill. Lake County, abundant in the old Abbott quicksilver mine. Napa County, abundant in long white fibers in the tunnels of the old Redington mine, Knoxville. Santa Clara County, abundant on the walls of the New Almaden and other cinnabar mines. Sonoma County, as associate of boussingaultite.
- Erythrite** (red cobalt ore). Los Angeles County, Kelsey mine, 4 miles north of Azusa. Mariposa County, Josephine mine, Fremont grant. Napa County, with smaltite in serpentine and chlorite in the Beryessa Valley.
- Feldspar.** Calaveras County, large crystals at Mokelumne Hill; albite is a common constituent of the schists of the Mother Lode. Contra Costa County, numerous veins of albite occur in the chlorite and actinolite schists, especially near San Pablo. Eldorado County, large, white crystals of orthoclase occurred at the old Cosumnes copper mine near Fair Play, with bornite, molybdenite, epidote, and axinite; massive red orthoclase occurs with tourmaline at Bucks Bar, Cosumnes River. Inyo County, white orthoclase occurred at the White Lime mine, Deep Spring district; good crystals of glassy adularia were found at Rialto in the Funeral Mountains. Kern County, near Woody and at the Long Tour mine. Los Angeles County, white veins of labradorite occur near Lang.

Marin County, albite veins are common in the schists. Mariposa County, orthoclase occurs with black tourmaline and molybdenite in the granites of the Yosemite Valley. Mono County, orthoclase occurs in pegmatite veins in the Blind Spring district. Monterey County, orthoclase is mined at Chualar for pottery; large phenocrysts occur at Pacific Grove and Cypress Point. San Bernardino County, orthoclase is mined at Saratoga Springs, veins occur in the mountains in the northeastern part of the county, massive red orthoclase occurs near Manvel. San Diego County, occurs in quantity at Dehesa and Lakeside; large veins of acid pegmatite, consisting of albite, orthoclase, and microcline, occur in diorite at Pala, Mesa Grande, Rincon, and Ramona, as well as northward into Riverside County. Shasta County, veins of orthoclase occur on Tom Neal Mountain. Tulare County, orthoclase occurs near Porterville and Visalia and at Three Rivers. Tuolumne County, large crystals of orthoclase occur on Sullivan Creek.

Fluorspar (fluorite). Inyo County, as gangue mineral with argentiferous galena in the Cerro Gordo, Darwin, and other districts. Los Angeles County, Glendora, Felix mine near Azusa, and on Santa Catalina Island, with galena and chalcopyrite. Mono County, in Ferris Canyon on the east slope of the Sweetwater Mountains. San Diego County, Palomar Mountain, Oak Grove.

Fuller's earth. Calaveras County, dug at Burson. Kern County, reported at Bakersfield and Famosa. Kings County, dug at Huron. Monterey County, Bradley. San Bernardino County, mined 14 miles northeast of Barstow. Solano County, dug at Vacaville.

Gabbro (norite). Placer County, dark, coarse-grained, quarried near Penryn, for building stone. San Diego County, at Dehesa.

Galena. Inyo County, mined in Cerro Gordo, Chloride Cliff, Darwin, Independence, Lookout, and other districts, argentiferous. Mono County, argentiferous galena forms important ore bodies, common in Bodie, Benton, and Lundy districts, and at the claims on the Sweetwater Range. Placer County, abundant at Booth, Gold Blossom, and other mines in Ophir region; argentiferous. San Bernardino County, argentiferous galena with lead carbonate is common in the Silver Mountain, Silver Reef, Calico, and Barstow districts. Shasta County, occurs at most of the copper mines. Also in Butte, Mono, Plumas, and other counties.

Ganister. San Bernardino County, 2 miles southeast of Siam, fine deposit.

Garnet. Alpine County, Hope Valley, fine green grossularite reported. Butte County, Cherokee, red and brown garnet common in the gold washings. Calaveras County, almandite occurs at Bald Point, Mokelumne River; occurs also in the gravel at San Andreas. Del Norte County, common in the sands at Crescent City, Gilbert Creek, and Smith River. Eldorado County, grossularite in copper ore in Rodgers mine in eastern part of county, in good crystals 9 miles southeast of Placerville, massive at Pilot Hill, common near Georgetown. Fresno County, occurs at Fresno Flat, Grub Gulch, and Fort Miller; grossularite, 35 miles east of Selma. Humboldt County, at Gold Bluff and Orleans. Inyo County, crystals and massive garnet occur in the Coso and Inyo mountains; fine large crystals of grossularite occurred with datolite and greenish-brown vesuvianite at San Carlos. Kern County, massive near Hot Springs, between Havilah and Kernville, and on summit between Walker Basin and Havilah. Lassen County, common at Diamond mine. Los Angeles County, in sands at Mount Meadows. Marin County, andradite crystals are common in the schist of the Tiburon Peninsula. Mariposa County, massive brown alman-

dite occurs on Mount Hoffman, good crystals at the junction of Moore Creek and Mokelumne River. Mendocino County, common in the sands at Fort Bragg. Monterey County, in the sands of the Los Burros district; uvarovite has been found coating chromite, and trautwinite also occurs. Nevada County, in concentrates of Rough and Ready district; with wollastonite at Grass Valley. Orange County, a constituent of the schists near Anaheim. Placer County, essonite at Deer Park and on American River near Towle; uvarovite has been found on chromite near Auburn. Plumas County, Good Hope mine and in sands at Nelson Point. Riverside County, essonite in tourmaline district near Coahuila, in the concentrates at Holcomb; occurs massive at the Santa Ana tin district; hyacinth or essonite at Hemet; abundance of grossularite and some andradite occurs in the crystalline limestone at Crestmore, associated with vesuvianite, diopside, and wilkeite. San Benito County, fine green crystals were found coating chromite and rhodochrome at New Idria. San Diego County, essonite mined for gems at Hercules, Lookout, Prospect, Little Three, and Surprise mines in Ramona district; fine crystals of transparent essonite occur in the tourmaline districts of Mesa Grande, Pala, and Rincon, and these have been extensively cut into gems under the name of hyacinth; essonite also occurs about 10 miles east of Jacumba Hot Springs with vesuvianite and quartz; garnet in the Julian district and at Ballina; spessartite was reported from the Mesa Grande, and fine granular red specimens at Rincon. Santa Barbara County, common in the sands at Point Sal. Santa Clara County, a constituent of the eclogites of Calaveras Valley. Shasta County, uvarovite has been found in chromite on Shotgun Creek; red garnet on Round Mountain; bands of garnet mixed with pyroxene on McCloud River on contact between diabase and Carboniferous limestone. Siskiyou County, in sands at Cecilville and on Klamath River. Sonoma County, large masses occur near Petaluma. Trinity County, uvarovite has been found at Carrville. Tulare County, white massive grossularite was found in the northwest corner of the county; essonite in good crystals occurs at Three Rivers; topazolite was found at the Old Soldier mine, Drum Valley, 12 miles northeast of Visalia; aplome, a manganese andradite, was found near Visalia. Tuolumne County, with epidote at Mutton Ledge; in schist on Jarvis ranch and at Soulsbyville.

Gas. See Natural gas.

Gilsonite (uintaite). Santa Barbara County.

Glauberite. San Bernardino County, prominent in the borax deposits at Searles Lake.

Gold. Gold is the predominant metal produced in 307 of the 413 mining districts of the State. It occurs in every county and is now produced in more than half of them. It was brought in with the intrusion through the Mesozoic sediments of the mass of granitic rock which forms the core of the Sierras. The annual production of gold is about \$20,000,000, of which about \$9,000,000 comes from placers.

Gold (lode). The mining districts in which gold derived from lodes is the chief metal produced are too numerous to mention. They can be found in United States Geological Survey Bulletin 507, Mining districts of western United States. For gold-bearing minerals see Amalgam, Calaverite, Electrum, Petzite, and Sylvanite.

Gold (placer). Gold derived from placers has been the principal metal produced in the following districts, many of which, once great producers, have long been idle: Amador County, Lancha Plana, Middle Bar, Oleta, Pine Grove,

and Volcano. Butte County, Bangor, Cherokee, Magalia, Nimsheiw, and Oroville. Calaveras County, Jenny Lind, Mokelumne Hill, Railroad Flat, and Vallicita. Del Norte County, Crescent City. Eldorado County, Indian Diggings, Newtown, and Pacific. Humboldt County, Blocksburg, China Flat, Hoopa, Klamath, Orick, Orleans, and Weitchpec. Kern County, Goler, Red Rock, and Summit. Los Angeles County, Arrastre Canyon. Mono County, Dogtown Diggings. Nevada County, Lowell Hill, North Bloomfield, and You Bet. Placer County, Damascus and Ralston Divide. Plumas County, Elizabethtown, Laporte, Lights Canyon, Sawpit Flat, and Spanish ranch. Sacramento County, Folsom. San Luis Obispo County, La Panza. Shasta County, Bayles, Jerusalem Creek, and Redding. Sierra County, American Hill, Brandy City, Church Meadows, Eureka, and Indian Hill. Siskiyou County, Cottage Grove, Deadwood, Etna, Forks of Salmon, Gilta, Gottville, Hamburg, Happy Camp, Knownothing, O'Mears, Sawyers Bar, Somes Bar, and Summerville. Stanislaus County, Knights Ferry. Trinity County, almost every one of the 24 mining districts. Tuolumne County, Columbia. Yuba County, Brownsville, Camp-tonville, Marysville, Smartville, and Wheatland. Placer gold is produced in many other districts, but is subordinate to lode gold or some other metal.

Granite (building). Amador County, quarried 4 miles northeast of Jackson. Eldorado County, Placerville. Fresno County, various shades blue, gray, and black granite quarried in sec. 13, T. 12 S., R. 22 E. Madera County, large quarries at Raymond. Nevada County, Grass Valley. Placer County, Loomis station, Lincoln, Penryn, and Rocklin. Riverside County, Riverside, Temecula, and elsewhere. Sacramento County, Folsom. San Bernardino County, Oro Grande and Victorville. San Diego County, San Diego, Foster, Santee, and Sweetwater. Tulare County, Porterville, Rocky Point quarry, sec. 8, T. 19 S., R. 27 E. Tuolumne County, Phoenix Lake quarry, 7 miles northeast of Sonora.

Granite (crushed stone, paving stone, road material). Alameda County, quarried at Berkeley, Leona Heights, and Newark. Amador County, Jackson. Butte County, Oroville. Calaveras County, Milton (Gopher Ridge. porphyrite). Contra Costa County, Richmond and elsewhere. Fresno County, Academy (Clovis). Humboldt County, Arcata and Eureka. Imperial County, Hanlon Junction. Lassen County, Susanville. Los Angeles County, Duarte, Hollywood, and Monrovia, and stream boulders crushed in San Fernando Valley and near Azusa. Madera County, Raymond. Marin County, San Rafael. Mariposa County, Jasper Point. Napa County, Napa. Nevada County, Grass Valley, Nevada City, Rough and Ready. Placer County, Lincoln, Penryn, and Rocklin. Plumas County, Chilcoot and Cuba. Riverside County, Corona, Elsinore, Perris, Riverside and West Riverside, and Temecula station. Sacramento County, Fair Oaks and Folsom. San Benito County, Logan. San Bernardino County, Crucero, Declez, Halleck, Hesperia, and Victorville. San Diego County, Campo, Dehesa, Escondido, Foster, Helix, San Diego, and Santee. San Francisco County, San Francisco. San Luis Obispo County, Port San Luis (Port Harford). Santa Clara County, San Jose. Solano County, Cordelia. Sonoma County, Allison, Santa Rosa, and Sonoma. Tulare County, Porterville.

Graphite (plumbago, black lead). Mendocino County, has been quarried 10 miles east of Point Arena, in sec. 8, T. 12 N., R. 15 W. Sonoma County, quarried 10 miles south of Healdsburg for mineral paint. San Bernardino County, 15 miles from East Highlands, in San Bernardino Mountains.

Tuolumne County, in large foliated and dull earthy masses in the limestones near Columbia, where it was formerly mined. Undeveloped deposits are reported near Los Angeles, Santa Cruz, and elsewhere.

Gypsum. Widely distributed; reported from Butte, Colusa, Fresno, Kern, Los Angeles, Riverside, San Benito, San Bernardino, San Luis Obispo, Santa Barbara, Tulare, and Ventura counties. Butte County, at St. Clair mine. Fresno County, quarried in Coalinga and Mendota, on the low hills on the north and south sides of Tumey Gulch, about 18 miles southwest of Mendota, and along Cantua Creek. Inyo County, occurs fibrous at Clarks Fork, Amargosa River, in the Cerro Gordo district, and at Tecopa. Kern County, near McKittrick and elsewhere in west side of oil field, Bakersfield, and Dudley, on Cottonwood Creek about 16 miles east of Bakersfield, in the bed of old Kern Lake, about 20 miles southwest of Bakersfield, and 5 miles from Connor, on the shores of Buena Vista Lake; small deposits near Cane Springs. Kings County, deposits occur on the range of low hills southeast of Dudley and on Kettleman Plains, about 5 miles north of Dudley and $5\frac{1}{2}$ miles northeast of Dudley. Lake County, selenite on Robinson's ranch; small amounts are also found at Sulphur Bank, Clear Lake. Lassen County, large slabs of selenite near Susanville; observed at Honey Lake. Selenite crystals are abundant in the diatomaceous shale throughout the Diablo Range, in the western part of Fresno, Merced, and Stanislaus counties, particularly notable on the west side of San Joaquin Valley north of Little Panoche Valley, where they form veins 18 inches to 2 feet in width. Los Angeles County, Palmdale and Los Angeles; gypsum occurs in Charley Canyon, 12 miles north of Castiac in shale rock; in seams in bluffs at San Pedro; 2 miles north of Lang; large selenite plates have been found in Soledad Canyon. Mono County, in the Bodie district. Monterey County, northeast of King City, Bitterwater Valley, east of Lonoak. Nevada County, fibrous radiate forms occur near Truckee. Riverside County, Corona; extensive deposits occur in the Palen Mountains interstratified with limestone deposits which are thought to be extensive also occur in the Santa Maria Mountains, just west of Colorado River, near Blythe, and in the Colorado Desert, about 12 miles east of Mecca. San Benito County, outcrops occur along the Coast Range in many places. San Bernardino County, Amboy, and in other dry lake depressions of the desert; in the lake bed south of Danby and near Kelso; at Searles Lake associated with borax; selenite occurred with colemanite in the Calico district. San Diego County, near Dos Palmas. San Francisco County, small amounts near Merced Lake. San Luis Obispo County, white bunches and veins occur on Alamo Creek, 16 miles from Santa Maria; some alabaster occurs at Arroyo Grande. Santa Barbara County, as alabaster at Casmalia and near Santa Barbara Creek, about 32 miles southwest of McKittrick, and in small amounts on Santa Rosa Island; massive gypsum was early worked at Point Sal. Santa Clara County, as selenite near Gilroy. Sonoma County, at the Geysers with sulphur and with boussingaultite. Stanislaus County, selenite near Modesto. Ventura County, in small amount on Dennison ranch, 3 miles east of Nordhoff; selenite in Lockwood Valley.

Halite. See Salt.

Halloysite. Inyo County, banded white and brown occurs at the Cerro Gordo mine and the variety lenzinite is reported from Owens Valley. Lassen

County, at Hayden Hill. Mono County, Detroit mine near Mono Lake. San Diego County, at Pala, massive pink occurs with the gem tourmaline. Ventura County, the variety lenzinite.

Halotrichite. Alameda County, in the Eureka tunnel near Livermore.

Hanksite. Common in the borax lake districts. Inyo County, found with borax in the sinks of Death Valley. San Bernardino County, Searles Lake.

Hematite (red iron ore). Large deposits await development. Alameda County, massive red earthy, mixed with limonite, forms the capping of the pyrite body at Leona Heights. Alpine County, common at Monitor. Amador County, large deposit in Ione formation, 2 miles west of Ione, also in Calaveras formation. Butte County, common in the gravels at Magalia, Butte Creek, Oroville, and Stirling City. Calaveras County, at Douglas Flat, Murphy, Wallace, and Quail Hill. Del Norte County, at the Kelsey tunnel, 14 miles southeast of Crescent City. Eldorado County, Pioneer mine; heavy masses at Shingle Springs, in the gravels at Diamond Springs, Green Valley, Virner, and other places. Humboldt County, large vein 3 miles south of Centerville. Inyo County, massive specular, at the Defiance mine, occurs also in Owens Valley. Kern County, at Kane Springs and Ricardo. Lake County, massive, near Red Glenrock, in Cobb Valley. Madero County, Minarets; one of the largest deposits of magnetite-hematite occurs here; much of this ore is martite. Marin County, massive specimens at the Maillard ranch, about 2 miles southwest of San Geronimo. Mono County, common in the Blind Springs district. Napa County, massive red near St. Helena, massive, at White Sulphur Springs and Placerville. Nevada County, with gold at Meadow Lake; minor deposits at Indian Springs and at Newton. Orange County, at Fullerton. Placer County, with magnetite at the Hotaling deposit about 6 miles north of Auburn, small amounts at Clippergap, Red Hill, and near Weimar. Plumas County, with magnetite near Crescent Mills, at Mumfords Hill, Lights Canyon, Genesee Valley, and Nelson Point. Riverside County, Eagle Mountain, derived from the extensive deposit of magnetite. San Bernardino County, near Kane Springs, Cima, Silver Lake, and Leastalk; at Dale, on Iron Mountain in the Kingston Range, Newberry on Providence Mountain, and in prospects in Cave Canyon area, north of Scott Station, and elsewhere in the county are deposits of massive hematite after magnetite or martite. Shasta County, abundant; the Ready or Pit River deposit has been utilized at the electric smelting furnace at Heroult; the cappings of the pyrite beds of this county are thick deposits of earthy hematite and limonite. Sierra County, found in small quantity. Siskiyou County, in the gravels of Shasta River. Sonoma County, large deposit at Noble's ranch, near Fort Ross, and near the west fork of Gualala River. Stanislaus County, foliated near La Grange. Tehama County, at Beegum. Trinity County, in the sands at Trinity Center. Yuba County, in the sands of the Brownsville district.

Hessite. Calaveras County, old Stanislaus mine on Carson Hill. Eldorado County, at Georgetown. Kern County, with silver minerals at Amalie mine. Nevada County, with pyrite, galena, and native gold at the Nevada City mine. Shasta County, in the Shearer and Rattler mine, 3 miles from Redding. Sierra County, in the Golden King mine on Kanaka Creek, near Alleghany. Tuolumne County, in the old Reist mine on Whiskey Hill and in the Jumper and Bouanza mines near Jamestown.

Hübnerite. Inyo County, reported from Tin Mountain. Nevada County, fibrous radiate forms occur near Truckee. San Bernardino County, with pyrite and chalcopryrite in quartz veins 5 miles from Barnwell, near Von-trigger, and at Clark Mountain; also near Goffs in Dirigo district.

Hydrozincite. Inyo County, at Cerro Gordo mine, with sphalerite, willemite, and calamine.

Ilmenite. Amador County, near Volcano. Butte County, at Oroville, Cherokee, Eagle Rock, Brush Creek, and Inskip. Calaveras County, San Andreas, Murphy, and Wallace, in considerable amount. Del Norte County, at Crescent City. Eldorado County, in the Brownsville district, at Green Valley, Placerville, and Grizzly Flats. Humboldt County, at Upper Gold Bluff. Kern County, in the black sands at Vaughn. Los Angeles County, in the beach sands at Ocean Park. Madera County, with magnetite in the Minaret Mountains. Mariposa County, near Princeton and as crystals in dolomite near Mariposa. Nevada County, at Rough and Ready, Nevada City, North Bloomfield, and Relief Hill. Orange County, at Fullerton. Placer County, Gold Run. Plumas County, Spanish ranch, Crescent Mills. Genesee, La Porte, and Nelson Point. San Bernardino County, near Needles. San Francisco County, in dikes. San Luis Obispo County, beach sands. Santa Barbara County, Point Sal. Santa Cruz County, at Aptos. Shasta County, Round Mountain, French Gulch, and Redding. Siskiyou County, in the sands of Jackson Creek, Happy Camp, Forks of the Salmon, Sawyers Bar, Scott River, and Shasta River. Trinity County, at Junction City, Carrville, Minersville, and on Trinity River. Tuolumne County, at American Camp. Yuba County, Marysville, Roundsville, Yuba River, Strawberry Valley, Indian Hill, and Oregon House.

Infusorial earth. See Diatomaceous earth.

Iridium. Found native, in most crude platinum, and with osmium as iridosmine, in the gold placers of Del Norte, Shasta, Siskiyou, and Trinity counties. Also recovered in small quantities during the refining of copper matte and gold bullion from different sources.

Iridosmine. See Iridium.

Iron. Iron ore has been produced in the following districts: Calaveras County, Murphy (Esmeralda). Del Norte County, Low Divide and Rattlesnake Divide. Eldorado County, Flagstaff Hill and Latrobe. Madera County, Minarets. Placer County, Hotaling. San Bernardino County, Cave Canyon, Garlic Spring, Iron Mountain, Kelso, Kingston Range, West Lava Beds, and Owl Holes. San Luis Obispo County, Perfumo Canyon and San Luis Obispo. Santa Clara County, Los Gatos. Shasta County, Baird and Shotgun Creek. Siskiyou County, Gazelle. Sonoma County, Cloverdale and Geyserville. Tehama County, Newville. See also Arsenopyrite, Brown iron ore, Chromite, Hematite, Ilmenite, Magnetite, Marcasite, Ocher, Pyrite, Pyrrhotite, and Siderite.

Jamesonite. Calaveras County, at Mokelumne Hill. Inyo County, Cerro Gordo mine with argentiferous galena. Napa County, with cinnabar at the Manhattan mine, near Kernville.

Jasper. Gem quality found in the following counties: Calaveras County, red, brown, and yellow, at Murphy. Los Angeles County, red, white, and bluish, near Acton. Marin County, 1 mile south of Sausalito. Plumas County, west of Meadow Valley. San Francisco County, near Lands End station. Santa Clara County, reported. Shasta County, near Hart. See Chalcedony.

Kalinite (alum). Alpine County, efflorescence in Silver Mountain district. Calaveras County, at Quail Hill. Fresno County, common in the oil districts at Coalinga with sulphur. Inyo County, Caso Springs, on the shores of Owens Lake. Lake County, common at Sulphur Bank cinnabar mine. Los Angeles County, near Newhall. Mono County, near Bodie. Napa County, at the Redington cinnabar mine near Knoxville; Nowell Mountain. Placer County, in the gold mines near Dutch Flat; in slates near Auburn. Sonoma County, at the geysers.

Kaolin. *See* Clay.

Kunzite (lilac spodumene). *See* Spodumene.

Labradorite. Los Angeles County, white labradorite occurs near Lang; with epidote at San Pedro.

Lapis lazuli. Los Angeles County, San Antonio Creek, near Upland. Madera County, reported in the Minaret Mountains. San Bernardino County, north slope of South Fork of Cascade Canyon, $1\frac{1}{2}$ miles east of Hogback Mountain, 12 miles from Upland.

Lava (light-colored tuffs, rhyolite, trachyte, andesite, and similar rocks). Quarried in the following places: Alameda County, San Leandro. Butte County, Pentz (Curtis ranch). Calaveras County, Jackson (Mokelumne Hill), Vallicita, Valley Springs. Eldorado County, Smith Flat near Placerville. Inyo County, 6 miles west of Laws. Los Angeles County, between Avalon and Empire Landing. Merced County, Merced Falls. Napa County, Calistoga, Napa, St. Helena. San Luis Obispo County, Arroyo Grande, Bishops Peak (Cerro Obispo), Los Berros, Morro Rock. Siskiyou County, Little Shasta, Macdoel, 8 miles east of Montague. Solano County, southwest of Winters. Sonoma County, Agua Caliente, Santa Rosa, Sonoma, Stony Point. Sutter County, Sutter City (Marysville Buttes). Tehama County, north of Paskenta, 20 miles west of Red Bluff.

Lazulite. Inyo County, occurs in a vein cutting schist in Breyfogle Canyon, Death Valley; the lazulite is confined to a few patches in the vein which can be traced several miles. Los Angeles County, in the San Gabriel Mountains. Mono County, near Bodie, near Mono Lake, blue lazulite occurs as bands in white quartzite with rutile. San Diego County, at Oceanside.

Lazurite. *See* Lapis lazuli.

Lead. Lead is the predominant metal produced in the following districts: Inyo County, Lookout, New Coso, Russ, Saratoga, Swansea, and Union. Orange County, Trabuco Canyon (very little). San Bernardino County, Silver Lake. It is of minor importance in several other districts in other counties. *See also* Altaite, Anglesite, Galena, Jamesonite, Linarite, Mimetite, Minium, and Pyromorphite.

Lepidolite (lithia mica). Riverside County, found with tourmaline in Coahuila Mountains. San Diego County, has been mined as a source of lithia and for ornamental purposes at Stewart mine near Pala; occurs with tourmaline, kunzite, etc., at Pala Chief, Naylor-Vanderburg, Caterina, Tourmaline King, Tourmaline Queen, and other places near Pala; at the Mack and Victor mines near Rincon; in the gem mines of the Ramona district.

Limestone (building). Well distributed over the State in extensive beds; chiefly used for cement and lime. Quarried for building stone, crushed stone, and road metal. Amador County, 4 miles east of Ione, Fresno, in Squaw Valley near Dunlap, 20 miles east of Sanger. Calaveras County, Campo Seco, Fosteria, Murphy. Modoc County, Cedarville. Monterey County, 6 miles southeast of Salinas. Nevada County, Grass Valley. Riverside

County, Corona (Orange), Riverside, San Jacinto. San Bernardino County, Cajon, Colton. San Mateo County, Rockaway. Santa Clara County, Mountain View. Santa Cruz County, Santa Cruz. Shasta County, Ingot, Redding. Tulare County, 2 miles northeast of Lemon Cove. *See also* Cement material, Marble, and Travertine.

Limestone (lime). Burned for lime at the following places: Alameda County, Alvarado. Amador County, near Ione. Calaveras County, Vallicita and Campo Seco, in sec. 20, T. 16 N., R. 5 W. Colusa County, Manzanita. Contra Costa County, near Concord, Oil Canyon, and near Antioch. Eldorado County, at Marble Valley, New Castle, and other places. Kern County, at Tehachapi, Keene, and Sparda. Monterey County, at Davenport. Riverside County, at West Riverside and San Jacinto. San Benito County, in several places. San Joaquin County, at Carnegie. San Luis Obispo County, near Lomon Pelon, Arroyo Grande, and elsewhere. Santa Barbara County, at Lompoc and Betteravia. Santa Clara County, at Black Mountain, 9 miles from Mountain View. Shasta County, at Kennett. Siskiyou County, at Callahan and Gazelle. Solano County, Tolenas. Tuolumne County, at Sonora. Ventura County, at Oxnard. At other places in other counties.

Limestone (manufacture of beet sugar). San Bernardino County, $1\frac{1}{2}$ miles east of Orogrande, quarried and used by beet sugar companies.

Limonite. *See* Brown iron ore.

Linarite. Inyo County, Cerro Gordo mine.

Lithiophilite. San Diego County, at Pala, with triphylite and purpurite.

Lithium. *See* Amblygonite, Lepidolite, Lithiophilite, and Spodumene.

Magnesite. Many deposits scattered along the Coast Range from Mendocino County to Los Angeles, and a few along the foothills of the Sierra Nevada; deposits generally occur as veins in serpentine. Alameda County, on Cedar Mountain, 22 miles southeast of Livermore. Calaveras County, near San Andreas. Fresno County, mined at Kings River, 10 miles east of Sanger. Kern County, development work has been done on deposits intercalated with sandstone and shale at Bissell, 11 miles east of Mohave, and near Walker Pass, east of Bakersfield. Mendocino County, pure-white veins on Hixon ranch, about 12 miles north of Cloverdale. Napa County, has been mined in Chiles and Pope valleys and in the serpentine of Beryesla Valley. Nevada County, at Nevada City. Placer County, mined at Iowa Hill; veins occur near Damascus and Michigan Bluff and at Gold Run, recently discovered near Towle. Riverside County, mined at Winchester for cement material. San Benito County, at the Sampson claims between the forks of Larios Creek in Diablo Range. San Francisco County, Fort Point. San Luis Obispo County, on the Kaiser ranch, about 9 miles northwest of Cambria. Santa Barbara County, north of Santa Barbara. Santa Clara County, large veins occur in the Diablo Range in the northeast corner of the county, and have been mined 32 miles southeast of Livermore; also mined near Madrone station. Sonoma County, has been mined near Cloverdale; veins occur 4 miles north of Cloverdale, called the Creon deposit, on the Eckert ranch near Cloverdale, at the William Creek deposit, 7 miles northwest of Guerneville, and at the Red Slide deposit in valley of East Austin Creek, about 8 miles north of Cazadero. Stanislaus County, the veins of the American Magnesite Co. extend across the line from Santa Clara County. Tulare County, is mined at Tule River, 9 miles east of Porterville, and has been mined at Harker deposit, 4 miles northeast of Porterville; veins on South

Fork of Tule River, in Round Valley, about 4 miles east of Lindsay; on Rocky Hill, about 2 miles east of Exeter, with californite; near Naranjo, with white opal; and near Auckland.

Magnetite (magnetic iron ore). Alameda County, at Cedar Mountain. Amador County, occurs on Sutter Creek; bowlders have been found at Volcano. Butte County, abundant at Magalia in gravels on Butte Creek and in the dredging sands at Oroville; in concentrates at Stirling City, Little Rock Creek, Brush Creek, Lovelock, and Inskip. Calaveras County, in concentrates at Douglas Flat, San Andreas, Murphy, and Wallace. Del Norte County, at Crescent City, Gilbert Creek, on Smith River. Eldorado County, massive about 2 miles northeast of Shingle Springs and in octahedrons in chlorite; the lodestone variety has been found at Coloma; common in the concentrates at Virnir, Green Valley, Grizzly Flats, Reliance mine, and in the Brownsville district. Fresno County, lodestone found at the Sparkling iron mine, Kings Creek district. Humboldt County, greater part of the black constituent of the beach sands at Gold Bluff and Upper Gold Bluff is magnetite; common also at Orleans and Trinidad. Kern County, abundant at Ricardo, Kane Springs, and Vaughn in black concentrates. Los Angeles County, solid masses near Russ station in Soledad Canyon and small deposits near Acton and in canyon about 10 miles northeast of Acton; black sands at Ocean Park and Santa Monica Bay. Madera County, large deposits of magnetite-hematite in the Minaret Mountains, deposits on the west slope of Mount Raymond. Modoc County, in the drift and black sands of Feather River. Mono County, massive in the Benton, Bodie, and Lundy districts. Nevada County, 1 mile west of Newtown and 4 miles south of Indian Springs, at the contact between diorite and diabase; in concentrates at Nevada City, Grass Valley, North Bloomfield, Relief Hill, and Rough and Ready. Orange County, in sands at Fullerton. Placer County, 6 miles north of Auburn, in Hotaling district; common in black sands and concentrates at Butcher ranch, Michigan Bluff, North Fork of American River, and other places. Plumas County, common in small deposits at Spanish ranch, Genesee, La Porte, Nelson Point, Crescent Mills, and on Rock Island Hill. Riverside County, one of the largest deposits of iron in the State occurs on Eagle Mountain and is magnetite-hematite or martite ore. Sacramento County, in the black sands at Michigan Bar. San Bernardino County, important deposits of magnetite not yet utilized occur with hematite near Dale, at Owl Holes on Kingston Range, at Cave Canyon, Garlic Springs, Newberry, and on Providence Mountain. San Francisco County, in the beach sands. San Luis Obispo County, common at La Panza. Santa Barbara County, in beach sands at Point Sal. Shasta County, numerous mines and prospects, mined as flux for Bully Hill smelter; large deposit at Hotaling on contact between diabase and slate; deposit near Baird; with hematite at Iron Mountain and at most of the copper mines; in the sands at French Gulch, Redding, and Round Mountain; on contact between diabase and Carboniferous limestone at Gray Rock and on McCloud River. Sierra County, large beds are said to occur. Siskiyou County, common in black sands at Happy Camp, Cecilville, Forks of the Salmon, Scott River, and many other places. Trinity County, in black sands at Trinity Center, Douglas City, and other places. Tulare County, massive at New Pass. Tuolumne County, in black concentrates at all the mines. Yuba County, common at

Marysville, Brownsville, Strawberry Valley, Indian Hill, Oregon House, and Camptonville, and on Yuba River.

Malachite (green copper carbonate). Amador County, Volcano; Calaveras County, Campo Seco, Copperopolis, old Hughes mine. Eldorado County, occurs in Alabaster Cave and Pioneer mines. Inyo County, Wisconsin and Kingman claims and Cerro Gordo district. Los Angeles County, in prospects 23 miles northeast of Acton and 3 miles southeast of Little Rock Creek. Madera County, has been mined at Joe Wagner mine, secs. 2 and 35, Tps. 8 and 9 S., R. 18 E. Mariposa County, mined with other copper ore in Caven Milling Co. mine; some in White Rock mine. Mono County, has been mined with cuprite in Copper Mountain; common in Blind Springs district. Plumas County, with bornite and chalcopyrite in Lights Canyon. Riverside County, has been mined in Homestake group, Mount King, and on other claims. San Bernardino County, mined at Copper World mine with other copper ores; occurs in the Calico district and quite common in the eastern part of the county. Shasta County, mined with other copper ores at Bully Hill mine.

Maltha. Los Angeles, Santa Barbara, and Ventura counties.

Manganese minerals and ore. See Braunite, Manganite, Psilomelane, Pyrolusite, Rhodochrosite, Rhodonite, and Wad.

Manganite. There are numerous small deposits of manganese in the State and much of the ore appears to be manganite mixed with a more or less siliceous psilomelane. The deposits consist generally of black porous ore in masses and lenses of red and brown jasper in the metamorphic rocks of the Coast ranges and to some extent in the Sierras. Alameda County, in Livermore-Tesla district southwest of Livermore in the Diablo Range, occurs in jasper lenses; much of the manganese produced in the State has come from this district, one of the earliest and best known mines being the old Ladd or Corral Hollow mine. Calaveras County, with psilomelane 2 miles northeast of San Andreas in mica schist. Colusa County, on the east flank of St. John Mountain, near Little Stony. Contra Costa County, on Red Rock Island in San Francisco Bay, with psilomelane. Marin County, in the red rock near Sausalito. Mendocino County, at the Cave mine, 10 miles northeast of Ukiah. Placer County, near Colfax. Plumas County, considerable in Meadow Valley and other districts, and the mineral probably is common. Riverside County, psilomelane and manganite occur in a network of veins in schist 6 miles northeast of Elsinore, in the Maria Mountains. San Joaquin County, in jasper in the Diablo Range. San Luis Obispo County, 5 miles west of San Luis Obispo. Santa Clara County, in the Black Wonder and other mines of the Diablo Range. Sonoma County, at the Shaw mine, 8 miles northeast of Cloverdale. Tuolumne County, with rhodonite 2 miles north of Sonora.

Marble. Quarried in the following places chiefly for cement: Amador County, at Carrara quarry, sec. 29, T. 7 N., R. 12 E.; white marble at Plymouth and Sutter Creek. Butte County, at several places, black mottled at Pentz, Oroville, and Pulga. Calaveras County, San Andreas and Vallecita. Inyo County, thick deposits of beautiful variegated dolomite marble occur at the foot of the Inyo Mountains between Keeler and Lone Pine. Kern County, of good quality on the Tehachapi Range, near Neenach. Los Angeles County, Avalon and Neenach (includes adjacent deposit in Kern County). Mono County, Topaz. Placer County, at several places. Riverside County, 6 miles south and 7 miles southwest of Eolom station. San Bernardino 27608°—Bull. 624—17—5

County, beautiful green brecciated variety 11 miles southwest of Barstow; also east of Oro Grande and at the Gem marble quarries in the Silver Mountain district, about 5 miles south of Oro Grande; Baker, Barstow, Mentone, Victorville. San Luis Obispo County, Musick (Arroyo Grande). Siskiyou County, large deposits of white and variegated material on Marble Mountain; Indian Creek. Tulare County, dark bluish gray at Porterville, for ornamental and monumental use. Tuolumne County, near Columbia, on Stanislaus River, white and blue veined marble; Columbia, colored marble, including pinkish, yellowish, and light to medium gray varieties quarried; quarry also at Sonora.

Marcasite. Napa County, abundant at old Reddington mine, Knoxville, with the cinnabar.

Meerschau. Santa Clara County, has been found in Arroyo de San Jose de Gracia.

Melaconite. Calaveras County, common with chalcopryite at Copperopolis and Campo Seco; large nodular masses have come from the Satellite mine. Colusa County, in serpentine with native copper and cuprite at the Gray Eagle mine. Del Norte County, with chalcopryite at the Alta and Pearl mines. Nevada County, Excelsior mine. Shasta County, at the Afterthought and other chalcopryite mines.

Mercury (native). In small and variable quantity in all quicksilver mines. Has been mined in Colusa, Eldorado, Fresno, Lake, Monterey, Napa, San Benito, Solano, Sonoma, San Luis Obispo, Santa Clara, Stanislaus, Trinity, and Yolo counties. *See also* Cinnabar, Metacinnabarite, Quicksilver, and Tiemannite.

Metacinnabarite. Has been found in the following places: Colusa County, in the Sulphur Creek district at Manzanita mine with cinnabar and gold. Inyo County, in Cerro Gordo mine. Lake County, prominent in Great Western, Baker, and Abbott mines. Monterey County, with cinnabar in the Parkfield district, Cholame Parkfield mine, 6 miles from Parkfield. Napa County, in the Redington, later Boston mine, Knoxville, in black amorphous-looking masses; also in the old Reed mine. San Benito County, New Idria and Picachos mines; was important ore. Santa Clara County, New Almaden and Guadalupe mines. Yolo County, Reed and California mines.

Mexican onyx. *See* Onyx marble.

Mica (muscovite). Small sheets have been found in the following places: Eldorado County, thickly interlaminated with gold; roscoelite, at the Stuckslager or Sam Sims mine on Granite Creek, near Coloma; several hundred pounds were found in Big Red Ravine, near the old Sutter mill. Kern County, at Tehachapi. Lassen County, Susanville. Plumas County, Gold Lake; muscovite and lepidolite occur with the gem tourmaline at Coahuila. San Bernardino County, Ivanpah; cookerite has been reported from Oro Grande. San Diego County, muscovite is common in the pegmatite veins which contain the gem tourmaline and kunzite. Tuolumne County, mariposite is common at the Rawhide Ranch mine, near Tuttletown. Ventura County, scrap mica has been mined in secs. 12, 13, and 24, T. 17 N., R. 20 W. Good sheets of muscovite have come from the Mount Almo mica mine.

Millerite. Common in small quantities in quicksilver mines.

Mimetite. Inyo County, found in Cerro Gordo mines. San Bernardino County, Morning Star mine, Lava Beds district.

Mineral paint. *See* Ocher and Sienna.

Minium. Kern County, Fort Tejon. Tulare County, in northern part, small amount. Napa County, old Redington cinnabar mine, Knoxville. San Bernardino County, in some dry salt basins.

Mirabilite. San Bernardino County, forms crusts about some of the dry salt basins.

Molybdenite. Eldorado County, T. 9 N., R. 12 E., Mount Diablo base and meridian, alone and with copper minerals. Fresno County, in granite, on Kings River, in T. 11 S., R. 14 E., and 9 miles east of Sanger. Inyo County, in quartz in White Mountains, and on the west side of Death Valley; on west side of Mount Tom, 8 miles southwest of Rand Valley. Kern County, found frequently in gold region near Havilah. Mono County, 12 miles westward from Fales Hot Spring, and at Coleville. Nevada County, abundant at Nevada City, mixed with limonite; on Red Mountain, 3 miles north of Cisco. Placer County, abundant in small scales in Golden Stag veins in Ophir region; at Elder mine in granodiorite, 4 miles west of Clipper Gap. Riverside County, small quantity in granite quarry near Corona; occurs also in sec. 3, T. 5 S., R. 2 E., San Bernardino base and meridian. Shasta County, found at Lamoine, in granite on Hazel Creek, and on Tom Neal Mountain, near Delta. Trinity County, in sec. 31, T. 33 N., R. 8 W., Mount Diablo base and meridian, south of Lewiston. Tulare County, in granite on South Fork of Tule River, and near Nelson's ranch on the south fork of Middle Fork of Tule River.

Molybdenum. See Molybdenite and Wulfenite.

Muscovite. See Mica.

Natural gas. Occurs at depths of a few hundred to a few thousand feet, associated with petroleum in Tertiary strata in all the oil fields in the State and is especially abundant in the Buena Vista Hills in the Midway district, western Kern County. It is piped from there to Bakersfield and Los Angeles, 160 miles distant, for use as fuel and in lighting. In places, chiefly in the Santa Maria field, Santa Barbara County, is converted into gasoline. Smaller quantities of gas are found in the Quaternary filling of San Joaquin and Sacramento valleys, chiefly at Sacramento, Stockton, and in Solano County. Found also at Marysville Buttes, Sutter County. See also Petroleum.

Nickel (native). Reported in minute grains in gravel in several counties but has not been found in sufficient quantity for mining. Nickel occurs in San Diego County in the Julian district with pyrrhotite and other sulphides, and in Imperial County on Coyote Mountain in unidentified oxidized minerals. See also Millerite, Pyrrhotite, and Zaratite.

Niter. Inyo County, beds in upper part of canyon on both sides of Amargosa River and Willow Creek, and at Tecopah; the common saltpeter occurs with the soda niter in the Death Valley region. Riverside County, in the desert northeast of Salton. San Bernardino County, beds in the side of the lower part of Amargosa River canyon, Saratoga, and elsewhere; not mined.

Obsidian. Occurs in regions of Tertiary volcanic rocks; small quantities cut for gems.

Ocher (mineral paint). Has been mined in the following places: Calaveras County, near Valley Springs. Napa County, near Calistoga. Nevada County, Spenceville. Riverside County, near Corona. Sonoma County, at Ochre and 10 miles south of Healdsburg. Stanislaus County, Knights Ferry, near Kenglas. Mineral paint occurs in quantity also in Butte, Los Angeles, Placer, Siskiyou, Trinity, and Yuba counties.

Oil. *See* Petroleum.

Olivine. Mainly in the sands at many places. In a few localities in clear green crystals large enough to be cut into gems. Butte County, in diabase at Mooreville Ridge and in the concentrates at Oroville and Cherokee. Del Norte County, in the sands at Crescent City, Gilbert Creek, and Smith River. Humboldt County, in beach sands at Gold Bluff, Orleans Bar, and Trinidad. Los Angeles County, at Ocean Park. Mendocino County, Fort Bragg. Nevada County, in gabbro-serpentine series at Grass Valley. Plumas County, in plumasite at Spanish Peak. San Diego County, in gabbro at Dehesa. San Francisco County, in serpentine of San Francisco. San Mateo County, in beach sands. Santa Cruz County, in sands at Aptos. Siskiyou County, in sands at the forks of the Salmon. Yuba County, prominent in sands at Marysville.

Onyx marble, California onyx, Mexican onyx. Quarried in the following places: Glenn County, northwest corner sec. 21, T. 18 N., R. 6 W. Kern County, different colors were quarried in sec. 2, T. 9 N., R. 17 W. Plumas County, large deposits in southwest part of county. San Diego County, gray, black, and white on Coyote Mountain, Colorado Desert. San Luis Obispo County, in sec. 9, T. 32 S., R. 15 E., and 5 miles north of Musick, beautiful onyx marble with mosslike inclusions of greenish chlorite. Siskiyou County, 6 miles south of Berrydale, all colors, principally pure white, in secs. 16, 19, 20, and 21, T. 43 N., R. 12 E. Solano County, Suisun, Tolenas, and Vacaville. Sonoma County, Healdsburg.

Opal. Alpine County, at Redwood Lake, occurs as wood opal. Amador County, wood opal at Volcano. Butte County, wood opal at Dodson mine. Calaveras County, common and hyalite opal at Mokelumne Hill; wood opal at Chile Gulch, Bald Hill, Angels, and other camps. Contra Costa County, hyalite and common opal on Mount Diablo. Fresno County, dendritic or moss opal in the mountains east of Fresno. Kern County, white opal on the summit of Tehachapi Mountain. Lake County, the transparent variety hyalite has been found 30 miles northwest of Mount Diablo; fluorite opal at Sulphur Bank; hyalite at Middletown and Kelseyville. Lassen County, wood opal in Sunrise Valley. Modoc County, good opal reported from vicinity of Fort Bidwell. Plumas County, wood opal in Gravel Range. Napa County, wood opal in large trees in fossil forest near Calistoga. Nevada County, wood opal at Chalk Bluff, Nevada City, North Bloomfield, and Shelley Hill; masses of moss opal at Newton. Placer County, wood opal at Gold Run and near Roseville. San Bernardino County, in seams, veins, and pockets 25 miles northwest of Barstow, amber-yellow and other colors, good stones cut; some clear hyalite occurs with it. San Diego County, glassy hyalite on quartz and albite at Rincon. San Francisco County, in the serpentine of San Francisco. Sierra County, wood opal at Downieville. Siskiyou County, fire opals at Dunsmuir. Tulare County, yellow opal has been found at Yokohl and Venice Hill, near Visalia, and "chrysoprase opal" has been mined with chrysoprase at Venice Hill and near Lindsay, and in hills east of Visalia and Porterville; wood opal in Kings River Canyon. Tuolumne County, wood opal near Columbia.

Peat. In Sacramento and other valleys where there are tule marshes. There is a plant for producing peat fuel near Huntington Beach and one making peat and petroleum briquettes near Sacramento.

Petroleum. Petroleum is the most important mineral product of California, which in 1912 to 1914 inclusive led all other States in the production of oil, by a fair margin of 10,000,000 barrels in 1914. Production in the

State in 1913 was 97,788,525 barrels valued at \$45,709,400. The marketed production in 1914 was 99,775,327 barrels, valued at \$48,066,096. The large productive fields are all located in the southern part of the State, Coalinga, in Fresno County, being the most northerly one. The principal districts in order of importance are the Temblor Range district, western Kern County, including the Midway, McKittrick, and Sunset fields; Coalinga district, Fresno County; Puente Hills district, Los Angeles and Orange counties; Kern River district, central Kern County; Lost Hills and Belridge districts, northern Kern County; Santa Maria district, northern Santa Barbara County; Los Angeles and Salt Lake districts, Ventura and Los Angeles counties; Santa Clara River valley fields, Ventura and Los Angeles counties; Summerland district (production now small), in southern Santa Barbara County. There are more than 7,000 producing wells in the State. Also numerous indications of oil in Devils Den, Kreyenhagen, and Kettleman Hills districts, Kern, Kings, and Fresno counties; San Emigdio district, southern Kern County; southern San Luis Obispo County; Parkfield and Lonoak districts, western Monterey County; Pleyto and San Antonio River district, southern Monterey County; Sargent and Moody Gulch districts, Santa Clara County; western San Mateo County; Vallecitos district, San Benito County; Livermore district, Alameda County; western Contra Costa County; Colusa County; southern Humboldt County.

Petzite. Calaveras County, with hessite in the Stanislaus and Melones mines on Carson Hill. Eldorado County, with calaverite at the Darling mine, about 3 miles northeast of American Flat. Inyo County, at Telluride in the Gilt Edge claim, 7 miles southeast of Olanche. Tuolumne County, Norwegian, Golden Rule, and Rawhide Ranch mines, near Tuttleton, Bonanza, and Sugarman mines, Sonora.

Platinum. Is recovered at dredges in Butte, Calaveras, Merced, Sacramento, and Yuba counties. A few ounces recovered annually at placers in Del Norte, Humboldt, Siskiyou, and Trinity counties. Found also in Inyo County in the concentrates of the Mount Hope mine, near Citrus. Kern County, in black sands at Kane Springs. Mendocino County, near Little River. Nevada County, at Rough and Ready and Relief Hill. Placer County, on North Fork of American River at Butcher, East Auburn, Blue Canyon, and Michigan Bluff. Plumas County, in the concentrates at Genesee, La Porte, and Rock Island Hill. Riverside County, at Holcombe. San Luis Obispo County, in beach sands. Santa Barbara County, in beach sands at Lompoc. Santa Cruz County, in beach sands. Shasta County, in the sands at Redding and on Cottonwood Creek. Siskiyou County, in sands at Callahan, Castella, Harley, Happy Camp, Sawyers Bar, Oak Bar, Fort Jones, Hornbrook, Cecilville, Klamath River, and Rock ranch. Tehama County, in sands near Beegum. Trinity County, in black sands of Trinity River and its tributaries at Douglas City, Burnt ranch, Junction City, Big Bar, Hawkins Bar, and in the Hay Fork district; nuggets weighing several ounces have come from the county. Ventura County, in black sands. Yuba county, in concentrates at Indian Hill, Camptonville, and in the Brownsville district.

Potash. Occurs in San Bernardino County, at Searles Lake, in solution in the lake waters with other salts. *See also* Alunite, Alunogen, Kalinite, and Niter.

Potash alum. *See* Kalinite.

Proustite. Kern County, with pyrargyrite in Amalie mine. Mono County, in the Oro and Bodie mines, Bodie district. Shasta County, occurred in the Chicago mine near Igo with galena, pyrite, and quartz.

Psilomelane (manganese ore). This is the chief ore of manganese in the State. It is almost always associated with manganite or pyrolusite, and often with limonite. Alameda County, near Tesla, and formerly mined on Cedar Mountain, 10 miles east of Livermore; a largely siliceous deposit occurs at Corral Hollow. Contra Costa County, on Red Rock, San Francisco Bay. Los Angeles County, asbolite occurred in the O. K. mine, San Gabriel Canyon. Marin County, large masses occurred on the San Geronimo ranch. Placer County, masses at Michigan Bluff. Plumas County, in Calaveras formation, 3 miles southwest of Meadow Valley. Riverside County, in the Maria Mountains, northeastern part of county. San Benito County, stringers and coatings occur with the benitoite. San Bernardino County, Owl Head, in northern part of county, 30 miles west of Tonopah & Tidewater Railroad and 40 miles from Silver Lake post office; large deposit mined. Tuolumne County, massive with pyrolusite near Columbia.

Pumice. Abundant in Mono, Modoc, Lake, San Diego, and San Francisco counties. Many deposits in the Sierra Nevada counties; not worked. Deposit near San Francisco formerly utilized.

Pyrargyrite (ruby silver). Alpine County, in the old IXL and Exchequer mines of the Silver Mountain district. Kern County, associated with argentite at the Amalie mine. Mono County, abundant with stephanite; in the Oro, Addenda, Fortuna, and other mines south of Bodie; it occurred in the Blind Spring mines, in the Tower mine, and in other mines near Benton. Napa County, associated with quicksilver at Calistoga. Nevada County, found in the Allison Ranch mine with pyrite, chalcopryrite, and galena; also in the Central mine south of Barnes Hill.

Pyrite. Alameda County, mined at Leona Heights, Oakland, and shipped to acid works. Amador County, with copper ore at Newton mine. Calaveras County, "Foothill Copper Belt," at Campo Seco and Union mine, Copperopolis; carries gold and silver, disseminated in gold quartz veins throughout the county; cubes and pyritohedrons occur with the gold on Carson Hill. Colusa County, at the Sulphur Creek deposit, occurs in hexagonal plates as pseudomorphs after pyrrhotite. Eldorado County, Pioneer mine, carries gold and silver, with copper ores. Fresno County, with galena and zinc blende in Fresno copper mines, argentiferous. Inyo County, Chloride Cliff district. Kern County, Butte mine, Randsburg quadrangle, mined for gold. Madera County, disseminated in gold quartz veins. Mariposa County, Cavan Mining & Milling Co. mine, and Pochontas mine, with copper ores. Nevada County, was mined at Spenceville with copper ore at Meadow Lake, and in all gold mines of county. Placer County, abundant in veins of Ophir district, auriferous, also in Dairy Farm district. Santa Clara County, New Almaden cinnabar mine. Sonoma County, on Austin Creek near Healdsburg. Shasta County, Mountain Copper, Balaklala, Trinity mines, etc., in copper district, carries gold and silver. Siskiyou County, Blue Ledge in Elliott district, carries gold and silver. Tuolumne County, with copper ores in Oak Hill copper mine, carries gold and silver, also disseminated in gold quartz veins.

Pyrolusite (manganese oxide). Alameda County, Cedar Mountain, and with psilomelane in the Diablo Range southwest of Livermore in the Corral Hollow district. Amador County, in the Seaton mine and in volcanic

ash at Volcano. Calaveras County, is not mined but occurs with quartz in mica schists of Calaveras formation 2 miles northeast of San Andreas; occurred at Wild Rose Flat near Murphy. Colusa County, prospects in jasper on east flanks of St. John Mountain, near Little Stony, and found at Stony Ford in association with cinnabar. Contra Costa County, occurred with psilomelane on Red Rock, San Francisco Bay. Marin County, on east slope of mountains north of Golden Gate, west of Sausalito, Mendocino County, at Red Mountain. Napa County, occurred as radiate concentric masses with cinnabar at the old Redington and Manhattan mines, Knoxville. Nevada County, in the Grass Valley district. Placer County, reported from foot of Cape Horn Bluff near Colfax, found near Auburn. Plumas County, common in the Diadem lode, Meadow Valley district, found near Meadow Valley and elsewhere. Riverside County, near Elsinore. San Bernardino County, with silver ores in the Calico and Barstow districts. San Francisco County, in veins in jasperoid rock. San Joaquin County, in the manganese deposits of the Diablo Range. San Luis Obispo County, was mined 5 miles west of San Luis Obispo. San Mateo County, at Baden. Santa Clara County, at the Washington mine and in mines of the Diablo Range. Sierra County, common as dendrite at Alleghany. Siskiyou County, occurs with rhodnite at Sawyers Bar. Sonoma County, at the Shaw mine. Tuolumne County, 2 miles north of Sonora; common with psilomelane at Knapp's ranch, near Columbia, and small quantities in auriferous gravel.

Pyromorphite. Tulare County, White Chief mine, Mineral King district.

Pyrophyllite. Alameda County, near Irvington. Marin County, on Mount Tamalpais. Mariposa County, gray masses of radiating fibrous rosettes occur at Tres Cerritos, southwest of Indian Gulch. Plumas County, at the Diadem lode, Meadow Valley. San Diego County, near San Diego, a compact cream-colored agalmatolite with dark-red streaks occurs near Encinitas. San Luis Obispo County, some massive has come from this county.

Pyrrhotite (magnetic pyrite). Del Norte County, has been mined with copper ores in Low Divide district on Diamond, Copper, and Shelly creeks. Fresno County, Fresno copper mines. Humboldt County, in bodies on Elk Creek (reported). Madera County, old Buchanan mine. Mariposa County, Green Mountain mines; common in the gold mines. Mono County, Tioga mine; common in quartz. Nevada County, Grass Valley, Nevada City, and in the Meadow Lake district. Placer County, Ophir mine. Shasta County, with pyrite, chalcopyrite, and zinc in Iron Mountain mine at Gray Rocks, Black Diamond, and other copper mines; common in gold ores in granite of East Lode. Siskiyou County, prominent with chalcopyrite at Callahan; said to be nickeliferous at the Hummer mine. Tuolumne County, in gneiss on north fork of Beaver River.

Quartz. Common gangue mineral in many mines.

Quartz (cat's-eye). Humboldt County, quartz-actinolite cat's-eyes have been found at Eureka. San Diego County, quartz cat's-eye at Point Loma. San Mateo County, at Pescadero Beach.

Quartz (crystals). Amador County, Volcano and Oleta, a section which has also produced amethyst, smoky and rose quartz, and Thetis hairstone. Butte County, smoky quartz on North Fork of Feather River. Calaveras County, near Murphy; from Green Mountain mine, 2 miles south of Moke-lumne Hill; large aggregates of good crystals occurred in many of the gold mines; have been shipped to New York and cut for ornaments; Angels and West Point have also produced large crystals. Eldorado

County, rock crystal, phantom crystals, and smoky quartz, which are the best in the State, have come from the vicinity of Placerville. Inyo County, in the Cerro Gordo and Darwin districts. Los Angeles County, Thetis hairstone near Los Angeles. Mariposa County, at Mount Bullion. Mono County, rock crystals, amethyst, and tabular drusy quartz have come from the Bodie district. Napa County, near Calistoga. Nevada County, at Grass Valley and Nevada City. Placer County, Ophir district, and quartz containing green chlorite occurs at Shady Run. Plumas County, Granite Basin, and rose quartz in Meadow Valley. Riverside County, at Coahuila, rock crystals, smoky quartz, and pink quartz in fine large crystals are associated with the gem tourmaline. Sacramento County, at Folsom. San Bernardino County, with rutile needles in the San Bernardino Range. San Diego County, at Pala, Mesa Grande, Rincon, and elsewhere fine specimens of rock crystals, smoky quartz, and pink quartz are associated with green and pink tourmaline in pegmatite veins. Sierra County, Bald Mountain. Tulare County, Three Rivers and in Drum Valley.

Quartz (for pottery, abrasives, etc.). Quarried at the following localities: Riverside County, near Perris; San Diego County, near Lakeside.

Quartz (rose). Alpine County, in Hope Valley and in Mogul and Monitor districts. Plumas County, in Meadow Valley. San Diego County, Pala, Mesa Grande, and Rincon; rose quartz mine near Mesa Grande. Tulare County, 9 miles north of Lemon Cove, and Parson claim, 8 miles southeast of California Hot Springs, near the Kern County line; also at Bull Run Meadows and Yokohl. Reported at several other places.

Quartz diorite. Fresno County, Clovis; Sacramento County, Folsom.

Quicksilver. Quicksilver (mercury) is the predominant metal produced in the following districts: Colusa County, Sulphur Creek; Contra Costa County, Mount Diablo (Ryen); Fresno County, Mercy mine, Mexican; Lake County, Baker, Mayacmas, and Sulphur Bank; Monterey County, Dutro and Table Mountain; Napa County, Bella Union, Knoxville, La Joya, and Mayacmas; San Benito County, Cerro Benito mine south of "Flanada," Alpine and Picacho mines south of New Idria, Central Benito, New Idria, and Stayton; Santa Clara County, New Almaden mine, and Guadalupe mine near Los Gatos; San Luis Obispo County, Adelaida, Oceanic, Ocean View, and Rinconada; Santa Barbara County, Los Prietos; Siskiyou County, Beaver Creek; Solano County, St. Johns; Sonoma County, Guerneville and Pine Flat; Trinity County, Altoona; Yolo County, Knoxville. *See also* Cinnabar, Mercury, Metacinnabarite, and Tiemannite.

Radium. *See* Uraninite.

Rhodochrosite. Butte County, on North Fork of Feather River. San Bernardino County, good specimens at the New York mine near Manvel.

Rhodonite. Alameda County, at the Corral Hollow deposit. Butte County, on North Fork of Feather River with rhodochrosite. Plumas County, occurs at Peters, near Taylorsville, and in the Genesee and other valleys, with copper at the Diadem Lode, Meadow Valley. Siskiyou County, 9 miles north of Happy Camp and at Sawyers Bar. Tulare County, near Ward ranch, 3 miles north of Lemon Cove. Tuolumne County, with manganese oxide, 2 miles north of Sonora, and on Rose Creek near Columbia. At many other localities.

Road metal (macadam, rubble, and concrete). Extensive industry. Various materials have been quarried, as listed below: Alameda County, trap, chert, sandstone, basalt, and Jasper. Colusa County, sandstone; Contra Costa County, sandstone and gravel. Los Angeles County, sandstone.

Marin County, sandstone, chert, and siliceous shale. Napa County, tuff. Riverside County, granite and gneiss. Sacramento County, diorite and granite. San Benito County, granite. San Francisco County, sandstone. San Joaquin County, chert and sandstone. Santa Clara County, siliceous shale. Santa Cruz County, limestone. Shasta County, limestone. Solano County, basalt. Sonoma County, basalt. Ventura County, limestone.

Roscoelite. Eldorado County, layers half an inch in maximum thickness and thickly interlaminated with gold were found at the Stuckslager or Sam Sims mine on Granite Creek, near Coloma.

Rose quartz. *See* Quartz (rose).

Rubellite (red tourmaline). *See* Tourmaline.

Salt. Evaporated from sea or lake water in the following places: Alameda County, at Alvarado, Newark, Mount Eden, and Russell (about 90 per cent of the State's production of salt is made in Alameda County). Imperial County, Salton Lake, northwest part of county; works no longer exist, owing to flooding of Salton Basin. Inyo County, at Owens Lake, Saline, and Salt Wells valleys; the bottom of Death Valley is an extensive salt marsh. Kern County, numerous salt lakes and wells in the Mohave Desert region; the alkaline desert from Kern River to the Canada de las Uvas is impregnated with salt; at the Buckthorn, Indian, and Mesquite springs, associated with borax. Los Angeles County, Long Beach. Riverside County, Salton Sea depressions contain immense deposits of white salt and have produced thousands of tons. San Bernardino County, in numerous dry lakes; near Daggett some of the salt was used for chloridizing the silver ores; a large lake deposit occurs in the desert about 25 miles southeast of Danby, and the Surprise salt mines have produced much; a bed of rock salt 12 feet thick is reported in the Avawatz Mountains; occurs with borax and nitrates along Amargosa River near the Inyo County line. San Diego County, La Punta. San Luis Obispo County, Soda Lake (dry) in Carissa Plains. San Mateo County, Redwood City and Leslie.

Sand (building). Dug in Alameda County, at Centerville and Niles; Contra Costa County, Antioch; Los Angeles County, Los Angeles, Long Beach, and Puente Largo; Monterey County, Lake Majella and Seaside; Napa County, Napa; San Diego County, Coronado, Lakeside, and San Diego; Sonoma County, Healdsburg; Yuba County, Marysville. Sand is dug in small quantity at many other places and occurs in great abundance in dunes along the coast.

Sand (filter). Monterey County, Fanshell Beach, 3 miles south of Pacific Grove.

Sand (fire). Monterey County, Lake Majella, near Pacific Grove; Fanshell Beach.

Sand (glass). Dug in Alameda County, at Tesla; Los Angeles County, Palmdale; Monterey County, Lake Majella, near Pacific Grove; San Joaquin County, near Stockton.

Sand (molding). Dug in Alameda County, at Centerville and Decoto; Monterey County, Lake Majella; Orange County, Horseshoe Bend; San Diego County, San Diego.

Sandstone. Quarried in the following places: Alameda County, Oakland, Piedmont. Amador County, 6 miles south of Ione, Lancha Plana. Calaveras County, at Valley Springs. Colusa County, near Sites. Contra Costa County, Clayton, Martinez, Stege. Del Norte County, Crescent City. Kern County, 6 miles south of Tehachapi. Los Angeles County, Chatsworth. Marin County, McNear's Point. Monterey County, Tassajara Hot

Springs. Napa County, near Monticello, near Napa, St. Helena, and in Maxwell Canyon, 15 miles from Rutherford. Orange County, El Modeno, Santa Ana, Santiago Canyon. Sacramento County, along Cosumnes River, fine white to yellow quarried near Michigan Bar. San Bernardino County, in sec. 7, T. 1 S., R. 1 W. San Francisco County, San Francisco. San Luis Obispo County, Berros, near Edna, near Santa Margarita, Arroyo Grande. San Mateo County, Colma, San Pedro Point. Santa Barbara County, Montecito, Santa Barbara, Mission Canyon, Santa Maria, Santa Ynez. Santa Clara County, Graystone, 10 miles from Los Gatos. Shasta County, northeast of Redding, Texas Spring, secs. 7 and 18, T. 32 N., R. 4 W., and sec. 29, T. 31 N., R. 5 W. Siskiyou County, Henley, Yreka. Sonoma County, Coast Bluffs, Freestone, Petaluma. Stanislaus County, Knights Ferry (Wright ranch). Ventura County, Camarillo, Santa Susana, Sespe, near Brownstone. Yolo County, Winters, Putah quarry, 9 miles from Winters. In small quarries at several other places.

Sapphire. Los Angeles County, have been found in drift in San Francisquito Pass.

Satellite (gem stone). Tulare County, variety of serpentine associated with asbestos at Venice Hill; put on the market in 1908.

Scheelite. Inyo County, 8 miles west of Bishop. Kern County, Johannesburg, small production from Winnie, Sydney, and other gold claims, Stringer district; also from several gold claims in Rand district; mined with hübnerite in Jawbone Canyon, in contact-metamorphic deposits, and with gold ores in Amalie district, and prospected near Weldon; with stibiconite and native silver at Little Caliente Springs. Nevada County, Grass Valley. San Benito County, with stibnite at some of the mines in the northeast part of the county. San Bernardino County, Atolia, 6 miles southwest of Perris, at Randsburg, and in the Clark Mountains with wolframite; Atolia field, $4\frac{1}{2}$ miles east of Randsburg, largest individual producer in the United States. Santa Clara County, with stibnite at some of the mines.

Serpentine. Amador County, has been quarried 2 miles west of Plymouth and near Sugar Loaf. Tulare County, a chrysotile variety giving cat's-eye effect and called "satellite" comes from this county.

Siderite. Inyo County, in masses at the Custer mine, Caso district. Los Angeles County, some massive in the Tejuanga Canyon. Shasta County, reported in large masses east of the Stillwater region.

Sienna. Colusa County, secs. 29 and 32, T. 17 N., R. 6 W.

Silver. Silver is the predominant metal produced in the following mining districts: Alpine County, Silver Mountain. Calaveras County at Quail Hill. Inyo County, Cerro Gordo, Daylight, Deep Springs, Independence, Kearsarge district, Panamint, and Wild Rose. Kern County, Amalie and near Garlock. Los Angeles County, at the Kelsey mine in San Gabriel Canyon. Mono County, at Blind Spring Hill near Benton, at the Diana and Comanche mines, Castle Peak and Cloverpatch, at Bodie, and in the Sweetwater range north of Bridgeport. Placer County, at the Ophir mine. Plumas County, Pocahontas mine, associated with copper and cuprite. San Bernardino County, Brightwood, Calico, and Cima; Grapevine, Silver Reef, and Silver Mountain districts, and in the Avawatz Mountains. Of minor importance in many other districts. See *also* Amalgam, Argentite, Calaverite, Cerargyrite, Electrum, Embolite, Hessite, Petzite, Proustite, Pyrargyrite, Stephanite, Stromeierite, and Sylvanite.

- Silver** (native). Alpine County, Silver Mountain district. Calaveras County, with copper ore at Quail Hill. Inyo County, Cerro Gordo and Kearsarge districts. Kern County, Amalie district, Little Caliente Springs, and near Garlock. Los Angeles County, Kelsey mine in San Gabriel Canyon. Mono County, Big Spring Hill, Bodie, and Sweetwater Range north of Bridgeport. Placer County, Gold Blossom and California mines, Ophir region. Plumas County, Pocahontas mine. San Bernardino County, Avawatz Mountains, Calico, Grapevine, Silver Mountain, and Silver Reef districts. Shasta County, Bully Hill, Afterthought, and Excelsior mines.
- Slate.** Eldorado County, large quarry of roofing slate at Slatington, near Placerville. Mariposa County, has been quarried at Chili Bar and in sec. 6, T. 6 S., R. 16 E. Merced County, quarry opened in 1912 about 11 miles east of Planada.
- Smithsonite.** Inyo County, found in Cerro Gordo mines; at the Ignacio mine with calamine and willemite. Kern County, occurred in drusy veins at Jewett mine on Cottonwood Creek. San Bernardino County, with calamine at the Cuticura mine near Daggett.
- Soapstone.** *See* Talc and soapstone.
- Soda.** Inyo County, mined at Owens Lake. Mono County, occurs at Long Valley Hot Springs and elsewhere in the county. San Luis Obispo County, at Soda Lake, Carriso Plain.
- Sphalerite.** Calaveras County, at Campo Seco and Copperopolis, common in the pyrite ore. Eldorado County, at Grizzly Flats, Pilot Hill, and other mines. Fresno County, with galena and pyrite in Fresno copper mines. Inyo County, common with galena in the Darwin, Cerro Gordo, and Inyo Mountain mines. Los Angeles County, on Santa Catalina Island, with galena and chalcopryrite. Mariposa County, in the mines along the Mother Lode. Mono County, Homer, Lundy, and Benton districts. Nevada County, in many of the gold mines; prominent in the Meadow Lake district and in the mines of Grass Valley and Nevada City. Placer County, Moore mines and elsewhere in Ophir region. Shasta County, important ore of Shasta district, rich in gold and silver; in masses in the Afterthought, Peck, Copper City, Iron Mountain, Mammoth, Bully Hill, Trinity, and other mines. Siskiyou County, common with galena and chalcopryrite at Callahan; in small amount with sulphides and oxides of iron and copper in Blue Ledge mine, Elliott district; carries gold and silver.
- Spinel.** Butte County, small crystals of ruby spinel occur in the rocks of the Diamond mine near Oroville. Humboldt County, ruby spinel occurs in the beach sands at Gold Bluff. Placer County, picotite at Rocklin. San Diego County, a few crystals were found in Mack mine, near Rincon. San Luis Obispo County, gems of good quality near San Luis Obispo.
- Spodumene** (gem varieties, kunzite, California iris, and hiddenite). Riverside County, found at Fano mine near Coahuila in the San Jacinto Mountains. San Diego County, pink, lilac, and greenish-colored crystals have been mined at Pala Chief, Caterina, and Stewart mines near Pala and at Mack mine near Rincon; at Pala it occurs with the gem tourmaline.
- Stephanite.** Mono County, in the Blind Spring Hill district and large masses occurred with pyrargyrite in the Oro, Addenda, and Fortuna mines in the Bodie district; in the Sweetwater Range north of Bridgeport. Nevada County, Grass Valley mines.
- Stibiconite.** Kern County, with native silver at Little Caliente Springs. San Benito County, with stibnite at some of the mines in the northeast part of the county. Santa Clara County, with stibnite at some of the mines.

Stibnite (gray antimony ore). Calaveras County, with gold at Mokelumne Hill and in the Mother Lode region. Colusa County, found with cinnabar at Manzanita mine, and mined for antimony at several points near Gilham and Antimony City. Inyo County, in Cerro Gordo district with silver-lead ores; in large bodies on the western slope of the Panamint Mountains, near Wild Rose Springs, associated with oxide of antimony. Kern County, was mined at San Emigdio Canyon; occurs 8 miles east of San Emigdio Creek, in the southwestern part of Antimony Peak and 4 miles farther east, on the head of Salt Creek, in quartz veins cutting schist, mainly amphibolite; on Erskine Creek and in the Caliente district, 18 miles east of Caliente; in the Amale mining district, near Lorraine (Paris), one-half mile from Caliente Creek, sec. 22, T. 30 S., R. 34 E., Mount Diablo base and meridian. Lake County, with cinnabar at Sulphur Bank, on Clear Lake. Los Angeles County, in the mountains south of Lancaster. Mariposa County, found in many mines in the gold districts. Mono County, common in Blind Springs district, associated with silver-lead ores; occurs also at the Comanche, Cornet, and Diana mines. Napa County, at Manhattan mine, and the Boston or old Redington mine at Knoxville. Riverside County, near Corona and at the Crowell mine, 5 miles southeast of South Riverside; San Benito County, at Stayton mine; many veins of it in the northeastern part of the county, associated with cinnabar deposits; it occurs also in the Antimony Mountains northeast of Hollister. Santa Clara County, near Gilroy and at the New Almaden cinnabar mines, associated with cinnabar. Sierra County, as one of the sulphides with the gold ores at Downieville. Tulare County, in the Mineral King district, as an associate of argentiferous galena.

Stromeyerite. Alpine County, believed to be a part of the ore in the Monitor and Mogul districts, associated with galena, sphalerite, pyrite, and enargite. Inyo County, found near Panamint, in Panamint Range, in the Silver Queen and other mines, associated with tetrahedrite and cerargyrite; occurs also in the Cerro Gordo and Wild Rose districts. San Bernardino County, has been found at Silver King mine, Calico district.

Strontianite. Plumas County, large masses of divergent columnar form were found in the Genesee Valley.

Strontium. See Celestite and Strontianite.

Sulphur. Colusa County, on banks of Sulphur Creek and in Manzanita mine. Imperial County, on rims of mud volcanoes near Volcano. Inyo County, Sulphur Bank, on Owens Lake, near Olancha. Kern County, on both sides of San Joaquin Valley with beds of impure gypsum and limestone. Lake County, at the Sulphur Bank quicksilver mine on Clear Lake. San Bernardino County, at Searles Lake, associated with borax. Sonoma County, at the geysers. Tehama County, large deposit reported on south slope of Lassen Peak. Ventura County, Sulphur Mountain, 3 miles east of Fillmore, and at borate deposit in Frazier Mountains.

Sylvanite. Calaveras County, in the Carson Hill mines and especially prominent in the Melones and Stanislaus mines. Trinity County, with gold in the Yellow Jacket mine and with nagyagite at the Dorleska mine, Coffee Creek district.

Talc and soapstone. Alameda County, light-green talc in serpentine about 20 miles southeast of Livermore. Amador County, has been quarried at Jackson. Butte County, soapstone occurs in the vicinity of Flea Valley and Clear Creek; narrow seams of talc occur in the Big Bend of North

Fork of Feather River; gray soapstone near Buck's ranch. Calaveras County, as seams 2 miles northeast of Angels and on Quail Hill; deposits $2\frac{1}{2}$ miles west of Murphys and $1\frac{1}{2}$ miles southwest of Vallecita have been utilized to some extent. Contra Costa County, in the schists near San Pablo. Eldorado County, in the Kelsey district and at Georgetown. Fresno County, occurs in large quantity. Glenn County, seams occur with the serpentine on the eastern border of the county. Kern County, steatite occurs on Soapstone Mountain. Los Angeles County, soapstone is found with serpentine at Empire Landing, Santa Catalina Island. Marin County, near San Rafael and Taylorville. Mariposa County, near Princeton and in the Lewis district. Napa County, as seams with serpentine in the Chiles district. Nevada County, in the Grass Valley region. Placer County, as outcrops a few miles north of Colfax. Riverside County, in white scaly forms 3 miles southwest of Winchester and near Perris. Sacramento County, with chromite on Bear Mountain, near Mormon Island. San Bernardino County, a talcose clay called "rock soap" is found near Waterman. San Diego County, a rock soap occurs near National City, at Otay, and in Tia Juana Valley; steatite occurs 5 miles from Escondido. Santa Barbara County, rock soap occurs on Santa Maria River. Santa Cruz County, near Aptos. Shasta County, occurs near Castella and on Boulder Creek. Sierra County, soapstone suitable for slabs has been quarried near Pike City. Siskiyou County, in several localities associated with serpentine areas, near Etna, near Fort Jones, near the head of Wolley Creek, near Scott, and in the Cottonwood Mountain. Sonoma County, associated with actinolite at Petaluma; a French chalk variety is found at Pine Flat. Trinity County, light-gray soapstone occurs on Browns Mountain. Tulare County, is quarried 8 miles east of Lindsay; occurs near Visalia. Tuolumne County, greenish-white talc occurs about 9 miles north of Sonora; talc also occurs at Shaws Flat and on Yankee Hill. Yuba County, soapstone has been quarried for local use near Camptonville and in the vicinity of Challenge and Oak Valley.

Tetradymite. Calaveras County, with gold in the Melones and the Morgan mines on Carson Hill, associated with other tellurides. Nevada County, at the old Murckie mine, near Nevada City. Tuolumne County, at the Soulsby mine.

Tetrahedrite (gray copper). Alpine County, Silver Mountain district. Calaveras County, in the mines on Carson Hill. Del Norte County, at Crookeshine. Imperial County, occurred in the Blue Jacket and other mines of the Picacho district. Inyo County, with malachite and cuprite in Ulida prospects, Ubehebe district; contained a large percentage of silver in the Cerro Gordo district; occurred also in some of the White Mountain mines, in the mines of the Dutton Range, and in the old San Carlos mine. Los Angeles County, in the Zapate mine in the San Gabriel Canyon. Mariposa County, common in the gold mines, associated with quartz, pyrite, galenite, and sphalerite; the silver-rich variety freibergite occurred in large masses in white quartz at the Live Oak mine near Mariposa; the mineral also occurred in the Pine Tree mine, near Coulterville. Mendocino County, in the Redwood Copper Queen mine, with chalcocopyrite, gold, and silver. Mono County, important silver ore in several districts; in the Diana, Comet, Comanche, and other mines of the Blind Spring Hill district it occurred massive, associated with petzite; also found in the Bodie district. Nevada County, in the Osborn Hill vein, with sphalerite and chalcocopyrite; at the North Banner and other

mines of the Banner Hill and Willow Valley districts. Placer County, with other sulphurets and with electrum at Boulder, Gold Blossom, Pine Tree, and Golden Stag mines, Ophir region. Plumas County, at the Irby-Holt mine in Indian Valley. San Bernardino County, massive in the New York and other mines in the New York Mountains. Shasta County, carries gold and silver in Afterthought mine, Ingot; in a barite gangue in the Bully Hill mine; sparingly in few mines of Mother Lode. Tuolumne County, on Whiskey Hill; massive in the Golden Rule mine near Jamestown.

Thenardite. Inyo County, white masses occur in the Funeral Range and in the dry depressions of Death Valley. San Bernardino County, in layers several feet in thickness at Searles Lake. San Luis Obispo County, at Soda Lake on the Carrizo Plain.

Tiemannite. Lake County, occurred in large masses in vicinity of Clear Lake and in masses in the Abbott mine, with cinnabar. Orange County, at the San Joaquin Ranch mine, with cinnabar and metacinnabarite. Santa Clara County, at the old Guadalupe mine, near Los Gatos, with cinnabar.

Tin. See Cassiterite.

Titanite. Santa Clara County, fine large crystals occur in the eclogites (dike rocks) of Calaveras Valley, and in quartzite and diorite of Oak Hill, near San Jose.

Titanium. See Ilmenite.

Topaz. San Diego County, mined $2\frac{1}{2}$ miles northeast of Ramona.

Tourmaline. Fine gems, red and pink (rubellite), blue (indicolite), green (Brazilian emerald), and other colors, mined in Riverside and San Diego counties. Alpine County, black tourmaline is common in Hope Valley. Eldorado County, black tourmaline occurs with orthoclase at Bucks Bar. Fresno County, black is common in Fine Gold Gulch, at the Enterprise mine, and at Eber Flat. Inyo County, black occurs in the Lee district. Kern County, black in the rocks of the Tehachapi Mountains. Mariposa County, black is very common in the granites of the Yosemite Valley. Nevada County, black occurs at Emerald Bay, Lake Tahoe, and near Crystal Peak, and brown 2 miles northwest of Colfax. Orange County, black is found at the Santa Ana tin mine, Santa Ana Mountains. Placer County, black at Soda Springs. Riverside County, in the Coahuila Mountains and San Jacinto Range. San Bernardino County, black at Halleck. San Diego County, in a series of pegmatite veins consisting mainly of white albite with quartz and lepidolite mica, cutting through the diorite hills in the northwestern part of the county from the vicinity of Mesa Grande northward through Pala and into Riverside. These veins have been prolific in their yield of beautifully transparent tourmalines of many shades of rose, red, and green. The richly colored red and green tourmalines found in this county are exceptionally fine and have become almost universally known and used as gems. At present the best tourmalines come from Mesa Grande, Himalaya, and other mines near Mesa Grande; Pala Chief, Catarina, Naylor-Vanderburg, Tourmaline King, Tourmaline Queen, Stewart, and other mines near Pala; Mack and Victor mines near Rincon; Little Three, Surprise, Hercules, Daggett, and other mines near Ramona. San Luis Obispo County, black tourmaline occurs in the rocks of the Santa Margarita Hills. Tulare County, black in Fraser Valley, Drum Valley, and at Mineral King. Tuolumne County, black near Crimea House, near Sonora, and near Soulsbyville.

Trap rock. Alameda County, quarried at Berkeley, Oakland, and elsewhere, mostly andesite. Butte County, Oroville. Contra Costa County, Richmond. Napa County, Napa City. Sacramento County, Dredge. San Francisco County, San Francisco. Solano County, Cordelia. Sonoma County, Santa Rosa, Mellita, Penn Grove, and Petaluma. *See also* Road metal.

Travertine. Mono County, large deposit near Bridgeport.

Tripolite. *See* Diatomaceous earth.

Trona (carbonate of soda). Obtained at salt lakes in Inyo, Mono, and San Bernardino counties. Mono County, in white layers along the shores of Owens Lake; the solid contents of the waters of this lake are mainly trona and the solid matter of the lake is more than 90 per cent pure soda. San Bernardino County, common in sinks and borate lakes; mined at Searles Lake, where it has accumulated in large amount in thick layers of solid trona with the borax, hanksite, thenardite, glauberite, and other salts; crystals are common.

Tufa (calcareous). Contra Costa County, quarried north of Mount Diablo. San Luis Obispo County, quarried at Creston. Has been used locally for making cement in Kern, Mono, Santa Cruz, San Luis Obispo, and Shasta counties.

Tuff. Calaveras County, massive rhyolite tuff has been quarried at Mokelumne Hill, Angels, and elsewhere; Eldorado County, near Placerville; San Luis Obispo County, near Los Berros; Sonoma County, near Santa Rosa. Sebastopol, and Sonoma; Sutter County, near Sutter; Tehama County, 20 miles west of Red Bluff, and in sec. 12, T. 24 N., R. 6 W.

Tungsten. *See* Hübnerite, Scheelite, and Wolframite.

Turquoise. Fresno County, bluish-green turquoise has been found at Taylor's ranch, Chowchilla River. San Bernardino County, mined 2 miles west of Cottonwood station, Himalaya mine or West Camp, 12 miles north-east of Silver Lake; Middle Camp, 16 miles northeast of Silver Lake; East Camp, 31 miles west of Nipton.

Ulexite (borate of lime). Inyo County, occurs at Bennetts Wells at the bottom of Death Valley, Furnace Creek, and elsewhere. Kern County, Cane Springs and a few miles north of Desert Wells. Los Angeles County, at Lang with colemanite. San Bernardino County, Cave Springs, Willow Springs Lake, Calico district; found at Borate and in the lower part of Death Valley and at several places in the Mohave Desert.

Uraninite. Calaveras County, Rathgeb mine near San Andreas.

Verde antique (marble). San Bernardino County, large quarry in sec. 28, T. 7 N., R. 2 W., between Victorville and Barstow.

Verde salt. *See* Thenardite.

Vesuvianite (californite). Butte County, at Big Bar on Feather River, 15 miles north of Oroville. Fresno County, found near Selma and Walls Valley, 32 miles east of Fresno City. Inyo County, with garnet and massive white datolite at the San Carlos mine. Riverside County, Crestmore. San Diego County, brown vesuvianite occurs with essonite garnet about 10 miles east of Jacumba Hot Springs. Siskiyou County, south fork of Indian Creek, 10 miles west of north of Happy Camp and 90 miles from Yreka, outcrops for 200 feet along the creek. Tulare County, near Exeter and Lindsay; east of Porterville, also with white grossularite garnet in the northwest corner of the county, about 35 miles east of Selma.

Volcanic ash. San Bernardino County, 3 miles southeast of Siam.

Wad (bog manganese). Nevada County, occurs near North Banner mine. Tuolumne County, found in few places in limestone and shale near Columbia.

Witherite. Mariposa County, near El Portal, in veins in slate associated with barite.

Wolframite. Inyo County, in Death Valley, 40 miles east of Keeler, and near Bishop. Kern County, with copper minerals in granite rocks at Woody; near Neurolia, in Jawbone Canyon. Madera County, small quantity in tungsten-bearing vein near Raymond. Mariposa County, in quartz vein about 12 miles north of Raymond; crystals and massive wolframite near Buchanan. San Bernardino County, with scheelite near Ivanpah and Nip-ton, Clark Mountain district, New York Mountains.

Wood (silicified). Sonoma County, occurs at The Geysers.

Wulfenite. Inyo County, with linarite and caledonite of Cerro Gordo mine. Kern County, 6 miles northeast of Home Springs. Plumas County, at the Diadem Lode on Mumford Hill. San Bernardino County, was found in considerable quantity with the lead carbonate of the Silver Reef district. San Luis Obispo County, at the Fairview mine.

Zaratite. Found as coating on chromite. Fresno County, near Madera. Monterey County, near San Benito River (?). San Benito County, near Hollister and near Panoche.

Zeolites. San Benito County, a large vein of white natrolite occurs near the headwaters of San Benito River on the west side of the Diablo Range, about 25 miles northwest of Coalinga, in which crystals of benitoite and neptunite are included. The natrolite is mostly granular.

Zinc. See Aurichalcite, Calamine, Hydrozincite, Smithsonite, and Sphalerite.

COLORADO.

- Acanthite.** Clear Creek County, small quantity with other silver ores; Dolores County, Enterprise mine, Rico.
- Agate.** Fremont County, mined at Garden Park, 7 miles north of Canon City, and at Curio Hill, $6\frac{1}{2}$ miles south of Canon City. Occurs at other places.
- Aikinite.** La Plata and Montezuma counties, in the La Plata Mountains, reported in fair quantities.
- Alabandite** (manganese sulphide). Park County, Quartzville. Summit County, Queen of the West mine, argentiferous, with rhodochrosite.
- Allanite.** Boulder County, near Boulder in flattish tabular crystals in gneisses and granites. Douglas County, at Devils Head.
- Almandite.** *See* Garnet.
- Altaite** (telluride of lead). Boulder County, in several mines in Gold Hill district, argentiferous and auriferous; has been mined.
- Aluminum.** *See* Bauxite and Cryolite.
- Alunite.** Conejos County, Platoro and other places. Custer County, Knickerbocker Hill and Rosita Hills. Hinsdale and Mineral counties, various localities in the San Cristobal quadrangle. Lake County, Leadville. Ouray County, National Bell mine and Red Mountain. Rio Grande County, Summitville, Jasper, Embargo, Summer Coon, and other places. Saguache County, on Tracey Creek, Bonanza, Beidell, and other places.
- Amalgam** (natural). Boulder County, several mines. La Plata County, Neglected mine, 15 miles from Durango.
- Amazon stone.** Douglas County, Devils Head Mountain. El Paso County, Pikes Peak region and Crystal Park near Manitou Springs. Teller County, 4 miles north of Florissant, at many places around Crystal Peak.
- Amber.** Boulder County, in the Boulder coal field and adjoining counties.
- Amblygonite.** Fremont County, the variety known as natramblygonite, because of the soda present, is mined and shipped near Canon City.
- Amethyst.** Has been mined at the following localities: Fremont County, 12 miles northwest of Canon City, 1 mile south of Twelvemile Park; Gilpin County, Nevada; Gunnison County, Elk Mountains; Hinsdale County, Henson Creek; Las Animas County, Animas Range; Mineral County, at Amethyst, near Creede, and head of Piedra River; Saguache County, Carners Creek.
- Anhydrite.** Eagle County, 2 miles north of Gypsum.
- Anglesite** (lead sulphate). Chaffee County, Monarch and Garfield area. Clear Creek County, Georgetown mines. Fremont County, occurs in croppings of Sedalia mine. Hinsdale County, near Lake City. Lake County, in silver-lead mines at Leadville. Ouray County, Red Mountain. Summit County, Breckenridge. Occurs also in many other places.
- Annabergite.** Custer County, in the Gem and other mines near Silver Cliff.
- Anthracite.** *See* Coal (anthracite).
- Antimony.** *See* Bournonite, Polybasite, and Stibnite.
- Apatite.** Eagle County, near Gypsum in the dark andesites of Cripple Creek. Gunnison County, at the Iron Hill area southeast of Powderhorn.
- Aquamarine.** Chaffee County, Mount Antero. Clear Creek County, near Georgetown. Fremont County, reported from vicinity of Royal Gorge, 5 miles northwest of Canon City. Jefferson County, near Creswell. Park County, Buffalo Mountain.
- Argentite** (silver glance). Clear Creek County, Silver Plume and Georgetown mines. Dolores County, Newton Hill mine, Rico district. Hinsdale County, near Lake City. Lake County, silver-lead mines at Leadville.

Montrose County, Cashin mine. San Miguel County, Marshall Creek, in quartz veins with tetrahedrite, galena, sphalerite, and some silver. Summit County, Montezuma district. Occurs in many other mines in small quantity all through the Sulphide Belt.

Arsenopyrite (mispickel). Gilpin County, of rare occurrence, some of it highly argentiferous but of no great economic value; auriferous; Central City and elsewhere. Gunnison County, near Ruby Camp, with proustite, argentiferous. San Juan County, Silverton. San Miguel County, Mount Wilson, argentiferous, with tetrahedrite, and at Telluride.

Asbestos. Boulder County, Allens Park, Mont Alto Park, and other places. Chaffee County, near Maysville. Fremont County, occurs in Sedalia mine. Rio Grande County, near Jasper.

Asphalt. Asphaltic rock occurs in Garfield, Rio Blanco, Routt, and other western counties and in Middle Park. Small deposits occur elsewhere, as near Morrison.

Aurichalcite. In oxidized zinc ore of Little Johnny and neighboring claims, Leadville.

Azurite (blue carbonate of copper). Fremont County, occurs in Red Gulch copper district. Routt County, Hahns Peak, prospected. San Juan County, occurs in ore bodies of Bear Creek.

Barite. Boulder County, many places in mining area; also vein of considerable size near Boulder. Mineral County, at the Wagon Wheel Gap fluorite mine. Pitkin County, gangue mineral of Aspen district. San Miguel County, occurs 2 miles north of Placerville in veins 2 to 7 feet wide.

Bauxite. Chaffee County, reported near Buena Vista.

Beegerite. Ouray and Park counties, in several mines; Old Lout mine near Ouray, mined for silver.

Beryl. Boulder County, near Glendale. Chaffee County, occurs near top of Mount Antero; color varies from light blue to deep aquamarine green; fine gems, worked intermittently. Clear Creek County, Georgetown. Fremont County, East Gulch, $6\frac{1}{2}$ miles north of Texas Creek; mined, few gems cut. Jefferson County, near Creswell. Park County, Buffalo Mountain.

Bismuth. See Beegerite, Bismuthinite, Bismutite, Cosalite, and Tetradymite.

Bismuthinite (bismuth sulphide). Boulder County, several mines. Chaffee County, at Granite. Grand County, at Cummins City, North Park. Jefferson County, Guy Hill. Lake County, Leadville district, Highland Mary and other mines. La Plata County, California district, Comstock mine. Larimer County, Big Thompson River. Ouray County, Red Mountain district, Indiana mine.

Bismutite. Boulder County, reported in mines. Chaffee County, on Mount Antero. La Plata and Montezuma counties, reported in La Plata Mountains.

Bituminous rock. Grand County, Middle Park.

Bornite (peacock ore). Larimer County, at Pearl. Moffat County, with vanadium deposits on Blue Mountain. Montrose County, in ore bodies of Cashin mine. Pitkin County, occasionally found in Aspen district; small quantities of ore found in many other places.

Bournonite. San Juan County, particularly in the Silverton area.

Brochantite. Chaffee County, was mined in Monarch mine.

Brown iron ore (limonite, brown hematite). Mined for flux, also for silver. Fremont County, Sedalia mine. Gunnison County, occurs in irregular masses along Tomichi Creek, Whitepine district. Hinsdale County, occurs near Lake City. Lake County, mined in silver-lead mines at

Leadville; mostly manganiferous. Pitkin County, common in Aspen district mines. Saguache County, large body interbedded with limestone at Orient; was extensively worked; still producing few thousand tons annually. Summit County, has been mined for flux. Occurs in thousands of vein cappings.

Cadmium. *See* Greenockite.

Calamine. In ore bodies at Leadville and Monarch, and in other silver-lead districts.

Calaverite. Boulder County, several mines. Teller County, mined in Cripple Creek district, at Raven mine, Prince Albert mine, and C. O. D. mines; principal gold mineral of Cripple Creek mines.

Calciovolborthite. Montrose County, found in crevices in sandstone near Uranium post office. *See also* Volborthite.

Carnotite. Dolores County, reported from points along Rio Dolores. Eagle County, in silver, copper, and vanadium-bearing sandstone on Brush Creek. Garfield County. Moffat County, on Blue Mountain, near Skull Creek, 15 miles north of Rangely, Rio Blanco County. Mesa County, as an impregnation in sandstone along the Rio Dolores, 40 miles southwest of Gateway. Montrose County, as an impregnation in sandstone along Roc, La Sal, and Paradox creeks, and in other places. Rio Blanco County, prospects near Coal Creek, 14 miles northeast of Meeker. Routt and other western counties. San Miguel County, near Cedar, along Disappointment Creek, and in adjacent territory, near Placerville; in small quantity with roscoelite.

Cassiterite. Garfield County, near Carbondale.

Cement material (Portland). Boulder County. Fremont County, Mississippian and Cretaceous limestone west and east of Front Range, suitable for Portland cement; cement plants at Portland and Concrete, east of Florence; limestone of Niobrara age used. Larimer County, Niobrara limestone from Laporte to point 8 miles west of Longmont, Boulder County, suitable for Portland cement; only very narrow band, 10 to 20 feet in width in Niobrara, at this point; widens southward into Boulder County. Good limestone occurs at several points in rocks of Pennsylvanian age east of range and in Carboniferous rocks in Chaffee, Gunnison, and other counties west of range. (*See also* Limestone.)

Cerargyrite (horn silver). Custer County, Illinois mine, Schanck Hill near Silver Cliff. Eagle County, a silver mineral reported to be cerargyrite occurs in vanadiferous sandstone on Brush Creek. Lake County, common in oxidized ores of silver-lead mines at Leadville. Summit County, occurs near Breckenridge, in small quantities impregnating a rhyolitic rock.

Cerium metals. *See* Allanite, Gadolinite, and Monazite.

Cerussite (lead carbonate). Clear Creek County, Georgetown area produced considerable quantity. Custer County, has been extensively mined at Silver Cliff. Fremont County, small quantity in Sedalia mine. Hinsdale County, occurs near Lake City. Lake County, mined in silver-lead mines at Leadville. Pitkin County, principal ore of upper zones of Aspen district. Routt County, Hahns Peak region, Tom Thumb mine only producer. Occurs also in greater or less quantity with galena ores of Chaffee, Eagle, Summit, and other counties.

Chalcanthite (bluestone, blue vitriol). In Clear Creek County and in adjacent parts of Summit County, in considerable quantities in veins, with tetrahedrite, galena, chalcopyrite, sphalerite, barite, etc. San Juan County, Silver Pick and Special mines.

Chalcedony. Grand County, Willow and Corral creeks, near old salt works, South Park. Park County, Thirty-one Mile Mountain, west of Guffey, blue chalcedony. Occurs also at several localities in surface gravels of Gunnison, Logan, Morgan, Ouray, Rio Grande, Saguache, and Weld counties.

Chalcocite (copper glance). Clear Creek County, occurs near Idaho Springs. Chaffee County, near Poncha Springs. Fremont County, Gem mine. Larimer County, occurs at Pearl. Montrose County, rich ore at Cashin mine, La Sal Creek; carries silver. Ouray County, has been mined at Iron-ton; argentiferous, massive. Routt County, seen at few places. San Miguel County, occurs with siderite and small crystals of sphalerite, argentiferous; also in sandstone with matrix of calcite (argentiferous). Common at other mines.

Chalcophanite. Associated with heterolite in oxidized zinc ores of Leadville.

Chalcopyrite (copper pyrites). Found in small quantities in nearly every camp in Sulphide Belt. Clear Creek County, in mines northwest of Idaho Springs; carries gold and silver. Dolores County, not abundant in Rico district; small amount in Newman, Silver Swan, and other mines. Gilpin County, occurs with uranium in Wood, Kirk, Belcher, and German mines near Central City. Gunnison County, Blistered Horn, Tincup district, Sandy Hook and Gold Links, Gold Brick district, Vulcan, and elsewhere; carries gold and silver. Hinsdale County, near Lake City. Larimer County, occurs at Pearl. Pitkin County, Aspen district. Routt County, occurs at Hahns Peak. San Juan County, Monticello lode, Silver-ton district, carries gold; also in Bear Creek district, carries gold and silver. Summit County, in veins of Montezuma district. Common in other places.

Chalk. In the eastern part of the State in Cretaceous limestone formations.

Chrysoberyl. Six miles west of Sedalia, at old mica prospect, with black tourmaline and muscovite and near large garnets. Seems to be only locality west of Greenfield, N. Y.

Chrysocolla (silicate of copper). Custer and Saguache counties, Sangre de Cristo Mountains; undeveloped. Jefferson County, Pine Grove and Bear Creek. Lake County, Leadville.

Cinnabar. Boulder, Clear Creek, and other counties, in small quantity at several points. La Plata County, in sandstone; said to be rich; undeveloped. Several small finds in southern part of State.

Clay (brick). Dug at the following places: Boulder County, Boulder, Trilby; Conejos County, Alamosa; Denver County, Argo and Denver; Douglas County, Parker; El Paso County, Colorado City, Colorado Springs, and Suburbs Springs; Fremont County, Canon City and Florence; Garfield County, Glenwood Springs and Rifle; Hinsdale County, Lake City; Jefferson County, Golden and Hall; Kit Carson County, Burlington; La Plata County, Bell Spur, La Plata; Larimer County, Fort Collins and Fossil Creek; Las Animas County, Trinidad; Mesa County, Grand Junction; Moffat County, Craig; Montrose County, Montrose; Morgan County, Brush and Fort Morgan; Otero County, La Junta and Fowler; Prowers County, Lamar; Pueblo County, Pueblo; Rio Grande County, Monte Vista; Teller County, Cripple Creek; Weld County, Greeley; Yuma County, Wray and Yuma.

Clay (fire). Douglas County, Larkspur. El Paso County, Colorado City and De Witt ranch, 4 miles from Colorado Springs. Fremont County, Canon City. Garfield County, plastic clay from Dakota sandstone near Glenwood Springs; has been mixed with crushed quartz and made into bricks

for coke ovens at Cardiff. Jefferson County, Golden. Lake County, Leadville. Pueblo County, Pueblo and Stone City.

Clay (kaolin). Occurs in thousands of mines as gouge, as at Durango Girl mine, on east slope of Lewis Mountain, La Plata County. Deposits near Newcastle, Parkdale, Salida, Silver Cliff, and elsewhere, but quality and extent are not known.

Clay (stoneware). Jefferson County, Golden; burns white, red, and buff.

Clay (zinc-bearing). Associated with oxidized zinc ores of Leadville.

Coal (anthracite). Gunnison County, mined at Crested Butte; coal-bearing area is about 25 square miles. Pitkin County, has been mined at Crystal City. Routt County, Yampa coal field; small local areas of good coal; not mined yet.

Coal (bituminous and subbituminous). Book Cliffs, Canon City, Durango, Grand Hogback, Grand Mesa, Raton, and South Platte are the principal coal fields. The principal producers are: Las Animas, Huerfano, Boulder, Fremont, Gunnison, El Paso, Weld, and Routt counties.

Book Cliffs field, Garfield, Rio Blanco, and Mesa counties.—There are about 360 square miles of workable, medium-grade bituminous coal. The four important mines are: Cameo (8-foot bed), Palisade (6-foot bed), and Book Cliff (7-foot bed), in Mesa County, and Carbonera (7-foot bed), in Garfield County.

Canon City field, Fremont County.—There are about 22,400 acres of high-grade noncoking bituminous coal. The average thickness of beds is 3 to 6 feet. Mining for domestic trade is extensive.

Colorado Springs field, El Paso County.—A good quality of subbituminous coal occurs in 3 beds 1 foot to 2 feet thick. There are 12 mines in operation.

Danforth Hills field, Rio Blanco and Routt counties.—The workable coal in 10 beds has a minimum thickness of 73 feet. There are about 159,700 acres of workable noncoking bituminous coal. Mined for local use.

Durango field, La Plata and Archuleta counties.—There are 3 beds, 3, 4, and 6 feet thick, of excellent coking bituminous coal, all of which are mined. There are also several workable beds of bituminous coal.

Glenwood Springs field, Garfield and Pitkin counties.—There are 9 beds mined, having a total thickness of about 96 feet. The coal is a good grade of bituminous, noncoking in Garfield County but coking in Pitkin County.

Grand Hogback field, Rio Blanco and Garfield counties.—There are about 41,720 acres of workable coal land. The 7 beds mined have a total thickness of 105 to 108 feet. The coal is noncoking bituminous. Mining is rather extensive.

Grand Mesa field, Gunnison, Delta, and Mesa counties.—There are about 550 square miles of workable bituminous coal, some of which is of coking quality. The field is divided into the Palisades district containing 11 feet of workable coal beds, the Rollins district containing 15 feet of workable coal beds, and the Somerset district containing 65 feet of workable coal beds. Of these the Somerset is the most important, producing most of the coal shipped.

Lower White River field, Rio Blanco, Routt, and Moffat counties.—A good grade of bituminous coal is mined in small quantities for local use.

North Park field, Jackson County.—There are about 75,000 acres of possible subbituminous coal land. The 2 beds mined have average thickness of 10 and 50 feet. One mine is shipping coal and six are mining for local use.

Raton Mesa (Trinidad) field, Las Animas and Huerfano counties.—About 1,115 square miles of high-grade bituminous coal. There are three series of beds, of which the lower is the most important; average thickness of beds is 6 feet; coal in the southern part of the area is largely consumed in the manufacture of coke. It is the most important coal field in Colorado, producing 62 per cent of the total annual tonnage.

South Park field, Park County.—There are 3 beds, 5, 6, and 8 feet in thickness, which were formerly mined; the mines have all been abandoned.

South Platt field (including Denver Basin and Boulder districts).—This field extends from the region south of Denver nearly to the Wyoming line, covering parts of Douglas, Elbert, Arapahoe, Jefferson, Adams, Morgan, and Weld counties. The coal is of subbituminous grade. Mining is extensive in Boulder County. Beds mined range from 2 to 15 feet in thickness.

Yampa field, Routt County.—Workable coal area is estimated at 1,200 square miles of bituminous coal. The northern part of the field contains many thick beds of subbituminous grade. The coal is mined for local use at Craig, Hayden, Pool, and Eddy.

Cobalt. See Erythrite and Smaltite.

Coloradoite. Boulder County, at Keystone, Mountain Lion, and Smuggler mines, with quartz, gold, native tellurium, and sylvanite.

Columbite. Fremont County, near Canon City; Jefferson County, Turkey Creek. Teller County, several points in Pikes Peak region.

Copper (native). Dolores County, California prospect near head of Iron Draw; Jefferson County, near Golden. Montrose County, has been mined and shipped from Cashin mine. Park County, Handcart Gulch. Routt County, in veins near Columbine, Hahns Peak region. Occurs also at many other places.

Copper minerals. Copper is the predominant metal produced in the following districts: Chaffee County, Cleora and Sedalia; Fremont County, Canon City, Cotopaxi, Red Gulch; Grand County, Harmon; Huerfano County, Huerfano (malachite); Jackson County, Pearl; Jefferson County, Evergreen; Larimer County, Empire and Steamboat Rock; Mesa County, Unaweep; Montrose County, La Sal; Ouray County, Red Mountain; Routt County, Copper Ridge, Elkhorn, Oak Creek, Rock Creek, Spring Creek; Teller County, East Beaver, 8 miles south of Rosemont. Of minor importance in many other districts. See also Azurite, Bornite, Brochantite, Chalcantite, Chalcocite, Chalcopyrite, Chrysocolla, Covellite, Cuprite, Enargite, Malachite, Melanconite, Stromeierite, Tennantite, and Tetrahedrite.

Cordierite. Fremont County, found 6 miles from Canon City.

Corundum. Chaffee County, occurs in crystals at Calumet. Clear Creek County, occurs in Saxon Mountain, near Georgetown. Routt County, near Hahns Peak, bluish.

Cosalite. La Plata County, several mines, including Comstock mine near Parrott City. Ouray County, Gladiator and other mines.

Covellite. Montrose County, rich ore at Cashin mine, La Sal Creek; carries silver. Rio Grande County, Summitville. San Juan County, several small finds.

Cryolite. El Paso County, occurs at St. Peters Dome, Pikes Peak district.

Cuprite. Chaffee County, near Poncha Springs, mined at Lily mine near Garfield. Fremont County, Sedalia mine. Jefferson County, Bear Creek and Pine Grove. Montrose County, occurs in ores of Cashin mine, La Sal

Creek. Pitkin County, in oxidized ores of Aspen district. Mined also in many other places.

Diatomaceous earth. Denver County, small bed at West Denver; not mined.

Dolomite. Dolomitic limestones of Silurian and Carboniferous age are country rocks of ore bodies at several mining districts.

Embolite (chlorobromide of silver). Lake County, near Leadville; of common occurrence, chiefly in a siliceous iron ore in cavities and on fissure planes.

Empressite. Saguache County, Empress Josephine mine, Bonanza district, associated with galena and native tellurium.

Enargite. Clear Creek County, small quantities occur. Gilpin County, has been mined at Russell Gulch, particularly at Powers mine; argentiferous; with pyrite and fluorite. Gunnison County, small quantities in several mines. Ouray County, several mines. Rio Grande County, Summit district; both auriferous and argentiferous; often carries free gold; with pyrites only, in quartz matrix. San Juan County, has been mined on Red Mountain; argentiferous, with tetrahedrite and galena in quartz veins.

Epidote. Chaffee County, Calumet, fine crystals. Fremont County, occurs near Canon City. Gunnison County, occurs on Italian Mountain.

Epsomite. In coal mines, mineral waters, alkali deposits, and alkali lakes.

Erythrite. Gunnison County, Tercelli Mountain.

Feldspar (microcline). El Paso County, near St. Peters, has been prospected and some sold to potteries.

Ferberite. Boulder County, Boulder, Nederland, in veins cutting granite, pegmatite, and gneiss; mined, Sunshine. Clear Creek County, small finds reported. Gilpin County, 2½ miles north of Blackhawk, mined.

Fluorspar (fluorite). Boulder County, mined at Jamestown, and shipped. Chaffee County, at Mount Antero. Clear Creek County, at Georgetown. Custer County, has been mined at Rosita. Dolores County, abundant gangue mineral in Blackhawk mine and prospects of Silver Creek, Rico region. Douglas County, at Devils Head. El Paso County, in quantity at Elk Creek, near Cheyenne and Pikes Peak; mined at Duffields. Gilpin County, in Gregory and Russell districts. Gunnison County, in lead ores near Sherrod, Iron Hill, and southeast of Powderhorn. Jefferson County, mined at Evergreen. Mineral County, mined at Wagon Wheel Gap. Park County, in northern part of Halls Valley; shipped from Jefferson. San Juan County, in quartz veins in Poughkeepsie Gulch. San Miguel County, in Telluride district. Teller County, Cripple Creek, with gold tellurides.

Freieslebenite. Gunnison County, on Augusta Mountain.

Fuller's earth. Chaffee County, low grade near Salida.

Gadolinite. Douglas County, mined on Devils Head Mountain. Washington County, was dug at Akron.

Galena (argentiferous auriferous lead ore). Boulder County, in small quantity in tungsten-bearing veins of Boulder district. Chaffee County, in Alpine, Chalk Creek, and Cottonwood districts. Clear Creek County, in mines 6 miles southwest of Idaho Springs; carries gold and silver. Dolores County, important ore mineral of Rico district, abundant in Enterprise mine, also Union, Carbonate, and Newman mines; argentiferous. Eagle County, in Red Cliff (Battle Mountain) district. Fremont County, at Cotopaxi. Gilpin County, reported with uranium in Wood, Kirk, and other mines near Central City. Gunnison County, mined at Blistered Horn, Tincup district; Sandy Hook and Gold Links, Gold Brick district, and elsewhere; Elkhorn and Timich districts, carries gold and silver. Hinsdale County, Galena district, 5 miles west of Lake City. Lake

County, important ore at Ohio mines; carries silver and gold; also in silver-lead mines at Leadville. Park County, Horseshoe district, 7 miles west of Garo, on easterly slope of Mosquito Range. Pitkin County, common silver-bearing ore in Aspen district; Mollie Gibson and other mines. Routt County, mined in Slavonia district and at Columbine and near Hahns Peak (Minnie D. and Tom Thumb mines); carries gold. Summit County, in veins of Montezuma district. Teller County, in small quantities in many mines of Cripple Creek district. Occurs in many other mines.

Garnet. Chaffee County, spessartite variety in rhyolite, east side of Arkansas River opposite Nathrop, on Ruby Mountain; large brilliant crystals near Salida; worked intermittently. Fremont County, Grape Creek, 2 miles southwest of Canon City; almandite variety; handsome gems cut; occurs also at Sedalia mine. Gunnison County, grossularite variety on Italian Mountain.

Gas. *See* Natural gas.

Gold (lode). Predominant metal produced in the following districts: Boulder County, Central, Gold Hill, Grand Island, Magnolia, Sugarloaf, and Ward; Chaffee County, Granite, Riverside, and Turret; Clear Creek County, Argentine, Idaho Springs, Lincoln, and Upper Union (Empire); Conejos County, Ute (Platoro), 45 miles southwest of Monte Vista; Dolores County, secondary importance in Lone Cone and Pioneer (Rico) districts; Eagle County, Fulford and Holy Cross; Fremont County, White Horn, 26 miles northeast of Salida; Gilpin County, Central City, Independence, and Pine; Grand County, Grand Lake (Wolverine) and La Platte; Gunnison County, Box Canyon, Cebolla, Cochetopa, Gold Brick, Tincup, and White Earth; Hinsdale County, Park (Sherman); Huerfano County, La Veta; Lake County, Twin Lakes, minor importance at Leadville; La Plata County, California, Needle Mountains (Florida); Montezuma County, East Mancos; Ouray County, Imogene Basin (Camp Bird), Sneffels, Uncompahgre; Park County, Buckskin, Consolidated-Montgomery, Hartsel, Mosquito, Tarryall; Rio Grande County, Decatur, Embargo, Summitville; Routt County, Hahns Peak; Saguache County, Baca Grant (Crespone); San Juan County, Animas (Silverton), Eureka; San Miguel County, Iron Spring (Ophir), Lower San Miguel, Upper San Miguel (Telluride); Summit County, Breckenridge, Frisco, Swan River; Teller County, Cripple Creek, from reduction of tellurides. *See also* Amalgam, Calaverite, Petzite, and Sylvanite.

Gold (placer). Produced in the following districts: Chaffee County, Granite; Clear Creek County, Lincoln; Costilla County, Greyback and Plomo; Eagle County, Holy Cross (Eagle River); Jefferson County, Golden; Lake County, Twin Lakes, 9 miles northwest of Granite; Moffat County, Lay (Jackrabbitt); Park County, Monquette and Tarryall; Routt County, Hahns Peak; San Miguel County, Lower and Upper San Miguel (Placerville and Telluride); Summit County, Breckenridge, Swan River. Produced in minor quantity in several other districts.

Goslarite. Lake County, at one time abundant in the old dumps containing zinc blende at Leadville.

Grahamite. Grand County, near Granby.

Granite. Boulder County, Craggs, Crescent, Lyons (quarried). Chaffee County, Barre, Granite, Salida (quarried), Turret (quarried). Clear Creek County, Lawson, Silver Plume. Douglas County, Castle Rock. El Paso County, Cascade. Fremont County, quarried at Cotopaxi and Texas Creek, Whitehorn. Gunnison County, fine grade at Aberdeen quar-

ries; State capitol is built of it. Jefferson County, quarried at Stone Spur, Buffalo Creek, and Golden. La Plata County, Durango. Larimer County, at Masonville, United States mint at Denver is built of it; Arkins and other points. Pitkin County, 10 miles southeast of Aspen. Rio Grande County, Del Norte; quarries also opened at O'Neill Spur, Platte Canyon, and other places.

Graphite. Chaffee County, good quality amorphous graphite, mined near Turret; originally coal, metamorphosed by igneous intrusion. Gunnison County, occurs $3\frac{1}{2}$ miles north of Pitkin; branches of Quartz Creek; impure; in quartz veins $2\frac{1}{2}$ feet thick. Las Animas County, occurs near Trinidad; carbon derived from coking coal by igneous intrusion.

Greenockite. Reported with zinc ores at Leadville and elsewhere.

Grindstones. Gunnison County, Gunnison.

Gypsum. Custer County, occurs near Arkansas River. Delta County, west side of Grand Canyon of Gunnison River, into Montrose County. Dolores County, as gangue mineral, Rico region, and elsewhere. Eagle County, at Ruedi; worked recently; occurs along Grand and Eagle rivers. El Paso County, has been worked extensively near Perry Park and near Colorado City. Fremont County, Coal Dale and Canon City. Jefferson County, opened near Mount Morrison. Larimer County, worked extensively at Arkins near Loveland; thick bed at Owl Canyon and on Sand Creek east of Boxelder, and at several other localities. Montrose County, several places.

Hematite (red iron ore). Gunnison County, prospects near Whitepine and north of Iola station. Lake County, has been mined at Breece iron mine, Breece Hill, near Leadville; very pure ore; large irregular deposits in porphyry. Pitkin County, very common in mines of Aspen district. Occurs at many other places in State.

Hessite (telluride of silver). Boulder County, Gold Hill district, important ore. Eagle County, Redcliff. La Plata County, occasionally important, has been mined. Hinsdale County, Hotchkiss mine.

Hetaerolite (wolfftonite). A hydrous zinc-manganese oxide found in the oxidized zinc ores of Leadville.

Hinsdalite. Hinsdale County, Golden Fleece mine, near Lake City.

Hübnerite. Lake County, Leadville, in gold ore and with scheelite in gold-bearing quartz-pyrite veins. Ouray County, Royal Albert vein, Uncompahgre district; mined. San Juan County, several mines near Silverton and Gladstone; has been mined. San Miguel County, Ames.

Hydrozincite. Of rare occurrence in Leadville oxidized zinc ores.

Infusorial earth. See Diatomaceous earth.

Iron. Chaffee County, predominant metal in South Arkansas district. See also Brown iron ore, Hematite, Magnetite, Marcasite, Pyrite, Pyrrhotite, and Siderite.

Jet. Las Animas County, Wet Mountain Valley, Trinchera Mesa.

Kaolin. See Clay.

Krennerite. Teller County, Cripple Creek, Independence, and other mines.

Lava. Probably tuff, suitable for many uses in building. Quarried in Douglas County at Castle Rock, Fremont County at Howard, Gunnison County at Gunnison, Rio Grande County at Del Norte, and other places.

Lead. Lead is the predominant metal produced in the following districts: Chaffee County, Alpine, Chalk Creek, Cottonwood; Clear Creek County, Trail, 6 miles southwest of Idaho Springs; Custer County, Spaulding, 14 miles southwest of Florence; Gunnison County, Elk Mountain, Tomichi; Hinsdale County, Galena, 5 miles west of Lake City; Lake County, Cali-

fornia (Leadville); Park County, Horseshoe, 7 miles west of Garo; Pitkin County, Columbia, Frying Pan, Roaring Fork (Aspen); Routt County, Slavonia, 40 miles north of Steamboat Springs; Saguache County, Blake (Kerber Creek); Summit County, Montezuma (Snake River). Lead is produced but is less important in many other districts. *See also* Altaite, Anglesite, Cerusite, Cosalite, Galena, Massicot, Mimetic, Minium, Plumbojarosite, and Pyromorphite.

Limestone. Boulder and Larimer counties, limestones of Lykins, Morrison, and Niobrara formations burned for lime along foothills of northern Colorado. Chaffee County, limestone quarried at Garfield and Newett. Douglas County, near Littleton. Arapahoe County, has been quarried at Silica for lime. El Paso County, Manitou, used for lime. Fremont County, quarried at Canon City and Calcite for crushed stone. Jefferson County, quarried at Mount Morrison and Golden. La Plata County, at Rockwood. Larimer County, at Ingleside, for sugar refining. Mesa County, near Dominguez. Pitkin County, burned at Thomasville. Pueblo County, quarried at Lime near Pueblo; Livesey. Abundant in many counties.

Limonite. *See* Brown iron ore.

Lithium. *See* Amblygonite.

Magnetite (magnetic iron ore). Chaffee County, has been mined in Arkansas Hills, 9 miles from Salida. Costilla County, interbedded with limestone at Grayback Gulch, 5 miles from Placer station. Dolores County, with chalcopryrite in Magnet and Eagle prospects; has been mined for flux. Fremont County, on Iron Mountain near Pine Creek; titaniferous. Gunnison County, prospects on Saguache Mountains and in Cebolla district. Pitkin County, prospects in Elk Mountain divide, 6 miles south of Ashcroft.

Malachite (green copper carbonate). Occurs in hundreds of places, among them: Fremont County, mined at Sedalia mine; Montrose County, in ores of Cashin mine, La Sal Creek; Routt County, prospects on Hahns Peak; San Juan County, in Bear Creek district.

Manganese. Eagle County, considerable manganiferous silver ore mined at Iron Mask mines, Gilman. Lake County, large output from lead-silver mines of Leadville district. *See also* Alabandite, Chalcophanite, Psilomelane, Pyrolusite, and Rhodochrosite.

Marble. Boulder County, small deposits. Chaffee County, Buena Vista, Calumet, Mayville, Monarch, and Salida. Fremont County, Fremont. Gunnison County, quarried extensively at Marble and along Yule Creek. Larimer County, small beds west of Fort Collins. Pitkin County, Aspen; quarried at Crystal City. Also in other localities.

Marcasite. Occurs in hundreds of mines, as in Routt County, in veins of Hahns Peak district; San Juan County, in ore bodies in Bear Creek district.

Massicot (oxide of lead). Occurs in many mines. Dolores County, with galena ores near Rico; argentiferous. Lake County, at Leadville, and elsewhere. San Miguel County, with galena in upper San Miguel region; argentiferous.

Melaconite. Pitkin County, thin coatings in Aspen district mines.

Mercury. Boulder County, sparingly in tellurium-bearing mines.

Mica (muscovite). Clear Creek County, reported from Idaho Springs; Fremont County, mined near Canon City and at Micanite; Jefferson County, at Morrison; Larimer County, on Buckhorn Creek; Mesa County, has been mined 8 miles south of Grand Junction.

Mica (phlogopite). Gunnison County, Iron Hill area, southeast of Powderhorn.

Mimetite. Chaffee County, Monarch and Garfield districts. Lake County, at Leadville.

Mineral paint. *See* Morrisite.

Minium. Lake County, Leadville. Pitkin County, in oxidized ores of Aspen district, and at other places. San Miguel County, Telluride.

Molybdenite (sulphide of molybdenum). Chaffee County, small quantities near Buena Vista and other places. Grand County, with molybdenum ochre, on Grand River, $1\frac{1}{2}$ miles above Radium. Gunnison County, 2 miles from Pitkin in quartz veins. Lake and Summit counties, Fremont Pass; promising. San Juan County, near Silverton. Teller County, in Cripple Creek district. Occurs also at many other places.

Monazite. Chaffee County, in black sands at Buena Vista. Costilla County, in San Luis Valley. Routt County, at Timber Lake.

Morrisite. Occurs in the eastern part of the State.

Muscovite. *See* Mica.

Natural gas. Boulder County, considerable quantity produced from Boulder field. Costilla County, near Mosca and other places in San Luis Valley. Delta County, occurs in oil shales of Green River formation on head of Muddy Fork. Fremont County, considerable quantity produced from Florence field. Pitkin County, "blowers" in middle Cretaceous shales at Coal Basin; natural flow limited. Pueblo County, Nepesta.

Niccolite. Custer County, small quantity at Silver Cliff. Fremont County, occurs at Gem mine, Grape Creek canyon; in dolomite, with bornite, and rarely with native silver.

Nicholsonite. A zinc-bearing aragonite, occasionally found near oxidized zinc ore bodies at Leadville.

Nickel. *See* Annabergite and Niccolite.

Oil. *See* Petroleum.

Oil shale. *See* Shale.

Opal. Opal of inferior quality is found at several places: Buffalo Peaks, Cripple Creek, Idaho Springs, Ute Creek.

Pearceite. Pitkin County, in Mollie Gibson mine, at Aspen, massive, in large quantity disseminated through pink barite, and in tabular crystals embedded in siderite, in both forms associated with galena.

Perofskite. Gunnison County, Iron Hill area, southeast of Powderhorn. Very abundant constituent of iron ore.

Petroleum. Boulder County, Boulder oil field, 3 miles northeast of Boulder; high-grade light illuminating oil. Fremont County, south of Florence, field 10–20 square miles. Mesa County, small wells near De Beque. Rio Blanco County, Rangely oil district. Routt County, Yampa field; used as lubricant. Petroleum has been found also in Archuleta, Pueblo, and Moffat counties. The production of petroleum in Colorado in 1914 was 222,773 barrels, valued at \$200,894.

Petzite (telluride of gold and silver). Found in many mines in Colorado in Clear Creek, Gunnison, and Hinsdale counties. Boulder County, in the Red Cloud and other mines. San Juan County, most valuable ore in Gold Bug and other mines in Bear Creek district.

Phenacite. Chaffee County, occurs at Mount Antero and Devils Head. El Paso County, occurs in Crystal Park, 2 miles southward of Manitou; has been mined at Pikes Peak as gem stone. Teller County, at Topaz Butte, near Florissant, and at Cripple Creek in the Gold King mine.

Pitchblende. Clear Creek County, Jo Reynolds mine. Gilpin County, mined in Kirk, Wood, German, Calhoun, and Belcher mines, near Central City; reported in other places. Jefferson County, in several mines.

Platinum. Chaffee County, occurs in black sands of Buena Vista. Clear Creek County, Centennial mine, Georgetown. Pitkin County, Aspen. Saguache County, Liberty. San Miguel County, Telluride, in small quantities.

Plumbojarosite. Occurs with lead-carbonate ores at Leadville and doubtless in other silver-lead districts.

Polybasite. Clear Creek County, mines at Georgetown and Silver Plume. Dolores County, considerable quantity at Newman Hill mine, Rico district. Ouray County, Yankee Girl mine. Pitkin County, in Molly Gibson and Smuggler mines, Aspen district. San Juan and San Miguel counties, occurs in Red Mountain district. San Miguel County, Marshall basin; occurs in quartz veins with pyrrargyrite, sphalerite, and stephanite; not uncommon in Mendota mine.

Potash. Occurs with other salts in solution in Soda Lake, near San Luis Lakes, Costilla County; being exploited. *See also* Alunite.

Proustite (ruby silver, light). Dolores County, Newman Hill mine, Rico district. Gunnison County, small quantity with arsenopyrite in Ruby district. Ouray County, at Yankee Girl mine. Routt County, in veins of Hahns Peak district. San Miguel County, at Sheridan mine. Occurs also in many other Colorado mines.

Psilomelane. Chaffee County, small quantity near Garfield. Custer County, occurs south of Round Mountain, at Silvercliff. Lake County, in the manganiferous ores of Leadville.

Pyrrargyrite (ruby silver, dark). Clear Creek County, in Georgetown mining district. Dolores County, reported from Newman Hill mine. Gilpin County, rare near Central City. Gunnison County, in Ruby district. Hinsdale County, near Lake City. Ouray County, in Sneffels district. Routt County, in Hahns Peak region. San Miguel County, in Marshall Creek basin. Summit County, in Montezuma mining district.

Pyrite. Pyrite is found in nearly every county along the Rocky Mountains: Boulder County, in Ward district. Clear Creek County, in Georgetown mining district; gold-silver ore. Dolores County, important ore of Rico district; carries small quantities of gold and silver; mined at Enterprise, Union, Carbonate, and other mines. Fremont County, mined at Sedalia mine for gold. Gilpin County, abundant; important gold ore. Gunnison County, Sandy Hook and Gold Links mines, carries gold; Vulcan, large body cupriferous. Hinsdale County, near Lake City. Lake County, mined at Leadville. La Plata County, Neglected mine, 15 miles from Durango. Larimer County, at Pearl. Ouray County, in mines along Uncompahgre River, between mouth of Dexter Creek and Ouray; contains gold and silver; common in other places. Pitkin County, original sulphide of Aspen district ore bodies; mined for silver. Rio Grande County, in Summit district. Routt County, common vein mineral of claim on Farwell Mountain, Hahns Peak region. San Juan County, Silverton district; mined at Ohio mine; common at many mines. San Miguel County, common.

Pyrolusite (black oxide of manganese). Gunnison County, occurs in Steuben Valley, 6 miles southwest of Gunnison, and in Cebolla Valley. Hinsdale County, occurs near Lake City. Saguache County, Beidell.

Pyromorphite. Lake County, occasionally found in oxidized ores of Leadville.

Pyrrhotite (magnetic iron pyrites). Chaffee County, Monarch and Garfield area. Jefferson County, Malachite mine and many other places. San Juan County, has been mined in Needle Mountains; auriferous.

- Quartz.** Jefferson County, mined from veins in foothills near Golden and used in manufacture of fire bricks at Golden.
- Quartz** (moss agate, silicified wood, smoky quartz, clear quartz, and crystal quartz). Very common and much used in the manufacture of jewelry, ornaments, etc. Smoky quartz occurs near Pikes Peak and is known in trade as "smoky topaz" or "clairngorm stone."
- Quartz** (rose). Fremont County, 6 miles north of Texas Creek; some mined as gems. Jefferson County, Floyd Hill, Bear Creek, etc. Larimer County, large body in granite 25 miles west of Fort Collins; cut as gem stone.
- Quicksilver.** Boulder County, occurs in Magnolia district. La Plata County, Ruby claim south of Cumberland Peak. *See also* Amalgam and Cinnabar.
- Radium.** *See* Carnotite and Pitchblende.
- Rhodochrosite.** Boulder County, Ward district. Dolores County, gangue mineral of Newman Hill and Enterprise mines, Rico region. Lake County, Alicante. San Juan County, in several mines. Summit County, Peru district.
- Rickardite.** Gunnison County, Good Hope mine near Vulcan.
- Road metal.** Disintegrated granite and other rocks, when not too badly decayed, are extensively used for ballast and road building. Paving blocks called Belgian blocks are made of different kinds of stone, such as the dolerite (basalt) of Golden and Valmont, certain rhyolites, and other rocks.
- Roscoelite.** Boulder County, sparingly in gold veins. Rio Blanco County, reported to occur along Coal Creek, near Meeker. San Miguel County, large deposits at Newmire and Placerville. In several other counties in western Colorado in scaly bunches and irregular grains in the La Plata sandstone.
- Rose quartz.** *See* Quartz (rose).
- Rutile.** El Paso County, occurs near St. Peters Dome, Pikes Peak district.
- Sand** (building). Dug at many places. Denver County, Denver. Fremont County, Canon City. La Plata County, Animas City and Durango. Pueblo County, Pueblo. Rio Grande County, Monte Vista.
- Sand** (molding). Dug at Denver and Pueblo.
- Sandstone.** Boulder County, quarried at Boulder, Lyons, and Noland. Conejos County, Osier. Delta County, Austin, Delta, and Montrose. Douglas County, Castle Rock, Sedalia. Eagle County, Basalt, Peachblow. El Paso County, Colorado City and Manitou. Fremont County, Canon City, Florence. Jefferson County, Mount Morrison. La Plata County, Durango. Larimer County, Arkins, Lowery, Bellvue, Stout, Fort Collins, and Loveland. Las Animas County, Trinidad. Montrose County, Montrose, Olathe. Pueblo County, Beulah, Pueblo, and Turkey Creek. Rio Grande County, Del Norte. Routt County, Steamboat Springs.
- Sandstone** (asphaltic). Grand County, Upper Willow Creek, sec. 24, T. 4 N., R. 77 W.
- Sapphire.** Chaffee County, Chalk Creek, 8 miles south of Buena Vista, in College Range.
- Scheelite.** Boulder County, small quantities with ferberite in the Boulder district. Chaffee County, $3\frac{1}{2}$ miles east of Salida, with copper minerals. Lake County, Leadville, with hübnerite in gold ore in quartz-pyrite veins, Golden Queen mine. San Juan County, near Silverton and Gladstone, with hübnerite.

- Serpentine.** Gunnison County, near Gothic. Park County, in Buckskin Gulch, a mottled rock, largely calcite, but deeply colored by true serpentine; prospective use as ornamental stone.
- Shale (oil).** In Green River formation (Eocene). Some rich in oil; some large areas in northwestern part of State on tributaries of Green and Grand rivers. Rio Blanco and Garfield counties, extensive deposits, constituting the greater part of the rocks of the Green River formation. In the Book Cliffs, the richer rock occurs in bands, about 50 in number, from 2 to 15 feet thick. Destructive distillation gives from 15 to 35 per cent of condensed hydrocarbons and 10 to 20 per cent of gas. Prospective source of lubricating oil, gasoline, kerosene, and ammonium sulphate.
- Siderite.** Manganosiderite in large quantities in mines at Leadville, Lake County, and Red Cliff, Eagle County. Gunnison County, occurs with magnetite and hematite in Cebolla Valley, near Powderhorn. Jefferson County, occurs near Bear Creek; zinciferous. Pitkin County, occurs in iron ore near Ashcroft, Taylor Peak district.
- Silver.** Predominant metal produced in the following districts: Chaffee County, La Plata, Monarch-Garfield. Clear Creek County, Georgetown, Jackson, Montana. Custer County, Hardscrabble (Rosita, Silver Cliff). Dolores County, Lone Cone and Pioneer (Rico). Eagle County, Battle Mountain (Red Cliff). Gunnison County, Quartz Creek, Rock Creek, Ruby. Hinsdale County, Lake (San Cristobal). Mineral County, Sunnyside (Creede). Park County, Halls Gulch and Sacramento. Pitkin County, Lincoln. Saguache County, Crystal Hill. San Miguel County, Mount Wilson. Summit County, Peru, Tenmile (Kokomo). Silver is of minor importance in many other districts. *See also* Acanthite, Amalgam, Calaverite, Cerargyrite, Embolite, Empressite, Hessite, Krennerite, Pearceite, Petzite, Polybasite, Proustite, Pyrargyrite, Stephanite, Stromeyerite, and Sylvanite.
- Silver (native).** Boulder County, occurs in Caribou mine and Up-to-Date property, and mines of Ward district, especially the White Raven. Clear Creek County, small quantity of wire silver found in Georgetown district. Dolores County, reported from Enterprise and Puzzle mines. Gunnison County, occurs in Ruby district and near Gothic. Hinsdale County, in Galena district. Lake County, occasionally found in silver-lead mines at Leadville. La Plata County, occurs along Bear Creek, usually with galena, tetrahedrite, and stephanite. Montrose County, Cashin mine, La Sal Creek., Pitkin County, irregular wires and masses of silver in Molly Gibson and Smuggler mines, Aspen district. Teller County, in small quantities in many mines of Cripple Creek district.
- Smaltite** (gray cobalt ore). Gunnison County, occurs near Gothic in calcite gangue, associated with small quantities of erythrite and native silver.
- Smithsonite.** In large ore bodies in Leadville and Monarch districts, and doubtless in other silver-lead districts.
- Sphalerite** (zinc blende). Chaffee County, Monarch and Garfield area. Clear Creek County, Georgetown and Silver Plume mines, Idaho Springs district; carries silver. Dolores County, with galena and chalcopryrite in Rico district; abundant in Newman Hill silver ores and Sambo mines; mined for zinc alone in Atlantic Cable mine. Fremont County, Sedalia mine. Gilpin County, a common mineral usually argentiferous, sometimes highly so, and occurring associated with pyrite, chalcopryrite, galena, and tetrahedrite; has been mined for silver. Gunnison County, Blistered Horn, Tincup district; Sandy Rock and Gold Links, Gold Brick district, and other mines, carries silver; Vulcan. Hinsdale, La Plata, Ouray, and San Miguel counties, a very common, usually argentiferous

mineral; common associate, galena; in many places with chalcopyrite, tetrahedrite, or pyrargyrite. Jefferson County, Malachite mine. Lake County, silver-lead mines at Leadville. Mineral County, Creede. Saguache County, Beidell. San Juan County, Ohio mine near Whitecross; mined for gold and silver; also at other places. Found also in other mining counties.

Spinel. Fremont County, occurs at Sedalia mine.

Stephanite (brittle silver). Clear Creek County, frequently associated with other silver-bearing minerals. Dolores County, reported from Newman Hill mine, Rico region. Gunnison County, mined at Red Jacket. Hinsdale County, limited quantity in Galena district. Ouray County, occasionally found in Sneffels and Uncompahgre districts. Summit County, occurs in Montezuma mining district. Mined also at other places.

Stibnite (antimony sulphide). Not known in commercially valuable deposits, though small quantities are found in many mining districts, as Boulder County, in several mines. Clear Creek County, Alice mine. Grand County, Lost Lakes. San Juan County, North Star mine. Teller County, in Cripple Creek district.

Stromeyerite (copper and silver sulphide). Boulder County, Grand Lodge. Clear Creek County, with bornite, tetrahedrite, etc., at Plutus mine. Idaho Springs; occasional. Ouray County, in quantity in Yankee Girl mine; has been mined. San Juan County, certain Silverton mines, Iron Spring district.

Sulphur. Gunnison County, has been mined at Vulcan. Mineral County, occurs 25 to 30 miles southwest of Creede, at Trout Creek. Several other deposits are reported.

Sylvanite. Boulder County, associated with tungsten ore at mines in Boulder district. La Plata County, occurs at Durango Girl mine on east slope of Lewis Mountain. Teller County, important gold ore of Cripple Creek district. Occurs also at other places.

Tantalum. See Columbite.

Tellurium. Boulder County, in a number of mines. Teller County, in mines at Cripple Creek.

Tennantite. Much of the so-called tetrahedrite of the sulphide ores of Colorado is tennantite. Clear Creek County, occurs in silver-bearing ores at Georgetown and at Silver Plume mines. Gilpin County, in large number of mines. Pitkin County, very common in Aspen district, Molly Gibson, and other mines. Also in mines of Ouray, Hinsdale, and San Juan counties.

Tetradymite (bismuth telluride). Boulder County, Red Cloud mine. Fremont County, occurs near Whitehorn.

Tetrahedrite (gray copper ore). In many mines in Boulder, Clear Creek, Gunnison, San Juan, and other counties. Clear Creek County, mined for silver in Georgetown and Silver Plume mines. Dolores County, silver-bearing in Rico district, Enterprise, and Rico-Aspen mines. Gilpin County, reported with uranium in Wood, Kirk, and other mines near Central City. Gunnison County, reported from Ruby district. Hinsdale County, has been mined near Lake City. Ouray and San Miguel counties, very abundant in silver ores. Pitkin County, very common in Aspen district, Molly Gibson, and other mines. San Juan County, important ore of Ohio mine, near Whitecross; mined for silver; Bear Creek district, Gold Bag, and other mines; gold and silver bearing. Teller County, mined in Cripple Creek district. Much of the ore called tetrahedrite in Colorado is tennantite.

Thorium. *See* Monazite.

Tin. *See* Cassiterite.

Titanium. *See* Ilmenite, Rutile, and Perovskite.

Topaz. Chaffee County, Mount Antero and Ruby Mountain; on east side of Arkansas River, near Nathrop. El Paso County, Crystal Park, 2 miles southwest of Manitou Springs. Lake County, at Chalk Mountain, near Leadville. San Juan County, found occasionally. Teller County, at Pikes Peak, and mined intermittently at Crystal Peak, 4 miles north of Florissant.

Tourmaline. Fremont County, 2 miles north of Royal Gorge and 5 miles northwest of Canon City; opaque but colored. Gilpin County, near Blackhawk. Larimer County, Estes Park. Teller County, Rhyolite Mountain.

Trona. Deposits estimated at 100,000 tons or more in the soda lakes of the San Luis Valley; some development done. Sparingly in other alkali lakes and areas.

Tungsten. *See* Ferberite, Hübnerite, and Scheelite.

Turquoise. Conejos County, 13 miles east of La Jara. Eagle County, Mount of Holy Cross. Mineral County, Last Chance mine, Creede. Saguache County, near Villa Grove.

Uranium minerals. *See* Carnotite and Pitchblende.

Uraninite. *See* Pitchblende.

Vanadinite. Montrose and San Miguel counties.

Vanadium. Found in many localities as carnotite, roscoelite, calciovolborthite, and possibly volborthite. Custer County, 7 or 8 miles southeast of Silver Cliff, reported to occur as in Huerfano County. Eagle County, with silver ores in sandstone on Brush Creek; form of mineral unknown. Huerfano County, in an unidentified mineral near head of Pass Creek, south of Malachite. Montrose County, found in the Paradox Valley country as calcium vanadate; possibly two forms; unnamed, awaiting future investigation. *See also* Volborthite.

Vesuvianite. Mount Italia, and north of Arkansas River in granite.

Vivianite. Leadville.

Volborthite. Huerfano County, near head of Pass Creek, south of Malachite. The mineral has not been definitely identified but is probably either volborthite or calciovolborthite, or both. La Plata County, Boren Gulch; vanadium occurs in a quartz vein in a mineral which is probably volborthite or calciovolborthite, and also in an amorphous yellowish-green mineral. Park County, reported from Garo.

Volcanic ash. Exists in enormous quantity in several of the eastern counties. La Plata County, near Durango. Teller County, Cripple Creek. Yuma County, has been shipped from Wray for scouring powder.

Wolframite. Boulder County, near Boulder.

Wolftonite. *See* Heterolite.

Wood (opalized). El Paso County, has been obtained in eastern part of county with jasperized wood; Bijou basin. Silicified wood is very common.

Yttrium. *See* Allanite and Gadolinite.

Zeolites. Jefferson County, Table Mountain, near Golden.

Zinc. Fremont County, predominant metal in Currant Creek (Micanite) district. *See also* Aurichalcite, Calamine, Chalcophanite, Heterolite, Hydrozincite, Nicholsonite, Smithsonite, and Sphalerite.

Zircon. St. Peters Dome, near Pikes Peak.

CONNECTICUT.

Agate. Hartford County, at Farmington. New Haven County, at East Haven. Litchfield County, at Woodbury; has been cut for seal stones. In different localities in amygdules in the trap.

Almandite. Litchfield County, Roxbury.

Amethyst. Occurs occasionally in amygdules in trap at Meriden.

Aquamarine. Middlesex County, some of gem quality has been found in Portland and Haddam. *See also* Beryl.

Arsenopyrite (arsenical pyrite). Fairfield County, in lead mine in Wilton and at Laues mine, Monroe. Middlesex County, in small quantities at the old Cobalt-Nickel mine, in Chatham. New Haven County, in mine at Derby and in Oxford and Bethany.

Asbestos (actinolite). Litchfield County, at New Hartford and Barkhamsted.

Azurite (blue carbonate of copper). Hartford County, in small quantities at Rocky Hill near Hartford; also at other copper deposits.

Barite. New Haven County, in Triassic sandstone in Cheshire and in small quantities elsewhere. The Cheshire barite was formerly mined to mix with white-lead paint.

Basalt. *See* Trap rock.

Beryl. Fairfield County, at Branchville. Litchfield County, gem golden beryl and aquamarine were mined with mica and feldspar 6 miles north of New Milford. Middlesex County, abundant in the pegmatite at several quarries in Middletown, Portland, Chatham, and Haddam; gem aquamarine found in some of these, especially in Portland and Haddam. New Haven County, found in Southford quarry.

Bismuth (native). Fairfield County, small quantities associated with arsenopyrite, pyrite, wolframite, and other minerals, in quartz vein at Monroe.

Bismuthinite. Middlesex County, with chrysoberyl in minute quantities at Haddam, and sparingly in a pegmatite dike at a small feldspar quarry formerly worked in Portland.

Bornite (variegated copper). Hartford County, at Bristol copper mine, Bristol. Litchfield County, with chalcocite and malachite at Wolcottville and elsewhere; occurs in quartz veinlets in Rocky Hill quarry at Winsted. New Haven County, occurs with diabase at Mount Carmel, Hamden.

Brown iron ore (bog iron ore, limonite). Litchfield County, mined at Davis and Orehill mines, near Lakeville; large deposits at Sharon and Salisbury have been mined. New London County, occurs at Colchester. Tolland County, bog iron mined and smelted in Stafford and Hebron townships. Windham County, at Woodstock.

Calamine (silicate of zinc). Fairfield County, with galena at Brookfield.

Cassiterite (tin ore). Middlesex County, few crystals found at Haddam.

Cement material. Outcrops of suitable limestone are small and few.

Cerium. *See* Monazite.

Cerussite (lead carbonate). Fairfield County, on galena at Brookfield.

Chalcocite (copper glance). Hartford County, was mined in very small quantity at Simsbury mine, Granby; splendid crystals formerly obtained in Bristol mine at Bristol; Tallwaa mine, Hampden. Litchfield County, with bornite and malachite, Wolcottville. New Haven County, occurs in southeastern part of Cheshire and in Hamden.

Chalcopyrite (copper pyrites). Fairfield County, in various places in Trumbull. Hartford County, Bristol, in granite gneiss. Litchfield County, with

- pyrrhotite at Mine Hill. Middlesex County, in Middletown lead mine. New Haven County, near Lamberts mine, Orange, and in small quantities at other places.
- Chrysoberyl.** Middlesex County, crystals at Haddam, little of gem quality. Locality has been inaccessible in recent years.
- Clay (brick).** Occurs abundantly; has been used in following districts: Berlin, Clayton, Cromwell, Elmwood, Hartford, Kensington, Middletown, Milldale, New Haven, Parkville, Quinnipiac, South Windsor, Thompsonville, and Windsor.
- Clay (fire).** Litchfield County, has been dug 2 miles south-southwest of Boardmans Bridge.
- Clay (kaolin).** Fairfield County, has been found at Sherman. Hartford County, at Granby. Litchfield County, dug at West Cornwall and shipped to potteries outside of State; occurs also at New Milford and Kent.
- Columbite.** Hartford County, with feldspar, near Glastonbury. Middlesex County, found in several feldspar quarries in Middletown, Portland, and Haddam. A large quantity found some years ago at one quarry in Portland no longer worked.
- Copper (native).** Hartford County, small quantities at Farmington. New Haven County, occasionally found in Triassic sandstone or trap, Hamden.
- Copper minerals.** See Azurite, Bornite, Chalcocite, Chalcopyrite, Cuprite, and Malachite.
- Cordierite.** Middlesex County, has been found at Haddam Neck.
- Corundum.** Litchfield County, found near Barkhamsted; with talc and pyrite at Litchfield. New London County, sparingly, with sillimanite near Norwich. Not mined.
- Cuprite.** Hartford County, Simsbury mine, Granby, very small quantity.
- Diabase.** See Trap rock.
- Dolomite.** Abundant; was quarried at New Preston. See also Marble.
- Feldspar (orthoclase or microcline).** Fairfield County, occurs at Branchville, ground and shipped out of State for manufacture of porcelain. Hartford County, several quarries have been worked south of Glastonbury; Howe quarry, 2 miles south of South Glastonbury. Middlesex County, numerous quarries, large and small, worked for longer or shorter times, in the pegmatites of Middletown, Portland, Haddam, and Chatham. New Haven County, mined near Southford.
- Flagstone.** Fairfield County, gneiss or schist near Bridgeport. Hartford County, red sandstone quarried at Enfield. Litchfield County, at Roxbury. Middlesex County, gneiss quarries on Connecticut River, at Middletown, Chatham, and Haddam. New London County, large flags quarried in Lebanon. Tolland County, mica schist of Bolton Mountain, formerly quarried extensively. Windham County, micaceous quartzites formerly quarried at Killingly.
- Fluorspar (fluorite).** Fairfield County, in topaz vein in Trumbull, used for flux. Litchfield County, at Plymouth. Middlesex County, Haddam Neck, and at the old lead-silver mine, Middletown. Windham County, in gneiss at Willimantic. Nowhere in considerable quantity except at Trumbull.
- Galena.** Fairfield County, in limestone at Brookfield, in quartz veins at Monroe. Hartford County, at Chatham. Middlesex County, with sphalerite, chalcopyrite, and pyrite at Middletown. Several other localities. Was mined for lead in colonial and Revolutionary times; for a few years, about 1860, mined for silver.

Garnet. Hartford County, quarry near South Glastonbury. Litchfield County, was mined at Roxbury as abrasive. Middlesex County, small garnets in pegmatite at Andrews quarry, Portland, and in Eureka quarry. New Haven County, in Southford quarry. In larger or smaller quantities at most of the pegmatite (feldspar) quarries.

Gneiss. Quarried for foundation stone at many places. Hartford County, Glastonbury. Middlesex County, at Haddam, quarried for curbstone. New London County, at quarries on Thames River above New London. Tolland County, at Union. Windham County, at Plainfield, Willimantic, and Putnam.

Granite (building, structural). Quarried at Branford, Bristol, Center Groton, Danbury, East Derby, East Glastonbury, Essex, East Lyme, Greenwich, Groton, Guilford, Haddam, Leete Island, Lyme, Middletown, Mystic, New London, Niantic, Norfolk, Oneco, Plainfield, Quaker Hill, Roxbury, Sachem Head, Seymour, South Manchester, Sterling, Stony Creek, Stonington, Thomaston, Torrington, Wallingford, West Mystic, and West Torrington. Much of the granite quarried is a granite gneiss.

Granite (curbing and trimming). Quarried at Ansonia, Bolton, Bridgeport, Cornwall, East Litchfield, Glastonbury, Norwalk, Roxbury, Seymour, Sterling, Torrington, Waterford, and Willimantic.

Granite (inscriptional, monumental). At Center Groton, East Lyme, Groton, Lyme, Stonington, Thomaston, and Waterford.

Granite (paving). At Guilford and Sterling.

Granite (riprap). At Sachem Head, Guilford, Mason Island, Stonington.

Granite (road material). At Bridgeport jail, Danbury, Torrington, Town Hill.

Graphite. Fairfield County, at Danbury and Redding. Litchfield County, found in western part of Cornwall. New Haven County, in northern part of Bethany. Windham County, has been quarried in northwest corner of Ashford.

Grindstone. Hartford County, fine-grained quartzose mica slate was quarried in Marlborough; not now produced.

Iron minerals. See Brown iron ore, Magnetite, Pyrite, Pyrrhotite, and Siderite.

Kaolin. See Clay (kaolin).

Lead minerals. See Cerusite, Galena, and Pyromorphite.

Lepidolite. Middlesex County; the largest quantity of lepidolite which has been found was obtained at Chatham in a pegmatite dike in the south part of the town, where it is abundant in granular masses. Some years ago it was quarried and exported for the manufacture of lithium salts; fine granular masses in pegmatite at Haddam and Middletown; larger plates or crystals in pegmatite at Portland and Haddam.

Limestone (crushed stone). Litchfield County, quarried at Canaan.

Limestone (flux). Litchfield County, was quarried at East Canaan.

Limestone (hydraulic). Hartford County, near Berlin, in Southington; in thin strata, compact, earthy, and somewhat bituminous. New Haven County, Northford, a gray limestone.

Limestone (lime). Fairfield County, magnesian limestone burned near Redding, Brookfield, Ridgefield, and Danbury; Litchfield County, at Canaan.

Limonite. See Brown iron ore.

Magnetite (magnetic iron ore). Fairfield County, was mined and smelted in small quantities at New Preston and at Redding. Litchfield County, in Sharon Township. Middlesex County, near Haddam. New Haven County, northwest of Madison. Winchester County, in northwest corner.

- Malachite** (green carbonate of copper). Hartford County, principal ore at Simsbury mine, Granby, but not abundant. Disseminated through sandstone.
- Marble.** Litchfield County, old quarries in East Canaan and Marbledale. *See also Dolomite.*
- Mica** (muscovite). Fairfield County, found with topaz at Trumbull. Litchfield County, was mined with feldspar and beryl 6 miles north of New Milford. Middlesex County, small quantities mined with feldspar in Middletown, Portland, Haddam, and elsewhere in pegmatites, mostly scrap mica for grinding but some suitable for glazing and insulating.
- Mineral paint.** Fairfield County, soapstone ground at Greenwich; asbestos rock at Stamford; talcose slate at Wilton. Litchfield County, soapstone ground at Barkhamsted.
- Molybdenite** (sulphide of molybdenum). Hartford County, in pegmatite at South Glastonbury. Middlesex County, in gneiss quarries at Haddam.
- Monazite.** Middlesex County, crystals in pegmatite at Andrews's quarry, Portland (no longer worked). New London County, in small crystals with sillimanite at Norwich. Nowhere in commercial quantities.
- Peat.** In fresh and salt water swamps and marshes in nearly every county in the State. Air-dried machine peat fuel has been produced recently at New Haven. Artificially dried peat fuel and peat charcoal are made in a small plant near Hartford.
- Pitchblende.** *See Uraninite.*
- Pyrite.** Fairfield County, at Newtown. Hartford County, in slate at Windsor. Litchfield County, at Winchester. New Haven County, near North Madison. Small quantities in other localities; not now produced.
- Pyromorphite** (green lead ore). Fairfield County, with galena at Brookfield.
- Pyrrhotite.** Fairfield County, small quantity mined at New Fairfield. Litchfield County, occurs with chalcopyrite and pyrite at Prospect Hill, Bradleyville. Middlesex County, in small quantities in pegmatite at Portland and elsewhere.
- Quartz.** New London County, at Long Hill and Lantern Hill, North Stonington. Litchfield County, at Canaan, 2 miles east of Roxbury station, and 3 miles north of Litchfield. New Haven County, quarried near Southford. The pegmatites of Portland and other places are worked chiefly for feldspar, but the quartz is also ground and used for different purposes. Rose quartz has been found in pegmatite at Portland and Chatham.
- Radium.** *See Uraninite.*
- Road metal.** *See Granite, Limestone, and Trap rock.*
- Rutile.** Fairfield County, at North Greenwich; has been mined in small quantities at Monroe. Hartford County, at Granby. Litchfield County, at Plymouth.
- Sand** (building). Hartford County, at Plainville, New Britain, and Windsor Locks. Dug in small quantity at other places.
- Sand** (molding). Hartford County, New Britain and Windsor Locks.
- Sandstone.** Ranges from nearly white to brick-red and dull brown; formerly quarried at all places named. Hartford County, Avon, Buckland, and Tariffville. Middlesex County, at Cromwell, Portland (now quarried). New Haven County, at East Haven. Also at other localities in the Triassic area. This area extends along both sides of Connecticut River from northern boundary of State to Middletown; thence it extends south-westward to New Haven.

Sandstone (brownstone). A well-known building stone of reddish-brown color; has been quarried at several places in the Triassic rocks of Connecticut Valley.

Sapphire (asteriated). Litchfield County, at Litchfield.

Scheelite (tungsten ore). Fairfield County, has been mined at Trumbull.

Schist. *See* Whetstone.

Serpentine. New Haven County, has been quarried at Milford.

Siderite (spathic iron ore). Litchfield County, has been mined at Mine Hill, Roxbury.

Slate. Tolland County, quarried in Stafford for local use.

Sphalerite (zinc blende). Fairfield County, Lane's mine, Monroe, and at Brookfield. Middlesex County, Middletown lead mine; in small quantity in pegmatite at Portland and elsewhere.

Spodumene. Fairfield County, in pegmatite at Branchville; crystals commonly very large; some of them altered to cymatolite; associated with numerous rare minerals.

Thorium. *See* Monazite.

Tin. *See* Cassiterite.

Titanium. *See* Rutile.

Topaz. Fairfield County, found at Trumbull; Windham County, at Willimantic.

Tourmaline. Fairfield County, occurs at Monroe. Middlesex County, found in quarrying for feldspar at Strickland quarry, Portland; mostly green with a little pink, both of gem quality; gem tourmaline was mined with feldspar at Gillette quarry at Haddam Neck. New Haven County, black, intergrown with quartz at Southford quarry. Black tourmaline in nearly all the pegmatite quarries.

Trap rock (road metal). Fairfield County, quarried at Bridgeport. Hartford County, near Newington, Rocky Hill, and Plainville. Middlesex County, Middlefield. New Haven County, Branford, East Haven, Meriden, Milford, New Haven, and Westville.

Tremolite. Litchfield County, in dolomite at Canaan.

Tungsten mineral. *See* Wolframite.

Uraninite (pitchblende). Fairfield County, at Branchville. Middlesex County, at Andrews quarry and Strickland quarry, Portland. Windham County, at Willimantic. At the two quarries in Portland it occurs in amorphous grains and in octahedral crystals, some of the crystals more than one-half inch in diameter. Occurs nowhere in commercial quantities; only as mineralogic specimens.

Whetstone. Tolland County, mica schist formerly quarried at Bolton and Vernon. Windham County, at Woodstock.

Wolframite (tungstate of iron). Fairfield County, at Lane's mine, Monroe, and in topaz-quartz vein at Trumbull.

DELAWARE.

Asbestos. New Castle County, in serpentine at feldspar quarries northeast of Wilmington; no production.

Brown iron ore (brown hematite, bog iron ore, limonite). Kent County, at East Dover. New Castle County, Iron Hill and Chestnut Hill near Newark, has been mined. Sussex County, Little Creek, 2 miles south of Laurel; near Georgetown; Collins's ore bed on Green Meadow Branch of Deep Creek; Green Branch, 10 miles west of Millsboro; Burtons Branch, 1 mile west of Burton.

Cement material (Portland). Limestone suitable for cement occurs in extreme northern part of State, but outcrops are small. Greensand marl may be used.

Clay (brick). Dug at the following places: Kent County, near Dover, Houston, Smyrna, and Wyoming; New Castle County, at Blackbird, Elsmere Junction, Newark, and elsewhere; Sussex County, Blades, Bridgeville, Dagsboro, and elsewhere.

Clay (fire). New Castle County, New Castle, dug and shipped; used for fire pots and crucibles.

Clay (kaolin). New Castle County, dug at Hockessin and 4 miles north of Newark.

Clay (pottery). New Castle County, was dug at Christiana.

Clay (tile). Kent County, near Smyrna Landing.

Corundum. New Castle County, small quantities near Chandlers Hollow.

Diatomaceous earth. Somewhat impure; abundant in Calvert formation; not used; outcrops on southern tributaries of Appoquinimink Creek and valley of Hangmans Run.

Feldspar. New Castle County, Tucker's quarry near Wilmington; Tweed's quarry, 2½ miles north of Newark, near Pleasant Hill; and Hockessin pits.

Glaucconite. *See* Marl.

Gneiss. Quarried in northern part of State.

Granite. Gneiss and granite are quarried for ballast, building, curbing, concrete, road making, rubble, and riprap at many places in northern part of State.

Infusorial earth. *See* Diatomaceous earth.

Iron. *See* Brown iron ore and Ocher.

Kaolin. *See* Clay.

Limestone. New Castle County, has been quarried at Jeane's, on Pike Creek; Klair's, 2 miles west of Centerville; Bullock's, on Brandywine Creek, near Pennsylvania State line.

Limonite. *See* Brown iron ore.

Marble. New Castle County, small exposures.

Marl (greensand). New Castle County, dug at many localities; occurs in Cretaceous deposits at St. Georges Hundred, St. Georges; 3 miles west of Middletown on Bohemia Creek, at head of tidewater; Cantrell's bridge, north side of Appoquinimink Creek; Silver Run; Dwyers Run; Noxontown Branch of Appoquinimink Creek; Port Penn; Latman's mill, on branch of Dwyers Creek; Scotts Run.

Ocher. Sussex County, with limonite.

Quartz. New Castle County, white granular quartz has been quarried 2½ miles north of Newark and ground at Tweed's mill, near Newark.

Road metal. Gravel is abundant in many localities. *See also* Gneiss, Granite, and Trap rock.

Sand (building). Large quantity of good quality at many places.

Sand (glass). New Castle County, dug at Christiana.

Sand (molding). New Castle County, dug at Christiana.

Serpentine. New Castle County, occurs 6 miles northwest of Wilmington.

Trap rock. New Castle County, quarried at Wilmington.

DISTRICT OF COLUMBIA.

- Clay** (brick). Occurs in extreme eastern and southern portion of Washington and at intersection of Bladensburg road and Florida Avenue, in Potomac and Columbia formations. Washington is supplied by large brickyards on west side of Potomac River in Virginia.
- Clay** (terra cotta). Worked extensively for terra-cotta tile at Lamond, Terra Cotta, and University station, on Metropolitan branch of Baltimore & Ohio Railroad. Many large masses east of Anacostia River.
- Diorite**. Has been quarried near Georgetown but is so tough and difficult to work that little is used; was quarried at east end of Connecticut Avenue Bridge for concrete used in bridge.
- Gneiss**. Granite gneiss has been quarried at east end of Chain Bridge and at the receiving reservoir near Chain Bridge.
- Granite**. Has been quarried on Broad Branch of Rock Creek and along Connecticut Avenue extended.
- Quartz**. Vein quartz abundant in northwestern part of District; has been crushed for concrete and road material.
- Road metal**. Granite, diorite, and granite gneiss are abundant and have been crushed for road material. *See also* Sand and gravel and Quartz.
- Sand** (building). Principal supply dredged from Potomac River. Deposits of Potomac formation have been worked at number of places in Washington and vicinity. Old pit half a mile south of Anacostia; new pit at Benning. Sand under clay at Terra Cotta is used for tempering clay. Dug near Lamond and made into sand-lime brick.
- Sand and gravel**. For road material and concrete; have been dug at many localities and dredged from Potomac River. Gravel dug at Benning is shipped for Maryland roads.
- Soapstone**. Half a mile southeast of Tenleytown and one-quarter mile west of Connecticut Avenue on the Albemarle road; formerly quarried on small scale.

FLORIDA.

Brown iron ore. *See* Limonite.

Cement material. Limestone suitable for cement covers large part of northern Florida; not utilized.

Clay (ball). Along Palatka River. From Lake and Putnam counties is derived the large supply of the United States. It is put on the market as ball clay, but is also termed plastic kaolin by some. Lake County, at Okahumpka and Richmond. Putnam County, at Edgar and Johnson.

Clay (brick). Dug in Alachua County, Campville. Clay County, Black Creek, B. P. Landing, and Green Cove Springs. Columbia County, Lake City. Duval County, Jacksonville and St. Nicholas. Escambia County, Brent station, Dolores, Quintette, and elsewhere. Gadsden County, Lawrence. Hillsborough County, Tampa. Holmes County, Eleanor. Lake County, Sorrento and Whitney. Leon County, Tallahassee. Nassau County, Callahan. Walton County, Glendale. Washington County, near Chipley. Occurs but not used in Hamilton County, near Marion, and on Suwannee River at White Springs. Leon County, 18 miles southwest of Tallahassee.

Clay (fire). Duval County. Escambia County, dug at Brent station. Floyd County, Flowery Branch. Grady County. Gadsden County, Quincy.

Clay (pottery). Lake County, dug at Yalaha, Okahumpka, and Richmond. Putnam County, at Edgar, Johnson, and McMeekin.

Coquina (limestone). Brevard County, St. Augustine quarries; Rock Ledge on Indian River; used for building stone. St. John County, Anastasia Islands and other points near ocean; used as building stone and road metal.

Diatomaceous earth. Lake County, near Eustis; mined to some extent.

Fuller's earth. Gadsden County, dug at Jamieson and Quincy, large deposits. Manatee County, at Ellenton. Occurs in following places but is not mined: Alachua County, Gainesville. Columbia County, High Falls, 8 miles southeast of Lake City. Leon County, 13 miles west of Tallahassee, sec. 26, T. 1 N., R. 3 W. Liberty County, Rock Bluff and along headwaters of Rock and Sweetwater creeks. Florida is now the leading State in the production, having reported for 1914 more than 75 per cent of the total quantity and value.

Gypsum. Sumter County, 6 miles west of Panasoffkee, with limestone. Not used.

Iron. *See* Limonite.

Lignite (brown coal). On Suwannee River; has been mined.

Limestone. Alachua County, has been quarried at Gainesville. Dade County, Miami oolite quarried at Miami for several large buildings, and used also as road metal. De Soto County, occurs at Charlotte Harbor. Hillsborough County, Fort Brooke. Jackson County, from Campbellton to Marianna. Manatee County, Manatee River. Marion County, Kendrick, Ocala, and Silver Springs. Monroe County, oolite at Key West. Orange County, Rock Spring. Wakulla County, St. Marks. Occurs also in Hernando, Holmes, Leon, Walton, and Washington counties. *See also* Coquina.

Limestone (lime). Marion County, burned at Ocala and Kendrick.

Limonite (bog iron ore). Duval County, found around Beauclerc. Volusia County, 12 miles east of Seville, and at several points on the Florida East Coast Railway.

Malachite (green carbonate of copper). Suwannee County, reported 5 miles southeast of Dowling Park.

Marl. Occurs very generally skirting the eastern and southern edges of the limestone ridge traversing the axis of the State. Isolated deposits have been noted at Jacksonville and on Fort George Islands, Duval County. The marl is used locally on many orange groves on the St. Johns River, particularly at Sanford, Orange Bend, and Lanier.

Mineral paint. Lee County, Estero Bay; not developed.

Peat. Extensive deposits throughout the State. "Machine peat" for fuel has been dug and made at Gulington Creek, Orlando, and Palatka, Orange County. Has been dug and prepared for fertilizer at Crescent City, Gulington Creek, and Palatka and near Pablo Beach.

Phosphate rock. The production in 1914 was 2,138,891 long tons of land pebble and hard rock phosphate, quarried in Alachua County, at Clark, Newberry, and elsewhere. Citrus County, Floral City, Hernando, and Istachatta. Columbia County, Fort White. Hernando County, Bay City. Hillsborough County, Plant City. Marion County, Anthony and Dunellon. Polk County, near Bartow, Fort Meade, Mulberry, and elsewhere; was formerly mined at Hull, De Soto County, and Buda, Orange County.

Road metal. See Coquina (limestone) and Limestone.

Sand (building). Dug at many places, principally in Duval County, Jacksonville; Hillsborough County, Tampa; Marion County, Lake Weir, Ocala; Orange County, Orlando; Putnam County, Interlachen.

Sand (glass). Clean white sand, apparently suitable for glass making, occurs abundantly in dunes on shore of Gulf of Mexico, in many places, notably at Pensacola; also in other parts of the State, as at Tarpon Springs, Pinellas County.

GEORGIA.

Abrasive. See Burrstone and Novaculite.

Agate. Fulton and Jones counties; not mined.

Aluminum. See Bauxite and Halloysite.

Amethyst. Rabun County, Ledbetter mine near Rabun Gap, stones of good color; North Georgia Co.'s mine, 4 miles northwest of Clayton, good gems reported; Wilson prospect, 4 miles southeast of Clayton. Reported also in Cobb and Oglethorpe counties.

Arsenopyrite. Cherokee County, at Canton mine and other places. Forsyth County, at Charles mine.

Asbestos. Habersham County, occurs at Hollywood. Hancock County, occurs at Sparta and many other places. Rabun County, has been mined at Hicks mine. White County, mined at Sal Mountain, near Nacoochee, shipped from Clarkesville.

Barite (heavy spar). Bartow County, present in nearly all other deposits of Cartersville district; mined at Cartersville, Emerson, and near Allatoona. Murray County, mined at Eton.

Bauxite. Occurs in northwestern part of the State, chiefly in Bartow and Floyd counties, and deposits are known extending from a point near Summerville or Adairsville to the Alabama State line. Cave Spring and vicinity have long been the center of the industry. Deposits are worked in the central part of the State near McIntyre, Wilkinson County, and have been discovered recently in Sumter County, near Andersonville.

Beryl. Rabun County, Beck beryl mine 7 miles east of Clayton. Large flawed crystals in pegmatite contain clear portions suitable for cutting.

Bismuth. Tallapoosa County, concentrates from the Hog Mountain gold mine, 12 miles north and east of Alexander, are comparatively rich in bismuth. The mineral form is unknown.

Braunite. Bartow County, Cartersville district, mined with other manganese ores. Floyd County, small quantity in Cave Spring district.

Brown iron ore (limonite). Bartow County, extensively worked near Hermitage and other places in Barnsley district. Fannin County, Blue Ridge. Floyd County, extensive deposits in Cave Spring district, mined at Atkinson mine. Murray County, large deposits in sandstone ridges north of Cohutta Springs. Polk County, extensively mined near Cedartown, Ledbetter, and Reed mines. Pulaski County, deposit at Hawkinsville. Whitfield County, openings near Tunnel Hill. Reported in Gilmer, Gordon, Hall, Haralson, Milton, Whitfield, and other counties.

Burrstone (millstone). Bulloch, Burke, Early, Jefferson, and Screven counties; has been quarried.

Cassiterite (tin ore). Lumpkin County, small quantity in placer gold near Dahlonega.

Cement material. Bartow County, limestone of Conasauga formation quarried for natural cement at Cement, 2 miles north of Kingston. Polk County, Rockmart and Davittes (Portland cement), limestone and slate used. Walker County, Chickamauga limestone used; natural cement at Rossville.

Chalcocite (copper glance). Cherokee County, Canton mine; other localities with chalcopyrite, not mined.

Chalcopyrite (copper pyrites). Cherokee County, Canton mine. Lincoln County, Phelps and Seminole mines. McDuffie County, Columbia mine and Landers prospect. Has been mined in other localities in Carroll,

Fannin, Fulton, Greene, Haralson, Lincoln, Lumpkin, Murray, Paulding (at Dallas), and Towns counties.

Chromite (chromic iron ore). Towns County, disseminated in minute crystals through chrysolite at Hog Creek near Hiawassee. Fine exposures in Heard and Fayette counties; not mined.

Chromium. *See* Chromite.

Clay (brick). Extensive deposits in all parts of the State. Dug at many places. The production of common brick in 1914 was valued at \$1,040,557.

Clay (fire). Glascock County, Gibson. Gordon County. Jones County, Griswoldville. Washington County, Chalker.

Clay (kaolin). Bibb County, Dry Branch. Jones County, Griswoldville. Wilkinson County, Lewiston (porcelain clay). Undeveloped deposits in Baldwin, Cherokee, Fulton, Heard, and other counties in the area of crystalline rocks.

Clay (paper). Habersham County, Cornelia. Glascock County, deposits near Gibson. Randolph County, Moyce property, $5\frac{1}{2}$ miles north of Cuthbert. Richmond County, Hephzibah, 9 miles southwest of Augusta. Taylor County, Butler clay mine, $2\frac{1}{2}$ miles west of Butler, shipped to northern markets. Twiggs County, near Dry Branch, Georgia kaolin mines. Wilkinson County, 1 mile west of Lewistown and at Dedrick.

Clay (pottery). Developed deposits: Baldwin County. Columbia County, pits at Grovetown. Crawford County, Williams mill, 6 miles east of Roberta. Habersham County, Cornelia. Hall County, small potteries at Oakwood and Gillsville operated at times. Jones County. Oconee County, Bogart. Polk County, small quantity near Aragon. Twiggs County. White County, number of small potteries operated at times. Undeveloped deposits: Chattooga County, small deposit near Menlo. Clarke County, 5 miles west of Athens. Glascock County, near Gibson. Washington County, Gilmore property, 10 miles north of Oconee, also at Chalker. Wilkinson County, 3 miles northwest of McIntyre.

Clay (slip). Habersham County, Cornelia.

Clay (terra cotta). Fulton County.

Clay (tile). Liberty County.

Coal (bituminous). Chattooga County, small area in northern part of county; not mined. Dade County, three workable seams in Lookout sandstone (Dade, Rattlesnake, and White Ash), mined near Cole City and in limited quantity near Rising Fawn. Walker County, coal confined to Pigeon Mountain and east side of Lookout Mountain, in Walden sandstone and Lookout sandstone, mined at Durham mine, 12 miles south of Chattanooga, Tenn.

Copper. *See* Chalcocite, Chalcopyrite, Covellite, and Malachite.

Corundum. Found in quantity at only few places. Prospecting as follows: In Cobb County, 2 miles south of Powder Springs. Forsyth County, 1 mile north of Sheltonville and elsewhere. Habersham County, Aleck Mountains. Hall County, in stream 1 mile west of Gainesville. Heard County, in magnesian rocks at Centralhatchee. Lumpkin County, 1 mile southeast of Porter Springs. Paulding County, has been mined in northeastern and southeastern corners of county. Rabun County, at Stone mine and Laurel Creek mine. Towns County, Bell Creek, Foster, and other mines (Seventeenth and Eighteenth districts). Troup County, sparingly near West Point. Union County, Track Rock mine. Upson County, 8 miles southwest of Thomaston. Walton County, near Monroe.

Covellite (indigo copper). Cherokee County, at Canton mine, with chalcopyrite and chalcocite; not mined.

Diamond. Four-carat diamond was found in Clayton County. Few finds in Hall and White counties.

Diopside. Pickens County, Southern marble quarries.

Fuller's earth. Bibb County, Dry Branch. Columbia County, near Grovetown, not mined. Decatur County, mined at Attapulugus. Twiggs County, mined at Pikes Peak.

Galena (sulphide of lead). Gwinnett County, abundant in Piedmont mine, argentiferous. Lincoln County, in small quantities at Ramsey property, abundant in Paschal and Phelps mines. McDuffie County, Columbia mine and Landers prospect.

Garnet. Lumpkin County, near Dahlonega. Abundant in garnet schists, and in gangues of some gold ores in Cherokee, Lumpkin, and other counties.

Genthite (nickel silicate). Towns County, with millerite; not mined.

Gneiss (biotite). Troup County, quarried 1 mile west of Mountville for macadam.

Gneiss (hornblende). Meriwether County, Tignor quarry.

Gold (lode). Bartow County, was mined at Glade mine. Cherokee County, Cherokee mine worked at times; Franklin mine near Creighton large producer; other mines. Cobb County, was mined at Mason mine, 8 miles northeast of Dallas, and at Freeman mine near Acworth. Coweta County, prospecting on Clarke property, near Hollingsworth Ferry. Dawson County, at Harris Branch, Magic, and other mines. Douglas County, at Pine Mountain. Forsyth County, at Strickland mine and elsewhere. Greene County, about 6 miles northeast of Union Point. Gwinnett County, important mining operations in vicinity of Buford. Habersham County, Royal mine near Walkers Creek, 3 miles southeast of Tallapoosa, old prospects near Clarkesville and near Chattahoochee River, in southeastern part of county, and at Hood and Nichols mines. Hall County, Odum and Potosi mines worked at intervals. Hart County, Brown mine, 6 miles south of Bowersville. Lincoln County, Paschal mine. Lumpkin County, Findley, Hedwig, Lockart, Preacher, Singleton, Whim Hill, and other mines, free and in quartz, mined at several points in Dahlonega and Auraria districts, and on Yahoola Creek and Chestatee River. McDuffie County, Columbia mines and others worked. Meriwether County, was mined at Wilkes and Lone Oak mines. Milton County, prospecting 4 miles from Sheltonville. Oglethorpe County, Buffalo, Guarantee, and Morgan mines, the last worked. Paulding County, free gold reported from Sheffield property near Huntsville. Rabun County, Lamar, Moore, and other mines. Towns County, Greater Pittsburg and Nancy Brown mines. Union County, Legal Tender. White County, Loud mine, 4 miles southwest of Cleveland; many old mines worked at intervals. Wilkes County, Latimer mine (free gold) and Stone Ridge mine worked at intervals.

Gold (placer). Bartow County, old placer mines on Gold Branch. Campbell County, Camp property, eighth district. Cherokee County, Cherokee, Kellogg, Sixes, and other mines. Cobb County, old placer mines. Coweta County, Bingham and Hill properties. Dawson County, old mines, Harris Branch, and others. Douglas County, limited amount of mining at Roach mine. Elbert County, along stream courses within few miles of Bowman. Fannin County, Rantze Hill mine near Noontootly Creek, found about 12 miles southeast of Blue Ridge. Forsyth County, Faver mine. Gilmer

County, White Path mine, 6 miles northeast of Ellijay, worked at intervals. Gwinnett County, considerable placer work was done on Richland Creek and tributaries. Habersham County, little work near Chattahoochee River in southeastern part of county; Nicholas mine, 6 miles east of Clarkesville, and few places along Soque River. Hall County, old prospects along creek emptying into Chattahoochee River in vicinity of Gainesville. Haralson County, old mines in eighth district. Hart County, small placer deposits mined on Red Hollow road about 4 miles from Bowersville. Lumpkin County, Etowah, Josephine, and other mines were worked. Madison County, small deposits on Smith property, Webb, etc. Meriwether County, small mine on Post property. Milton County, old mines. Murray County, Cohutta mine 4 miles east of Chatsworth. Newton County, 7 miles southwest of Covington. Paulding County, Austin mines 7 miles southeast of Dallas, Yorkville and Dunaway mines irregularly worked. Rabun County, considerable mining on Pages Creek and Lawground Branch. Towns County, Hightower Creek belt in vicinity of Visage northeast to near Georgia-North Carolina line, mining confined to Hightower Creek. Union County, extensive mining along Coosa Creek. Walton County, Malcome, Smith, and other mines have been worked. White County, Longstreet, Loud, and other mines extensively worked.

Granite (building and monumental). Bibb County, quarried at Macon. Campbell County, fine-grained medium light-gray biotite granite was quarried near Fairburn; Union City. Clark County, Athens. Cobb County, Austell. Coweta County, Senoia; several quarries in vicinity of Newnan. Dekalb County, dark blue-gray biotite granite; Congress and Lithonia quarries and at many quarries on Stone Mountain. Elbert County, medium light-gray biotite granite in Elbertson area, several quarries. Fayette County, near Fayetteville, coarse-grained biotite granite. Fulton County, Atlanta. Hancock County, near Sparta, Granite Hill. Heard County, Flat Rock, at Wynn quarries near Franklin, fine-grained biotite granite. Henry County, Stockbridge. Jackson County, Winder. Madison County, Brown and Deadwyler quarries. McDuffie County, near Thomson, fine-grained biotite granite. Meriwether County, Woodbury, dark blue-gray medium-fine biotite granite quarried near Greenville. Monroe County, Dames Ferry. Muscogee County, Columbus. Oglethorpe County, dark blue-gray and light-gray fine, even-grained biotite granite quarried near Lexington. Newton County, Freeman quarry near Covington. Oglethorpe and Madison counties, Oglesby area, superior fine-grained dark-blue biotite granite, 6 quarries. Putnam County, massive, fine, even-grained dark blue-gray biotite granite quarried near Eatonton. Richmond County, biotite granite gneiss quarried near Augusta, rough work. Rockdale County, Conyers. Spalding County, medium coarse grained light-gray biotite granite, at Griffin and Turner. Stephens County, Toccoa. Troup County, Hogansville and Trimble. Walton County, Logansville.

Granite (crushed stone). Henry County, quarried for crushed stone at Stockbridge. Stephens County, 3 miles from Toccoa. Troup County, Hogansville.

Granite porphyry. Columbia County, undeveloped, near Appling; Greene County, extensive body about 10 miles south of Greensboro. Lumpkin County, several exposures near Dahlonega. Morgan County, few outcrops, principal one on Hard Labor Creek, 5 miles northwest of Madison. Pike County, granular to porphyritic granite, dark gray, 9 miles west of Zebulon. Also in Muscogee and Wilkes counties.

Graphite (plumbago). Bartow County, extensive deposits of graphitic slate for fertilizer filler mined near Emerson. Cobb County, was mined at Powder Springs. Occurs in Carroll, Cherokee, Clarke, Douglas, Elbert, Habersham, Hall, Heard, Madison, Paulding, Pickens, Rabun, and Spalding counties.

Halloysite. Chattooga County, $4\frac{1}{2}$ miles northeast of Gore, extensively prospected. Dade County, near Rising Fawn, was mined and shipped. Floyd County, scattered through bauxitic clay in Holland Spring bank. Fulton County, near Lakewood, Atlanta. In Catoosa, Cherokee, and Walker counties, not mined.

Hematite (red ore, fossil ore). Bartow County, in minable quantities between Emerson and Etowah rivers, also near Warford, not mined. Catoosa County, abundant as float ore in Dicks Ridge; also occurs in Taylors Ridge and White Mountain. Chattooga County, mined along base of Lookout Mountain and $3\frac{1}{2}$ miles east of Summerville; also on Dirtseller Mountain. Dade County, mined on Johnson Creek. Polk County, occurs north of Rockmart. Walker County, mined at West property, tenth district. Has been mined also in Floyd and Whitfield counties.

Hematite (specular iron ore). Cherokee County, occurs in Allatoona Hills, along Etowah River, extensive deposits. Also in valley of Etowah River, in Bartow, Cass, Cobb, Fannin, Floyd, Gilmer, Lumpkin, Milton, Murray, Paulding, Pickens, Towns, and Union counties.

Hyalite. *See* Opal.

Iron. *See* Brown iron ore, Chromite, Hematite, Magnetite, Ocher, and Pyrite.

Itacolumite (flexible sandstone). Hall County, Chattahoochee Ridge. Meriwether County, near Warm Springs.

Kaolin (nonplastic and plastic). At many places throughout the Cambrian belt, which extends across the State. Developed: Bartow County, Sheet mine, 3 miles south of Adairsville. Greene County, small quantity mined 4 miles northeast of Union Point. Houston County, small mine on Yancey property, 2 miles northwest of Perry. Richmond County, in clay bed at Hephzibah, 9 miles southwest of Augusta. Twiggs County, Georgia kaolin mine, 2 miles southeast of Dry Branch, and other mines. Undeveloped: Columbia County, deposits located 1 mile east of Grovetown. Glascock County, large deposit near Gibson. Hancock County, Carrs station. Jones County, Griswoldville, 11 miles east of Macon. McDuffie County, 3 miles southwest of Dearing. Paulding County, prospecting at old Turner mica mine, 5 miles north of Dallas. Pickens County, in vicinity of Jasper. Polk County, Ledbetter mine. Taylor County, Butler. *See also* Clay.

Lazulite. Lincoln County, Graves Mountain, not mined.

Lead. *See* Galena and Pyromorphite.

Limestone (building). Catoosa County, quarried at Graysville. Dade County, Rising Fawn. Gilmer County, Ellijay. Polk County, Rockmart. Walker County, Chickamauga and Rossville.

Limestone (crushed stone). Bartow County, quarried at Cartersville and Clifton. Catoosa County, Graysville. Walker County, Chickamauga.

Limestone (flux). Walker County, quarried at Chickamauga.

Limestone (lime). Bartow County, quarried at Cartersville. Catoosa County, Graysville. Hall County, Gainesville. Walker County, Rossville.

Limonite. *See* Brown iron ore.

Magnetite (magnetic iron ore). Cherokee County, found in marble at Mabel station, 6 miles northeast of Canton. Carroll County, near Villa Rica, no

well-defined vein. Occurs also in Cherokee, Cobb, Dekalb, Gilmer, Greene, Gwinnett, Habersham, Hall, Lumpkin, and other counties; not mined.

Malachite (green carbonate of copper). Fannin County, mines of Ducktown, Tenn., belt.

Manganese ore. Occurs with brown and manganiferous iron ores in area of Paleozoic rocks, which includes 10 northwestern counties of State. Bartow County, mined in Cartersville district. Fannin County, small deposits were mined at Blue Ridge. Floyd County, mined in Cave Springs district. Habersham County, has been mined at Mount Airy. Haralson County, small deposits in Draketown district. Hart County, mined 1½ miles east of Bowersville. Murray County, occurs with iron-ore deposits 4 miles north of Cohutta Springs. Paulding County, has been mined in Draketown district. Polk County, mined in Cave Springs district. Whitfield County, mined in vicinity of Tunnel Hill. *See also* Braunite, Manganite, Psilomelane, Pyrolusite, Rhodochrosite, and Wad.

Manganite. Bartow County, associated with psilomelane and pyrolusite in Cartersville mines; not mined.

Marble. Cherokee County, extensive exposures of dark-colored marble near Mabel station and on Longswamp Creek. Gilmer County, extensive exposures of pink and white marble; quarried at Marble Bluff. Pickens County, white, gray, and pink marble; the first two varieties are extensively quarried and comprise almost the entire production of the State. Polk County, white marble near Van Wert, not quarried. Whitfield County, dark chocolate-grayish marble in northwestern corner of county. Colored marbles in Bartow, Catoosa, Chattooga, Floyd, Gordon, Polk, and Walker counties.

Marl. Occurs in Bibb, Bullock, Charlton, Chatham, Chattahoochee, Clay, Crawford, Effingham, Emanuel, Houston, Jefferson, Pulaski, Quitman, Randolph, Screven, Stewart, Thomas, and Washington counties; not mined.

Mica (muscovite). At many places throughout the Cambrian belt, which extends across the State. Cherokee County, has been mined 10 miles east of Canton and 2 miles northwest of Toonigh; prospects found near Holly Springs and Woodstock. Elbert County, has been mined near Elberton. Fannin County, found near junction of Cutcane and Hemp-town creeks. Hall County, has been mined near Gainesville. Lumpkin County, mined near Tworun. Rabun County, 10 miles east of Clayton. Union County, mined near Blairsville and 9 miles from Dahlonega; has been mined at Gaddistown, Quebec, and Ward Gap. Also occurs in Carroll, Gwinnett, Heard, Towns, and Warren counties.

Millstone. *See* Burrstone.

Mineral paint. *See* Ocher.

Nickel. *See* Genthite.

Novaculite (oilstone). Undeveloped beds in Heard, Lincoln, McDuffie, Meriwether, Oglethorpe, and Troup counties.

Ocher (mineral paint). Bartow County, mined extensively near Cartersville, large plants.

Oilstone. *See* Novaculite.

Opal. Fire opal is found in Bulloch and Washington counties; hyalite in Burke, Rabun, and Screven counties.

Peat. Extensive deposits occur in the Okefenokee Swamp and in swamps and marshes in the coastal region.

Psilomelane. Bartow County, important ore of Cartersville district; mined near Cartersville, Emerson, and Rowland Spring.

- Pyrite.** Bartow County, occurs in quartzite in Cartersville district; Carroll County, mined near Bremen, at Reids Mountain, and at Villa Rica; Cherokee County, mined at Ball Ground and near Creighton; Cobb County, mined at Acworth; Dawson County, occurs in large quantities on Shelton property; Greene County, small quantities in east part of county; Haralson County, mined near Westbrook, Draketown district; Lumpkin County, mined 6 miles northeast from Dahlonega; McDuffie County, occurs in considerable quantities in Columbia mine and Landers prospect; Murray County, occurs near Cohutta; Oglethorpe County, occurs in large quantities in quartz in Guarantee and Morgan mines; Paulding County, has been mined near Hiram; White County, occurs in large quantities in Blake mine.
- Pyrolusite** (black manganese oxide). Bartow County, important ore in Cartersville district, mined near Cartersville, Emerson, and Rowland Spring; Catoosa County, occurs but not mined; Fannin County, occurs with brown iron ores 10 miles northeast of Blue Ridge; Floyd County, important ore of Cave Spring district, mined in several places; Paulding County, occurs in residual mica schist clay in Draketown district; Whitfield County, occurs but not mined.
- Pyromorphite.** Lincoln County, at few points in Seminole mine. McDuffie County, occasionally found in oxidized vein of Columbia mine; not mined.
- Quartz** (rock crystal). Gem quality, occurs in Franklin, Forsyth, Fulton, Jones, Rabun, and Wilkes counties.
- Radium.** *See* Uranophane.
- Rhodochrosite.** Polk County, in iron mines near Cedartown; Towns County, in small quantity lining cavities several miles west of Hiawassee; not mined.
- Road metal.** Suitable material in northern part of State consists of the Knox dolomite and the Chickamauga and Bangor limestones. Chert deposits of Knox and Fort Payne formations: Granite, gneiss, diorite, schist, quartzite, and trap rock widely distributed.
- Ruby.** Rabun County, Laurel Creek mine. Towns County, Hiawassee mine. Union County, near Caldwell.
- Sand** (building). Dug in Cobb County, Oakdale; Crawford County, Zenith; Floyd County, Rome; Fulton County, Bolton; Habersham County, Demorest; Henry County, Stockbridge; Monroe County, Popes Ferry; Muscogee County, Columbus; Taylor County, Howard; Telfair County, Lumber City; Walker County, Flintstone; Whitfield County, Dalton.
- Sand** (glass). Dug in Crawford County, Zenith; Richmond County, Augusta; Taylor County, Butler; Telfair County, Lumber City.
- Sand** (molding). Dug in Catoosa County, Ringgold; Gilmer County, Ellijay; Habersham County, Demorest; Newton County, Almon; Taylor County, Howard; Walker County, Flintstone; Whitfield County, Dalton.
- Sandstone** (flexible). *See* Itacolumite.
- Sapphire.** Rabun County, Laurel Creek mine.
- Serpentine.** Cherokee County, quarried at Verde Antique marble quarry, Holly Springs. Occurs also in Rabun, Towns, and Union counties; not quarried.
- Shale** (brick). Catoosa County, occurs near Ringgold; Chattooga County, small quantity 3 miles west of Lyerly, mined and shipped; Floyd County, mined near Rome; Gordon County, mined at Calhoun; Murray County, Chatsworth; Walker County, Mission Ridge; Whitfield County, Conasauga shale, 3 miles southeast of Dalton, not used.
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Silver. Small quantity recovered from placer and lode gold in Cherokee, Hall, Lumpkin, Paulding, and White counties.

Slate. Bartow County, quarried near Fairmount. Polk County, several producing quarries near Rockmart; was formerly quarried near Van Wert.

Soapstone. *See* Talc.

Sphalerite (zinc blende). Lincoln County; Seminole mine; not mined.

Staurolite. Fannin County, long noted for its very perfect staurolite crystals. The mineral also occurs more or less plentifully in Cherokee, Pickens, Towns, Union, and other counties in north Georgia.

Sulphur. *See* Pyrite.

Talc (soapstone). Cherokee County, occurs near Ball Ground and Holly Springs. Fannin County, has been mined near Blue Ridge. Murray County, good grade of talc for burners and crayons, lower grade for grinding; mined at several places near Chatsworth. Undeveloped in Clayton, Cobb, Dekalb, Elbert, Fannin, Fulton, Gilmer, Hall, Habersham, Jasper, Paulding, Union, and White counties.

Tin. *See* Cassiterite.

Tourmaline. Rabun County, Laurel Creek corundum mine. Towns County, Hog Creek corundum mine near Hiawassee.

Tremolite. Fannin County, Park property near junction of Cutcane and Hemp-town creeks; Pickens County, Southern marble quarries, near Tate.

Tripoli. Has been mined in Chattooga County, near Lyerly. Murray County, at Chatsworth and Spring Place. Whitfield County, near Dalton.

Uranophane. Dekalb County, found in joints of granite at Stone. It is coated thinly by hyalite.

Verde antique. *See* Serpentine.

Wad. Bartow County, associated with psilomelane and pyrolusite in Cartersville manganese mines; not mined.

Zinc. *See* Sphalerite.

IDAHO.

- Anglesite** (lead sulphate). Found in surface ores of some of the argentiferous lead mines in Blaine County, at Sawtooth, Vienna, and Wood River. Custer County, at Bay Horse. Lemhi County, in Texas Creek and other districts. Shoshone County, in surface levels of Wardner lode and other mines in the Coeur d'Alene district.
- Antimony ore.** Idaho County, in Yellow Pine Basin and Big Creek district. Owyhee County, at Diamond Basin and Boulder Creek. Shoshone County, in ores of Stanley mine, at Burke, in the Coeur d'Alene district; stibnite in quartz; on Pine Creek, at Kellogg, the Brown Antimony mine is being developed. *See also* Cervantite, Polybasite, and Stibnite.
- Argentite.** Occurs at the following places: Blaine County, Silver King and Vienna mines. Custer County, Bay Horse and Yankee Fork districts. Elmore County, Yuba City, Monarch mine at Atlanta, and Banner mines. Idaho County, Warren district. Owyhee County, Black Jack, Trade Dollar, and other Silver City mines.
- Arsenopyrite.** Common in many mining districts; has been mined in the following places: Ada County, Black Hornet (Shaw Mountain) district, 8 miles east of Boise. Blaine County, mined for gold at North Star, Red Cloud, and Croesus mines; argentiferous near Ketchum. Boise County, mined for gold and silver at Gold Hill, Checkmate, Good Friday, and other claims in Willow Creek district. Bonner County, near Granite. Elmore County, Neal and Rocky Bar districts. Idaho County, Warren district. Washington County, Mineral district.
- Asbestos** (amphibole). Idaho County, 16 miles south of Grangeville. Lewis County, has been mined 14 miles southeast of Kamiiah.
- Azurite.** Blaine County, has been mined with lead ore in Wood River district. Custer County, has been mined with other copper ores. Elmore County, in Tahoma mine, Atlanta district. Oneida County, has been mined at Blackstone mine. Shoshone County, occurs in gangue of silver-lead ores near Mullan; abundant in Hunter; less so in Morning mine and other mines and prospects; also common in mines and prospects of the Seven Devils Range in Adams and Washington counties.
- Barite.** Blaine County; undeveloped deposits reported. Shoshone County, common gangue mineral in the Gold Hunter mine at Mullan and occurs in several other mines in the Coeur d'Alene district.
- Basalt.** Occurs extensively in western and southern Idaho. Has been quarried intermittently at Idaho Falls, Bonneville County; Warren station (near Nampa), Canyon County; Cottonwood, Idaho County; Coeur d'Alene, Kootenai County; Lewiston, Nez Perce County; Twin Falls, Twin Falls County.
- Bornite.** Adams County, mined for gold and silver in Seven Devils district. Bannock County, Moonlight property near Pocatello. Kootenai County, prospects on the east side of Lake Pend Oreille. Lemhi County, Copper Queen mine. Shoshone County, Snowstorm and Copper King mines, Coeur d'Alene district. Washington County, Weiser district.
- Brown iron ore** (limonite). Common in outcrops of lode deposits in many mining districts; not mined for iron; used as flux at Muldoon, Blaine County.
- Cassiterite.** Occasionally found in Jordan Creek and other streams, Bitterroot Mountains; in Lemhi County, on Panther Creek; and in Shoshone County, in the Coeur d'Alene district.
- Cement materials** (Portland). Blaine County, limestone and shale abundant at Arco. Clearwater County, limestone at Orofino. Nez Perce County,

limestone and shale on Snake River, about 18 and 25 miles south of Lewiston. Teton County, associated with bed of high-grade steam coal at Horseshoe Creek. No cement thus far produced.

Cerargyrite (horn silver). Has been mined in the following places: Blaine County, surface ore in Wood River district; Custer County, Bay Horse district; Elmore County, surface ore of Monarch lode, Atlanta, and Smoky district; Idaho County, Warren district; Lemhi County, districts in the southeastern part of the county; Owyhee County, De Lamar and Silver City districts. Reported from other districts.

Cerium. See Monazite.

Cerussite (lead carbonate). Common oxidized ore in silver-lead mines of Blaine County, Wood River district; Custer County, Bay Horse and other districts; Lemhi County, Junction, Nicholia, Spring Mountain, and Texas Creek districts; Shoshone County, Coeur d'Alene district.

Cervantite (antimony ochre). Blaine County, has been mined in Wood River district.

Chalcanthite. Washington County, Mineral district, and in copper mines in other districts.

Chalcedony. Custer County, occurs in Yankee Fort district. Lemhi County, Gravel Range and Parker Mountain districts. Owyhee County, Silver City.

Chalcocite. Adams County, Seven Devils district. Bannock County, Moonlight mine, near Pocatello. Bear Lake County, in Triassic rocks near Montpelier. Fremont County, Sedalia mine. Shoshone County, mined for gold and silver in the Snowstorm mine, and in small quantity in the Park, Reindeer, and Carney copper prospects, Coeur d'Alene district.

Chalcopyrite. Adams County, Seven Devils district. Blaine County, mined for gold at Argent and Jay Gould mines, Wood River district. Boise County, rare in Willow Creek district. Custer County, chief ore of White Knob copper mine; auriferous in Lost Packer mine. Idaho County, Big Buffalo, Monte Cristo, and Jumbo mines, Buffalo Hump district; prospects near Harpster and Mount Idaho; carries gold and silver. Kootenai County, prospects east of Pend Oreille Lake. Owyhee County, mined for gold and silver at Black Jack and Trade Dollar mines, Silver City. Shoshone County, chief copper ore in Monitor mine, and many prospects of St. Joe basin and Coeur d'Alene district; subordinate part of ore in Snowstorm mine. Washington County, Mineral district.

Cinnabar (sulphide of mercury). Custer County, in gold-bearing gravel, Willis placers, on Stanley Creek. Elmore County, stringers of cinnabar in granite are reported in the Pine mining district about 40 miles north of Mountain Home. Idaho County, Pringle-Smith prospect on Sugar Creek, 10 miles east of Roosevelt.

Clay (brick). Dug in the following places: Ada County, at Boise. Adams County, Meadows. Bannock County, Pocatello. Bear Lake County, Paris. Bingham County, Idaho Falls. Bonner County, Sandpoint and Albany Falls. Canyon County, Caldwell and Payette. Cassia County, Oakley. Fremont County, St. Anthony. Gem County, Emmett. Idaho County, Grangeville and Keuterville. Kootenai County, Coeur d'Alene and Huettner. Latah County, in Genesee, Kendrick, and elsewhere. Lewis County, Ilo. Nez Perce County, Kippen, Lewiston, and elsewhere. Oneida County, Preston. Washington County, Weiser.

Clay (fire). Latah County, Deary.

- Coal.** Bituminous coal has been mined in the eastern part of Bonneville and Fremont counties in an extension of the Sublette field of Wyoming. Lignite has been mined in the ridges between Horseshoe Bend and Jerusalem, Boise County, and near Salmon, Lemhi County.
- Cobalt.** Lemhi County, occurs near Blackbird. *See also* Erythrite.
- Copper.** The predominant metal produced in the following districts: Adams County, Seven Devils district. Bannock County, Fort Hall. Bear Lake County, Bear Lake. Blaine County, Hamilton. Bonner County, East Shore (Clark Fork). Bonneville County, Mount Pisgah. Custer County, Alder Creek. Fremont County, Skull Canyon and Camp Howard. Lemhi County, Blackbird. Shoshone County, Bald Mountain and Black Prince. Washington County, Heath. Of minor importance in many other mining districts. *See also* Azurite, Bornite, Chalcantinite, Chalcocite, Chalcopyrite, Covellite, Cuprite, Malachite, Melanconite, and Tetrahedrite.
- Copper (native).** Adams County, Seven Devils district. Lemhi County, Beaver Creek and several other places. Shoshone County, rare in Snowstorm mine, Coeur d'Alene district.
- Corundum.** Custer County, in placers, Stanley basin.
- Covellite.** Adams County. Bear Lake County, small quantity near Montpelier. Shoshone County, in Last Chance mine of Coeur d'Alene district.
- Cuprite (copper oxide).** Lemhi County, Galbraith mine on Beaver Creek, Bell group on Carmen Creek, and other places. Shoshone County, in Snowstorm and Monitor mines, Coeur d'Alene district. Washington County, occurs in Weiser district; argentiferous at River Queen copper deposit, one-half mile above Ballards.
- Diatomaceous earth.** Blaine County. Owyhee County, near Murphy station. Washington County, at Council.
- Dufrenoyite.** Blaine County, with lead ores in considerable quantity in Wood River district; has been mined. Bonner County, occurs in Crown Point mine.
- Erythrite.** Lemhi County, near Blackbird.
- Ferberite.** Blaine County, East Fork of Corral Creek, Soldier Mountain, 6 miles from Corral. Boise County, Deadwood district.
- Freibergite (argentiferous tetrahedrite).** Blaine County, has been mined in Columbia, Pilgrim, and other mines in the Sawtooth district; Soldier Mountain, 9 miles north of Corral.
- Galena.** Blaine County, the principal ore of Wood River district, mined for lead and silver near Hailey and elsewhere. Boise County, Checkmate, Good Friday, and other claims in Willow Creek district, mined for gold and silver. Boundary County, occurs with gold at Buckhorn mine, east of Moyie River. Custer County, Bay Horse district, extensively mined; also in copper ores of White Knob mines. Elmore County, mined in Neal district for gold and silver. Idaho County, Little Giant, Rescue, and other mines in Warren district, mined for gold and silver; Big Buffalo and Monte Cristo mines, Buffalo Hump district. Kootenai County, mines and prospects on south and west sides of Lake Pend Oreille, argentiferous; Snowshoe mine, near Troy. Lemhi County, Texas Creek, Junction, Spring Mountain, and Nicholia districts; extensively mined. Owyhee County, South Mountain, Black Jack, and Trade Dollar mines, Silver City. Shoshone County, chief ore of silver-lead mines, Coeur d'Alene district; associated with gold in Golden Chest and other mines near Murray; prospects in St. Joe basin. Washington County, mined for gold and silver in Mineral district, Blue Mountain gold belt.

Garnet (spessartite). Adams County, with bornite and powellite in Peacock claim, Seven Devils district. Boise County, a few gems found in gold placers of Deadwood Gulch.

Gas. *See* Natural gas.

Gold (lode). Predominant metal produced in the following districts: Ada County, Black Hornet and Boise (McIntire). Blaine County, Camas, Little Smoky, and Rosetta. Boise County, Highland Valley, Idaho City, Quartzburg, Summit Flat, and Westview. Bonner County, Mooyie Yaak, Blacktail, and Pine Creek. Cassia County, Connor Creek. Clearwater County, Musselshell Creek and Pierce. Custer County, Loon Creek, Seafoam, Stanley basin, Washington basin, and Yankee Fork. Elmore County, Atlanta, Black Warrior, Neal, Pine Grove, and Rocky Bar. Idaho County, in nearly every district. Lemhi County, in nearly every district. Owyhee County, De Lamar and Mammoth. Shoshone County, Eagle (Murray), St. Regis, and Summit.

Gold (placer). The predominant metal produced in the following districts: Ada County, Snake River. Adams County, Meadows, 16 miles northeast of Evergreen. Benewah County, Camas Cove. Bingham County, Snake River at Blackfoot, Rich, and Otis. Blaine County, Soldier and Snake River, near Wampi. Boise County, Moore Creek, Deadwood, Gold Fork, Payette River, and Twin Springs. Cassia County, Snake River. Clearwater County, Burnt Creek, Moose Creek. Elmore County, Highland Valley. Idaho County, Crooks Corral, Maggie, Salmon River. Latah County, Gold Creek and Moscow. Lemhi County, Kirtley Creek, Leesburg, Mackinaw, and Pratt Creek. Owyhee County, gravels of Snake River. Shoshone County, St. Joe, 25 miles west of Iron Mountain, Mont.

Granite. Occurs extensively in central and also in northern part of State, but for most part not very accessible. Has been quarried on small scale 5 miles east of Boise, Ada County, and on Snake River, 25 miles south of Lewiston, Nez Perce County.

Gypsum. Washington County, prospected in bluffs of Snake River, T. 13 N., R. 7 W.

Halite. *See* Salt.

Hematite. Widespread in outcrops of lode deposits. Washington County, in massive deposits in Iron Mountain.

Hübnerite. Boise County, Deadwood basin, 30 miles north of Boise. Lemhi County, mined on Patterson Creek, Bluewing district.

Iron. *See* Brown iron ore, Hematite, and Magnetite.

Lead (native). Blaine County, reported in Wood River district.

Lead minerals. Lead is the predominant metal in the following districts: Bear Lake County, St. Charles. Blaine County, Dome, Elkhorn, Galena, Muldoon, and Mineral Hill. Bonner County, Priest Lake. Custer County, East Fork, 24 miles west of Mackay. Jefferson County, Little Lost River, 25 miles northeast of Arco. Lemhi County, Junction, Spring Mountain, and Texas Creek. Owyhee County, South Mountain, 46 miles south-southwest of Murphy. Shoshone County, Beaver, Evolution, Hunter, Leland, Pine Creek, Slate Creek, Wallace, and Yreka. Washington County, Mineral, 29 miles north-northeast of Huntington, Oreg. *See also* Anglesite, Cerusite, Dufrenoy'site, Galena, Massicot, and Pyromorphite.

Lignite. Boise County, has been mined near Horseshoe Bend. Cassia County, occurs in Goose Creek field. Lemhi County, has been mined near Salmou.

Limestone (building). Blaine County, Arco. Bonner County, 3 miles north-east of Lakeview. Franklin County, Franklin, Mission Creek. Nez Perce County, 5 miles south of Taplin.

- Limestone** (lime). Bannock County, burned at Pebble. Cassia County, near Burley. Kootenai County, at Squaw Bay on Pend Oreille Lake.
- Limonite.** *See* Brown iron ore.
- Magnetite** (magnetic iron ore). Blaine County, occurs in Wood River country. Also in Custer and Lemhi counties. Shoshone County, rare in ores of Coeur d'Alene district. Washington County, occurs in Mineral district, Blue Mountain gold belt.
- Malachite** (green carbonate of copper). Adams County, Seven Devils district. Blaine County, has been mined with other copper ores in Wood River district. Idaho County, Warren district. Washington County, Mineral district.
- Marble.** Small quantities have been quarried or prospected at Little Basin, Cassia County, and on Snake River, 25 miles south of Lewiston, Nez Perce County.
- Marcasite.** Blaine County, has been mined for gold and silver in Wood River district. Owyhee County, in Trade Dollar mine, Silver City, and at South Mountain mines.
- Massicot.** Shoshone County, oxidized lead ore in Coeur d'Alene district, Hercules, California, and other mines.
- Melaconite.** Adams County, was mined with other copper minerals in Seven Devils and other districts.
- Mica.** Adams County, was mined 15 miles from Council. Cassia County, prospecting 30 miles from Albion. Idaho County, prospecting at Pardee. Latah County, prospecting at Avon and Troy.
- Molybdenite.** Blaine County, Bear Creek. Boundary County, near Copeland. Elmore County, on Sheep Creek. Lemhi County, Junction mining district, near Leadore.
- Monazite.** Ada County, occurs in black sands at Boise and Boise Basin. Adams County, Meadows, Snake River, and John Day Creek. Boise County, has been mined at Centerville, found in placers near Placerville, Idaho City, and elsewhere. Canyon County, Payette River. Clearwater County, Orofino, Dent, and elsewhere. Idaho County, best deposit at Warren district (placer). Lemhi County, at Leesburg. Lincoln County, at Minidoka. Nez Perce County, Musselshell Creek, 28 miles east of Greer, and 10 miles from Weippe. Owyhee County, at Oreana.
- Natural gas.** Small quantities have been found in Canyon County, near the junction of Payette and Snake rivers; in Owyhee County near Enterprisé; and in Washington County, at Weiser.
- Nickel ore.** Custer County, at East Fork, with pyrrhotite and pyrite. Idaho County, Big Creek. Lemhi County, deposits at Blue Bird.
- Opal.** Canyon County, opaline near Snake River, southwest of Caldwell, formerly worked. Lemhi County, Panther Creek district, some cut for gems. Owyhee County, near Oreana.
- Opalized wood.** Clover Creek, Logan County, some of beautiful grain, sawed, and polished.
- Phosphate rock.** Bannock County, occurs in many parts of the county. Bear Lake County, near Georgetown, Montpelier, and Paris. Bingham County, in hills 10 miles southeast of Shelley. Bonneville County, along Snake River near Irwin and along the State line. Madison County, along the State line.

Platinum. Found in small quantity in black sands of Boise, Idaho, and Shoshone counties, and also in the following localities: Ada County, Payette River. Bingham County, Snake River. Clearwater County, Pierce district. Elmore County, Rocky Bar. Idaho County, Elk City district. Nez Perce County, Clearwater River.

Polybasite. Owyhee County, occurs at Silver City.

Proustite (light ruby silver). Blaine County, associated with pyrrargyrite in Sawtooth and other districts. Elmore County, in Monarch and Buffalo mines, Atlanta. Owyhee County, has been mined at Silver City. Shoshone County, in Coeur d'Alene district.

Pumice. Oneida County, has been mined at Rockland. Owyhee County, at Castle Creek.

Pyrrargyrite. Blaine County, has been mined in Wood River district. Boise County, has been mined in small quantity for gold and silver in Banner silver veins. Idaho County, in Warren district. Owyhee County, in De Lamar district.

Pyrite. Boise County, mined for gold and silver at Checkmate, Gold Hill, and other veins in Willow Creek district. Custer County, important ore of White Knob copper mine. Elmore County, in Neal district. Idaho County, at Big Buffalo and Jumbo mines in the Buffalo Hump district. Lemhi County, at Gibbonsville and elsewhere. Shoshone County, found in all deposits of Coeur d'Alene district; mined for gold at Golden Chest mine, north of Littlefield. Washington County, at Mineral silver mines, Blue Mountain region.

Pyromorphite. Shoshone County, Coeur d'Alene district; mined at Idaho Giant and elsewhere.

Pyrrhotite. Blaine County, has been mined in Croesus, Camas, and Tip Top mines, Wood River district. Lemhi County, in ores of Blackbird and Indian Creek districts. Shoshone County, Coeur d'Alene district, and in copper veins of St. Joe basin.

Radium. See Uranophane.

Rhyolite. Mostly light colored, quarried for building stone at the following places: Ada County, Boise. Bingham County, Goshen. Bonneville County, hills east of Idaho Falls, Prospect, and Willow Creek. Cassia County, 6 miles southeast of Albion, Oakley. Jefferson County, Rigby. Madison County, Sunnyside. Dominant volcanic rock of Snake River basin east of Weiser and in places has a capping of basalt.

Road metal. See Basalt, Granite, Limestone, Monzonite, Rhyolite, Sand and gravel, and Sandstone.

Salt (brine). Bannock County, Stump Creek and Tygee valleys, west of Star Valley.

Salt (rock). Bannock County, mined on southeast side of Crow Creek valley.

Sand and gravel. Ada County, dug at Boise. Bannock County, Pocatello. Bonneville County, Idaho Falls. Dug in other localities.

Sandstone. Quarried in the following localities: Ada County, at Boise and Table Rock. Bannock County, small quarries at Crow Creek, 5 miles southwest of Fairview, Wyo. Bear Lake County, southeast of Dingle.

Sapphire. Adams County, in concentrates from Rock Flat gold placer near Meadows. Clearwater County, various shades of blue and green in gravel deposits near Pierce, especially along Rhodes and Orofino creeks.

Scheelite. Blaine County, small quantity reported from North Fork mining district, northeast of Ketchum. Idaho County, has been mined for gold and silver in the Warren mining district. Lemhi County, found as secondary mineral in Bluewing district. Shoshone County, found in Golden Chest and Golden Winnie mines, at and near Murray.

Silver. The-predominant metal produced in the following districts: Blaine County, Antelope, Lava Creek, Sawtooth, and Warm Springs. Boise County, Banner. Boundary County, Kootenai, 40 miles northwest of Iola. Custer County, Bay Horse and Sheep Mountain. Kootenai County, Lakeview and Medimont. Lemhi County, Bluewing and Parker Mountain. Owyhee County, Carson and Flint. Silver is of only less importance in many other districts. *See also* Argentite, Cerargyrite, Freibergite, Polybasite, Proustite, and Pyrargyrite.

Silver (native). Shoshone County, associated with cerusite in Last Chance mine, Coeur d'Alene district; rare; and in oxidized portion of many lodes in the State but nowhere is an abundant ore.

Specularite. Idaho County, at Peacock claim, Seven Devils district.

Sphalerite (zinc blende). Blaine County, mined for gold and silver at Silver King and Vienna mines. Boise County, Gold Hill, Good Friday, Checkmate, and other veins in Willow Creek district. Custer County, occurs with lead-silver ores. Elmore County, small quantity in Neal district. Idaho County, Monte Cristo, and other mines in Buffalo Hump district, and Little Giant, Rescue, and other mines in Warren district. Lemhi County, occurs with lead-silver ores. Owyhee County, Silver City and South Mountain. Shoshone County, associated with galena, etc., in some mines in the Coeur d'Alene district; Interstate-Callahan mine, Ninemile district, third largest producer of zinc sulphide in the world. Washington County, Mineral district.

Stibnite. Blaine County, occurs in Wood River district. Boise County, occasionally found at Gold Hill and near Idaho City. Elmore County, occasionally found in the Neal district. Shoshone County, has been mined in Gorge Gulch, 1 mile from Burke, where it carries gold, and from three shipping mines at Price Creek. *See also* Antimony.

Sulphur. Bannock County, sulphur springs deposits near Soda Springs; has been mined.

Tetrahedrite (gray copper ore). Has been mined in the following localities: Blaine County, intergrown with galena in number of mines in the Wood River district. Custer County, great deposits in Bay Horse district. Elmore County, small quantity in Banner mines. Idaho County, mined for gold and silver at Big Buffalo, Jumbo, and other mines in Big Hump district, and at Little Giant, Rescue, and other mines in Warren district. Owyhee County, small quantity at Flint, Silver City. Shoshone County, at some lead-silver mines in the Coeur d'Alene district. Washington County, at Mineral silver mines, Blue Mountain gold belt.

Thorium. *See* Monazite.

Tin. *See* Cassiterite.

Tungsten. *See* Ferberite, Hübnerite, Scheelite, and Wolframite.

Uranophane. Boise County, Carterville.

Vivianite. Owyhee County, Trade Dollar and Black Jack mines, Florida Mountain, near Silver City.

Wood (opalized). *See* Opalized wood.

Wolframite. Blaine County, at head of Fish Creek, 7 miles west of Martin. Custer County, Pahsimeroi River, reported. Lemhi County, at Patterson Creek, with hübnerite in quartz; Big Eight Creek, tungsten ore reported.

Zinc. *See* Sphalerite.

Zircon. In Clearwater region and elsewhere in black sand and certain granitoid rocks.

ILLINOIS.

- Cement material.** Large deposits suitable for development. Those developed are: Clark County, "Lower Magnesian" (Ordovician) limestone mined for natural cement near Utica. Cook County, blast-furnace slag and crushed limestone used for Portland cement at Chicago. La Salle County, Pennsylvanian ("Coal Measures") limestone quarried for Portland cement material at Oglesby and east of La Salle. Lee County, "Trenton" limestone quarried at Dixon for Portland cement.
- Cerussite** (carbonate of lead). Jo Daviess County, secondary mineral of lead-zinc mines.
- Clay** (brick). Clay suitable for brick making is dug at one or more places in practically every county in the State. The value of common brick produced in Illinois in 1914 was \$4,898,698. Total clay products were valued at over \$13,300,000.
- Clay** (fire). Dug in Alexander County, at Elco. Calhoun County, Golden Eagle. Fulton County, Avon. Greene County, 2½ miles northeast of Whitehall and at Drake. Grundy County, at Coal City. La Salle County, near Streator, Utica, Deer Park, and Ottawa. Livingston County, 1½ miles south of Streator. McDonough County, 1 mile north of Macomb, Colchester. Pope County, on branch of Robustle Creek. Rock Island County, at Carbon Cliff. Scott County, Alsey. Union County, Kaolin and Jonesboro. Warren County, Monmouth. Winnebago County, Rockton. Also in several other counties.
- Clay** (kaolin). Pope County, has been dug at Raum. Union County, dug at Kaolin.
- Clay** (paper and medicinal). Pulaski County, occurs at Pulaski. Ogle County, at Adeline.
- Clay** (pottery). Pits in Greene County, at Drake (ball clay also dug). Jersey County, Fieldon. La Salle County, Lowell. Massac County, Round Knob. McDonough County, Colchester. Pulaski County, Yates Landing and near Lockharts Landing. Rock Island County, Carbon Cliff. Warren County, Monmouth.
- Clay** (sewer pipe). McDonough County, Macomb.
- Clay** (terra cotta). Cook County.
- Coal** (bituminous). Nearly three-fourths of the State is underlain by productive coal measures, the total area being estimated at 35,600 square miles. Fifty counties reported some coal production in 1914. Franklin and Williamson counties produced over 7,000,000 short tons each; Sangamon County exceeded 5,000,000 tons; and four other counties, Macoupin, Madison, St. Clair, and Saline, produced over 3,000,000 tons each. The total production of the State in 1914 was 57,589,197 short tons, valued at \$64,693,529.
- Flagstone.** Alexander County, Thebes. Madison County, Alton. Monroe County, Columbia and Monroe. Wayne County, Fairfield. Will County, Joliet, Twelve-mile Grove, and Wallingford. In Calhoun, Hamilton, Pike, Scott, Wabash, White, and other counties.
- Fluorspar.** Hardin County, mined in Rosiclare and Hicks district, at Cave-in-Rock, Fairview Landing, and elsewhere. Pope County, mined at Pittsburg, McClellan, and other mines.
- Galena.** Hardin County, occurs in small bunches in fluorspar at the Fairview mine, also in Empire mine. Jo Daviess County, occurs in numerous mines. Produced as by-product in cleaning fluorspar at Empire, Rosiclare, and other mines.

Gas. *See* Natural gas.

Geodes. Hancock County, abundant in shale at Warsaw.

Iron. *See* Siderite.

Lead. *See* Cerusite and Galena.

Limestone (building). Quarried in Adams County, at Front, Jefferson, and Quincy. Boone County, Belvidere. Carroll County, Lanark, Mount Carroll, and Savanna. Clark County, Martinsville. Coles County, Charleston. Cook County, Gary, Hillside, Lagrange, Lemont, Sag Bridge, and elsewhere. Dupage County, Elmhurst. Greene County, Eldred. Hancock County, Hamilton, Nauvoo, and Niota. Harden County, Elizabethtown. Henderson County, Biggsville. Jersey County, Delhi, Elsau, and Grafton. Jo Daviess County, Elizabeth, Galena, near Woodbine, and Warren. Kane County, Batavia, Geneva, North Aurora, South Elgin. Kankakee County, Bonfield, Essex, Lehigh, Momence, and Waldron. Kendall County, Oswego. La Salle County, La Salle. Lee County, Dixon. McHenry County, Marengo. Madison County, Alton. Monroe County, Maestown, Millstadt Junction, and New Hanover. Montgomery County, Hillsboro. Ogle County, Lead River, Mount Morris, and Rochelle. Pike County, Valley City. Randolph County, Chester, Menard, Prairie du Rocher, and Red Bud. Rock Island County, Moline and Rock Island. St. Clair County, Belleville, Centerville station, Columbia, and East Carondelet. Scott County, Alsey. Stephenson County, Kent. Union County, Anna. Vermillion County, Fairmount. Whiteside County, Garden Plain, Rockfalls, and Sterling. Will County, Elwood, near Lemont, Joliet, Manhattan, Romeoville (mail Lockport). Winnebago County, Durand, Pectonica, Rockford, and Winnebago.

Limestone (crushed stone). Quarried in Adams County, at Quincy. Boone County, Belvidere. Carroll County, Savanna. Cook County, Bellwood, Chicago, Summit, and elsewhere. Dupage County, Elmhurst. Hancock County, near Niota. Jersey County, Elsau and Grafton. Kane County, Batavia and South Elgin. Kankakee County, Kankakee and Momence. La Salle County, La Salle. Lee County, Dixon. McHenry County, Marengo. Madison County, Alton. Monroe County, Millstadt Junction. Montgomery County, Hillsboro. Ogle County, Rochelle. Pike County, Valley. Randolph County, Menard. Rock Island County, Port Byron and Moline. St. Clair County, Belleville, Falling Springs, and Stolle. Union County, Anna. Whiteside County, Fulton and Sterling. Will County, Elwood and Joliet. Winnebago County, Rockford and Rockton.

Limestone (fertilizer). Good limestone for fertilizer occurs in Alexander County along river bluff $\frac{1}{2}$ mile south of Thebes; Coles County, near Charleston; Hardin County, Rosiclare; Johnson County, Belknap; Pulaski County, near Ullin; Union County, Anna.

Limestone (flux). Quarried in Adams County, at Quincy; Cook County, Chicago; Jersey County, Elsau; Monroe County, Millstadt Junction; Vermilion County, Fairmount; Will County, Joliet.

Limestone (lime). Quarried in Adams County, at Marblehead and Quincy. Cook County, many points in vicinity of Chicago. Jo Daviess County, Stockton. Kankakee County, Kankakee. Madison County, Alton. Monroe County, New Hanover. Rock Island County, Port Byron. Whiteside County, Fulton, Sterling. Will County, Joliet. Winnebago County, Rockford.

Natural gas. Gas was produced commercially in 1914 principally in the following counties: Cumberland, Clark, Crawford, and Lawrence counties. Usable quantities are recoverable from practically all oil pools. Shallow wells in the following counties furnish gas for local consumption: Bureau, Champaign, Dewitt, Edgar, Lee, Logan, Montgomery, Morgan, and Pike. McHenry and Randolph counties were formerly producers. There were 417 productive gas wells in the State at the end of 1914.

Oil. *See* Petroleum.

Oil shale. *See* Shale.

Peat. Occurs in Boone County, Boone Township. Bureau County, Gold Township. Cook County, in several localities. Kane County, Carpentersville, Hampshire, and Rutland. La Salle County, west of Utica. In Lee, Lake, and McHenry counties. Mason County, at Manito, produced for fertilizer filler, stock food, and for use in mud baths. Ogle County, Monroe. Stephenson County, Florence. Whiteside County, in Cattail Slough, very large body; in glacial drift 50 to 90 feet below surface, of variable quality, most commonly only a soil rich in humus; produced for fertilizer filler at Morrison.

Petroleum. The principal oil fields of the State lie in the following counties: Clark, with 60 square miles of productive territory. Crawford, 110 square miles. Cumberland, 12 square miles. Lawrence, 60 square miles. These are adjoining counties and the fields in them extend also into Coles, Jasper, and Wabash counties. There are small fields near Carlyle, Clinton County; Centralia and Sandoval, Marion County; Carlinville, Macoupin County; Litchfield, Montgomery County; Sparta, Randolph County; and Plymouth, McDonough County. The production of the State for 1914, ranking third of the States in the Union, was 21,919,749 barrels, valued at \$25,426,179.

Pyrite. Hardin County, occurs in small quantities in Fairview, Empire, and other mines. Jo Daviess County, with galena and sphalerite in lead-zinc mines.

Road metal. *See* Limestone (crushed stone), Sand and gravel, and Sandstone.

Sand (building). Dug in Alexander County, at Cairo. Bond County, Greenville. Boone County, Belvidere. Bureau County, Buda and Wyanet. Carroll County, Savanna. Cook County, Lake Michigan, and Worth. Dekalb County, Genoa. Dupage County, Warrenville. Henderson County, Gladstone. Jo Daviess County, East Dubuque. Kane County, Aurora, Carpentersville, and elsewhere. Kendall County, Millington. Lake County, Antioch, Beach, and elsewhere. La Salle County, La Salle, Ottawa, and Wedron. Lee County, Dixon. Logan County, Kickapoo Creek and Lincoln. McHenry County, Algonquin and Cary station. Madison County, Alton. Mercer County, Keithsburg. Ogle County, Hazelhurst and Woosung. Peoria County, Peoria. Piatt County, Hammond. Rock Island County, Moline. Tazewell County, Pekin. Whiteside County, Galt and near Sterling. Will County, Joliet, Millsdale, and Plainfield. Winnebago County, Rockford and South Beloit. Dug also at other places.

Sand (fire). La Salle County, Ottawa, Utica, and Wedron.

Sand (glass). Bond County, pits at Greenville. Calhoun County, Cap au Iris. Kendall County, Millington. La Salle County, important quarries in St. Peter sandstone at Ottawa, Utica, and Wedron. Lee and Ogle counties, occurs along Rick River.

Sand (molding). Pits in Alexander County, at Cairo. Bond County, Greenville. Bureau County, Wyanet. Fayette County, Vandalia. Hancock County, Niota. Henderson County, Gladstone. Kane County, Aurora, Batavia, and Elgin. Kendall County, Millington. La Salle County, Ottawa, Utica, and Wedron. Lee County, Pitt. McHenry County, Algonquin. Madison County, Collinsville and East Alton. Jackson County, Cora. St. Clair County, East St. Louis and French village. Shelby County, Cowden. Tazewell County, Pekin. Whiteside County, Round Grove. Will County, Joliet. Winnebago County, Rockton.

Sand and gravel. Abundant and used in many counties for making concrete and for road metal.

Sandstone. Quarried in Alexander County, at Elco and Tamms. Carroll County, Lanark and Savanna. Clay County, Xenia. Fulton County, Lewistown and Marietta. Henry County, Colona. Lee County, Ashton. St. Clair County, Millstadt, Paderborn, and Smithton. Stephenson County, Pearl City. Union County, small quantity 6 miles east of Anna, Dongola. Was formerly quarried in Jackson County, Drury Creek; Peoria County, Kickapoo River; Rock Island County, Andalusia; St. Clair County; Sangamon County, west of Springfield; Warren County, Berwick and Greenbush.

Shale (brick). Used at Jackson County, Murphysboro. Abundant supply throughout State.

Shale (oil). Devonian; underlies much of the southern two-thirds of the State at considerable depth and thins westward.

Siderite (iron carbonate). Crawford County, Palestine. Edwards County, T. 1 S., R. 10 E. Hardin County, Sellers Landing. Schuyler County, Sugar Creek, T. 2 N., R. 1 W. Wayne County, at several localities. These and other localities in Pennsylvanian ("Coal Measures") rocks; beds from 1 to 2 feet thick, generally poor.

Silica. Sandstone, called silica in the trade, is quarried for pottery, paint, abrasives, etc., in La Salle County, near Ottawa and Wedron, and in Ogle County, near Oregon. *See also* Tripoli.

Silver. Hardin and Pope counties, recovered from lead concentrates in fluorspar district.

Smithsonite. Jo Daviess County, mined in Galena district.

Sphalerite (zinc blende). Jo Daviess County, principal ore of Galena district. Hardin and Pope counties, small quantities are obtained as a by-product in cleaning fluorspar.

Tripoli. Alexander County, mined near McClure. Union County, large quantity mined near Anna, Jonesboro, Reynoldsville, and Wolf Lake; refineries at Jonesboro and near Wolf Lake; less abundant deposits elsewhere.

Zinc. *See* Smithsonite and Sphalerite.

INDIANA.

- Abrasive.** *See* Grindstones and scythestones, Oilstones, and Whetstones.
- Asphalt.** Gibson County, bed several feet thick in deep well near Princeton; also seeps into bottom of a coal mine in considerable quantity at same place.
- Brown iron ore** (bog iron ore, limonite). Clay County, Harmony and in T. 10 N., R. 6 W. Daviess County, several localities. Greene County, vicinity of Cincinnati and along creeks. Lawrence County, a few workable deposits. Martin County, south of Shoals near Coal Hollow, extensive deposits near Baltimore & Ohio Southwestern Railroad have been mined. Monroe County, small deposits along Indian Creek, formerly used in furnaces. Noble County, Ore prairie. Orange County, in many hills. Vermilion County, Nortons Creek and Hilton prairie. Occurs also at several localities in Jasper, Kosciusko, Laporte, and St. Joseph counties but is not mined.
- Cement material (natural).** Clark County, Devonian hydraulic limestone quarried and burned for natural cement at Sellersburg, Belknap, Speeds, Watson, and Charlestown.
- Cement material (Portland).** Plants are operating on local deposits of marl in Lagrange County at Stroh and in Kosciusko County at Syracuse; on limestone, in Lawrence County at Mitchell. Limestone worthy of consideration as source of cement material occurs in three geologic divisions: Cincinnati series (Upper Ordovician), only in southeastern Indiana, occupying all or part of Dearborn, Fayette, Franklin, Jefferson, Ohio, Ripley, Switzerland, Union, and Wayne counties. Mississippian series (lower Carboniferous), in belt 20 miles wide from Harrison County on Ohio River northwest to Benton County. Pennsylvanian series ("Coal Measures" or upper Carboniferous), in southwestern part of State, underlying 14 counties. *See also* Marl, which is suitable for Portland cement.
- Clay** (brick). In nearly every county in the State. Indiana ranked sixth of the States in value of clay products in 1914.
- Clay** (draintile). In nearly every county.
- Clay** (fire). Of common occurrence, associated with coal beds in 14 counties in southwestern part of State. Mined in Clay County, at Brazil. Dubois County, Huntingburg. Vermilion County, West Montezuma, Hillsdale. Wells County, Bluffton. In many other places.
- Clay** (kaolin). Greene County, occurs near Newark. Lawrence County, has been mined near Huron and 2½ miles west of Shoals. Martin County, large deposit near Indian Springs Hotel. Occurs at other places in Lawrence, Martin, and Owen counties.
- Clay** (pottery). Productive localities: Clay County, Brazil and Center Point. Dubois County, Huntingburg. Owen County, high-grade, pinkish red, 1½ miles southwest of Freedom. Parke County, at Bloomingdale. Spencer County, at Lincoln City. Wayne County, alluvial deposits along White-water River. Slip clay mined at Elkhart, Elkhart County. Good quality clay, not mined at present, occurs at following places: Clark County, formerly mined near Port Fulton. Daviess County, near Washington, Cannelburg, Montgomery, and elsewhere. Fountain County, superior quality along bottoms of Coal Creek; also found near Shawnee Creek. Greene County, good grade one-fourth mile east of Cincinnati and near mineral City, was mined at Owensburg. Jefferson County, southeast of Dupont. Knox County, Enterprise mine near Bicknell. Martin County, Burns City pike, Little Boggs Creek, and elsewhere. Miami County, fine deposit on

Weasaw Creek near Denver. Owen County, occurs in vicinity of Cata-ract, was mined at Spencer. Putnam County, superior quality near Cloverdale. Sullivan County, was mined at Pleasantville. Switzerland County, was mined at Vevay. Vanderburg County, was mined at Ingle-field. Vermilion County, near Hillsdale. Vigo County, at Coal Bluff and elsewhere. Warrick County, in vicinity of Folsomville.

Clay (terra cotta). Lake County, Hobart. Newton County, Brook.

Coal (bituminous). Indiana ranked sixth in United States in 1914, producing over 16,500,000 tons. Coal area about 6,500 square miles in 26 differ-ent counties in southwestern part of State; 8 workable beds 3 to 10 feet thick. Produced commercially in following 19 counties: Clay, Daviess, Dubois, Fountain, Gibson, Greene, Knox, Martin, Owen, Parke, Perry, Pike, Spencer, Sullivan, Vanderburg, Vermilion, Vigo, Warren, and Warrick. "Brazil Black," peculiar to northeastern part of Clay County, has special value as furnace fuel; bed approaching exhaustion.

Diamond. Found in panning and placer washing gravels of glacial drifts in Brown and Morgan counties. The largest stone weighed $4\frac{1}{2}$ carats; a diamond weighing 2.28 carats was found in 1912.

Dolomite. Cass County, quarried at Kenneth for flux. The Niagara limestone quarried along Wabash River is all dolomite.

Flagstone. Decatur County, large quantities quarried at Greensburg and St. Paul. Franklin County, at Laurel; several quarries. Orange County, near Paoli. Putnam County, large quantity quarried at Putnamville. Wabash County, Wabash and vicinity. Other localities for local use.

Gas. See Natural gas.

Gold (placer). Occurs very sparingly in glacial drift; washed from sands and gravel along streams in Brown and Morgan counties in small quantity. Few flakes found in other counties.

Grindstones and scythestones. Have been quarried in Harrison County at Leavenworth. Lawrence County, at Huron. Warren County, at Red-wood Creek. See also Oilstones and Whetstones.

Halite (common salt). In most deep borings or wells more or less salt water is found; not utilized. Salt was made from brines on small scale years ago in Harrison County, at Glen Fort salt works.

Hematite (red iron ore). Greene County, along Ore Branch, Richland Creek, and vicinity of Cincinnati. Lawrence County, sec. 28, T. 5 N., R. 2 W.; Martin County, south of Shoals; not used.

Iron. See Brown iron ore, Hematite, Pyrite, and Siderite.

Kaolin. See Clay.

Limestone (building). Adams County, Decatur, Geneva, and Linn Grove. Bartholomew County, Burnsville, Elizabethtown, Hartsville, and Hope. Blackford County, Montpelier. Cass County, Kenneth, Trimmer, and Logansport. Clark County, Jeffersonville and Sellersburg. Crawford County, Marengo and Milltown. Decatur County, Clarksburg, Greensburg, Harris City, Letts, Millhousen, New Point, St. Omer, St. Paul, Westport, Williamstown. Delaware County, Muncie and Yorktown. Floyd County, Edwardsville. Fountain County, Yeddo. Franklin County, Andersonville, Laurel, and Stips Hill. Grant County, small quantity quarried at Marion, Mier, Rigdon, and near Somerset. Harrison County, Corydon, Kings Cave. Howard County, Kokomo. Huntington County, Huntington, Warren. Jasper County, Rensselaer. Jefferson County, Hanover. Jennings County, Brewersville, Commiskey, Queensville, Scipio, Slate, Vernon, and North Vernon. Lawrence County, Bed-

ford, Buff Ridge, Heltonville, Oolitic, Peerless, Walner, and Williams. Madison County, Alexandria and Ingalls. Monroe County, Bloomington, Clear Creek, Ellettsville, Sanders, Stinesville, and Victor. Montgomery County, Waveland. Orange County, French Lick and Paoli. Owen County, Quincy, Romona, and Spencer. Posey County, Cynthiana and Mount Vernon. Putnam County, Cloverdale, Greencastle, and Putnamville. Randolph County, Farmland and Ridgeville. Ripley County, Batesville, Holton, and Osgood. Rush County, Milroy. Shelby County, small quantity quarried at Waldron. Sullivan County, Carlisle. Vanderberg County, Evansville and Howell. Laurel limestone (Niagaran) quarried from extensive beds in Decatur County, at New Point, St. Paul, and Westport. Wabash County, Red Bridge; similar stone quarried near Wabash. Oolitic limestone, principal quarries: Harrison County, Corydon. Lawrence County, Bedford, Dark Hollow, and Oolitic. Monroe County, Bloomington, Ellettsville, Sanders, and Stinesville. Owen County, near Romona. Warrick County, Elberfeld. Washington County, Campbellsburg. Wells County, Bluffton, Petroleum. White County, Monon. The quarries at Bedford and Bloomington are the most extensive in the United States.

Limestone (crushed stone). Grant County, crushed at Marion and near Roseburg. Wabash County, on river bluff near Wabash.

Limestone (flux). Quarried in Cass County at Trimmer. Franklin County, Laurel. Lake County, Indiana Harbor. Lawrence County, Bedford. Monroe County, Bloomington and Ellettsville.

Limestone (lime). Has been or is burned in Carroll County, at Delphi. Cass County, Keesport. Clark County, near Utica. Crawford County, Milltown. Franklin County, near Laurel. Huntington County, Huntington. Jay County, Portland. Lawrence County, Mitchell. Madison County, near Ingalls. Ripley County, near Napoleon. Washington County, Salem.

Limestone (road metal). Quarried in Adams County, at Decatur, Geneva, and Lenn Grove. Blackford County, Montpelier. Carroll County, near Delphi. Cass County, Trimmer. Clark County, Jeffersonville and Sellersburg. Decatur County, small quantity quarried at Clarksburg. Delaware County, Muncie and Yorktown. Floyd County, Edwardsville. Fountain County, Davis Township. Franklin County, Brookville; Derbyshire Falls, and Laurel. Grant County, Liberty Township (Fairmount). Hamilton County, small quarries southwest of Fishersville. Harrison County, Corydon. Howard County, Kokomo. Huntington County, Huntington and Warren. Jasper County, Rensselaer. Jay County, Portland. Jennings County, North Vernon and Queensville. Lawrence County, 2 miles northeast of Mitchell, Williams, and elsewhere. Madison County, west part of Alexandria. Montgomery County, Waveland. Newton County, in vicinity of Kentland. Owen County, Spencer. Putnam County, Cloverdale and Greencastle. Pulaski County, Francesville. Randolph County, Farmland and near Ridgeville. Ripley County, Nolton. Rush County, New Salem. Shelby County, Waldron. Vanderburg County, Inglefield, Evansville, and Howell. Wabash County, Wabash. Wells County, abundant in central part. White County, quarried at Bluffton, near Monon.

Limestone ("rock wool"). Madison County, upper layers Niagara limestone used at Alexandria for mineral or "rock wool" by melting and blowing into threads.

Limonite. See Brown iron ore.

Marl. Calcareous marl in glacial lakes in Elkhart, Fulton, Kosciusko, Lagrange, Lake, Marshall, Noble, St. Joseph, Starke, Steuben, and Whitley counties; minor deposits in Cass, Clinton, Laporte, Miami, Randolph, Vermilion, and White counties; largest marl bed is in Lake Wasassee, 1,700 acres, and thickest is 45 feet in Turkey Lake, Lagrange County.

Mineral paint. *See* Ocher.

Natural gas. At the close of 1914 there were 2,224 productive gas wells in the State distributed over the following counties, the main fields being in the east-central part of the State: Adams, Bartholomew, Blackford, Daviess, Decatur, Delaware, Franklin, Grant, Hamilton, Hancock, Harrison, Henry, Howard, Jay, Jefferson, Madison, Miami, Marion, Martin, Pike, Randolph, Ripley, Rush, Shelby, Spencer, Sullivan, Tipton, and Wayne. For 20 years, from 1886 to 1905, Indiana was one of the three or four leading States in the production of gas, and it still produces about \$1,000,000 worth a year.

Niter. Crawford and Harrison counties, occurs in caves; not mined.

Ocher (mineral paint). Dearborn County, deposits near Dillsboro. Dubois County, excellent quality has been mined near Ferdinand. Greene County, occurs near Washington. Martin County, has been extensively worked 1 mile west of Dover Hill. Miami County, in several places near Denver and in large quantities in vicinity of Chili. Vigo County, has been mined in Pierson Township.

Oil. *See* Petroleum.

Oil shale. *See* Shale.

Oilstones. Orange County, produced at Bonds, French Lick, and Orleans.

Peat. Peat bogs in Allen, Dekalb, Elkhart, Fulton, Jasper, Kosciusko, Lagrange, Lake, Laporte, Marshall, Miami, Newton, Noble, Porter, Pulaski, St. Joseph, Starke, Steuben, Wabash, White, and Whitley counties. Plant operating at Lakeville, St. Joseph County, makes fertilizer filler and briquets. Prepared and used in the manufacture of fertilizers and for stock food at Fort Wayne, Allen County. Factories for producing peat fertilizer filler have also been operated at Knox in Starke County. Peat stable litter and peat paper were formerly produced at Garrett, Dekalb County.

Petroleum. Production in 1914 was 1,335,456 barrels, valued at \$1,548,042. Producing wells in the following counties: Adams, Blackford, Delaware, Fulton, Gibson, Grant, Greene, Hamilton, Huntington, Jay, Madison, Perry, Pike, Randolph, Sullivan, Vigo, and Wells. The main fields are in the east-central and southwestern parts of the State. Indiana is one of the eight or nine States which have produced a total of more than 100,000,000 barrels.

Pyrite. Knox County, has been mined at Bicknell. Parke County, Coxville. Vigo County, mined with coal at Terre Haute and Macksville.

Road metal. *See* Limestone (road metal).

Salt. *See* Halite.

Sand (building). Dug in Allen County, at Fort Wayne. Clark County, Jeffersonville and near New Albany. Clay County, Brazil. Daviess County, Washington. Floyd County, New Albany. Fountain County, Attica, Covington, and Silverwood. Hancock County, near Mohawk. Jefferson County, Madison. Lake County, Liverpool and Miller. Laporte County, Michigan City. Marion County, Indianapolis. Parke County, Montezuma. Porter County, Crisman and Willow Creek. Posey County, New Har-

mony. Randolph County, Farmland, Modoc, and Winchester. St. Joseph County, Mishawaka and South Bend. Sullivan County, Merom. Tippecanoe County, Lafayette. Vanderburg County, Evansville. Vermillion County, Clinton. Vigo County, Terre-Haute. Warren County, Kickapoo. Wells County, Liberty Center.

Sand (glass). Friable sandstone is quarried and crushed in Martin County, at Loogootee. Parke County, at Coxville. White County, near Wolcott. Occurs in Blackford County, Montpelier. Floyd County, New Albany. Fountain County, near Hillsboro. Greene County, Johnson. Hamilton County, Lapel. Harrison County, Depauw. Madison County, bed has been quarried near Pendleton.

Sand (molding). Dug in Clark County, at Jeffersonville and near New Albany. Clay County, Aurora and Brazil. Jackson County, Brownstown and Seymour. Laporte County, Michigan City. Marion County, Indianapolis. Martin County, Loogootee. Morgan County, Centerton. Parke County, Coxville. Porter County, Crocker, McCool, and 4 miles southeast of Valparaiso. Spencer County, Rockport. St. Joseph County, South Bend. Wayne County, Fort Wayne.

Sand and gravel. Very abundant in many counties on bluffs and flood plains of streams.

Sandstone (building). Quarried in Clay County, at Brazil. Fountain County, at Riverside. Harrison County, Corydon. Jasper County, Rensselaer. Orange County, at West Baden and Paoli. Parke County, Coxville. Perry County, at Cannelton. Putnam County, near Raccoon and Bainbridge. Spencer County, at Grandview and Rockport. Vermillion County, at Worthy. Wabash County, Lagro. Occurs in Dubois County, at St. Anthony. Parke County, at Judson and elsewhere. Warren County, at Green Hill, Independence, Williamsport, and elsewhere.

Sapphire. Morgan County, bronze-colored sapphires are found in small number in gold placers.

Shale (oil). Devonian. Underlies the southwestern part of the State and a considerable area in the northern part. Dips from outcrop to depth of 2,000 feet.

Siderite. Fountain County, reported as occurring on Coal Creek and Wabash River. Martin County, south of Shoals near Coal Hollow. Monroe County, Indian Creek Township. Putnam County, formerly mined at Eaglesfield. Scott County, lean manganiferous ores in Vienna and Finley townships. Vermillion County, Browntown Branch and Big Vermillion River. Vigo County, Terre Haute and Brouillets Creek. About 3,000 acres in Cass, Jasper, Starke, and White counties in beds 1 to 3 feet thick.

Tripoli (polishing powder). Dubois County, has been extensively worked near Ferdinand. Jackson County, deposits near Mooney. Lawrence County, Bedford. Sullivan County, near Merom. Washington County, near Bartle. "Drift marl" found in quantity in Clay County, near Carbon and Rushville. Owen County, near Gosport. Porter County, at Boone Groove.

Whetstones. Indiana ranks second among States in production of whetstones. Dubois, Martin, and Orange counties, Carboniferous sandstones (Pennsylvanian and Mississippian) afford abundant good grindstone "grit." Floyd County, have been quarried at Floyds Knobs. Orange County, have been quarried at Bonds, French Lick, Orleans, Paoli, and West Baden.

IOWA.

Anhydrite. Appanoose County, deep well at Centerville.

Brown iron ore (limonite). Allamakee County, Iron Hill. Clayton County, in lead and zinc regions. Dubuque County, in lead and zinc regions. Henry County, a lean ore on Skunk River. Jackson County, not in workable quantity. Webster County, in limited quantities.

Cement material. Shales and clays suitable for cement abundant in many parts of the State; calcareous constituent may be obtained from limestone, chalk, and marl. Cement plants operating at Des Moines and Mason City. *See also* Chalk, Limestone, and Marl.

Cerussite (lead carbonate). Allamakee County, at Lansing mine (abandoned). Dubuque County, found throughout Dubuque lead region but not in sufficient quantity to be valuable as an ore, except as mined with galena.

Chalcedony. Story County, near Ames, not used. In the geodes of southeastern Iowa.

Chalk. Associated with Cretaceous deposits of northwest Iowa; outcrop confined mainly to valley of Big Sioux River, between Sioux City and Harwarden; bed 30 to 50 feet thick.

Chert. Abundant in the Mississippian rocks in southeastern Iowa; also found associated with the Silurian rocks.

Clay (brick). Abundant in many counties; has been or is dug at one or more places in nearly every county in the State.

Clay (drain tile). Cerro Gordo, Webster, and many other counties.

Clay (fire). Blackhawk County, has been used at Waterloo. Hardin County, Eldora. Montgomery County, Red Oak. Occurs in Clay, Des Moines, Henry, Jefferson, Polk, Van Buren, and Wapello counties.

Clay (gumbo). Cedar County, abundant. Decatur County, has been burned at Davis City. Monroe County, ~~Selection~~. Pottawattamie County, on flood plains, used for railroad ballast.

Clay (pottery). Delaware County, has been dug and used in Galesburg. Des Moines County, near Parrish. Lee County, Donaldson. Mahaska County, 3 miles north of Eddyville, black ware only made. Montgomery County, Red Oak. Muscatine County, Fairport, mined and shipped. Polk County, Pennsylvanian ("Coal Measures") clay of Des Moines group, used for coarser grades of pottery. Van Buren County, Vernon. Webster County, Fort Dodge. Wapello County, Ottumwa. Occurs, but not used: Johnson County, thin seams near Iowa City. Monroe County, has been mined near Attica. Woodbury County, extensive deposits in lower part of the Benton or upper part of the Dakota at Sioux City.

Coal (bituminous). Coal-bearing formations occupy area of about 20,000 square miles in central and southern part of State; thin beds, noncoking. Mined in 21 counties as follows: Adams, Appanoose, Boone, Dallas, Greene, Guthrie, Jasper, Jefferson, Keokuk, Lucas, Mahaska, Marion, Monroe, Page, Polk, Taylor, Van Buren, Wapello, Warren, Wayne, and Webster.

Dolomite. Quarried extensively in Dubuque, Jackson, and other counties. Fine crystals in cavities: Lee County, Keokuk. Webster County, near Fort Dodge. It is prevalent in the Paleozoic rocks of the State.

Galena. Allamakee County, mined at New Galena. Clayton County, mined near Guttenberg and Buena Vista. Dubuque County, the important lead ore of Dubuque region.

Gas. *See* Natural gas.

Geodes. Lee County, abundant around Keokuk; sold for museum specimens.

Gold (placer). In drift in small quantities in Des Moines, Fayette, Keokuk, and Lee counties; no importance.

Granite. Boulders in drift in several counties; locally used.

Gravel. Abundant in glacial deposits and river terraces. Used for road metal in Buchanan, Ida, Palo Alto, Pocahontas, Sac, Scott, and other counties; Polk County, dug for ballast along Fourmile Creek.

Gypsum. Extensive deposits in Webster County are quarried at Fort Dodge. A deposit was found in well boring in Appanoose County, at Centerville.

Hematite. Allamakee County, principal ore body at Iron Hill; widely distributed through shales and sandstones of the Pennsylvanian ("Coal Measures"). Jasper County, has been mined near Monroe for manufacture of metallic paints.

Iron. See Brown iron ore, Hematite, and Pyrite.

Lead minerals. See Cerusite and Galena.

Limestone (building, crushed stone). Quarried at one or more places in more than half the counties in the State.

Limestone (lime). Has been burned at several places in Benton, Blackhawk, Bremer, Cedar, Cerro Gordo, Clayton, Clinton, Davis, Des Moines, Henry, Humboldt, Jackson, Johnson, Linn, Mills, Mitchell, Monroe, Montgomery, Plymouth, Scott, Union, and other counties.

Limonite. See Brown iron ore.

Lithographic stone. Floyd County, occurs in Devonian. Mitchell County, southwest of Osage.

Marble. Not at present quarried in State. Floyd County, at Charles City, fossiliferous marbles were formerly used for mantels and table tops; Van Buren County, occurs at Chequest Creek, known to the trade as Chequest marble, white. The Bonaparte (gray) marble of the trade occurs near Bonaparte.

Marcasite. Des Moines County, abundant in Pennsylvanian ("Coal Measures") rocks; not mined.

Marl. Calcareous marl occurs in many small lakes in north-central part of State; no beds of importance yet discovered.

Mineral paint. See Hematite, Ocher, and Shale.

Natural gas. Small quantities in glacial drift. Dallas County, wells 100-115 feet deep produced small quantity of gas for several years; used for light and heat in a few homes. Guthrie County, shallow wells near Bagley had several pounds' pressure; shut in, not used. Louisa County, wells about 100 feet deep near Letts and Wapello; gas from 4 wells has been used in owners' houses. Muscatine County, small showings of gas in shallow wells in southern part of county; not used.

Ocher (mineral paint). Allamakee County, deposits at Iron Hill and various points along Paint Creek. Jasper County, has been quarried at Fairview Township. Keokuk County, undeveloped deposit near Hayesville. Monroe County, deposits near Hamilton. Webster County, mined at Fort Dodge.

Oil. See Petroleum.

Oil shale. See Shale.

Peat. Occurs quite generally distributed through the northeastern counties of the State. A plant for producing machine peat fuel has been operated near Fertile, in Worth County.

- Petroleum.** Nowhere discovered in commercial quantity, but rather widely disseminated as shown by traces in wells; found near Fort Madison, Lee County, in very small quantity.
- Pyrite.** Clayton County, associated with galena and sphalerite in lead-zinc mines. Dubuque County, in lead mines of Dubuque.
- Quartz.** Widely distributed; crystals in geodes near Keokuk, Lee County, and in mines of Des Moines County, exceptionally fine; sought for museum specimens.
- Quartzite.** Lyon County, valuable for building material, not utilized.
- Road metal.** Dallas County, gravel beds at Redfield and Van Meter worked extensively for railroad ballast. Dubuque County, dolomite quarried at Dubuque for macadam. Johnson County, stone crushed north of Coralville for railroad ballast; stone from Iowa City also used. Madison County, large quantities of limestone crushed for use in Des Moines. Montgomery County, limestone in this county would make excellent macadam. Polk County, gravel beds at Des Moines extensively worked for railroad ballast.
- Sand** (building). Large supply of good building sand along streams and in sand hills of Benton, Cedar, and Jackson counties; at various points along river in Humboldt County. Pits are worked in the following counties: Appanoose, Audubon, Blackhawk, Buena Vista, Butler, Cherokee, Clinton, Des Moines, Dickinson, Dubuque, Emmet, Fayette, Grundy, Hardin, Howard, Ida, Johnson, Jones, Kossuth, Lee, Linn, Lyon, Mahaska, Marion, Montgomery, O'Brien, Osceola, Palo Alto, Plymouth, Polk, Sac, Scott, Sioux, Story, Van Buren, Wapello, Webster, Woodbury, and Wright.
- Sand** (fire). Clayton County, Clayton.
- Sand** (glass). Allamakee County, glass sand is abundant in St. Peter sandstone but is not used. Clayton County, pits worked near Clayton. Johnson County, River Junction. Linn County, Cedar Rapids.
- Sand** (molding). Dug in Appanoose County at Centerville; Audubon County, Kimballton; Cherokee County, Cherokee; Linn County, Cedar Rapids; Lyon County, Doon; Marshall County, Marshalltown; Polk County, Des Moines and Valley Junction.
- Sand and gravel.** Large quantities in stream and drift deposits of Des Moines, Franklin, Lee, Marshall, Muscatine, and other counties.
- Sandstone.** Sandstone has been quarried as follows: In Allamakee County. Blackhawk County, at Laporte City. Clay County, at Greenville. Clayton County, at Garnaville. Dallas County, Redfield. Davis County, Carbon; local use. Des Moines County, Burlington and Danville. Dubuque County, Spechts Ferry. Fayette County, Brainard. Guthrie County, quarried at many points for local use. Hardin County, Eldora and near Steamboat Rock. Jackson County, several small quarries. Jasper County, near Lynnvile, Newton. Jones County, Olin. Keokuk County, Delta. Lee County, very small quantity quarried at Franklin Township. Mahaska County, Eveland. Marion County, Tracy, large supply at Red Rock quarry. Marshall County, Quarry. Muscatine County, along Mississippi River from Scott County to 3 miles west of Muscatine; also quarries on West Branch of Pine Creek in Montpelier Township. Polk County. Scott County, small quantity quarried at Buffalo and McCausland. Tama County, Butlerville. Webster County, Evanston, Fort Dodge. Woodbury County, near Sioux City.
- Shale** (oil). Devonian rocks, which underlie the southeastern corner of the State, contain a little shale which may yield oil.

Shale (paint). Webster County, ground for use as pigments at Fort Dodge.

Silver. Dubuque County, in minute quantities in lead ore at Dubuque; not recovered.

Smithsonite. Clayton County, in lead mines near Buena Vista and Guttenberg.

Dubuque County, a common zinc ore at Dubuque mines.

Sphalerite. Allamakee County, mined 5 miles west of Lansing. Clayton County, associated with galena in flat crevices and fissures in Galena limestone. Dubuque County, mined near Dubuque.

Tripoli (polishing powder). Des Moines County, abundant, not used.

Zinc ore. See Smithsonite and Sphalerite.

KANSAS.

Abrasive. *See* Pumice.

Anhydrite. Ellsworth County, Kanopolis. Kingman County, Kingman. Rice County, Lyons.

Asphalt. Many "tar springs" and occurrences of brea in Miami County, and scattered ones elsewhere, particularly in southeastern part of State.

Calamine (zinc silicate). Cherokee County, Galena.

Cement material. Limestone and shale used for Portland cement in Allen County, at Iola and Concreto. Anderson County, at Mildred. Bourbon County, Fort Scott. Ellis County, Yocemento. Montgomery County, Independence and Le Hunt. Wilson County, Neodesha and Fredonia. Wyandotte County, Bonner Springs. In great abundance generally in eastern two-thirds of State.

Cerussite (lead carbonate, "dry bone"). Cherokee County, secondary mineral of lead ores mined at Galena.

Chalk. In the western part of the State in Cretaceous limestone formations.

Clay (brick). Dug in the following counties: Allen, Atchison, Bourbon, Chautauqua, Cherokee, Clay, Cloud, Crawford, Douglas, Elk, Franklin, Hamilton, Labette, Leavenworth, Linn, McPherson, Marshall, Miami, Montgomery, Nemaha, Neosho, Phillips, Saline, Shawnee, Wilson, and Wyandotte.

Clay (drain tile). Cherokee, Nemaha, and other counties.

Clay (fire). Fire clay in Pennsylvanian ("Coal Measures") rocks in Bourbon County, at Fort Scott, under the coal. Crawford County, Pittsburg. Douglas County, Lawrence. Ellsworth County. Leavenworth County, near Leavenworth, Mill Creek. In all the eastern counties as far west as Manhattan. Not pure.

Clay (pottery). Montgomery County, Coffeyville.

Clay (sewer pipe). Crawford County.

Coal (bituminous). About 20 workable beds, from a few inches to 5 feet thick, essentially steam coals. Mined in Atchison County, near Atchison. Cherokee County, Cherokee coal, 18 inches to 5 feet thick, mined at Scammon, excellent quality. Crawford County, Frontenac, Pittsburg, and elsewhere. Franklin County, near Ransomville. Leavenworth County, Leavenworth. Osage County, Osage seam 20-22 inches, along Santa Fe Railway, and many other places. Southeastern part of the State, south of Kansas River and east of the Shawnee, has workable beds in nearly every county, and beds crop out in Allen, Bourbon, Brown, Coffey, Doniphan, Douglas, Franklin, Greenwood, Jackson, Jefferson, Miami, Nemaha, Neosho, Osage, Shawnee, Wabaunsee, and Woodson counties.

Galena. Cherokee County, most abundant lead ore at Badger-Peacock, Galena, and Lawton districts.

Gas. *See* Natural gas.

Gypsum. Gypsite (gypsum earth), found in low swampy ground in central Kansas, formerly basis of greater portion of plaster manufacture. Was mined in Barber County at Kling. Butler County. Clay County, at Longford. Rock gypsum, mined in Barber and Comanche counties, in Medicine Lodge area. Dickinson County, at Hope. Marshall County, Blue Rapids. Saline County, near Gypsum. In comparative abundance at numerous places in the Permian rocks of Kansas; in smaller quantities along Smoky River, Ellsworth and McPherson counties; in Tertiary formations in southwestern part of Meade County and in Seward County, commonly in fine crystals. Nearly all gypsite beds in Kansas are exhausted.

Halite. *See* Salt.

Hydrozincite. Cherokee County, with calamine and smithsonite, Galena district.

Iron. *See* Pyrite and Siderite.

Lead. *See* Cerusite and Galena.

Lignite (brown coal). Extensive beds in the Cretaceous strata and sparingly in Tertiary, Smoky Hill Valley; beds of good brown coal over large part of western Kansas, range from 1 to 3 feet thick; few beds in Dakota (Cretaceous) strata, all of inferior quality; most important seam, 10 to 36 inches thick, is traceable for 170 miles from the northern boundary southwestward across the State, and is found in Barton, Cloud, Ellsworth, Lincoln, McPherson, Mitchell, Ottawa, Republic, Rice, Saline, Washington, and perhaps other adjoining counties.

Limestone (building). Quarried in following places: Allen County, Gas and Iola. Anderson County, Garnett. Atchison County, Atchison. Bourbon County, Fort Scott. Brown County, Fairview and Hiawatha. Butler County, Augusta and Eldorado. Chase County, Cottonwood Falls and Strong. Chautauqua County, Sedan. Coffey County, Waverly. Cowley County, Silverdale and Winfield. Douglas County, Baldwin, Lawrence, Lecompton. Franklin County, Ottawa and Wellsville. Geary County, Junction City. Greenwood County, Hilltop and Madison. Hamilton County, Syracuse. Jackson County, Delia. Jewell County, Randall and near Formosa. Johnson County, Olathe. Labette County, one-half mile south of Parsons. Leavenworth County, Leavenworth. Lyon County, Admire, Allen, and near Americus and Emporia. Marion County, Aulne, Florence, and Marion. Marshall County, Barrett, Beattie, Florena, Frankfort, Marysville, Oketo. Miami County, Paola. Montgomery County, Coffeyville and Independence. Morris County, Dunlap, Dwight, and Helmick. Nemaha County, America City and Sabetha. Neosho County, Chanute and Erie. Ness County, Bazine. Pottawatomie County, Belvue, Emmett, Onaga, St. Marys, and Wamego. Riley County, Keats and Manhattan. Rush County, Alexander. Russell County, Russell. Saline County, Salina. Shawnee County, Richland, Tevis, and Topeka. Sumner County, Caldwell. Wabaunsee County, Alma and Alta Vista. Washington County, Hanover. Wilson County, Fredonia, Benedict, and Neodesha. Wyandotte County, Kansas City, Quindaro, Loring, and Rosedale.

Limestone (crushed stone). Atchison County, Atchison. Brown County, Fairview and Hiawatha. Butler County, Augusta and Eldorado. Chase County, Cottonwood Falls. Chautauqua County, Sedan. Cowley County, Silverdale and Winfield. Douglas County, Lawrence. Elk County, Moline. Franklin County, Ottawa and Wellsville. Greenwood County, Hilltop and Madison. Jackson County, Delia. Johnson County, Olathe. Labette County, one-half mile south of Parsons. Leavenworth County, Leavenworth. Lyon County, near Allen and Americus. Marion County, Florence. Marshall County, Beattie, Irving, Frankfort, and elsewhere. Miami County, Paola. Morris County, Dwight. Neosho County, Chanute and Erie. Pottawatomie County, Emmett. Riley County, Manhattan. Russell County, Russell. Saline County, Salina. Shawnee County, Topeka. Wyandotte County, Loring, Quindaro, and vicinity.

Limestone (hydraulic, water lime, cement rock). Bourbon County, magnesian limestone occurs at Fort Scott, to some extent hydraulic. Manufactured at Fort Scott.

- Limestone** (lime). Burned for lime: Bourbon County, at Fort Scott. Chautauqua County, at Sedan. Elk County, at Moline. Shawnee County, at Topeka.
- Marcasite.** Cherokee County, abundantly associated with lead and zinc ores at some mines in Galena district. Requires roasting and electric treatment to remove from ore.
- Natural gas.** Wells in southeast corner of State in Allen County, Iola, La Harpe, Moran, Savonburg, and Humboldt. Chautauqua County, Peru, Sedan, and many points in southern half of county. Franklin County, Rantoul. Johnson County, Spring Hill. Linn County, Pleasanton, local use. Miami County, Paola and Osawatimie. Montgomery County, Cherryvale, Coffeyville, Independence, Caney, Havana, Jefferson, and Dearing. Neosho County, Chanute, Erie, and Thayer. Wilson County, Altoona, Benedict, Buffalo, Fredonia, Neodesha, New Albany, and Vilas. Wyandotte County, Bonner Springs and Kansas City.
- Oil.** See Petroleum.
- Petroleum.** Production in 1914 was 3,103,585 barrels, valued at \$2,433,074. There were 3,054 wells in the State at the beginning of that year. Producing wells in Allen County, vicinity of Moran and Humboldt; Chautauqua County, Sedan and southern part; Miami County, high-grade oil, Paola; Montgomery County, Coffeyville, Wayside, and elsewhere in Bolton field; Neosho County, Chanute; Wilson County, in vicinity of Benedict, Neodesha, and Buffalo; Woodson County, vicinity of Toronto. Occurs at numerous other places in State.
- Pumice.** Dug in Gove County, Quinter; Meade County, Meade; Phillips County, Woodruff; and has been found in many other places.
- Pyrite.** Cherokee County, associated with lead and zinc ores in Galena district; also abundant in many coal mines of the State.
- Road metal.** See Limestone (crushed stone).
- Salt** (brine). Brines obtained from Cherokee and other shales throughout the oil and gas fields. Manufacturers of evaporated salt in Ellsworth County, Ellsworth; Reno County, Hutchinson; and Rice County, Sterling.
- Salt** (rock). Mined in Ellsworth County, at Ellsworth and Kanopolis. Harper County, Anthony. Kingman County, Kingman. Rice County, Sterling and Lyons.
- Sand** (building). Dug in Douglas County, at Lawrence. Leavenworth County, at Leavenworth. Reno County, at Hutchinson. Sedgwick County, at Wichita. Shawnee County, at Topeka. Wyandotte County, at Armourdale and Kansas City. Dug also at many other places.
- Sand** (glass). Friable sandstone in Buxton formation, of suitable quality, in Montgomery County, near Caney and Independence; Wilson County, Fredonia.
- Sandstone.** Quarried in Bourbon County, at Fort Scott, Hiattville, and Redfield. Chautauqua County, Chautauqua Springs. Cherokee County, Galena. Crawford County, Farlington and Pittsburg. Elk County, Howard. Greenwood County, Madison. Labette County, Parsons. Linn County, Pleasanton. Montgomery County, Independence. Pawnee County, Larned. Pottawatomie County, Onaga. Wilson County, Neodesha. Woodson County, Yates Center.
- Shale.** Montgomery, Wilson, Neosho, Labette, and other counties in southeastern part of the State.

Siderite (spathic iron ore). Bourbon County, occurs in Pennsylvanian ("Coal Measures") rocks on Marais des Cygnes, near Fort Scott. Also on the Neosho and many other streams, interstratified with beds of good coal. Not sufficiently abundant for use.

Smithsonite (zinc carbonate). Cherokee County, mined in Galena district.

Sphalerite (zinc blende). Cherokee County, principal ore of zinc in Badger-Peacock, Galena, and Lawton districts.

Volcanic ash. Abundant throughout the central and western parts of the State. Produced as an abrasive in Morton and Phillips counties.

Zinc. See Calamine, Hydrozincite, Smithsonite, and Sphalerite.

KENTUCKY.

Asphalt. Asphaltic sandstones are found in the following places: Breckinridge County, quarried 2 miles southwest of Garfield and 2 miles southeast of Harned. Carter County, prospected at Soldier. Edmondson County, small tar springs and many deposits of asphaltic sandstone in Bee Spring region, quarried at Pittsburg Landing on Green River. Grayson County, prospect 3 miles south and 9 miles north of Leitchfield, large abandoned quarry at Tar Hill, 9 miles northeast of Leitchfield. Logan County, quarry 5 and 6 miles northeast of Russellville. Rowan County, prospected near Morehead. Warren County, two quarries at Youngs Ferry.

Barite. Anderson County, at Lawrenceburg. Bourbon County, has been mined at Millersburg and near Paris. Boyle County, mined near Danville. Caldwell County, was mined at Fredonia and shipped. Fayette County, mined and shipped from vicinity of Lexington and from about 6 miles northwest of Lexington. Franklin County, gangue mineral of Clerk vein near Kissinger. Gerrard County, 4 miles west of Lancaster. Harrison County, in Ordovician limestone, 3 miles southeast of Cynthiana, at Lair station and vicinity. Henry County, Lockport and other points, mined and shipped. Jessamine County, 1 mile northeast of Ambrose. Mercer County, was mined near Harrodsburg. Owen County, Gratz mine and other points. Scott County, about $5\frac{1}{2}$ miles southwest of Georgetown, gangue mineral of Johnson vein $1\frac{1}{2}$ miles from Duvall station and other points. Woodford County, with galena and sphalerite at Shyrock Ferry, Shropshire, Prewitt, and other prospects. At points in Garrard, Jessamine, Lincoln, Madison, and Russell counties.

Bituminous rock. *See Asphalt.*

Brown iron ore (bog iron ore, limonite). Bath County, mined at Preston ore banks; occurs in Red River iron region, between Licking and Kentucky rivers—ores at base of Pennsylvanian series ("Coal Measures"); Hanging Rock region, embracing whole or parts of Boyd, Carter, Greenup, Johnson, and Lawrence counties, in northeastern part of State. Iron made from these ores noted for its excellence for castings. In abundance from Ohio River southward to southern part of Carter County; Cumberland River iron region, embracing whole or parts of Caldwell, Crittenden, Livingston, Lyon, and Trigg counties, in western part of State; occurs in clay and chert above Mississippian limestones; irregular shape and uncertain extent, but aggregate of ore immense; most extensive deposits are between the Tennessee and Cumberland rivers and of excellent quality. Nolin district, in Butler, Edmonson, Grayson, Muhlenberg, and Ohio counties; ores occur near base of the Pennsylvanian rocks ("Coal Measures"). "Oriskany" ore on north slope of Pine Mountain, Bell County, has been mined.

Calcite. Fayette County, in vicinity of Morton's mill, and 6 miles north of Lexington. Livingston County, Spees mine, was mined. Mercer County, is mined and milled at Chinn mine on Kentucky River at mouth of Shawnee Run. Owen County, gangue mineral in Gratz mine. Woodward County, with sphalerite at Shyrock Ferry. Most abundant mineral associated with fluorite in western Kentucky.

Cement material (Portland). Jefferson County, only plant in State in 1915 at Kosmosdale; oolitic limestone from Meade County used. Limestones suitable for Portland cement are abundant in north-central and western parts of State; in Barren County near Cave City and Glasgow; Campbell County, at Mentor; Kenton County, at Ludlow; Powell County, at

Stanton; Rockcastle County, Pine Hill and near Livingston. Large quantity of pure clay suitable for Portland cement in counties of the Jackson's Purchase region in western Kentucky, west of Tennessee River.

Cement material (natural). Jefferson County, cement rock first discovered in Central States in digging canal at Louisville. Quarried for natural cement. Similar materials in Lewis and other counties along western border of eastern coal field.

Clay (ball). Graves County, at Hickory, Pryorsburg, and Clay switch (mined).

Clay (brick). Widely distributed; used in nearly all counties of the State.

Clay (fire). Ballard County, Wickliffe. Graves County (high grade). Flint and plastic clay in Boyd, Carter, Elliott, Fulton, Greenup, Jackson, Jefferson, Kenton, Covington, Laurel, Lewis, Powell, Pulaski, Rockcastle, Rowan, Wolfe, and other counties of east Kentucky. Siliceous refractory clays in counties west of Tennessee River and also in Crittenden and Livingston counties.

Clay (pottery). Ballard County, thin beds of white plastic clay from Laketown southward and in a few places in eastern part of county. Calloway County, at Pottertown. Fulton County, large quantity in bluffs at Hickman and southward to Tennessee line. Graves County, white, ball, and sagger clay mined at Clay switch. Hart County, near Bonnieville. Hickman County, pottery clay near Columbus. Madison County, Waco and Bybeetown; McCracken County, in eastern and middle portions and 5 miles south of Paducah. Marshall County, near Scales, west of Benton, near Palma; was mined at Scale and Hardin. Rockcastle County.

Clay (slip). Graves County, Pryorsburg.

Clay (tile, not draintile). Kenton County.

Coal (bituminous). Pennsylvanian ("Coal Measures") rocks occupy the eastern and western parts of the State. Some of the coals in both the eastern and western coal fields are coking. Twelve or more beds which range from 2 to 8 feet in thickness are identified in the eastern field. Most coals hard bituminous, semiblock, excellent for steam and domestic uses. High-grade coking coals in Big Sandy Valley. The coal-producing counties of eastern Kentucky are Bell, Boyd, Breathitt, Carter, Clay, Elliott, Floyd, Greenup, Harlan, Jackson, Johnson, Knott, Knox, Laurel, Lawrence, Lee, Leslie, Letcher, Magoffin, Martin, Morgan, Owsley, Perry, Pike, Pulaski, Rockcastle, Wayne, Whitley, and Wolfe. The coal-producing counties of western Kentucky are Butler, Christian, Crittenden, Daviess, Edmonson, Grayson, Hancock, Henderson, Hopkins, McLean, Muhlenberg, Ohio, Union, Warren, and Webster.

Dolomite. Ordovician, excellent building material, found along Kentucky River in Clark, Fayette, Franklin, Jessamine, and Woodford counties; a buff and cream-colored dolomite, convenient to transportation; "Corniferous" limestone in Bullitt and Nelson counties, of excellent quality and in vast quantities; quarried to some extent.

Fluorspar. Caldwell County, near Princeton and other points. Crittenden County, at Crayne, Marion, and Mexico. Fayette County, in Ordovician limestone in vicinity of Morton's mill. Jessamine County, south of Ambrose, on north side of McKenna Branch. Livingston County, Salem and other points. Mercer County, with calcite and barite around bend of Kentucky River and Two Chimneys and Fantail mines. Trigg County, at Gracey. Woodford County, at Faircloths Ferry, below Brooklyn, and elsewhere, and was mined at Withrow vein near Spring station.

Galena. Bourbon County, prospects at Paris and vicinity. Caldwell and Crittenden counties, with fluorspar at Asbridge, Glendale, Tabor, and other mines. Fayette County, Russell Cave and elsewhere. Franklin County, large masses at Kissinger. Harrison County, was prospected near Cynthiana and Lair station. Livingston County, Evening Star mine. Owen County, Gratz mine. Scott County, Johnson vein about $1\frac{1}{2}$ miles from Duvall station. Woodford County, with barite at Withrow vein near Spring station. Other points in central Kentucky barytes district.

Garnet (pyrope). Elliott County, in peridotite dike on Ison Creek.

Gas. *See* Natural gas.

Gravel. Ballard County, mined at Wickliffe. Hickman County, thick beds in bluffs around Columbus. McCracken County, Paducah. Abundant in region west of Tennessee River along Ohio River and in regions bordering coal fields, from conglomerate sandstone. Abundant at a number of other points in Jackson's Purchase.

Hematite (red iron ore). Bath County, mined near Owingsville. Graves County, small quantity in gravel beds $2\frac{1}{2}$ miles south of Hard Money. Was mined in Fleming County. Marshall County, small quantity near Birmingham.

Iron. *See* Brown iron ore, Hematite, and Siderite.

Lead. *See* Galena.

Lignite. Ballard County, Fort Jefferson Bluff, and near Blandville. Graves and Hickman counties.

Limestone. Widely distributed. Used in many counties. Quarried: Adair County, at Columbia. Anderson County, Lawrenceburg. Barren County. Bourbon County, Millersburg. Boyd County, Ashland. Boyle County, Danville, Mitchellsburg, Parkville, and Perryville. Bracken County, Bradford. Breckinridge County, Basin Spring, and Mystic. Bullitt County, Clermont. Campbell County, Fort Thomas and Newport. Carter County, Lawton and Olive Hill. Christian County, Herndon. Clark County, Winchester. Fayette County, Lexington. Franklin County, Benson and Frankfort. Greenup County, Amanda (mail Russell), Limeville. Hardin County, Elizabethtown and West Point. Harrison County, Berry and Cynthiana. Hart County, Dividing Ridge. Jefferson County, Buechel, Florida Heights (mail Prospect), Jeffersontown, Louisville, O'Bannon and Tucker. Jessamine County, Hanly, Highbridge, Nicholasville, and Wilmore. Kenton County, Covington and Latonia. Lee County, Beattyville. Logan County, Gasper, Russellville. Marion County, Lebanon. Mercer County, Burgin and Harrodsburg. Monroe County, Tompkinsville. Montgomery County, Mount Sterling. Nelson County, Woodlawn. Owsley County, Booneville. Pendleton County, Carntown, Ivor, and Menzies. Powell County, McCormick. Rockcastle County, Dudley. Trigg County, Hematite. Warren County, Bowling Green, Hadley, Memphis Junction, Rockfield. Wayne County, Monticello. Has been quarried in the following places: Barren County, near Glasgow Junction. Caldwell County, near Princeton and Leitchfield. Pulaski County, near Somersset. Also in Grayson, Meade, Simpson, Todd, Wolfe, and other counties.

Limestone (flux). Quarried: Boyd County, at Ashland. Carter County, Lawton and Limestone. Kenton County, Covington. Rockcastle County, Burr.

Limestone (lime). Quarried: Christian County, at Hopkinsville. Hardin County, Elizabethtown. Meade County, near Battletown and Cedar Branch. Rockcastle County, Mount Vernon. Union County, Mississippian limestone was burned near Morganfield.

Limestone (oolitic). Large quarries in Warren County. The oolitic limestone outcrops around eastern and northern edge of western coal field and across from there to western edge of eastern coal field.

Lithographic stone. Most important quarry in United States at Bradensburg, Meade County. Found in Bath, Estill, Pulaski, Rowan, Warren, and Wayne counties.

Marble. Barren County, pink and yellow varieties have been quarried near Cave City. Warren County, near Bowling Green. Also in Bath and Rowan counties.

Marl. Bullitt and Spencer county line, in Ordovician. Garrard, Lincoln, Madison, Marion, Nelson, and Washington counties, in Silurian shales. In the Chester group of the Mississippian series in many counties is a marly shale, containing 4 to 6 per cent of potash, 1 or 2 per cent of phosphoric acid, and 15 per cent of lime. Worked near Leitchfield, Grayson County.

Mineral paint. *See* Ocher.

Natural gas. Barren County, small quantity near Glasgow. Boyd County, at Ashland and near Catlettsburg. Breckinridge County, number of wells in Mississippian limestone at Cloverport; used for light and fuel in town. Clay County, near Manchester. Estill County, near Irvine. Hardin County, at Elizabethtown. Knox County, large flow was obtained from Big Injun sand near Barbourville. Lawrence County, in Berea sandstone in Horsford well. Logan County, near Diamond Springs. Martin County, large field near Eden. Meade County, most important gas district of western Kentucky; a number of wells in vicinity of Brandenburg and Rock Haven in Devonian shale. Menifee County, "Corniferous" limestone source of large supply of gas; wells on Gay, Mynhier, and other farms near Frenchburg; piped to Mount Sterling, Winchester, and Lexington. Morgan County, Caney sand at Caney, source of high-pressure gas; little development; also on Licking River, supplies West Liberty. Warren County, near Bowling Green; no economic value. Wayne County, large producing wells at Pisgah. Wolfe County, near Campton and near Hazel Green.

Ocher. Ballard County, yellow ocher was mined in ravine east of Wickliffe. Calloway County, near Murray. Carlisle County, yellow ocher was mined in the bluffs of creeks near Laketon. Crittenden County, 5 miles southwest of Marion. McCracken County, mined 3 miles east of Paducah. Marshall County, on banks of Tennessee River at Highland Landing.

Oil. *See* Petroleum.

Oil shale. *See* Shale.

Onyx marble. Barren, Hart, and Edmonson counties. Found in limestone caverns. Quarried intermittently on small scale.

Petroleum. Total production in the State in 1914 was 502,441 barrels, valued at \$498,566. Oil-producing areas: Allen County, Scottville and Petroleum. Barren County, near Glasgow. Bath County. Breathitt County, Frozen Creek. Cumberland County, near Burkville. Estill County, near Irvine. Floyd County, Right Beaver, Salt Lick, and Middle creeks near Prestonburg. Knox County, vicinity of Barbourville. Lawrence County, Busseyville. Logan County, Diamond Springs. McCreary County, Rock Creek, South Fork, and elsewhere. Menifee County. Morgan County, Caney and West Liberty. Ohio County, near Hartford. Rowan County, Triplet Creek. Warren County, near Richardsville, in Shallow Mills in the Mississippian limestone. Wayne County, number of wells, Steubenville, Sinking Creek, Barrier, Cooper, Parmleysville, Griffin, Mount Pisgah, Slickford,

Dry Fork, and elsewhere. Webster County, Lebreer. Whitley County, near Williamsburg. Wolfe County, near Campton. Oil showings reported in Allen, Boyd, Breckinridge, Caldwell, Carroll, Carter, Christian, Clark, Clinton, Harrison, Hart, Jefferson, Johnson, Knott, Lawrence, McLean, Magoffin, Martin, Meade, Montgomery, Oldham, Pike, Pulaski, Rockcastle, Russell, and Warren counties.

Phosphate rock. Clark County, near Price Grove station. Fayette County, near Lexington. Franklin County, near Forks of Elkhorn. Jessamine County, near Huletts station. Scott County, near Georgetown. Woodford County, mined at Midway; occurs in thin plates and finely comminuted débris from weathering of phosphate limestone beds at the top of the Lexington limestone and base of the Winchester limestone (Ordovician), near Versailles, and many other points, especially in Fayette, Franklin, Scott, and Woodford counties.

Road metal. See Gravel, Limestone, and Sandstone.

Salt. Salt brines found in gas and oil wells in Breckinridge, Clay, Estill, Hancock, Henderson, Jefferson, Meade, Union, and other counties. May be utilized as source of salt.

Sand (building). Dug: Boyd County, at Ashland. Campbell County, Dayton. Jefferson County, Louisville and Shively. McCracken County, Paducah. Rockcastle County, Dudley and Withers. Warren County, Bowling Green.

Sand (glass). Dug: Calloway County, in hills bordering Beechy Creek. Carter County, Lawton. Hardin County, at Tip Top, 28 miles southwest of Louisville. Kenton County, Ludlow.

Sand (molding). Dug: Boyd County, at Ashland. Campbell County, Newport. Kenton County, Covington and Visalia. Warren County, Bowling Green.

Sandstone. Quarried in the following places: Bell County, at Pineville. Breckinridge County, near Garfield. Knox County, Barbourville. Logan County, near Russellville. Muhlenberg County, South Carrollton. Rockcastle County, Langford and Wildie. Rowan County, Bluestone, Farmers, Freestone, and Morehead. Occurs in many other counties of the State.

Shale (oil). Devonian. Underlies most of State, excepting several counties south of Cincinnati and perhaps westernmost six or eight counties, but shallow enough to be readily workable in only a part of this area.

Siderite. Boyd, Carter, and Greenup counties, original mineral of Hanging Rock iron ores. Butler, Edmonson, Grayson, Hart, and Muhlenberg counties, occurs in Nolin River district near base of the Pennsylvanian series ("Coal Measures"), largely undeveloped. Whitley County, near Cumberland Falls.

Silver. Crittenden County, recovered from lead concentrates separated from fluorspar.

Smithsonite (zinc carbonate). Crittenden County, mined and shipped from Old Jim, Brown, Hodge, Columbia, and other mines.

Sphalerite (zinc blende, blackjack). Crittenden County, mined at Old Jim and Columbia mines. Livingston County, Evening Star mine. Occurs in many other mines, usually associated with fluorspar and galena, as accessory mineral in central Kentucky barytes district, and in veins in Lewis County.

Sulphur. Sulphur springs are common all over the State.

Tripoli. Fulton County, in gray silt in top of Hickman Bluff and southward, and at several points in eastern parts of Calloway and Marshall counties; not used.

LOUISIANA.

Anhydrite. Calcasieu Parish, near Vinton, in deep well.

Brown iron ore (brown hematite, limonite). In Tertiary sands in Bienville, Bossier, Caddo, Claiborne, Lincoln, and Union parishes; not used.

Cement material (Portland). Chalk occurs only in small isolated outcrops and State is practically devoid of limestone, so it is not likely ever to be a producer of Portland cement.

Clay (brick). Abundant throughout the State; dug in following parishes: Ascension, Assumption, Avoyelles, Caddo, Calcasieu, De Soto, East Baton Rouge, East Feliciana, Franklin, Grant, Iberia, Harvey, Lafourche, Lincoln, Livingston, Natchitoches, Ouachita, Pointe Coupee, Rapides, Richland, St. Landry, St. Martin, St. Mary, St. Tammany, Tangipahoa, Vermilion, Webster, and West Feliciana.

Clay (fire). St. Tammany Parish, Covington.

Clay (pottery). Numerous outcrops of very pure white clay called "chalk" in Caddo Parish near Spring Ridge church, Chalk Hills, and elsewhere. Catahoula Parish, in north-central part. La Salle Parish, has been mined at Rosefield. Natchitoches Parish, lignitic clay near Robeline. Rapides Parish, pure white potter's clay reported in "Grand Gulf" rocks near Lena. Sabine Parish, 10 miles southeast of Fort Jesup. St. Tammany Parish, Covington.

Gas. See Natural gas.

Gravel (road metal). Extensive deposit in hills of southern Rapides Parish; also in Catahoula, Claiborne, Grant, Sabine, St. Landry, Washington, and Winn parishes; largely used.

Gypsum. Bienville Parish, with limestone at Rayburns salt works, sec. 31, T. 15 N., R. 5 W. Calcasieu Parish, large quantity in sulphur deposits at Lake Charles. Caldwell Parish, selenitic clays 85 feet thick at Grand View, on Ouachita River. St. Landry Parish, at Pine Prairie.

Hematite. Occurs in Bienville, Grant, Natchitoches, Rapides, Red River, Sabine, Winn, and other parishes; not used.

Iron. See Brown iron ore and Hematite.

Lignite. Bienville Parish, occurs in eastern part. Caddo Parish, West Shreveport. Caldwell Parish, near Columbia. Claiborne Parish, near Homer. De Soto Parish, northwestern part. Sabine Parish, Coalkill Creek, 6 miles east of Fort Jesup.

Limestone (building). St. Landry Parish, small outcrops, good building stone.

Limestone (crushed stone). Winn Parish, produced at Winnfield.

Limestone (lime). Natchitoches Parish, was burned locally 5 miles from Natchitoches. Sabine Parish, Rocky Spring. St. Landry Parish, Pine Prairie, and on Bayou Chicot.

Limonite. See Brown iron ore.

Marl. Occurs in Catahoula Parish, at Sicily Island; Claiborne Parish, in vicinity of Homer and Lisbon; Grant Parish, near Montgomery; "Zeuglodon marl" contains glauconite; Natchitoches Parish, phosphatic and greensand marl in bluff at Natchitoches; calcareous.

Natural gas. Caddo Parish, large production from Caddo field, near Shreveport. Calcasieu Parish, considerable quantities at Welsh oil wells. De Soto Parish, abundant at Mansfield and Naborton. East Baton Rouge Parish, occurs in several gas pockets in well at Deerford. Grant Parish, in well at Colfax. Iberia Parish, abundance on Bayou Bouillon, 30 miles northeast of New Iberia. Lafourche Parish, small production. Sabine Parish, in salt spring near mouth of Bayou Negreet. St. Martin Parish,

above oil in Anse-La-Butte field, and considerable quantity from "Natural Gas Spring," 2½ miles from Breaux Bridge. St. Mary Parish, Belle Isle. Terrebonne Parish. Common occurrence in the extensive marshy Quaternary areas of the State.

Petroleum. The total production of the State in 1914 was 14,309,435 barrels, valued at \$12,886,897, and there were about 1,000 productive wells at the beginning of that year. Caddo Parish, Caddo field important producer. Calcasieu Parish, Edgerly pool, Vinton gushers, and in numerous wells 6 miles northeast of Jennings, in Quaternary and Miocene beds, best lubricating oil in southern region in wells near Welsh. Cameron Parish, small quantity of oil from wells on Hackberry Islands. Iberia Parish, small quantity in wells at Bayou Bouillon, 30 miles northeast of New Iberia. Red River Parish, near Abington. St. Landry Parish, Pine Prairie, gusher 1912. St. Martin Parish, in coarse shallow sands at Breaux Bridge, Anse-La-Butte district.

Road metal. See Gravel and Limestone.

Salt (brine). Bienville Parish, Rayburn's salt works, and Kings. Lafayette Parish, salt brines in wells of Anse-La-Butte oil field and other oil fields, and artesian boring for brine, T. 12 N., R. 5 W. Natchitoches Parish, old salt works.

Salt (rock). Evangeline Parish, occurs at Pine Prairie, not mined. Iberia Parish, large quantities mined from shafts on Weeks and Avery islands. North Bienville Parish, has been mined on Saline Bayou and about 8 miles from Bienville. Sabine Parish, has been mined near Coal Bluff and near mouth of Bayou Negreet. Occurs also at Belle Isle and Jeffersons Island but is not mined.

Sand (building). Dug: Caddo Parish, at Shreveport. St. Tammany Parish, Bayou Lacombe, and Covington. Webster Parish, Lanesville. West Baton Rouge Parish, Baton Rouge.

Sandstone. Catahoula Parish, small quarries in "Grand Gulf" sandstone near Harrisonburg. Sabine Parish, quarried on Bayou Toro, canal and railroad construction. Winn Parish, best in small exposure at Coochie Brake.

Sandstone (ballast). Iberia Parish, occurs in Iron Mine Run on Petite Anse. Rapides Parish, "Grand Gulf" sandstone quarried between Boyce and Lena.

Sulphur. Calcasieu Parish, obtained from wells in extensive deposit about 3 miles from town of Sulphur; sulphur and associated beds are some hundreds of feet thick; sulphur, associated with limestone above gypsum, melted by superheated water and pumped out by Frasch process.

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MAINE.

Amethyst. Oxford County, gem crystals found on Deer Hill, in town of Stow, and on Pleasant Mountain, in town of Denmark.

Apatite. Androscoggin County, in transparent pink, purple, blue, and green crystals, at Apatite Hill, Wade, and Pulsifer quarries in town of Auburn, Berry quarry, town of Poland. Oxford County, at Hebron.

Aquamarine. *See* Beryl.

Argentite (silver glance). Hancock County, reported from Sullivan silver mine.

Arsenopyrite (arsenical pyrite). Franklin County, Titcombs Hill, Farmington. Hancock County, occurs in Blue Hill and Brooksville copper mines and Sullivan silver mines; was prospected on Verona Island. Knox County, occurs at Owls Head and South Thomaston. Oxford County, occurs at Corinna, Greenwood, Rumford, and at Mount Rubellite in town of Hebron. Waldo County, occurs in veins in schist at Fort Point. York County, Bonds Mount and Newfield, and accompanying silver ores at Lebanon and Acton.

Beryl. *Aquamarine.*—Kennebec County, at Winslow, with mica and fluorite in cassiterite vein. Oxford County, French Mountain, town of Albany; Dunton mine, town of Newry; Mount Mica, town of Paris; associated with corundum, town of Greenwood; Sugar Hill and Harndon Hill, town of Stoneham. Sagadahoc County, at Topsham feldspar quarries.

Cæsium beryl.—Androscoggin County, Berry quarry, town of Poland. Oxford County, town of Hebron; on Dudley farm, town of Buckfield.

Golden beryl.—Oxford County, Edgecomb Mountain, town of Stoneham, and Speckled Mountain, town of Peru.

Opaque varieties common in pegmatites, notably: Androscoggin County, Apatite Hill, town of Auburn. Hancock County, in cassiterite-bearing granite at Catharine Hill. Oxford County, Noyes mine, town of Greenwood.

Bornite (purple copper ore). Hancock County, has been mined in Ellsworth schist at Blue Hill. Washington County, Lubec lead mine and Pembroke copper prospects; not abundant.

Brown iron ore (bog iron ore). Lincoln County, occurs on Pemaquid Ledge. Oxford County, at Rumford. Piscataquis County, Dover; several deposits of large size. Somerset County, Skowhegan; several large deposits. York County, New Limerick and Newfield.

Brown iron ore (brown hematite, limonite). Aroostook County, occurs at Houlton and Linneus. Hancock County, most abundant oxidized mineral in Blue Hill and Brooksville district. Piscataquis County, has been mined at Katahdin mines. Washington County, has been mined at Prescott and at Lubec lead mine; at latter place trace of gold, some silver.

Calcite. Knox County, Rockland in massive and crystalline forms in quarries. **Cassiterite.** Kennebec County, occurs in 1-inch vein at Winslow. Oxford County, a few specimens at Mount Mica and Greenwood.

Cement material. Knox County, limestone near Rockland suitable for Portland cement.

Cerargyrite (silver chloride). Hancock County, reported from Sullivan silver mine.

Chalcocite (copper glance). Hancock County, sparingly on chalcopyrite at Blue Hill copper mines; at Douglas mine carries gold and silver.

Chalcopyrite (copper pyrites). Hancock County, important mineral of Blue Hill; has been mined at Douglas, Twin Lead, and other mines for gold

and silver. Somerset County, has been mined at Robinson mine. Washington County, occurs in old mines at Cooper; has been mined at Cherryfield and Lubec lead mine for gold and silver, at Pembroke copper prospect.

Clay (brick). Dug: Androscoggin County, at Danville, Durham, Leeds Junction, and elsewhere. Aroostook County, Masardis and Presque Isle. Cumberland County, Brunswick, North Yarmouth, and Portland. Hancock County, East Sullivan, Ellsworth, Orland, and elsewhere. Kennebec County, Augusta, Waterville, and Winslow. Knox County, deposits and brick works at Thomaston, South Thomaston, and Rockland. Oxford County, East Bethel. Penobscot County, Bangor, Brewer, and Howland. Piscataquis County, Abbot Village and East Dover. Sagadahoc County, Bath, Topsham, and Woolwich. Somerset County, Madison. Washington County, Calais and Lubec. York County, Eliot, Kennebunk, Saco, and elsewhere.

Columbite. Androscoggin County, sparingly in pegmatite at Apatite Hill, town of Auburn. Cumberland County, town of Standish. Oxford County, Mount Mica, town of Paris. Sagadahoc County, Harndon Hill, town of Stoneham, in Fishers quarry in pegmatite; Mount Ararat and Willes feldspar quarry, town of Topsham.

Copper. See Bornite, Chalcocite, and Chalcopyrite.

Diabese. Penobscot County, near Bangor at Harmon Hill.

Diatomaceous earth (tripolite, "fossil meal"). Hancock County, occurs abundantly in all pond bottoms near coast; was mined at Blue Hill (in beds 4 to 6 feet thick) and Surry. Washington County, was mined at Beddington.

Epidote. Sagadahoc County, occurs at Phippsburg.

Essonite. Sagadahoc County, Phippsburg. Oxford County, found at several places.

Feldspar. Extensively quarried from pegmatite deposits. Androscoggin County, quarried at Apatite Hill, town of Auburn; Berry quarry, town of Poland. Lincoln County, has been quarried in town of Edgecomb. Oxford County, has been quarried at Hibbs quarry and Mills quarry, town of Hebron; at Mount Mica, town of Paris; and at West Peru. Piscataquis County, has been quarried at Brownsville. Sagadahoc County, quarried at Goldring's quarry; Georgetown, Willes quarries; Mount Ararat; and at Fisher's quarry, town of Topsham.

Flagstone. Mica schist suitable for flagging occurs in Kennebec County, at Winthrop. Sagadahoc County, at Phippsburg. York County, Acton and Lebanon, and at other localities. Also sandstones in northern part of State.

Galena. Hancock County, occurs in Ellsworth schist near Blue Hill and Brooksville. Oxford County, in granite at Mount Glines. Penobscot County, in thin veins near Hampden and Corinna. Piscataquis County, at Dover. Somerset County, abundant at Bingham mine; small quantity at Robinson mine has been mined. Washington County, Cherryfield, Lubec lead mine, and Pembroke copper prospect.

Garnet. See Essonite.

Gold. Franklin County, associated with pyrite-bearing slates at Strong. Hancock County, has been mined in granite with molybdenite at Catharine Hill; is sparingly present with sulphides in Blue Hill mines and in some river gravels and crevices in underlying rocks. Oxford County, has been found in some river gravels. Somerset County, occurs at Moscow and in

some river gravels. Washington County, in quartz veins at Bailey, Baring, and Cutler, and in some river gravels and in crevices in underlying rocks.

Granite. Quarried: Aroostook County, Smyrna. Cumberland County, at Brighton, Brunswick, Freeport, North Yarmouth, Portland, Pownal, Westbrook, Woodfords, and Yarmouth. Franklin County, Chesterville, Farmington Falls, and North Jay. Hancock County, Bar Harbor, Blue Hill, Brooksville, Dedham, Franklin, East Franklin, West Franklin, Hall quarry, Mount Desert, Northeast Harbor, Orland, Sedgwick, Southwest Harbor, Stonington, Sullivan, West Sullivan, North Sullivan, and Swan Island. Kennebec County, Augusta, Hallowell, Mainstream, and Wayne. Knox County, Clark Island, Hurricane Isle, Long Cove, Pequoit, Rockland, South Thomaston, St. George, and Vinal Haven. Lincoln County, Round Point, Waldoboro, and Whitefield. Oxford County, Bryant Pond, Fryeburg, Norway, Oxford, Waterford, and Welchville. Penobscot County, Lincoln, black granite at Hermon Hill. Piscataquis County, Guilford. Somerset County, Canaan, Mainstream, Norridgewock, and South Norridgewock. Waldo County, Frankfort, Lincolnville, Searsport, and Swanville. Washington County, Addison, Baileyville, Calais, Charlotte, Jonesboro, Jonesport, Marshfield, Millbridge, and Red Beach. York County, Alfred, Berwick, Biddeford, Kennebunkport, North Berwick, Sanford.

Graphite (plumbago). Cumberland County, occurs in pegmatite dike near Yarmouth. Franklin County, in schist near Madrid. Hancock County, in pegmatite and schists near Blue Hill and Brooksville. Kennebec County, at Gardiner, on Kennebec River. Oxford County, sparingly in granite and mica schist in towns of Paris, Rumford, and Woodstock. Sagadahoc County, has been mined at Georgetown and Phippsburg. Waldo County, occurs at Belfast, disseminated through clay slate.

Gravel. Abundant in nearly all parts of the State and is at present the principal source of road material.

Hematite (red iron ore). Aroostook County, occurs at Curriers. Piscataquis County, has been mined at Katahdin mines.

Iron. See Brown iron ore, Hematite, Magnetite, and Pyrite.

Kunzite (spodumene). Oxford County, lilac-colored, occurs in pegmatite in town of Andover.

Lead. See Galena.

Lepidolite. Androscoggin County, in pegmatite deposits at Apatite Hill, and in the Wade and Pulsifer quarries, town of Auburn. Oxford County, at the Denton quarry, in the town of Newry, and at Mount Mica, town of Paris; Mount Rubellite, town of Hebron.

Limestone (lime). Knox County, extensively quarried and burned in vicinity of Rockland, Rockport, Thomaston, and West Warren. Waldo County, Searsmont.

Limonite. See Brown iron ore.

Magnetite (magnetic iron ore). Aroostook County, occurs at Linneus, impregnating slaty rock. Cumberland County, Raymond, in thin sheets in epidotic gneiss. Hancock County, in schist at Douglas, Twin Lead, Owen, and other mines near Blue Hill and Brooksville, and on Marshall Island. Knox County, Union. Oxford County, Buckfield. Sagadahoc County, at Topsham, Spragues quarry, as trisectahedral crystals in pegmatite.

Manganese. See Wad and Rhodonite.

- Marl.** Aroostook County and elsewhere in ponds and swamps in the northern part of the State.
- Mica** (biotite). Common in many pegmatite deposits of the State.
- Mica** (muscovite). Abundant in all of the pegmatite deposits. Oxford County, small quantities have been mined at Mount Mica, town of Paris, Bennett and Pingree farms, town of Albany; Hibbs quarry, town of Hebron; southwest part of town of Waterford.
- Molybdenite** (sulphide of molybdenum). Cumberland County, occurs in granite in close connection with pegmatite at a number of places in Brunswick. Hancock County, under similar conditions at Catharine Hill and on Long Island in Bluehill Bay. Washington County, Cooper, 22 miles southwest of Calais, with fluorspar and bismuth in narrow pegmatite dikes cutting granite along joints, and as impregnations in granite.
- Ocher.** Androscoggin County, has been mined at Lisbon. Cumberland County, occurs at Bridgton, Naples, and Sarmonite.
- Peat.** Common and widely distributed over the entire State. A small plant for manufacturing machine peat has been operated for several years at Lewiston. Experimental plants have intermittently produced some peat fuel near Bangor and Portland.
- Platinum.** Knox County, in peridotite, East Union. Penobscot County, at Hermon. Piscataquis County, in pyrrhotite ores.
- Pollucite.** Oxford, found in pegmatite at Buckfield and Hebron.
- Pyrargyrite** (ruby silver). Hancock County, occurs at Sullivan, Franklin, and Hancock, with galena, native silver, silver glance, pyrite, chalcopyrite, etc., sparingly.
- Pyrite.** Hancock County, Douglas, Twin Lead, Bluehill, and other mines in Bluehill and Brooksville district, and in granite at Catharine Hill. Oxford County, in granite at Mount Glines. Somerset County, has been mined at Robinson mine. Washington County, Cherryfield; has been mined at Lubec lead mine.
- Pyrrhotite.** Hancock County, Douglas, Twin Lead, Monmouth, and other mines have been worked. Knox County, Miller farm, East Union. Piscataquis County. Somerset County, Robinson mine.
- Quartz.** Abundant in all pegmatite deposits. White quartz: Androscoggin County, mined with feldspar at Apatite Hill, town of Auburn. Cumberland County, has been mined near Cumberland Mills. Rose quartz: occasionally used as a gem. Oxford County, Tubbs Ledge and French Mountain, town of Norway; Mount Mica, town of Paris. Smoky quartz: Androscoggin County, occurs at Apatite Hill, town of Auburn. Oxford County, Blueberry Hill, town of Stoneham.
- Quartzite.** Hancock County, Mount Desert Island, a mile south of Bar Harbor, on the east and west sides of Strawberry Hill (quarried), $3\frac{1}{2}$ miles west of Bar Harbor and about 2 miles south of Salisbury Cove (quarried). Knox County, Thomaston Township, eastern part; abundant at Mount Battie and near by, north of Camden, west of Rockport, on west shore of Rockport Harbor; Rockland, and Thomaston; Pine Hill, north of Clam Cove; South Thomaston Township, north of the north end of Weskeag River estuary. Waldo County, western part of North Islesboro.
- Rhodonite.** Hancock County, was mined on Osgood farm, Blue Hill, when furnace of Katahdin Iron Works was in blast.
- Rhyolite.** Common in eastern part of Penobscot Bay region. Aroostook County, in the region between Ashland and Presque Isle. Hancock

County, Frenchmans Bay region, western part of Brookville Township, Castine Township, abundant throughout, northwestern part of Deer Isle, western part of Isle au Haut, Little Deer Isle, southern part of Mount Desert Island. Knox County, on the islands of Vinal Haven, and on North Island, and in northern part of the village of Vinal Haven. Piscataquis County, Mount Kineo region near Moosehead Lake. Washington County, eastern part; Englishman Bay region and Cobscook Bay region; Machias Township, west of East Machias; in town of Eastport, including Moose Island (abundant); just northeast of the railroad station at Eastport; along the shore opposite Clark Ledge in the northern part of the village of Eastport; on the large hill east of Carryingplace Cove; Jonesboro Township, eastern part, $1\frac{1}{2}$ miles northwest of Black Head, near Shoppees Point; constitutes the greater part of the peninsula northeast of Lubec (Seward Neck); Perry Township, abundant in southern part.

Road metal. The coastal region of Maine is well supplied with hard-rock road materials of good quality, which are in many places so situated that they can be cheaply quarried and shipped by water. The rocks named in order of utility are trap, rhyolite, quartzose schist, and quartzite conglomerate, but granite, quartzite, limestone, slate, and clayey schist are also used. At the present time gravel, which occurs in abundance in nearly all parts of the State, is the principal road material used in Maine. *See* Gravel, Limestone, Quartzite, Quartzose schist, Rhyolite, and Trap.

Rose quartz. *See* Quartz.

Sand (building). Dug at many places throughout State.

Sand (glass). Knox County, Camden, abundant; not mined. Waldo County, Liberty, pure, granular quartz.

Schist (quartzose schist). Cumberland County, near Portland and Gorham and southeast of Sebago Lake, between Fryeburg Lake and Ossipee River; Brunswick Township, just north of the Harpwell line (quarried); Cape Elizabeth Township, south and west of Portland; Standish Township, western part. Washington County, considerable areas in eastern part from Machias to West Quoddy Head and Lubec; Jonesboro Township, eastern part, at Black Head on the northeast shore of English Bay and elsewhere; Machias Township, at numerous points within a distance of 2 miles from Machias along the road to Machiasport. York County, in eastern part a belt 3 miles wide extends from Old Orchard 16 miles northward to a point beyond Buxton and occupies a coastal area of about 50 square miles, comprising areas in Kennebunk and Kennebunkport; the rock is well exposed along the coast from York to Kennebunkport; in the western part it forms a belt about 6 miles wide, extending from York and Kittery on the coast 50 miles northward to Saco River and Cumberland County line; the rock is well exposed at Kittery and South Brunswick, between these two points, and along the road between Kittery and the southern portion of the town of York; quarried at Saco near Boston & Maine depot; Wells Township, abundant.

Silver (native). Hancock County, reported from Eggemoggin and Sullivan mines. *See also* Argentite, Cerargyrite, Pyrargyrite, and Stephanite.

Slate. Piscataquis County, slate region in central part of State; quarried at Barnard plantations, Blanchard, Brownville, Monson, and Williamsburg. Somerset County, prospect in southwest corner of town of Forks.

Sphalerite (zinc blende). Hancock County, occurs sparingly in Blue Hill copper deposits; argentiferous in Gouldsborough mine; has been mined; also found in Eggemoggin, Deer Isle, and other mines, and at Harborside. Somerset County, has been mined at Robinson mine. Washington County, has been mined at Cherryfield; also occurs at Pembroke copper prospect.

Stephanite (silver glance). Hancock County, reported from Sullivan mine.

Syenite. Kennebec County, Litchfield.

Talc (soapstone). Hancock County, Harpswell, Jaquish, Deer Isle. Kennebec County, Ovis Island, bed 14 feet wide; Vassalboro.

Tin. *See* Cassiterite.

Topaz. Oxford County, Harndon Hill, town of Stoneham.

Tourmaline. Colored tourmalines of gem quality. Androscoggin County, mined at Apatite Hill, town of Auburn; has been mined at Wade and Pulsifer quarries, town of Auburn, Berry quarry, town of Poland. Oxford County, mined at Mount Mica, town of Paris; has been mined in town of Greenwood, at Mount Rubellite, town of Hebron, Mills quarry, town of Hebron, Dunton quarry, town of Newry. Sagadahoc County, Willes feldspar quarry, town of Topsham.

Trap (trap rock). Cumberland County, a mile south of Hartswell Center, near Brunswick. Hancock County, Brooksville Township, near Brooksville; forms the peninsula west of Bucks Harbor near the village of South Brooksville; in the northern part of the township there are large areas; northwestern part of Deer Isle; Penobscot Township, near Penobscot; Goldsborough Township, at numerous places in southern part, and a belt 2 miles wide extends from a point near Sullivan 7 miles eastward through the village of Goldsborough; east shore of Isle au Haut; Little Deer Island; Mount Desert Island, at many places, especially on landward side, a mile south of Bar Harbor on the east and west sides of Strawberry Hill (quarried); abundant at village of Mount Desert, and on many of the larger islands in Frenchman and Bluehill bays and elsewhere. Knox County, North Isle; North Sullivan Island (mostly composed of trap); St. George Township, mainly in the region extending from Long Cove northeastward beyond the border of the township (quarries near St. George and northeastward); island of Vinal Haven, point west of Carvers Cove, southwest of the village of Vinal Haven (has been quarried); on the north shore of the island from Youngs Point to Hopkins Point, and in the eastern part of the island near Coombs Hill and Barley Hill; Brimstone Island $1\frac{1}{2}$ miles southeast of Vinal Haven. Lincoln County, Round Pond. Penobscot County, at Hermon Hill near Bangor (quarried). Waldo County, town of Lincoln, 3 miles west of the coast (quarried), southern part of South Salisbury. Washington County, Addison Township, near Addison (quarried); Calais Township, along the American bank of St. Croix River about a mile southeast of Calais, $2\frac{1}{2}$ miles east of Calais; Eastport Township, abundant; city of Eastport (quarried); Shackford Head and Estes Head are the two most favorable occurrences in the State for cheap quarrying and shipment by water; Jonesboro Township, eastern part, notably at Black Head on northeast shore of English Bay; Lubec Township, abundant in eastern part south of Lubec; fine-grained trap constitutes most of Rodgers Island and Dudley Island; coarse diabase, which is exposed abundantly in the village of Lubec and along the west shore of Johnson Bay, forms most of the hills in the region between Lubec village and West Quoddy Head and also in the region

southeast of West Lubec; abundant on Long Island in South Bay and in the vicinity of Bassett Creek and Black Head at the mouth of Federal Harbor; small areas are abundant throughout this part of the township; Machias Township, $1\frac{1}{2}$ miles southwest of East Machias; south of East Machias and about half a mile north of Randles Point is a large hill composed of excellent material; $2\frac{1}{4}$ miles southeast of Machias, along the south side of the Machiasport road, the trap forms a large hill; smaller outcrops occur all along the road between this hill and Bucks Harbor in Machiasport; just north of the village of Machiasport; Pembroke Township, forms a large hill just north of Ayers Junction, along railroad 2 miles west of junction, at several points along the road from the junction toward Pembroke; in the southern part of the township trap rock forms a chain of hills from one-half to three-fourths of a mile broad extending in a northwesterly direction from East Bay; trap also occurs along the southwest shore of Pennamaquan River about opposite the mouth of Hersey Cove; it forms the hill just west of Garnet Point and the hill east of the mouth of Hersey Cove, and also the ridge just east of Pembroke village; it occupies large areas on the peninsula between Youngs Cove and Falls Island; Perry Township, abundant in southern part, where it forms the hill just southwest of the reservoir dam near Perry village and occupies most of the east shore of East Bay from its head nearly to Birch Point; exposures occur along the Perry and Pembroke roads about one-half mile northwest of the toll bridge to Moose Island; in the northeastern part of the township trap rock is exposed on the hills just north of Perry village; the rock forming the large hill a quarter of a mile southwest of the reservoir dam near Perry would furnish the best road metal. York County, as dikes in nearly every part of the county; Biddeford Township, northern part, at Hollis Beach on south bank of Saco River, 5 miles southeast of the city of Biddeford, and elsewhere; Kennebunkport Township, Cape Porpoise, Redin Island, on the coast east of Kennebunkport; Kittery Township, common as dikes and stocks, near Piscataquis River, about half a mile north of Kittery depot, a quarter of a mile northeast of the Kittery-Portsmouth bridge near the junction of the Portsmouth and the Navy Yard roads (has been quarried); in Wells Township dikes are exposed from Ogunquit to Bald Head, along the coast a mile north of Ogunquit, and opposite Eldridge's hotel along the trolley line.

Tripolite. See Diatomaceous earth.

Vesuvianite. Oxford County, Rumford. Sagadahoc County, Phippsburg. York County, Sanford.

Wad (bog manganese). Occurs in Aroostook County, at Hodgdon. Hancock County, at Blue Hill (mined). Knox County, at Thomaston, on Dodges Mount. Oxford County, at Sumner. Piscataquis County, at Dover. York County, at Mount Agamenticus.

Zinc. See Sphalerite.

MARYLAND.

Antimony. *See* Stibnite.

Asbestos (chrysotile). Baltimore and Harford counties, small, inferior deposits of fibrous serpentine have been quarried at several places. Cecil County, at West Nottingham.

Barite. Carroll and Frederick counties, lens-shaped bodies have been found.

Bornite (peacock copper). Carroll County, occurs at Mineral Hill, 7 miles southwest of Finksburg and near New Windsor. Frederick County, mined at Liberty mine between Union Bridge and Libertytown; occurs in Linganore copper region.

Brown iron ore (bog iron ore). Found at several localities in small quantity. Was mined and made into pig iron many years ago at Federalsburg, Caroline County, and on Nassawango Creek, Worcester County, latter locality producing as high as 700 tons in one year.

Brown iron ore (brown hematite, limonite). Was formerly mined more or less extensively at the following places: Allegany County, Nicholas Mountain and Shriver Ridge. Baltimore County, near Bosley, 2 miles west of Cockeysville, 2 miles west of Glencoe, near Lutherville, Stevenson, and Towson. Carroll County, at Avondale, Bachman Mills, Ebbvale, Lineboro, Melrose, and Westminster. Frederick County, east foot of Catoclin Mountains near Thurmont, near Feagaville, Frederick Junction, Unionville, and Washington Junction. Harford County, at Hess, and 2 miles southwest of Jarrettsville. Washington County, 1 mile south of Boonsboro, 3 miles north and 4 miles southwest of Clear Spring, 1 mile and 3 miles northwest of Harpers Ferry, near Green Spring, 2 miles northeast and 1 mile southeast of Indian Spring, 1 mile and 2 miles south of Ponds ville.

Calamine (zinc silicate). Carroll County, zinc mines near New Windsor, with sphalerite and smithsonite, not worked.

Cement (natural). Allegany County, Silurian limestone used for natural cement at Cumberland and Potomac. Baltimore County, Cockeysville and Texas. Carroll County, vicinity of Union Bridge. Washington County, at Cavetown, Cayuga, Chewsville, Hagerstown, Hancock, and Tonoloway station.

Cement material (Portland). Allegany County, has been quarried at Cumberland and Pinto. Frederick County, Ordovician limestone suitable for Portland cement lies along Monocacy River in east-central part of county. Washington County, same rock in two belts, one north and south through center and one in east third of county, has been quarried at Round Top.

Chalcocite (copper sulphide). Baltimore County, occurs at Bare Hills and Dolly Hyde mines. Carroll County, has been mined at Mineral Hill mine and Roop farm. Frederick County, mined occasionally at Liberty mine.

Chromite (chromic iron ore). Baltimore County, has been mined at Bare Hills and Soldiers Delight. Carroll County, occurs in a belt from near New Lisbon, through Montgomery County, nearly to Potomac River. Cecil County, formerly mined in small way along State line near Rock Springs. Harford County, was mined at several points in serpentine. Montgomery County, near headwaters of Seneca Creek in serpentine.

Chromium. *See* Chromite.

Chrysocolla (copper silicate). Carroll County, sparingly in red sandstone between Middleburg and Big Pipe Creek.

Chrysotile. *See* Asbestos.

- Clay** (brick and tile). Clay suitable for the manufacture of brick and tile is common throughout the State. Common brick are made from sedimentary clays of the Coastal Plain, residual clays of the Piedmont region, and shaly deposits of the Appalachian region. There are 67 brick, tile, and terra-cotta works in the State, including 4 at Baltimore, 2 at Cambridge, 5 at Hagerstown, 3 at Salisbury, 3 at Westminster, and one or more at many localities in 16 different counties.
- Clay** (fire). Allegany County, worked at Cumberland, Frostburg, and Mount Savage. Anne Arundel County. Baltimore County, Pleistocene, also residual clays of Algonkian, worked at 4 places. Cecil County, 4 yards near Northeast. Frederick County, 1 yard at Frederick. Garrett County, Blaine. Harford County. Howard County. Prince George County. Wicomico County, 1 yard at Salisbury.
- Clay** (kaolin). Baltimore County. Calvert County, near Drum Point and St. Leonard Creek. Cecil County, residual, white, derived from feldspathic gneisses, is used chiefly in manufacture of paper. Howard County.
- Clay** (pottery). Anne Arundel County, important outcrops along western shore of Chesapeake Bay from Bodkin Point southward. Cecil County, found at many places in Patapsco formation. Pottery clay is worked near Baltimore, Catonsville, Cumberland, Frederick, and Hagerstown.
- Coal** (bituminous). Occurs in five basins, known as Castleman, Georges Creek, Upper Potomac, Lower Youghiogheny, and Upper Youghiogheny, all in Allegany and Garrett counties; Pittsburg principal seam, mines from Frostburg to Midland; Ocean, Union, and Carlos largest mines; lower beds of Allegheny formation extensively mined from Moscow to Westernport, at Loarville, Barrellville, and along west bank Potomac River on east border of Garrett County; Lower Kittanning coal (in Allegheny formation), 6 feet, mined North Potomac Valley; Mercer coal bed (in Pottsville formation), 2-4 feet, mined for firing brick at Mount Savage, also mined to slight extent near Westernport; Pittsburg coal (in Monongahela formation), 5-20 feet, extensively mined in Georges Creek district; high-grade steam and blacksmith coal.
- Copper** (native). Frederick County, Catoctin Mountain, specimens only.
- Copper ores.** See Bornite, Chalcocite, Chrysocolla, and Malachite.
- Diabase.** See Road metal.
- Diatomaceous earth.** Bed 30 feet thick at base of Miocene has been traced from Herring Bay on the Chesapeake to Popes Creek on the Potomac, across Anne Arundel, Calvert, and Charles counties; has been dug for polishing powder; chief production at Lyons Creek on Patuxent River, Anne Arundel County.
- Dolomite.** Quarried in Baltimore County, and near Hagerstown, Washington County.
- Feldspar.** Baltimore County, orthoclase and microcline mined near Woodstock, Granite, and Hollofield, and across the line in Howard County. Montgomery County, 4 miles west of Laurel, microcline mined. Cecil County, soda feldspar (albite) mined near Conowingo.
- Flagstone.** Frederick County, Catoctin Mountain, Emmitsburg, High Knob, near Frederick.
- Flint.** See Quartz.
- Fluorspar** (fluorite). Allegany County, occurs near Cumberland.
- Gabbro.** Baltimore County, quarried at Dickeyville and Woodberry. Harford County, near Havre de Grace. Howard County, Savage. See also Road metal.

Galena (lead ore). Baltimore County, traces in Jones Falls quarries. Carroll County, with limestone in western part of Carroll and eastern part of Frederick County. Montgomery County, has been mined for gold in Maryland mine at Great Falls.

Glaucconite. *See* Marl (greensand).

Gneiss. Quarried at Baltimore, and in Baltimore County at Loch Haven, Pikesville, Phoenix, Stevenson, and opposite Ellicott City.

Gold. Baltimore County, found in quartz veins at Catonsville. Carroll County, found in small quantity at Mineral Hill. Montgomery County, was mined with pyrite, galena, etc., at Great Falls and Glen Echo.

Granite. Baltimore County, Dickeyville, Gardenville, Granite, Raspeburg, Reisterstown, Towson, and Whitehall. Baltimore City, Baltimore. Cecil County, quarried extensively at Frenchtown, Port Deposit, Rising Sun, and Rowlandsville. Harford County, Havre de Grace. Howard County, Ellicott City, Guilford, and Savage. Montgomery County, Dickerson, Forest Glen, and Glen Echo.

Hematite (Clinton oolite). Allegany County, was stripped many years ago on west side of Wills Mountain, near Roberts and near Cumberland; it occurs in Wills Mountain, Evitts Mountain, and Tussey Mountain.

Hematite (specularite). Carroll County, was formerly mined at Springfield and Carroll mines near Sykesville, Mineral Hill mine near Louisville, and Patapsco mines at Finksburg.

Iron ores. *See* Brown iron ore, Chromite, Hematite, Magnetite, Oriskany brown ore, Pyrite, Pyrrhotite, and Siderite.

Kaolin. *See* Clay (kaolin).

Lead. *See* Galena.

Limestone (building). Allegany County, Cresaptown and Mount Savage. Baltimore County, Belfast and Loch Raven. Washington County, Sharpsburg. Very little limestone is quarried for dimension building stone. Small quantities are taken at a few places for local use.

Limestone (crushed stone). Quarried: Allegany County, at Cumberland. Baltimore County, Baltimore, Glyndon. Frederick County, Catoctin Furnace, Frederick, Lime Kiln. Washington County, Cavetown, near Hagerstown, at Maugansville, Pinesburg, and elsewhere.

Limestone (lime). Quarries where stone is or formerly was procured to burn for lime: Allegany County, Cumberland and near Allegany Grove. Baltimore County, Butler, Dover, Glyndon, and Texas. Carroll County, Avondale, Linwood, Uniontown, Union Bridge, near Westminster, and elsewhere. Frederick County, Buckeystown, Catoctin Furnace, Daysville, Mount Pleasant, Mount Savage, and elsewhere. Howard County, Clarkville, Fulton, and Highland. Washington County, Cavetown, Cayuga, Chewsville, Clear Spring, Hagerstown, Pinesburg, and elsewhere.

Limonite. *See* Brown iron ore.

Linnæite (siegenite, cobalt pyrites). Carroll County, Mineral Hill copper mines, Finksburg, in small quantities with copper ores in chlorite schist.

Magnetite. Baltimore County, was mined 1 mile southeast and $2\frac{1}{2}$ miles northeast of Whitehall. Frederick County, 15,000 tons or more of ore was taken on hill southwest of Catoctin Furnace, near Thurmont. Harford County, small quantity was mined 1 mile southeast of Minefield. Besides these places where magnetite has been mined, there are several mines and prospects where it has been found in very small quantity or might be found by driving through the limonite cap.

- Malachite** (green carbonate of copper). In Blue Ridge district and crystalline rocks of Frederick, Carroll, Howard, and Baltimore counties. Liberty mine, Frederick County, only producer.
- Manganese ore** (mined). Reported in small quantities in Cambrian and Ordovician rocks at following localities: Allegany County, Keysers Ridge and Bear Creek, Youghiogheny Valley. Frederick County, New Market, associated with copper. Montgomery County, at Brookville and Mechanicsville. Washington County, north shore of the Potomac, 3 miles north of Harpers Ferry; pyrolusite has been mined. *See also* Pyrolusite.
- Manganite**. Occurs in small quantity, from indeterminable amounts to 10 per cent of the ore, in most manganese deposits in the State.
- Marble**. Baltimore County, at Cockeysville, fine dolomitic marble quarried for building and decorative purposes; at Texas, coarse grained, quarried for flux and lime. Carroll County, a few miles south of Union Bridge, variegated marble suitable for decoration; development work begun. Frederick County, Liberty, New Market, Sams Creek, variegated; east slope Catocin Mountain, "Potomac or calico marble."; valley of Monocacy River. Washington County, Eakles Mills and Boonsboro, cream-colored and variegated has been quarried; Benevola and Hagerstown, quarried.
- Marl** (greensand). Glauconitic, occurs abundantly in Anne Arundel, Charles, Kent, and Prince Georges counties.
- Marl** (shell). Occurs abundantly in Calvert, Caroline, Queen Annes, St. Marys, and Talbot counties. Caroline County, deposit in bank of Choptank River, near Denton, has been used for road material.
- Mica** (muscovite). Baltimore County, with quartz and feldspar in quarry near Hollofield station. Howard County, has been mined 5 miles northeast of Laurel and 1½ miles north of Scaggsville and near Woodstock. Montgomery County, prospects 4 miles northwest of Laurel on south side of Patuxent River.
- Ocher**. Anne Arundel and Prince Georges counties, was formerly mined from Patapsco and Arundel formations. Frederick County, considerable shipments from Catocin Furnace pits.
- Oriskany brown ore**. Western part of State.
- Pyrite**. Anne Arundel County, in Magothy formation on Magothy River, was roasted for sulphuric acid. Montgomery County, abundant in quartz at Maryland mine near Great Falls. Prince Georges County, Oxon Creek, was mined for gold.
- Pyrolusite**. Frederick County, near Point of Rocks. Montgomery County, Brookville, abandoned mines. Washington County, was mined on north shore of Potomac River, 3 miles north of Harpers Ferry.
- Pyrrhotite**. Howard County, in small quantities with hornblende, near Woodstock.
- Quartz**. Baltimore County, quarried at Glen Morris and Woodstock. Carroll County, Louisville. Harford County, Flintville, Deer Creek, and 1½ miles west of Conowingo (Cecil County). Howard County, Marriotsville; all ground for use in pottery manufacture. Montgomery County, mined 4 miles west of Laurel with mica and feldspar.
- Road metal**. Gabbro, extensive in Baltimore, Cecil, Harford, Howard, and Montgomery counties; diabase, long narrow outcrops in Baltimore and Howard counties, more extensive in Frederick and Montgomery counties; marble, limestone, and sandstone, extensive in valleys north of Baltimore City, and in Frederick and Hagerstown valleys: gravels and marls, Anne

Arundel, Calvert, Cecil, Charles, Kent, Prince Georges, Queen Annes, and Talbot counties.

Sand (building). Anne Arundel and Baltimore counties, dug and dredged near Baltimore. Prince Georges County, Farmington. Washington County, Hancock and opposite Great Cacapon, W. Va.

Sand (glass). Anne Arundel County, dug at Robinson, has been worked on both banks of upper part of Severn River.

Sand (molding). Anne Arundel County, dug at Magothy River. Baltimore County, Catonsville. Washington County, Rock Forge. Found also in Cecil, Harford, and Kent counties.

Sandstone (building). Quarried in small quantity in Allegany County, at Cumberland. Baltimore County, Lystra (mail Stevenson). Carroll County, Kump and Taneytown. Garrett County, Bloomington. Montgomery County, near mouth of Seneca Creek. Washington County, Hancock.

Sandstone (crushed stone). Allegany County, quarried at Cumberland. Garrett County, Bloomington.

Serpentine. Baltimore County, quarried at Bare Hills and Reistertown. Cecil County, forms wall rock at West Nottingham quarry. Harford County, quarried at Dublin, has been quarried at Broad Creek, near Cambria, at Coopstown, and Deer Creek.

Siderite (spathic iron ore). Confined to Cretaceous deposits of Coastal Plain; found in Anne Arundel, Baltimore, Cecil, and Prince Georges counties; ore occurs in lenses in clay. A large number of ore banks are found on a line from Poplar, through Baltimore, Eldridge, Annapolis Junction, and Muirkirk, to Branchville.

Silver. Frederick County, Catoclin Furnace, in sphalerite and galena.

Slate. Frederick County, has been quarried at Ijamsville and Bennett Creek, near Thurston. Harford County, quarried for roofing in Peachbottom area, Cardiff. Montgomery County, occurs at Hyattstown.

Smithsonite (carbonate of zinc). Carroll County, zinc mine near New Windsor, with sphalerite and calamine; has been mined.

Soapstone. Small quantity sawn into slabs, more ground for acid-proof and fireproof paints. Carroll County, quarried from extensive deposit northwest of Marriottsville; small quantity ground near Westminster. Cecil County, Patersons, on west branch of Northeast River; New Leeds, on Little Elk. Harford County, soapstone occurs but quarrying abandoned. Montgomery County, near Clopper's mills, Rockville, and Smell's bridge.

Sphalerite (zinc blende). With crystalline limestone in west part of Carroll County and east part of Frederick County.

Stibnite. Frederick County, Middletown Valley.

Talc (French chalk). Cecil County, Rock Springs, in serpentine; Montgomery County, 6 miles from Rockville on Darnestown road.

Tetradymite. Montgomery County, has been mined with gold in Great Falls mines.

Tourmaline. Montgomery County, chrome tourmaline near Etchison.

Verde antique. See Serpentine.

Zaratite (emerald nickel). Cecil County, small quantity in chrome ore mine in northern part of county.

Zinc. See Calamine, Smithsonite, and Sphalerite.

MASSACHUSETTS.

Alum. Dukes County, lignitic clays in vicinity of Gay Head and elsewhere on Marthas Vineyard, once shipped to Salem for alum.

Anthracite. *See* Coal.

Aquamarine. Found at Royalston and Fitchburg. *See also* Beryl.

Asbestos. Berkshire County, was mined in connection with talc at Dalton. Hampshire County, mined near Pelham.

Basalt. *See* Trap rock.

Beryl. Worcester County, at Royalston, best locality in State, blue and yellow gem quality, worked intermittently. Found also in Franklin County at Northfield. Hampden County, Blandford. Hampshire County, Chesterfield, Goshen, and Norwich.

Beryl (emerald). Hampshire County, reported specimens found at Chesterfield and Goshen.

Brown iron ore (limonite, bog iron ore). Dukes County, deposits in swamps and in Tertiary rocks in Marthas Vineyard. Hampden County, formerly worked near Brimfield.

Brown iron ore (brown hematite). Berkshire County, numerous and extensive beds in Richmond, has been mined to some extent; also in vicinity of Lenox and Stockbridge, and in an area which extends 6 or 7 miles northward from these towns toward Pittsfield, it has been mined at a dozen or more places. Bristol County, large quantities at Dartmouth and Easton; has been mined at West Stockbridge.

Cement material (Portland). Suitable limestone occurs in northwest part of State, particularly Berkshire County, but no shales occur near these limestones, and the glacial clays are too sandy.

Chalcopyrite (copper pyrites). Essex County, with galena, pyrite, etc., middle vein, Newburyport lead mines. Franklin County, occurs in very small quantity at Davis, Greenfield, Leverett, Montague, and elsewhere; was shipped from Davis mine. Hampshire County, Loudville and Southampton. Worcester County, with siderite in mica slate at Sterling.

Chiaustolite. Worcester County, good specimen locality in argillaceous slate at Westford and Lancaster; abundant gem quality, some cut.

Chromite (chromic iron ore). Hampden County, in serpentine at Chester, three outcrops 5 to 18 inches wide; 1,200 pounds of ore once obtained.

Chromium. *See* Chromite.

Clay (brick). Dug in following places: Barnstable County, at West Barnstable. Berkshire County, Braytonville. Bristol County, near Taunton. Dukes County, Gay Head. Essex County, Danvers, Danversport, Salisbury, and elsewhere. Franklin County, Turners Falls, Montague City, and elsewhere. Hampton County, Springfield, West Brimfield, and Williamsette. Hampshire County, Amherst, Easthampton, Northampton, and elsewhere. Middlesex County, Belmont, Cambridge, and Medford. Plymouth County, Bridgewater, Middleboro, Plymouth, and elsewhere. Suffolk County, Chelsea and Revere. Worcester County, East Brookfield, South Fitchburg, Still River, and elsewhere.

Clay (fire). Dug in Bristol County, at Fall River. Dukes County, Chilmark, Gay Head, and Mahonikey.

Clay (kaolin). Berkshire County, occurs 4 miles south of Clayton. Dukes County, occurs at Gay Head and elsewhere. Hampden County, dug at Blandford.

- Clay** (plastic). Barnstable County, occurs at Truro on Cape Cod. Dukes County, abundant in southeastern part of Chilmark and at Gay Head, Marthas Vineyard. Nantucket County, Nantucket. Plymouth County, beneath sands at Duxbury.
- Clay** (pottery). Dukes County, underlies district from Tisbury Brook westward to cliffs at Gay Head, Marthas Vineyard, mined at Gay Head. Essex County, mined at Danvers; shipped, not used locally.
- Coal** (anthracite). The Rhode Island coal field extends northeast into this State and small quantities of coal were mined years ago in Bristol County, at Mansfield; Norfolk County, at Wrentham; Plymouth County, at Middleboro and West Bridgewater. The coal is graphitic and not suitable for domestic fuel. The so-called coal at Worcester is graphitic phyllite and that on the bank of Agawam River at West Springfield is of somewhat the same character. *See also* Lignite.
- Corundum** (emery). Hampden County, has been mined in vicinity of Chester, at Sacket, Wright, and other mines, and with asbestos at Pelham.
- Cyanite**. Hampshire County, Chesterfield.
- Diabase**. *See* Trap rock.
- Diatomaceous earth**. Middlesex County, has been mined at Framingham.
- Emerald**. *See* Beryl.
- Emery**. *See* Corundum.
- Feldspar**. Hampden County, small quantities quarried near Blandford.
- Flagstone**. Berkshire County, Washington. Franklin County, Montague, red micaceous sandstone was quarried. Hampshire County, has been quarried at several places near Chesterfield and Goshen.
- Fluorspar**. Franklin County, occurs at Conway, Deerfield, and Northfield; Hampshire County, occurs in Southampton lead mine, near Northampton, and West Springfield.
- Fuller's earth**. Worcester County, produced at Lancaster.
- Galena**. Hampden County, was formerly mined at Montgomery. Hampshire County, argentiferous galena in masses to more than 1 foot in diameter were found in Southampton lead mine.
- Garnet**. Franklin County, many stones almost suitable for cutting on Northfield Mountain. Hampden County, fine crystals at Chester and Russell; large quantity was obtained from Russell.
- Gneiss**. Franklin County, has been quarried at Montague. Hampden County, Wilbraham and Monson. Worcester County, Boylston, Dudley, Milbury, Westboro, and Uxbridge.
- Granite**. Quarried at following places for building, monuments, paving, road metal, and other uses: Berkshire County, Becket, Chester (near), Lenox, Lenoxdale, and Stockbridge. Bristol County, Dartmouth and North Dartmouth, Fall River, New Bedford, and near Mattapoissett. Essex County, Annisquam, Beverly Farms, Gloucester, Haverhill, Lanesville, Lawrence, Lynn, Lynnfield, Manchester, Methuen, Newburyport, Peabody, Pigeon-cove, and Rockport. Franklin County, Shelburne Falls and Warwick. Hampden County, Chester and Monson. Hampshire County, Chesterfield, Northampton, and Pelham. Lowell County, Westford. Middlesex County, Dunstable, Graniteville, Hopkinton, Medford, North Acton, North Chelmsford, Somerville, Waltham, Westford, West Townsend, and Winchester. Norfolk County, East Weymouth, Quincy, East Milton, Gass place, West Quincy, and Wrentham. Plymouth County, Hingham. Suffolk County, Franklin Park and West Roxbury. Worcester County, Dud-

ley, Fitchburg, Leominster, Milford, North Milford, Northbridge, Oxford, Uxbridge, West Auburn, and Worcester. Principal quarrying centers are Becket, Milford, Quincy, and Rockport.

Graphite. Franklin County, impure bed about 5 feet wide reported at Charlemont. Worcester County, in gneiss at Sturbridge; has been mined.

Grindstones (millstones). A slate suitable for grindstones found at Malden and Quincy in the Cambridge slate. Berkshire County, millstone produced at Washington.

Hematite. Franklin County, has been mined in small way at Bernardston, Montague, and Warwick. Hampshire County, at Hawley.

Infusorial earth. *See* Diatomaceous earth.

Iron. *See* Brown iron ore, Chromite, Hematite, Magnetite, and Siderite.

Jade. Middlesex County, has been obtained at Framingham; possibly williamsite and not true jade.

Jasper. Essex County, Saugus. Franklin County, in mica slate at Conway. Middlesex County, has been mined at Framingham.

Kaolin. *See* Clay (kaolin).

Lead. *See* Galena.

Lignite (brown coal). Dukes County, Marthas Vineyard, 50 tons mined in 1908, none since.

Limestone (building). Berkshire County, quarried at Dalton and North Adams. Middlesex County, has been quarried at Acton, Carlisle, Chelmsford, Littleton, and Stoneham. Worcester County, has been quarried at Bolton.

Limestone (lime). Berkshire County, burned at Adams, Cheshire, and elsewhere.

Limonite. *See* Brown iron ore.

Magnetite (magnetic iron ore). Franklin County, considerable quantity of iron sand at Montague. Hampden County, large quantity impure at Warwick, considerable quantity has been mined at Sacket mine, Chester. Hampshire County, small bed at Plainfield.

Manganese. *See* Psilomelane, Pyrolusite, Rhodonite, and Wad.

Marble. Berkshire County, quarried at Alford, Ashley Falls, Lee, North, Adams, South Egremont, Stockbridge, West Stockbridge. Hampden County, Westfield.

Marl. Berkshire County, occurs at Lenox, Pittsfield, and Williamstown. Plymouth County, considerable quantity at Duxbury.

Mica (muscovite). Worcester County, at Beryl Hill, Royalston; has been prospected recently. Hampden County, occurs near Huntingdon. Hampshire County, occurs near Knightsville.

Mineral paints. Berkshire County, ocher and sienna were once worked at Williamstown. Franklin County, at East Whately.

Molybdenum. *See* Wulfenite.

Novaculite. Middlesex County, in beds of argillaceous slates at Malden. Norfolk County, Quincy. Suffolk County, Charlestown; not used.

Peat. Numerous deposits in swamps and bogs principally in eastern and central parts of State. Peat fuel has been produced in small quantities at East Lexington, North Rynham, and at other points. There is a plant for producing peat for fertilizer at East Lexington.

Psilomelane. Franklin County, in quartz veins at Conway. Hampshire County, with slate near Plainfield; not mined.

Pyrite (iron pyrites). Franklin County, Davis mine near Rowe, cupriferous; shipping. Worcester County, mined for copperas at Hubbardston.

- Pyrolusite.** Franklin County, in quartz veins at Conway. Hampshire County, in beds 3 feet thick at Plainfield.
- Pyrrhotite.** Franklin County, in veins in gneiss at Charlemont. Hampden County, in Chester emery mine.
- Quartz.** Berkshire County, quarry near Cheshire.
- Quartz diorite.** Quarried at several places in the eastern part of the State.
- Quartzite.** Berkshire County, quarried and crushed near Cheshire; marketed as silica.
- Rhodonite.** Berkshire County, at Sheffield. Franklin County, Conway and Hawley. Hampshire County, fine material in Silurian schist at Cumington; has been mined for ornaments.
- Road metal.** See Granite, Quartz diorite, and Trap rock.
- Sand (building).** Dug in following places: Berkshire County, at Williamstown and North Adams. Essex County, Lawrence and Methuen. Middlesex County, Watertown. Norfolk County, Walpole. Plymouth County, East Bridgewater and East Wareham. Suffolk County, Boston and Brighton. Worcester County, Worcester. Also at many other places.
- Sand (glass).** Berkshire County, large supply from granular quartzite at Cheshire and Washington. Dukes County, Tertiary sands abundant at Gay Head and vicinity of Marthas Vineyard, probably suitable for glass making.
- Sand (molding).** Dug in Berkshire County, at Cheshire. Plymouth County, East Bridgewater. Worcester County, Worcester.
- Sandstone.** Hampden County, quarried at East Longmeadow and Holyoke. Suffolk County, conglomerate with sandstone beds, quarried at Brighton, Dorchester, Jamaica Plains, and Roxbury in Boston; also in Brookline (Norfolk County).
- Schist.** Hampshire County, mica schist was quarried at Chesterfield and Goshen.
- Serpentine.** Beds extend across State from Rowe to Granville. Berkshire County, occurs at Windsor. Essex County, Newbury (precious serpentine), Lynnfield, quarried at Westfield. Franklin County, on north side of Deerfield River in Zoar. Hampden County, in west part of Westfield. Hampshire County, Middlefield and Hoosac Mountain. Middlesex County, Chelmsford and Littleton.
- Siderite (spathic iron ore).** Berkshire County, at West Stockbridge, with limonite ore. Dukes County, Gays Head, Marthas Vineyard, in clay. Essex County, Newburyport, with galena at the silver-lead mine in middle vein in small quantities. Worcester County, in mica slate in Sterling and Worcester.
- Sienna.** See Mineral paints.
- Silica.** Berkshire County, produced from quartzite near Cheshire.
- Slate.** Franklin County, Connecticut River slate quarried at Bernardston. Middlesex County, quarried at Somerville and Watertown. Norfolk County, slate formerly extensively quarried at Quincy. Worcester County, Harvard, Lancaster, Pepperell, and Shirley; has been quarried at Lancaster for roofing and gravestones.
- Soapstone.** Berkshire County, has been quarried at Windsor. Hampden County, Blandford. Hampshire County, fine bed associated with serpentine in northeast part of Middlefield. Middlesex County, Groton. Worcester County, Worcester.

Sphalerite (zinc blende). Essex County, has been mined at Newburyport lead mines. Hampshire County, principal ore in vein at Northampton. Worcester County, considerable quantity in mica slate at Sterling.

Spinel (ruby, pleonaste). Middlesex County, in limestone at Littleton and Boxboro. Worcester County, specimen once found at Bolton.

Syenite. Essex County, Salem and vicinity, Cape Ann.

Talc. Berkshire County, mined near Hoosac Tunnel and Dalton. Franklin County, mined and milled at Rowe and Zoar. Hampshire County, has been mined in Middlefield. Occurs in small quantity in several other places associated with serpentine.

Tetrahedrite (gray copper ore). Essex County, in lead mine, Newburyport, in small quantities with galena, pyrite, chalcopyrite, and siderite.

Tourmaline. Berkshire County, has been found in limestone at Dalton. Hampden County, at Sacket mine near Chester. Hampshire County, Huntington and asbestos mine at Pelham. Colored tourmaline crystals (not gems), 3 miles northwest of Goshen and $1\frac{1}{2}$ miles north of West Chesterfield.

Trap rock. Quarried in Essex County, at Beverly, Danvers, Lynn, Salem, and Salisbury. Franklin County, East Deerfield. Hampden County, Westfield and West Springfield. Hampshire County, Amherst. Middlesex County, Arlington, Medford, Newton, Somerville, Weston, Woburn, and Winchester. Norfolk County, Brookline, Cohasset, North Stoughton, and Quincy. Plymouth County, Hingham. Suffolk County, Boston, Franklin Park, and West Roxbury. Worcester County, Sterling.

Verde antique. Berkshire County, occurs at Becket. Essex County, at Newbury. Hampden County, at Westfield. *See also* Serpentine.

Wad. Berkshire County, occurs at Sheffield. Franklin County, Conway, Leverett, and Whately. Hampshire County, Chesterfield and Plainfield.

Whetstone. Hampshire County, mica schist quarried at Enfield and Huntington. Norfolk County, extensive quarries in northeastern part of Bellingham.

Wulfenite (molybdate of lead). Hampshire County, found in Manhan lead mine, Loudville, and in Southampton.

Zinc. *See* Sphalerite.

MICHIGAN.

- Agate.** Amygdulæ and pebbles found at many places along shore of Lake Superior are polished for jewelry. Agates from Petoskey are mainly polished limestone corals.
- Amethyst.** A few good specimens in trap rock of Keweenaw Point.
- Anhydrite.** Found in deep drillings at Benton Harbor, Ecorse, Grand Lake near Alpena, Kalamazoo, Manistee, Marine City, Mount Pleasant, Milan, Niles, and Oakwood, South Detroit.
- Asbestos.** Marquette County, occurs in serpentine rocks north of Ishpeming and near Republic.
- Asphalt.** In fissures and cavities of Trenton limestone near Rapid and Whitefish rivers in northern peninsula.
- Bromine.** Midland County, produced as a by-product from brine at Midland. Occurs in small but appreciable quantities in brines from the Marshall sandstone in central Michigan. Formerly produced in Crawford County at Grayling. Gratiot County, St. Louis (idle). Huron County, Harbor Beach. Isabella County, Mount Pleasant. Saginaw County, St. Charles and Saginaw. A maximum of 2,000 parts per million in deep copper mine waters. *See also* Salt.
- Brown iron ore** (bog iron ore, limonite). Occurs locally in considerable quantities in the iron-bearing districts of the western part of the northern peninsula. Bog iron ore is common in many parts of the State as a surface accumulation in springy or swampy places but is not utilized.
- Celestite.** Monroe County, occurs near Maybee in scattered masses and in geodes in the Detroit River dolomite. Wayne County, near Rockwood, in masses in the Sylvania sandstone. Possibly of limited commercial importance, being quarried near Rockwood with glass-sand rock.
- Cement material** (Portland). Limestone for Portland cement is quarried in Alpena County, at Alpena; Eaton County, Bellevue; Emmet County, Petoskey. Limestone also occurs but is not used for Portland cement in the following counties: Alpena County, Rockport and Bolton, and enormous deposits occur in Alpena and Maple Ridge townships. Arenac County, between Omer and Twining. Charlevoix County, Charlevoix and near Bay Shore. Emmet County, at different points along south shore of Little Traverse Bay. Cheboygan County, vicinity of Afton and Le Grand and at Mill Creek. Huron County, Bay Port and Sebawaing. Jackson County, near Portage River, 5 or 6 miles north of Jackson and also 1 mile northeast of Parma. Monroe County, near Dundee. Newaygo County, Newaygo. Presque Isle County, in vicinity of Calcite, Rogers, and Onaway, and at many other points in the county. Wayne County, at Sibley, near Trenton, and at Belleville. Glacial clay is used in manufacture of cement in Branch County near Coldwater and Union City; Genesee County at Fenton; Hillsdale County at Mosherville; Lenawee County at Cement City, and Washtenaw County at Fourmile Lake, near Chelsea. Other deposits of suitable glacial clay occur at many points in the State. Marl, more largely used in cement manufacture, is obtained from a great number of localities distributed over the entire State. The more important localities are in Alpena, Antrim, Barry, Branch, Cass, Crawford, Genesee, Hillsdale, Jackson, Kent, Lenawee, Livingston, Manistee, Mason, Newaygo, Ogemaw, St. Joseph, and Washtenaw counties. In Branch County, at Coldwater, Quincy, Union City, and near Bronson. Genesee County, at Fenton. Hillsdale County, at Mosherville. Lenawee County, at Cement City. Washtenaw County, at

Fourmile Lake near Chelsea. Shale is quarried for cement manufacture in Alpena County at Paxton, 7 miles north of Alpena; Branch County at Coldwater, near Union City, and (formerly) at Bronson; Charlevoix County, near East Jordan; Eaton County at Bellevue; Newaygo County at Newaygo. *See also* Limestone.

Chlorastrolite. Keweenaw County, collected and cut as gem stone at Isle Royal and occasionally found near Porcupine Mountain and Mandan. Keweenaw Point, cut as a gem.

Chrysocolla. Keweenaw County, at Allouez mine. Ontonagon County, Algoma mine at Lake Mine.

Clay (brick). Obtained from small local deposits of glacial clays over greater part of State. Important developed deposits occur in Ingham County near Lansing, Ionia County at Ionia, Saginaw County at Paines and Saginaw, and Wayne County in Springwells and West Detroit. Less developed but important deposits occur in Chippewa, Genesee, Gratiot, Huron, Lenawee, Macomb, Monroe, Ontonagon, and Sanilac counties. Huron County, Sebawaing. Jackson County, Jackson. Kalamazoo County, Kalamazoo. Shiawassee County, Corunna. Wayne County, Detroit. Wexford County, Harriette. Clay (or very soft shale) suitable for sewer pipe, vitrified brick and tile, conduit, and fireproofing is utilized on a large scale at Grand Ledge, Eaton County, and Jackson, Jackson County, and occurs in connection with coal in Saginaw and Bay counties at West Bay City. Genesee County, at Flushing. *See also* Cement material and Shale.

Clay (fire). So-called "fire clay" (soft shales) is obtained in Eaton County at Grand Ledge and Eaton Rapids; Jackson County in Jackson, and in Spring Arbor coal mines at Batchelder Place for sewer pipe, vitrified brick and tile, conduit, and fireproofing; and similar clays also occur in association with coal beds near Owosso and Corunna, Shiawassee County, and in Bay and Saginaw counties. *See also* Shale.

Clay (pottery). Ionia County, glacial drift used for pottery at Ionia and near Detroit. Jackson County, 5 miles west of Jackson, not worked. Wahtenaw County, glacial drift used for pottery at Ann Arbor. Wayne County, at Detroit. Wexford County, at Harriette, not worked. Other deposits of glacial clay occur at several places—for example, 5 miles west of Jackson, in the vicinity of Saginaw and Bay City, and near Alpena.

Clay (slip). Ontonagon County, large deposits mined at several places at and near Rockland. Wexford County, Harriette, undeveloped.

Coal (bituminous). Coal basin covers an area of approximately 11,000 square miles. Principal developments in the eastern portion of the field and in a line from Bay City, Bay County, south to Jackson, Jackson County. More important operations in Bay and Saginaw counties, near Bay City, Saginaw, and St. Charles, and in Tuscola and Genesee counties, though coal is mined also in Clinton, Eaton, Ingham, and Shiawassee counties.

Copper (native). Michigan has produced about 30 per cent of the output of copper from the United States since 1845. The Lake Superior region is unique in that a large output is derived from native copper. Large quantity mined in Houghton, Keweenaw, and Ontonagon counties, Lake Superior region, in the northwestern part of the northern peninsula. Copper was formerly mined on Isle Royal, Lake Superior. "Float" copper and nuggets more or less altered to carbonates occur in masses scattered throughout the glacial drift.

Copper minerals. See Chrysocolla and Mohawkite.

Datolite. From copper mines of the northern peninsula, where it occurs in crystals and porcelain-like masses in amygdaloidal traps of the copper district; cut as a gem.

Diamond. Berrien County, one found at Buchanan in glacial drift.

Feldspar. Deposits occur in pegmatite dikes in granites in several localities in the northern peninsula—for example, near Republic, Marquette County, and northeast of Gogebic, Ontonagon County. Undeveloped.

Flagstone. Huron County. Jackson County, has been quarried at Napoleon.

Galena. Occurs in small amounts at many points in Marquette County. A few tons mined over 50 years ago at the Holyoke silver-lead mine north of Negaunee.

Gas. See Natural gas.

Gold. Marquette County, Ropes mine, near Ishpeming, T. 48 N., R. 27 W., free gold with auriferous pyrite, chalcopyrite, and other minerals. Also several prospects in T. 48 N., R. 28 W., and T. 49 N., R. 27 W. Occurrence of gold in glacial drift reported at many places, particularly in the vicinity of Gaylord, Otsego County; Atlanta, Montmorency County; and near Alcona, Alcona County. Scattered grains and small nuggets occasionally found in sand and gravel banks.

Granite. Abundant in the western part of the northern peninsula. Quarried to a small extent in Dickinson County prior to 1910.

Graphite. Baraga County, graphitic slate, quarried about 10 miles east of and milled at L'Anse for paint manufacture.

Gravel (concrete and road metal). Occurs in great abundance in the glacial deposits over most of the State, in ridges or hogbacks, irregular hills, and outwash plains. Greatest developments in Berrien, Calhoun, Genesee, Ingham, Jackson, Kalamazoo, Kent, Lenawee, Macomb, Manistee, Mason, Oakland, Ottawa, and Washtenaw counties, along the lake shores in the vicinity of Benton Harbor, Manistee, and Point Aux Barques, and in St. Clair and Saginaw rivers.

Grindstone. Huron County, quarried in the Marshall sandstone at Port Austin, Eagle Mills, and Grindstone City, and formerly near Ubly. Sanilac County, quarried in Marshall sandstone in Austin Township.

Gypsum. Iosco County, mined at Alabaster. Kent County, near Grand Rapids and Grandville. Occurs also at shallow depths in several workable beds in northern Arenac County, Iosco County, Kent County, and southeast Ogemaw County, not mined. Mackinac County, deposits of probable commercial importance near Point Aux Chenes, 7 miles west of St. Ignace, and in the vicinity of St. Martins Bay, not mined at present. See also Anhydrite.

Hematite. The most important iron ore of the State; mined at the following places: Baraga County, west of Michigamme. Dickinson County, Iron Mountain, Loretto, Metropolitan, Norway, Quinnesec, Randville, Vulcan, and Waucedah. Gogebic County, Bessemer, Ironwood, Ramsay, Verona, and Wakefield; new explorations 5 miles north of Marenisco. Iron County, Alpha, Amasa, Crystal Falls, Iron River, Mansfield, Palatta, Stambaugh, Wakefield; new mines being opened at Alpha and Mastodon. Marquette County, Champion, Diorite, Gwinn, Humboldt, Ishpeming, Michigamme, Negaunee, North Lake, Palmer, Princeton, and Republic.

Iron. See Brown iron ore, Hematite, Magnetite, Marcasite, and Pyrite.

Jaspilite. Marquette County, formerly quarried for road metal at Ishpeming, Negaunee, and Palmer.

Limestone. For use in sodium bicarbonate, for soda ash, beet sugar, carbide, and agricultural purposes. Extensively quarried at Alpena County, Alpena; Charlevoix County, Charlevoix; Cheboygan County, Afton and Mill Creek; Delta County, Nicholsonville; Eaton County, at Bellevue; Mackinac County, Hendricks and Fiborn Quarry; Wayne County, Sibley. *See also* Cement material.

Limestone (building). Quarries in Alpena County, at Alpena; Arenac County, Omer; Charlevoix County, Charlevoix; Cheboygan County, Afton; Chippewa County, near Drummond, Drummond Island; Delta County, near Escanaba, Groos, Hyde; Emmet County, small quantity at Petoskey; Huron County, Bay Port and Pigeon; Kent County, Grand Rapids; Mackinac County, Fiborn Quarry and Ozark; Marquette County, Marquette; Menominee County, Menominee; Monroe County, Dundee, Ida, Maybee, Monroe, Newport, Ottawa Lake, and Temperance; Oakland County, Clarkston; Presque Isle County, Calcite and Onaway, near Rogers; Schoolcraft County, Blaney and Manistique. Much of the building stone is produced only incidentally to other limestone products.

Limestone (crushed stone). Quarried and crushed in Alpena, Charlevoix, Cheboygan, Delta, Emmet, Huron, Mackinac, Menominee, Monroe, Presque Isle, Oakland, Schoolcraft, and Wayne counties, for road metal, concrete, and ballast.

Limestone (flux). Quarried on large scale in Alpena, Charlevoix, Cheboygan, Emmet, Mackinac, Monroe, Presque Isle, and Schoolcraft counties.

Limestone (lime). Quarried and burned in Alpena, Charlevoix, Cheboygan, Eaton, Emmet, Huron, Jackson, Kent, Monroe, Mackinac, Sanilac, Schoolcraft, and Wayne counties. Formerly lime was burned for local use in a large number of places. An abundance of suitable limestone occurs also in Chippewa, Delta, and Luce counties.

Limonite. *See* Brown iron ore.

Magnetite. Occurs in small quantities in metamorphosed iron formation and associated schists, particularly in the Marquette Iron Range in Pheo-keegobebic Range.

Manganese ore. Manganiferous iron ore mined in the Iron River, Crystal Falls, and in Gogebic district; occurs near Copper Harbor, Keweenaw Point, not now mined.

Marble. Formerly quarried for building purposes near Metropolitan, Dickinson County; now quarried and ground for paint filler and other uses. Verde antique variety reported in Marquette County north of Marquette and Ishpeming, and in Iron County north and east of Crystal Falls.

Marcasite. Bay County, abundant in coal seams or associated shales in several mines in Lower Verne coal bed. Huron County, common in black shales near Antrim, abundant in coal mines of Sebawaing, and in shales at Point Aux Barques lighthouse; formerly mined in connection with coal at Sebawaing. *See also* Pyrite.

Marl. Large deposits in many inland lakes used to a small extent in agriculture. Antrim County, mined for polishing powder and burned for lime at Lake Wetzell and other places. Monroe County, was formerly mined for polishing powder north of Plaisance Creek. *See also* Cement material.

Mica (muscovite variety). Occurs in small quantities in the vicinity of Republic, Marquette County, and Bessemer, Gogebic County.

Mohawkite. Houghton County, in the Mohawk Copper mine in fissure vein.

Natural gas. Macomb, Oakland, and St. Clair counties; local consumption; also small amount obtained from sand and gravel beds in glacial drift in Manistee, Washtenaw, and Wayne counties.

Novaculite. *See* Whetstone.

Oil. *See* Petroleum.

Oil shale. *See* Shale.

Peat. Peat fuel produced in Hillsdale County, at Montgomery, and Kalamazoo County at Kalamazoo. Large deposits of peat throughout the State, especially in the northern peninsula. Important deposits occur in Chippewa, Clare, Clinton, Eaton, Jackson, Kalamazoo, Kent, Lenawee, Luce, Mackinac, Mecosta, Ottawa, St. Clair, St. Joseph, Sanilac, Shiawassee, Tuscola, Van Buren, and Washtenaw counties. In the southern peninsula has been utilized to slight extent in manufacture of fuel, paper, and peat litter.

Petroleum. St. Clair County, small production at Port Huron, from Dundee limestone; formerly moderate production from small wells in Allegan County, at Allegan, and Saginaw County, at Saginaw.

Pyrite. Occurs in nodules, masses, and seams in iron ores of the northern peninsula; in coal beds and associated black shales in central Michigan. Alpena County, in black shale at Paxton. Charlevoix County, Norwood, as disseminated crystals and masses in limestone. Eaton County, at Bellevue. Huron County, Bayport. Formerly mined in connection with coal at Sebawaing (*see* Marcasite) and in Monroe County.

Quartz. Marquette County, mined for abrasive and wood filler at Ropes mine, near Ishpeming; occurs as veins in igneous and metamorphic rocks.

Quartzite. Formerly utilized for road metal and as a lining for converters used in the manufacture of Bessemer steel. Abundant in many localities in the iron-bearing districts of the northern peninsula, especially Marquette County.

Road metal. *See* Gravel, Jaspillite, Limestone, Quartzite, and Trap rock.

Salt. From natural brine obtained from the Marshall sandstone in Saginaw Valley at Bay City, Midland, Mount Pleasant, Saginaw, and St. Charles. Dissolved from rock-salt beds at Delray, Detroit, Ecorse, Marine City, Port Huron, St. Clair, and Wyandotte. Manistee County, Manistee, Filer City, and Eastlake. Mason County, at Ludington. St. Clair County, Marine City and Port Huron. Wayne County, Delray, Detroit, Ecorse, and Wyandotte. Rock salt mined only in Wayne County, at Oakwood shaft, South Detroit, just outside city limits. Large rock-salt beds exist in southeastern Michigan from Wyandotte, Wayne County, to Port Huron, St. Clair County; also in Alpena and Presque Isle counties, and much smaller beds in Manistee and Mason counties. Formerly most of the salt produced in the State was manufactured in Saginaw Valley, in connection with the lumber industry, from natural brines of the Marshall sandstone. The strong pure brines of the Berea sandstone were formerly utilized for salt at several places in Arenac, Huron, and Iosco counties. *See also* Bromine.

Sand (building). Abundant throughout the State.

Sand (fire). Berrien County, dug at Benton Harbor.

Sand (glass). Monroe County, Sylvania sandstone quarried near Steiner. Wayne County, near Rockwood. Shipped to Saginaw for glass-making and abrasive purposes.

Sand (molding). Occurs generally in small deposits or "pockets" at many places in the State and is utilized by local foundries and manufacturing concerns. Produced chiefly in Berrien County at St. Joseph and Niles; Calhoun County at Battle Creek; Eaton County at Dimondale; Ingham County at Lansing; Tuscola County at Cass City, and in Macomb, Manistee, and Oakland counties. Occurs but is not utilized in Delta, Genesee, Kent, Marquette, and Wayne counties.

Sandstone. Quarried in Baraga County, numerous quarries at L'Anse. Calhoun County, Battle Creek. Eaton County, Grand Ledge. Genesee County, Flushing. Houghton County, Jacobsville. Huron County, Caseville, Eagle Mills, Grindstone City, and Port Austin. Ionia County, Lyons. Jackson County, Springport, Parma, Sandstone, and Napoleon. Keweenaw County, Isle Royal. Marquette County, Marquette. Monroe County, Ottawa Lake. Ottawa County, Holland. Formerly quarried at many places in Alger County. *See also* Grindstone and Whetstone.

Sandstone (glass). *See* Sand.

Shale. Largely quarried for cement materials. Also quarried for manufacture of sewer pipe, vitrified brick, and tile conduit and fireproofing in Bay County, near Bay City. Charlevoix County, East Jordan. Eaton County, Grand Ledge. Genesee County, Flushing. Ionia County, Ionia. Ingham County, Williamston. Jackson County, Jackson, and Shiawassee County, Corunna. Important deposits occur in Alpena, Antrim, Branch, Charlevoix, Cheboygan, Delta, Huron, Presque Isle, and Sanilac counties, and also in association with coal beds in Saginaw Valley. *See also* Cement material.

Shale (oil). Devonian. Underlies large southern peninsular portion of the State, but mostly at considerable depth.

Silver (native). Small quantity mined with copper in Houghton, Keweenaw, and Ontonagon counties, Lake Superior region. Formerly mined on Silver Islet. Associated with copper and made into so-called "half-breed" jewelry.

Slate. Large deposits in association with the iron-bearing formations in the northern peninsula. Black slate formerly quarried for roofing material in Baraga County at Arvon. Large deposits of black slate reported at other places in Baraga County.

Specularite. Occurs with hematite. *See also* Hematite.

Strontium. *See* Celestite.

Sulphur. Native sulphur found in small quantities associated with celestite in Monroe County near Maybee and in Wayne County near Rockwood.

Talc. Talcose schists, common in green schists in pre-Cambrian rocks of iron-bearing ranges of the northern peninsula. Not known to be of commercial grade.

Thomsonite. Keweenaw Point amygdules and Lake Superior shore pebbles; polished for jewelry.

Trap rock. Occurs in abundance in several localities in the western part of the northern peninsula. Quarried for road metal and concrete in Marquette County near Negaunee and Marquette and on Copper Range, and also produced in connection with copper mining in Keweenaw Peninsula.

Whetstone. Huron County, quarried at Grind Stone City, Port Austin, and elsewhere. Ontonagon County, novaculite along Carp River, between Jackson Forge and Teal Lake. Marquette County, was formerly quarried.

Zeolites. Houghton and Keweenaw counties, important gangue mineral in Michigan copper ores. *See also* Chlorastrolite.

MINNESOTA.

- Brown iron ore** (limonite). St. Louis County, large production from Mesabi and Vermilion ranges. Large quantities in contact plane of Cretaceous on Silurian and Devonian, as in Brown, Lesueur, Fillmore, and other counties; also in Cuyuna district.
- Calcite.** Houston County, large mass at sand quarry near Caledonia suitable for quicklime.
- Catlinite** (pipestone). Pipestone County, in many localities; largely worked into articles of use and ornament.
- Cement material** (natural). Blue Earth County, "Lower Magnesian" (Ordovician) limestone used at Mankato. Mower County, Austin.
- Cement material** (Portland). Fillmore County, "Trenton" limestone in vicinity of Wykoff and Spring Valley; not used.
- Chalcocite** (copper glance). Chisago County, occurs in Taylors Falls, argenteriferous, and at Pigeon Point; of little importance. Pine County, near Pine City on Snake River.
- Chalcopyrite** (copper pyrites). Itasca County, occurs in Rainy Lake region. St. Louis County, near Tower.
- Clay** (brick). Utilized in nearly every county in the State.
- Clay** (fire). Brown County, has been dug at New Ulm. Redwood County, Redwood Falls. Steele County, dug 1 mile east of Owatonna.
- Clay** (kaolin). Occurs in Cretaceous strata in Minnesota River valley; also in Itasca County.
- Clay** (pottery). Dug in Blue Earth County, near Mankato. Brown County, New Ulm. Goodhue County, extensively dug at Red Wing. Hennepin County, Northtown. Carver County. Steele County, 1 mile east of Owatonna. Itasca County, Cretaceous clays suitable for pottery; not used.
- Clay** (sewer pipe). Goodhue County, Claybank.
- Copper** (native). Keweenawan series ("Cupriferous") extends into northeastern part of the State in Chisago, Cook, Pine, and St. Louis counties; of no commercial importance to date.
- Copper minerals.** See Chalcocite and Chalcopyrite.
- Feldspar.** Lake County, considerable quantity quarried, ground at Duluth. St. Louis County, at Point Corundum near Duluth, and at Rices Point.
- Flagstone.** Blue Earth County, Mankato, on Minnesota River. Brown County, New Ulm. Lesueur County, Ottawa and Kasota. Nicollet County, Redstone; and valley of Minnesota (red quartzite). Magnesian limestone on Mississippi, from Winona, Winona County, to Hastings, Dakota County, and thence to Stillwater, Washington County.
- Galena.** Itasca County, has been mined in Rainy Lake region. Small quantities here and there in "Trenton" limestone in southern part of State.
- Gas.** See Natural gas.
- Gneiss.** Redwood County, quarried at Redwood Falls.
- Gold** (lode). Beltrami County, occurs in many prospects in Archean rocks around Lake of the Woods and near Rat Portage. Itasca County, was mined in Rainy Lake region. St. Louis County, occurs near Vermilion Lake, in quartz in talcose slate, and with pyrite; workings abandoned.
- Gold** (placer). Fillmore County, small amounts in drift of Spring Valley and Jordan. Olmsted County, along streams. Wabasha County, Chester, and elsewhere.

Granite. Quarried in Benton County, East St. Cloud, Sauk Rapids, and Watab. Bigstone County, Ortonville. Houston County, Caledonia. Itasca County, Giants Range north of Mesabi Range, also north of Net Lake and elsewhere. Kanabec County, Mora and Warman. Lac qui Parle County, near Ortonville, Bigstone County. Lake County, Two Harbors. Morrison County, Little Falls. Redwood County, North Redwood. Renville County, Morton. St. Louis County, Duluth. Sherburne County, near Haven. Stearns County, Rockville, St. Cloud, and Sauk Center.

Hematite (red iron ore). St. Louis County, large quantity, many mines in Mesabi, Vermilion, and Cuyuna ranges. Shipments amount to millions of tons annually.

Hematite (specular iron ore). Mined in Cook and Itasca counties.

Iron. See Brown iron ore, Hematite, Magnetite, and Pyrite.

Kaolin. See Clay.

Lead. See Galena.

Lignite. Itasca County, occurs in Rainy Lake region; of doubtful value.

Limestone (building). Blue Earth County, important quarries of magnesian limestone at Mankato. Cottonwood County, limestone was quarried at Selma and Delton for foundations and walls. Lesueur County, magnesian limestone, important quarries at Kasota.

Limestone (crushed stone). Quarried in Anoka County, at Fridley. Blue Earth County, Judson and Mankato. Dakota County, Mendota, Farmington, and Lakeville. Dodge County, Mantorville and Wasioja. Fillmore County, Chatfield, Fillmore, Peterson, Preston, Rushford, Washington, and Wykoff. Goodhue County, Cannon Falls, Frontenac, Pine Island, Red Wing, and Wanamingo. Hennepin County, Minneapolis. Houston County, Caledonia and Freeburg. Lesueur County, Kasota and Ottawa. Nicollet County, St. Peter. Olmsted County, Rochester. Ramsey County, St. Paul. Rice County, Cannon City and Faribault. Scott County, Louisville. Sibley County, Faxon and Jessenland. Steele County, Clinton Falls, near Owatonna. Traverse County, Austin. Wabasha County, Mazeppa, Minneiska, and Plainview. Washington County, Stillwater. Winona County, Fresbach, Elba, Fairwater, Homer, Lamaille, Lewiston, Minnesota City, Rolling Stone, St. Charles, Stockton, and Winona.

Limestone (hydraulic). Dodge County, Galena limestone at Mantorville, has properties of hydraulic limestone.

Limestone (lime). Limestones widely distributed and burned in many counties in the State.

Limonite. See Brown iron ore.

Magnetite (magnetic iron ore). St. Louis County, mined in Cuyuna, Mesabi, and Vermilion districts. Great quantities of lean magnetic iron-bearing rocks occur at east end of Mesabi Range, in Gunflint district, where Duluth gabbro cuts overlying formation.

Manganese ore. Crow Wing County, near Crosby (mined).

Marl. Very frequently under the peat bog bordering many small lakes. Has been burned for lime.

Mica. Itasca County, occurs in pegmatite dikes in Rainy Lake region.

Mineral paint. Redwood County, kaolinized gneiss and granite was used for paint at Redwood Falls.

Natural gas. Small quantities found in Big Stone, Freeborn, and Waseca counties, and elsewhere in glacial drift; little importance.

- Nickel.** Cook County, small quantity in gabbro.
- Peat.** Anoka County, Coon Creek, formerly manufactured into fuel; many other localities.
- Pyrite** (auriferous). Has been mined in Cook County, at Pigeon Point, Lake Superior, with chalcopyrite. Itasca County, Rainy Lake region. St. Louis County, Vermilion Lake.
- Quartzite.** Pipestone County, quarried near Pipestone. Occurs in Brown County at New Ulm, and in Cottonwood, Pipestone, Rock, and Watonwan counties; a very hard and durable stone.
- Road metal.** *See* Granite, Limestone (crushed stone), Sandstone (concrete, crushed stone), and Trap rock.
- Sand** (building). Dug in Dakota County, at South St. Paul. St. Peter sandstone furnishes sand for mortar in several places. Fillmore County, St. Peter and Jordan sandstones, suitable for mortar sand, at Fillmore and Rushford. Goodhue County, Red Wing. Hennepin County, Minneapolis. Houston County, St. Peter and Cambrian sandstones quarried near Caledonia and Union. Nicollet County, Courtland. Rice County, near Northfield. Rock County, Luverne. St. Louis County, Lake Superior, near Duluth. Scott County, Jordan. Washington County, Stillwater. Winona County, Winona.
- Sand** (filter). Goodhue County, dug at Red Wing.
- Sand** (molding). Dug in Pine County, at Kerrick. Ramsey County, St. Paul. Rice County, near Northfield. St. Louis County, Duluth. Washington County, Stillwater.
- Sandstone** (building). Pine County, quarried at Sandstone on Kettle River; fine quality.
- Sandstone** (concrete, crushed stone). Quarried in Brown County, at New Ulm. Chisago County, at Taylors Falls. Hennepin County, near Fort Snelling. Pine County, Banning. Pipestone County, Jasper and Pipestone. Rock County, Luverne. St. Louis County, Duluth, near Fond du Lac. Scott County, Jordan along Sand Creek. Winona County, Dresbach.
- Silver.** Cook County, small quantity found in Animikie rocks.
- Slate** (roofing). Has been quarried in Carlton County, at Thomson. St. Louis County, a few miles west of Duluth. In favorable situations and large quantity at Vermilion Lake and other points in northeastern Minnesota.
- Specularite.** *See* Hematite (specular iron ore).
- Sphalerite** (zinc blende). Itasca County, was mined in Rainy Lake region. Washington County, Stillwater. Small scattered masses at several places in "Trenton" limestone in southeastern Minnesota.
- Trap rock.** Quarried in Chisago County at Taylors Falls and in St. Louis County at Duluth.
- Tripoli** (polishing powder). Washington County, occurs at Stillwater between bluffs of Browns Creek.
- Zinc.** *See* Sphalerite.

MISSISSIPPI.

- Brown iron ore** (limonite). Benton, Lafayette, Marshall, and Tippah counties, in considerable quantities associated with siderite. Tishomingo County, Iuka Lake, not used; common in orange sand but unimportant.
- Burrstone.** Attala, Carroll, Leake, and Neshoba counties furnish hard quartzitic sandstone used locally for building stone.
- Cement material.** Suitable material for Portland and natural cement is found in the northeastern part of the State, in Alcorn, eastern Chickasaw, Clay, Itawamba, Lee, western Lowndes, western Monroe, Noxubee, Oktibbeha, Prentiss, and Tishomingo counties and in a belt extending nearly east and west across the center of the State, including parts of Clarke, Hinds, Jasper, Rankin, Scott, Smith, Warren, Wayne, and Yazoo counties; none produced.
- Clay.** Clay is found in nearly every county in the State. "Buckshot" clay burned and used as road metal at Clarksdale and elsewhere, Coahoma County.
- Clay** (brick). Brick is made locally from clay found in various formations in the following counties: Adams, Alcorn, Amite, Attala, Chickasaw, Claiborne, Clarke, Clay, Coahoma, Copiah, Covington, De Soto, Forrest, Franklin, Greene, Grenada, Hancock, Harrison, Hinds, Holmes, Jackson, Jones, Lafayette, Lamar, Lauderdale, Lee, Leflore, Lincoln, Lowndes, Madison, Monroe, Montgomery, Newton, Noxubee, Oktibbeha, Panola, Pike, Pontotoc, Prentiss, Quitman, Smith, Sunflower, Tallahatchie, Tate, Tippah, Tunica, Union, Warren, Washington, Wayne, Webster, Wilkinson, Winston, Yalobusha, and Yazoo.
- Clay** (cement). Tishomingo County, Yellow Creek and Mingo.
- Clay** (fire). Fire brick is made in Jefferson County at Stonington. Marshall County, Holly Springs. Smith County, Taylorville.
- Clay** (kaolin). Itawamba County, Fulton. Tishomingo County, Iuka.
- Clay** (pottery). Pottery is made from the clays in Harrison County, at Biloxi. Itawamba County, at Miston and vicinity. Jefferson County, at Stonington. Lauderdale County, at Lockhart and Lauderdale. Marshall County, Holly Springs. Tishomingo County, Lake Coma. Webster County, Mathiston. Winston County, western part. Excellent clays for pottery, stoneware, and terra cotta abundant at Oxford, Lafayette County; not used at present.
- Gypsum.** Rankin County near Cato, block 10 by 12 inches once found; no value. Gypsiferous marls in Attala, Carroll, Hinds, Holmes, Leake, Madison, Rankin, and Scott counties.
- Iron.** See Brown iron ore and Siderite.
- Lignite** (brown coal). Found over a large part of the State. Of possible future importance in Benton, Calhoun, Choctaw, Holmes, Itawamba, Kemper, Lafayette, Lauderdale, Monroe, Panola, Pontotoc, Scott, Tate, Webster, Winston, and Yalobusha counties. No production at present. Thickest beds are 20 inches near Reedsville, Itawamba County, and two beds each 5 feet thick, separated by less than 2 feet of clay, at Tchula, Holmes County.
- Limestone.** Quarried for building material for local use in Clarke, Jasper, Noxubee, Smith, and Wayne counties. Burned for lime in Jasper, Rankin, and Wayne counties.
- Limestone** (hydraulic). See Cement material.

Limonite. *See* Brown iron ore.

Marl. Marls suitable for local use as fertilizer are found in Attala, Carroll, Chickasaw, Claiborne, Clarke, Hinds, Holmes, Leake, Lowndes, Madison, Pontotoc, Rankin, Scott, Smith, Tippah, Tishomingo, Warren, and Wayne counties.

Millstone. *See* Burrstone.

Ocher (mineral paint). Tishomingo County, extensive beds of red ocher, some yellow ocher near Iuka; was formerly mined and shipped.

Road metal. Burned clay used at Clarksdale, Coahoma County. Clay suitable for this use found throughout the Yazoo delta region. Crushed limestone from Tishomingo County used locally. Also chert gravel and beds of fine chert near Tennessee River in northeastern Tishomingo and in Itawamba counties. Other suitable material is burrstone of Attala, Clarke, Grenada, Lauderdale, Leake, Montgomery, Neshoba, and Newton counties.

Sand (building). Dug in Carroll County at Carrollton; Forrest County at Hattiesburg; Hinds County at Jackson; Warren County near Vicksburg; Washington County at Greenville. Immense quantity at Oxford, Lafayette County, and in most of the north-central counties where the Wilcox group outcrops.

Sand (glass). Hinds County, occurs at Byram and Jackson and elsewhere along Pearl River; Jackson County, large deposit of dune sand on Horn Island, formerly used; Tishomingo County, large deposit of fine-grained silica 1 mile from Tennessee River now worked.

Sand (molding). Dug in Alcorn County at Corinth; Hinds County at Jackson.

Sandstone. Attala, Carroll, Leake, and Neshoba counties, burrstone locally used. Claiborne County, sandstones of Grand Gulf region of inferior quality. Hinds County, has been quarried near Raymond. Lafayette, Marshall, Tippah, and Yalobusha counties, some stone suitable for building. Rankin County, quarried at Starr. Tishomingo County, 3 miles northeast of Tishomingo, on railroad, new quarry of excellent building stone just opened along Big Bear Creek; Bay Spring, Gardner, on Rock Creek, and below Scott's mill.

Siderite. Notable deposits of iron carbonate have recently been discovered in Benton, Lafayette, Marshall, and Tippah counties. Pig iron has been produced from this iron field at Winborn.

MISSOURI.

- Anglesite.** Jasper County, Joplin district. In fine tabular crystals on galena in lead and zinc mines in southeast and southwest Missouri.
- Asphalt** (bitumen, mineral pitch). Barton County, occurs impregnating sandstone and is quarried near Liberal. Lafayette County, in small quantity near Higginsville.
- Azurite** (blue carbonate of copper). Crawford, Dent, and Phelps counties, found in small quantities in many of the hematite deposits. Franklin County, at one time mined and smelted near Sullivan.
- Barite** (heavy spar). Cole County, mined at Eugene, Henley, and Hickory Hill. Franklin County, at Morrellton and St. Clair. Jefferson County. Miller County, at Etterville and Bagnell. Morgan County, at Versailles. St. Francois County, Blackwell. Washington County, Barytes, Cadet, Fertile, and elsewhere. Occurs as important gangue of central and southeastern lead regions.
- Brown iron ore** (limonite). Franklin County, mixed with ocher and chert in cavities at Bowlen Bank, Iron Hill, and Stanton Hill Bank, dug from pits near Moselle, and shipped; Howell County, Lamons mine, near West Plains, mined and shipped to lead smelters in Kansas City; Madison County, Mine Lamotte, formerly used mainly for flux. Found chiefly in Cambrian limestones widely distributed over counties of the southern and central parts of the State; has been mined in numerous localities.
- Cadmium.** *See* Greenockite.
- Calamine** (silicate of zinc). Jasper County, mined in Joplin district. Lawrence County, at Aurora; Newton County, at Granby.
- Calcite.** Jasper County, occurs in Joplin district, museum specimens.
- Cement** (natural). Clinton County, shales and limestone suitable for natural cement in vicinity of Plattsburg.
- Cement material** (Portland). Ordovician and Devonian limestones and shales in narrow belt along eastern border of State from Ralls County on north to Cape Girardeau County on south. Mississippian limestones over extensive areas in northeast and southwest Missouri. Pennsylvanian ("Coal Measures") limestones and shales in northern and western parts of State best adapted for Portland cement. Plants at Cement City, east of Kansas City; Prospect Hill and Continental, near St. Louis; and Cape Girardeau.
- Cerussite** (carbonate of lead). Jasper County, mined in Joplin district. Newton County, Granby district; and in other mines in Dade, Greene, Lawrence, and Madison counties.
- Chalcocite** (copper glance). Occurs in subordinate quantity in Crawford County, in Sullivan mines. Shannon County, Slater and Tyrell mines near Eminence. Ste. Genevieve County, in Cornwall mines.
- Chalcopyrite** (copper pyrites). Franklin County, irregularly distributed through clay at Sullivan mine. Madison County, disseminated through limestone at Mine Lamotte, and mined at Mine Lamotte and Fredericktown. Shannon County, mined at Slater and Jerktail mines. Ste. Genevieve County, mined at Ste. Genevieve mines. Widely distributed in small quantities in Joplin district, Jasper, Lawrence, and Newton counties.
- Clay** (brick). Widely distributed and utilized in nearly every county of the State.

Clay (brick shale). Barry County, numerous beds of shale at Golden City and elsewhere. Camden County. Cape Girardeau County, in Pennsylvanian ("Coal Measures") rocks near Jackson City. Clay County, extensive Pennsylvanian shale along Missouri River bluffs at Liberty Landing and Wayne City. Dade County, near Everton and Lockwood. Daviess County, near Gallatin and elsewhere along streams. Gasconade County, Owensville. Greene County, near Springfield and Willard. Iron County, near Belleview and Kaolin. Livingston County, several Pennsylvanian shale beds along streams. McDonald County, Sugar Creek and Mill Creek, in southern portion of county. Mercer County, near Princeton. Platte County, in Pennsylvanian rocks along river. Polk County, near Humansville. Ralls County, Louisiana to Hannibal along Mississippi River bluffs. Saline County, Slater, near Marshall, and elsewhere. Scott County, near Oran, and Benton. Shelby County, near Lakenan. St. Louis County, Prospect Hill and Cheltenham. Sullivan County, near Milan. Webster County, near Marshfield. Wright County, near Mansfield.

Clay (fire). Mined in the following localities: Audrain County, at Mexico and Vandalia. Boone County, near Columbia. Callaway County, at Fulton. Crawford County, at Leasburg, flint clay. Franklin County, at Union and Washington; flint fire clays occur throughout the county. Gasconade County, at Canaan, Owensville, and Rosebud. Johnson County, at Knobnoster. Linn County, at Laclede. Montgomery County, at Jonesburg. Morgan County, at Versailles. Newton County, at Gregg. Phelps County. Shelby County, at Lakenan. St. Charles County, has been mined near St. Charles; plastic. St. Louis County, at Cheltenham and St. Louis; also glass-pot clay. Stoddard County, near Dexter. Warren County, shipped from Truesdail and Pendleton.

Clay (flint). Boone County, occurs near Columbia. Crawford County, extensive deposits near Wesco. Franklin County, old pit near Washington. Maries County, excellent white in Lanes Prairie district. Monroe County, near Stoutsville, and Clapper. Montgomery County, mined at Jonesburg. Osage County, excellent quality abundant in central and southern part. Phelps County has been extensively worked at Knobview, Rolla, and St. James. St. Clair County, small deposits occur near Baker and elsewhere on Osage River. St. Louis County, near Glencoe and elsewhere.

Clay (kaolin). Bollinger County, large deposits near Glen Allen, mined and shipped for pottery. Cape Girardeau County, pure white near Jackson, mined and shipped for paints, etc.; Morgan City, in Buffalo lead mines near Versailles, mined and shipped for enameling work. Occurs also in Carter County, at Chilton. Cooper County, Clifton City. Howell County, near West Plains and Sterling, and near Willard Springs. Iron County, in old pits and prospects at Kaolin, 12 miles west of Iron Mountain. Madison County, near Fredericktown. Oregon County, near Thayer. Perry County, near Silver Lake. Reynolds County, near Centerville and Lesterville. Ripley County, near Doniphan. Shannon County, near Winona, and old pits near Monteer. Texas County, in vicinity of Sargent and Wayne counties, near Brunot.

Clay (pottery). Cass County, dug near Harrisonville on Grand River. Cooper County, near Boonville. Franklin County, near Union. Henry County, Calhoun. Jasper County, near Webb City. Jefferson County, excellent ball clay mined at Regina. Johnson County, Knobnoster and Mont-

serrat. Linn County, Kelsey and Laclede. Livingston County, near Chillicothe. Marion County, "pipe" clay on south side of New River and elsewhere. Monroe County, abundant, mined at Stoutsville and near Clapper. Ozark County, residual clay near Gainesville, mined to limited extent for local trade. Scott County, near Commerce, local use. Stoddard County, Dexter. Texas County, near Plato. Vernon County, near Deerfield. Pottery clay occurs in many other counties of the State.

Clay (shale, plastic). St. Louis County, from Pennsylvanian rocks, mined at Castello, Glencoe, and Prospect Hill.

Coal (bituminous). Coal found in the Des Moines group of the Pennsylvanian. Six producing fields: (1) Bevier field occupies parts of Boone, Chariton, Howard, Macon, and Randolph counties; (2) Lexington field in Clay, Lafayette, and Ray counties; (3) Southwestern field in Barton, Bates, Henry, and adjacent counties; (4) Novinger field in Adair County; (5) Marceline field in Linn County; and (6) Mendota field in northwestern Adair, Putnam, and Schuyler. Coal also underlies Grundy, Mercer, and Platte counties.

Cobalt. Linnæite, sulphide of cobalt and nickel, associated with chalcopyrite and pyrite in some of the mines of southeastern Missouri, especially Fredericktown and Mine LaMotte, Madison County, and in St. Francois County; recovered from the copper matte made in smelting these ores.

Copper. See Azurite, Chalcocite, Chalcopyrite, Cuprite, and Malachite.

Cuprite (copper oxide). Ste. Genevieve County, subordinate quantity in Cornwall mines, has been mined.

Feldspar. Camden and Laclede counties, in pegmatite granite on border line between counties. Ste. Genevieve County, in granite near Jonca, was used in Belleville pottery.

Fluorspar. Madison County, Einstein silver mine near Iron Mountain; St. Louis County, in St. Louis limestone near St. Louis.

Galena. Large production from disseminated deposits in southeastern district in Franklin, Jefferson, Madison, St. Francois, and Washington counties; associated with zinc in southwestern region, in Jasper, Lawrence, and Newton counties; and in central region in Cole, Miller, Moniteau, and Morgan counties.

Gas. See Natural gas.

Granite. Carter County, quarried in Van Buren. Iron County, extensively quarried at Graniteville. Madison County, Cornwall and Mine LaMotte. St. Francois County, Doe Run, Farmington, Knob Lick, and Syenite. Ste. Genevieve County. Wayne County, Granite Bend.

Greenockite. Occurs with sphalerite in Joplin district, Jasper, Lawrence, and Newton counties.

Grindstone. Johnson County, sandstone at Warrensburg, has been used in the manufacture of grindstones. St. Clair County, a few made at Collins and Griessel.

Hematite (red iron ore). Crawford County, in sandstone at Craig mine. Dent County, Flank, Hawkins, and Sligo mines. Franklin County, at Leslie mine. Phelps County, at De Camp. Reynolds County, good quality in sandstone on west limit of Bee Fork of Black River in January mine. Also in Callaway, Cooper, Henry, Lincoln, and Saline counties.

Hematite (specular ore). In porphyry, mined in Pilot Knob and Iron Mountain districts in St. Francois and Iron counties. In sandstone, has been mined in Crawford, Dent, Franklin, Iron, Montgomery, Phelps, and other counties.

Hübnerite. Madison County, Silver Mine.

Iron. *See* Brown iron ore, Hematite, Marcasite, Mineral paint, Ocher, and Pyrite.

Kaolin. *See* Clay (kaolin).

Lead. *See* Anglesite, Cerusite, and Galena.

Limestone (building). Limestones suitable for building purposes are widely distributed over the State. Large quarries in Cape Girardeau County. Greene County, Phenix. Jasper County, at Carthage. Ste. Genevieve County, about 4 miles north of Ste. Genevieve, new quarry opened in 1914. Many other quarries in eastern, northern, and western counties of the State.

Limestone (crushed stone, road metal, and other uses). Quarried extensively throughout the State, with the exception of counties in the south-central part. Jackson County and St. Louis City and County are the largest producers.

Limestone (flux). Lincoln County, quarried at Ellsberry, and St. Louis County, near White House, and in many other counties.

Limestone (lime). Limestones excellent for lime making are burned at many localities in the State. Large plants are located at Ash Grove, Cape Girardeau, Glencoe, Glen Park, Hannibal, Louisiana, Mincke, Pierce City, Sarcxie, Springfield, and Ste. Genevieve.

Limonite. *See* Brown iron ore.

Linnæite. *See* Cobalt.

Malachite. Franklin County, mined near Sullivan. Shannon County, mined at Jerktail, Slater, and other mines. Ste. Genevieve County, at Cornwall mines. Occurs with azurite in many hematite deposits of Crawford, Dent, and Phelps counties.

Manganese ore. In porphyritic rocks around Pilot Knob, in Iron, Madison, and Reynolds counties. *See also* Wad.

Marble. Occurs in Cape Girardeau, Iron, Madison, and other southeastern counties. Jasper County, quarried at Carthage.

Marcasite. Franklin County, occurs in commercial quantities underneath hematite ores in central ore district, is mined at Leslie. Jasper County, occurs in abundance associated with lead and zinc ores in Joplin district; few carloads shipped.

Mineral paint. Iron ore, ferruginous shales, and limestones, lead ores, and ocher are used.

Natural gas. Barton, Bates, Cass, Clay, Clinton, Jackson, and Johnson counties, small quantities in shallow wells, and in Platte County, north of Parkville.

Nickel. Nickel and cobalt recovered from matte produced from ore from some of the mines of southeastern Missouri. *See also* Cobalt.

Ocher. Henry County, common in the Pennsylvanian rocks of western part of the State, near Calhoun. Johnson County, Knobnoster, many exposures in this vicinity. A red ocher in Andrey County, Amazonia, and Jackson County, Hickman Mills. Others in Buchanan, Lafayette, and Ray counties. Produced to some extent in hematite mines of central Ozark region.

Oil. *See* Petroleum.

Oil shale. *See* Shale.

Onyx marble. Undeveloped commercial deposits in caves of Ozark region. Other localities in Atchison, Carroll, Daviess, Henry, Jackson, Lafayette, and Livingston counties.

Petroleum. Small quantity produced in Jackson and Vernon counties in 1914. No shipments. Shows of oil have been found in a few other places in southwestern corner of the State.

Pyrite (iron pyrites). Franklin County, Leslie mine principal producer; also at Morrelton. Jasper County, occurs in Joplin district. Madison County, disseminated through limestone at Mine Lamotte. Phelps County, Rolla. St. Francois and Washington counties, gangue mineral of Federal, St. Louis, and other mines. *See also* Marcasite.

Road metal. Andrew County, oolitic limestone was quarried at Schuster station. Clay County, Bethany Falls limestone was quarried near Liberty. The crushed cherty material of the Missouri lead and zinc ores, known as "chats," is much used for road making. *See also* Granite, Limestone (crushed), and Sandstone (crushed).

Sand (building). Obtained chiefly from along Mississippi and Missouri rivers and their tributaries, where the supply of sand and gravel is inexhaustible; also in streams of the Ozark region. On the Mississippi pumping plants are operated at Cape Girardeau, Crystal City, St. Louis, Louisiana, Hannibal, and Canton, and along the Missouri the supply is obtained at St. Charles, Jefferson City, Glasgow, Lexington, Kansas City, and St. Joseph. Plants on the Meramec pump an excellent grade of sand and gravel at Pacific, Drake, Sherman, and Valley Park. On Black River plants are located at Poplar Bluff and Mill Spring. Gravel is dredged from Joachim Creek near Festus, and Piney Creek supplies sand to shipping plants at Arlington and Newburg, in Phelps County. Roofing gravel is obtained from Osage River at Osage City, and a dredge located on Salt River near New London is working a large gravel bar. In the northwest part of the State Nodaway River furnishes sand at Maitland and Skidmore. Atchison County, dug at Rockport. Benton County, Warsaw. Buchanan County, St. Joseph. Callaway County, near Fulton. Carroll County, Carrollton. Christian County, Ozark. Cole County, Jefferson City. Cooper County, Boonville. Daviess County, Gallatin. Franklin County, Pacific. Gasconade County, Drake. Grundy County, Trenton. Jackson County, Kansas City. Jefferson County, Crystal City. Marion County, Hannibal. Phelps County, Jerome. St. Charles County, Klondike and St. Charles. Scott County, Commerce.

Sand (fire). Produced from friable sandstone in Jefferson County at Crystal City, Herculaneum, and Pacific Grove.

Sand (glass). Most important deposit by far is St. Peter sandstone, a beautiful and uniformly clean, friable rock of round clear quartz grains, which outcrops in a belt from a thin strip to 20 miles wide along Mississippi River from Ralls to Cape Girardeau County and also along Missouri River up as far as Callaway County. Important quarries in Franklin County at Becker, Gray Summit, and Pacific; Jefferson County at Crystal City and Silica; St. Charles County at Klondike.

Sand (molding). Number of small pits in Franklin County, at Gray Summit and Pacific. Kent County, Black Hills. St. Charles County, Klondike.

Sandstone (building, monuments, crushed stone, etc.). Barton County, quarried near Lamar and Liberty. Bates County, Butler, Rich Hill, and Rockville. Benton County, near Cole Camp. Callaway County, Fulton. Carroll County, De Witt and near Miami station. Clark County, near Kahoka, local use. Franklin County, near Union. Henry County, near Clinton, Montrose, and Ulrich. Hickory County, Weaubleau. Howard

County, Glasgow. Johnson County, near Warrensburg. Putnam County, Worthington. Ste. Genevieve County, Jonca. Saline County, near Miami station, Sweet Springs. St. Clair County, near Collins. Schuyler County, Queen City. Bituminous sandstone quarried in Lafayette County, near Higginsville.

Shale (oil). Devonian, underlies a considerable area in the northeastern part of the State, extending from the north boundary southward to St. Louis.

Shale (paint). *See* Mineral paint.

Silver. Recovered from the lead ores of Jefferson, Madison, St. Francois, and Washington counties, southeastern Missouri, and from oxidized copper ores of the Cornwell copper mine in Ste. Genevieve County.

Smithsonite (carbonate of zinc). Jasper County, in quantity in many mines of the Joplin district. Jefferson County, principal zinc ore at Valles Mines. Newton County, at Granby. Occurs also in central district in Cole, Miller, Moniteau, and Morgan counties; and mined in Howell and Oregon counties.

Specularite. *See* Hematite (specular ore).

Sphalerite (zinc blende). Principal ore of the Joplin district, Jasper, Lawrence and Newton counties. Mined also in central district, Cole, Miller, Moniteau, and Morgan counties. Has been mined at Frumet and at Valles Mines, Jefferson County. Occurs also in small quantity in the deeper disseminated lead ores of Madison and St. Francois counties.

Tripoli (polishing powder). Chariton County, quarried extensively at Dalton. Jefferson County, occurs at Hillsboro. Newton County, quarried extensively near Racine and Seneca for filters; chips and waste used for polishing powder and scouring soap; occurs at Stella.

Tungsten. *See* Hübnerite and Wolframite.

Wad. Found in connection with brown iron ore deposits in southeastern Missouri.

Wolframite. Madison County, Silver Mine.

Wurtzite. Jasper County, Joplin district, in the eastern part of Joplin, near the Missouri Pacific tracks in a deserted mine on the Missouri Lead & Zinc Co.'s land.

Zinc. Chief production from mines in Jasper County, about Alba, Carterville, Carthage, Duenweg, Joplin, Neck, Reeds, Sarcxie, Thoms station, and Webb City. Lawrence County, Aurora. Newton County, Granby, Spurgeon, and Wentworth. *See also* Calamine, Smithsonite, Sphalerite, and Wurtzite.

MONTANA.

- Ægirite.** Lincoln County, vanadiferous ægirite occurs in quartz veins associated with sulphides of iron and copper in the Rainy Creek district, 4 miles east of Libby.
- Agate** (moss agate). Found along Yellowstone River, from Glendive to Yellowstone Park, and on the mesas and buttes for many miles to the northwest of the river. Has been cut into beautiful gems.
- Antimony.** *See* Polybasite and Stibnite.
- Argentite** (silver glance). Cascade County, in Neihart district. Deer Lodge County, at Cable mine. Granite County, Granite-Bimetallic mine, Philipsburg. Jefferson County, Ruby mine, Boulder and Clancey. Silver Bow County, Butte mines.
- Arsenic.** Smelter by-product saved at the Washoe smelter, Anaconda, in smelting arsenical copper ores. *See also* Arsenopyrite.
- Arsenopyrite.** Deer Lodge County, in Cable mine. Granite County, Granite-Bimetallic mine, Philipsburg, mined for silver and gold. Jefferson County, Corbin, Elkhorn, Warm Spring Creek, and Wickes (auriferous). Missoula County, Mineral Point mines, silver bearing. Powell County, Elliston. Lewis and Clark County, Tenmile district, formerly mined for gold contents. Park County, near Gardiner, Sheepeater mining district; abundant, massive, and gold bearing; not mined.
- Azurite** (blue carbonate of copper). Of mineralogic rather than economic interest. Found in small quantity in many mines and prospects. Deer Lodge County, Cable mine. Granite County, Granite-Bimetallic mine near Philipsburg. Jefferson County, in minute clusters in Elkhorn mine and in McClellan Creek district. Lewis and Clark County, Drumlummon mine, Marysville. Silver Bow County, Butte district.
- Bentonite.** Beaverhead County, near Glendale. Big Horn County, reported from Hardin.
- Bismuth.** *See* Tetradymite.
- Bornite** (peacock ore). Deer Lodge County, in small quantity at Cable mine, carries gold. Granite County, at Granite-Bimetallic mine. Jefferson County, Corbin. Silver Bow County, common ore mineral, Butte district.
- Brown iron ore** (limonite). Cascade and Meagher counties, found at a number of localities in Little Belt Mountain district. Deer Lodge County, at Cable mine. Fergus County, formerly mined in Judith Mountains, prospected at Woodhurst Mountain and in Little Belt Mountains. Jefferson County, at many places in Elkhorn and Wickes districts; mined at Elkhorn Peak iron mine. Phillips County, occurs in oxidized ores of gold deposits near Landusky and Alabama.
- Cassiterite.** Silver Bow County, in the Mountain View and other mines at Butte.
- Cement material.** Hill County, suitable materials known to exist at Havre. Gallatin County, limestone and shale quarried for Portland cement at Trident; suitable material at other places but not used.
- Cerargyrite** (horn silver). Granite County, was important ore of Granite mine, 2½ miles southeast of Philipsburg. Silver Bow County, found in small quantity in Summit Valley (Butte) district and other mining districts.
- Cerium.** *See* Monazite.
- Cerussite** (lead carbonate). Jefferson County, has been mined in Elkhorn and Wickes districts. Meagher County, Castle Mountain district. Occurs in many other districts.
- Chalcanthite** (copper sulphate). Silver Bow County, minor ore of oxidized zone, Butte district.

Chalcocite (copper glance). Deer Lodge County, in small quantities at Cable mine. Silver Bow County, important ore of Butte mines. Occurs in many other districts.

Chalcopyrite (copper pyrite). Broadwater County, Beaver Creek and Crow Creek districts. Deer Lodge County, Cable mine. Granite County, Philipsburg. Jefferson County, with pyrite in Amazon, Clancey, Corbin, Elkhorn, McClellan Creek, Rimini, Warm Spring Creek, and Wickes districts, Lewis and Clark County, Drumlunnon mine, Marysville (rare). Lincoln County, Troy, Grouse Mountain prospects, Rainy Creek, near Libby. Park County, abundant with galena, New World district near Cooke and at many other places. Ravalli County, Mineral Point, silver and gold bearing. Silver Bow County, minor ore in silver veins at Butte.

Chrysocolla (silicate of copper). Deer Lodge County, occurs in Cable mine. Granite County, Granite-Bimetallic mine near Philipsburg. Silver Bow County, in claims east of Butte along the foothills of East Ridge.

Clay (brick). Can be found abundantly throughout the State. Beaverhead County, dug at Dillon. Cascade County, Great Falls. Custer County, Miles City. Flathead County, Kalispell and Whitefish. Gallatin County, Bozeman. Hill County, Havre. Jefferson County, Boulder. Lewis and Clark County, Helena. Missoula County, South Missoula and Riddle Spur. Park County, Livingston. Powell County, Blossburg. Ravalli County, Stevensville. Rosebud County, Forsyth. Sanders County, Thompson Falls. Sheridan County, Plentywood. Silver Bow County, Butte and Williamsburg. Valley County, Glasgow. Yellowstone County, Columbus.

Clay (fire). Cascade County, dug near Armington and at Fields. Deer Lodge County, Anaconda and Lost Creek. Jefferson County, Whitehall. Lewis and Clark County, Helena.

Clay (plastic). *See* Bentonite.

Coal (bituminous and subbituminous). Areas of workable coal are known to exist in the following counties: Blaine, Carbon, Cascade, Chouteau, Fergus, Flathead, Gallatin, Hill, Madison, Missoula, Musselshell, Park, Rosebud, Teton, and Yellowstone. Coal is mined in the following places: Blaine County, Chinook and Harlem. Carbon County, Bear Creek, Bridger, Burgin, Carbon, Fromberg, Joliet, Red Lodge, and Washoe. Cascade County, Armington, Belt, Eden, Geyser, Sand Coulee, and Stockett. Chouteau County, Big Sandy and Mackton. Fergus County, Buffalo Creek, Giltedge, Lewistown, Stanford, Smith, Utica, and Windham. Gallatin County, Chestnut. Hill County, Havre. Missoula County, Missoula. Musselshell County, Roundup. Park County, Cinnabar and Coke-dale. Yellowstone County, Bull Mountains.

Coal (lignite). Areas of workable lignite are known to exist in Custer, Dawson, Rosebud, Sheridan, and Wibaux counties. Custer County, mined at Miles City and Stacey. Dawson County, Cobagen, Jordan, and Glendive. Sheridan County, Brockton and Culbertson. Wibaux County, Wibaux. Chiefly for local use.

Copper ores. Copper is the predominant metal produced in the following districts: Beaverhead County, Beaverhead, Elkhorn, Utopia. Broadwater County, Hellgate. Meagher County, Copperopolis. Missoula County, Denemora, Wallace. Ravalli County, Mineral Point. Silver Bow County, Butte. *See also* Azurite, Bornite, Chalcanthite, Chalcocite, Chalcopyrite, Chrysocolla, Covellite, Cuprite, Enargite, Malachite, Tennantite, and Tetrahedrite.

Copper (native). Deer Lodge County, small quantities in upper level of Cable mine at Cable. Silver Bow County, in oxidized zone of Butte.

Corundum. Gallatin County, was formerly mined at Bozeman, Salesville, and headwaters of Elk Creek for abrasive. No abrasive corundum is now mined in Montana.

Corundum (sapphire). See Sapphire.

Covellite (indigo copper). Jefferson County, Boulder (rare). Silver Bow County, ore of minor importance in Butte mines.

Cuprite (red copper oxide). Silver Bow County, minor mineral in ore of Butte district.

Enargite. Silver Bow County, next to chalcocite the most abundant copper mineral at Butte.

Galena (argentiferous). Beaverhead County, mined in Hecla and Trapper districts. Blaine County, Bearpaw Mountains. Broadwater County, Argenta, Beaver Creek, Crow Creek, Indian Creek, Park, and Winston districts. Cascade County, Barker and Neihart districts. Deer Lodge County, Cable district (rare). Granite County, Philipsburg. Jefferson County, Amazon, Basin, Clancey, Elkhorn, Gregory, Lump Gulch, and Wickes districts. Lewis and Clark County, Bald Butte, Helena, Ottawa, Rimini, and Tenmile districts. Lincoln County, Troy and Snowshoe. Meagher County, Castle Mountain. Mineral County, Iron Mountain. Park County, New World. Powell County, Elliston. Ravalli County, Hamilton (Curlew mine). Silver Bow County, sparingly in silver veins and in some of the later fault veins of the copper area, Butte.

Garnet. Madison County, small quantity recovered from gold dredges at Alder Gulch and at Ruby; cut for jewelry.

Gold (lode). Widely distributed in southwestern quarter of the State. Principal districts that have produced are: Beaverhead County, Bald Mountain and Bannack. Blaine County, Bearpaw. Broadwater County, Lone Mountain, Park, and Radersburg. Deer Lodge County, Cable and Heber. Granite County, Philipsburg and Red Lion. Jefferson County, Cataract, Colorado, and Lump Gulch. Lewis and Clark County, Bald Butte, Helena, Marysville, and Rimini. Lincoln County, Cabinet, Fisher Creek, and Sylvanite. Madison County, Pony, Norris, and Whitehall. Mineral County, St. Regis. Missoula County, Clinton and Ninemile. Phillips County, Landusky. Silver Bow County, Fleecer Mountain, German Gulch, and Highland. Gold tellurides were formerly mined in Fergus County, in Judith Mountains, Spotted Horse mine.

Gold (placer). Placer mining, formerly very important, is still carried on to some extent in Broadwater, Chouteau, Granite, Jefferson, Lewis and Clark, Lincoln, Madison, Mineral, Missoula, Park, Powell, Ravalli, and Silver Bow counties. Hydraulic and dredge mining, in the following counties: Beaverhead County, hydraulic near Bannack. Granite County, hydraulic at Bear Gulch and Basin Gulch. Madison County, dredged in Alder Gulch. Mineral County, dredged and hydraulicked in Cedar Creek. Powell County, hydraulic at Pioneer, Ophir, and Washington Gulch.

Granite. Abundant in western part of the State. Jefferson County, quarried at Welch and near Corbin. Lewis and Clark County, quarried at Baxendal, near Helena, also at Helena.

Graphite. Beaverhead County, mined near Dillon.

Grindstone. Yellowstone County, produced at Columbus.

- Gypsum.** Widely distributed throughout eastern flanks of the Rocky Mountains. Cascade County, formerly mined at Kibby and Riceville. Carbon County, Bridger. Fergus County, mining begun in 1916 at Hanover and development begun near Heath. Jefferson County, quarried near Limespur. Park County, occurs at Hunters Hot Springs.
- Hematite** (red iron ore). Deer Lodge County, found in Cable mine. Jefferson County, with magnetite, in iron mine on Elkhorn Peak, Elkhorn district.
- Hematite** (specularite, turgite). Deer Lodge County, found at Cable mine, carrying gold. Granite County, mined for flux near Philipsburg. Occurs at many localities in Little Belt Mountains district, Cascade, Fergus, and Meagher counties, and prospected at Woodhurst Mountain; in small quantities at other places.
- Hübnerite.** Granite County, occurs at Philipsburg. Madison County, with silver ore in Potosi district, 8 miles southwest of Pony. Powell County, occurs at Sugarloaf Mountain. Silver Bow County, Birdie silver mine and Gagnon and Leonard mines, Butte, small quantities mined.
- Iron.** *See* Brown iron ore, Hematite, Magnetite, and Pyrite.
- Lead.** *See* Cerusite, Galena, and Pyromorphite.
- Lignite.** *See* Coal.
- Limestone** (building). Abundant in western part of the State. Quarried in Carbon County, at Bridger. Flathead County, Kalispell. Gallatin County, Trident. Lewis and Clark County, Helena and East Helena. Silver Bow County, Maiden Rock.
- Limestone** (flux and lime). Cascade County, quarried at Albright and Logging Creek. Gallatin County, Bozeman. Jefferson County, Limespur. Lewis and Clark County, East Helena. Powell County, Elliston. Silver Bow County, Divide.
- Limonite.** *See* Brown iron ore.
- Magnetite.** Blaine County, with apatite and augite in Black Diamond prospect, Bearpaw Mountains, high grade, not mined. Deer Lodge County, was formerly mined for flux at Cable mine. Gallatin County, near Bozeman. Jefferson County, formerly mined with hematite in iron ores on Elkhorn Peak.
- Malachite.** Deer Lodge County, at Cable mine. Granite County, Granite-Bimetallic mine near Philipsburg. Jefferson County, small quantities in Elkhorn mine and McClellan Creek district. Phillips County, found in small quantities in gold-bearing veins near Landusky. Silver Bow County, Butte district and in many other places. Of more mineralogic than economic interest.
- Manganese ore.** Cascade County, manganiferous silver ore, mined at Neihart. Deer Lodge County, carries gold and silver at Cable mine. Granite County, was mined in Granite-Bimetallic mine near Philipsburg. Madison County, prospected on Wigwam and Cherry creeks, 15 miles southeast of Virginia City, and in Madison Valley, 7 miles southeast of Norris. Silver Bow County, oxidized ore of Butte mines, silver bearing. *See also* Psilomelane, Pyrolusite, Rhodonite, and Wad.
- Marble.** Gallatin County, near Manhattan. Lincoln County, near Libby.
- Marcasite.** Deer Lodge County, carries gold at Cable mine. Lincoln County, found in Troy, Grouse Mountain prospects. Silver Bow County, common in Butte mines.
- Mica** (phlogopite). Lincoln County, Rainy Creek near Libby; exceptionally abundant.
- Molybdenite.** Beaverhead County, occurs in quartz veins near Dillon. Cascade County, at Neihart. Granite County, Drummond and at head of Little Gold Creek. Jefferson County, at Homestake.

Monazite. Granite County, has been found in black sands at Princeton. Madison County, at Norris. Powell County, locality not reported.

Natural gas. One well in Dawson County at Glendive and two wells in Hill County at Havre, drilled in 1914.

Oil. *See* Petroleum.

Pearceite. Lewis and Clark County, at Marysville, in the Drumlummon mine, associated with quartz, calcite, and chalcopyrite.

Petroleum. Teton County, in northwest part; no production.

Phosphate. Granite County, good bed at Philipsburg. Madison County, thin beds in canyon of Jefferson River between Limespur and Cardwell. Powell County, good bed near Elliston, and 6 miles north of Garrison. Silver Bow County, Melrose.

Pisanite. Silver Bow County, common in old drifts in Butte copper mines.

Platinum. Granite County, rare in black sands at Princeton, not mined.

Polybasite. Cascade County, with galena and sphalerite in Neihart district. Lewis and Clark County, rich in silver, Drumlummon mine, Marysville.

Proustite. Granite County, sparingly scattered through ore in Granite-Bimetallic mine, Philipsburg.

Psilomelane. Silver Bow County, at Butte, common surface ore in many veins, usually contains silver.

Pyrargyrite (ruby silver). Cascade County, common in Neihart district, usually associated with polybasite. Deer Lodge County, known but not now mined. Granite County, Granite-Bimetallic mine near Philipsburg, with galena and sphalerite. Lewis and Clark County, Drumlummon mine, Marysville.

Pyrite. Common ore of gold, has been mined in the following districts: Broadwater County, Beaver Creek, Crow Creek, Indian Creek, Radersburg. Cascade County, Neihart. Deer Lodge County, Cable. Fergus County, Ford Creek, Giltedge, Maiden. Granite County, Philipsburg. Jefferson County, near Basin, Boulder, Clancey, Elkhorn, Gregory, Warm Spring Creek. Lewis and Clark County, Bald Butte. Lincoln County, Sylvanite. Madison County, Pony. Missoula County, Mineral Point, Mineral Hill. Phillips County, Landusky, Alabama. Powell County, Elliston. Silver Bow County, Butte (cupriferous).

Pyrolusite (black oxide of manganese). Granite County, mined for flux in Flint Creek (Philipsburg) district. Meagher County, large veins at Castle, carry small quantities of lead. Phillips County, with high-grade gold ores in mines near Landusky and Alabama. Silver Bow County, common surface ore in many veins at Butte carrying rhodonite, etc. Usually contains silver and is much sought for as flux for siliceous ores.

Pyromorphite (phosphate of lead). Cascade County, found in one mine in Narrow Gauge Gulch, Neihart district. Granite County, in Granite-Bimetallic mine, near Philipsburg.

Pyrrhotite (magnetic pyrites). Blaine County, found in Bearpaw Mountains. Deer Lodge County, at Cable mine, carries gold. Jefferson County, Elkhorn district.

Radium. *See* Thorianite.

Rhodochrosite. Silver Bow County, in silver veins at Butte.

Rhodonite (manganese silicate). Silver Bow County, gangue mineral of silver veins of Butte mines, cut as gem.

Road metal. *See* Granite, Limestone, and Sandstone.

Sand (building). Dug at many places for local use.

Sandstone. Beaverhead County, quarried south of Dillon for building stone, and a variety consisting of nearly pure silica has been used for fluxing and converter lining at the Washoe smelter in Anaconda. Cascade County, quarries at Field and Great Falls. Gallatin County, Salesville and Sappington, near Bozeman. Hill County, at Havre; sandstone suitable for dimension stone is abundant. Park County, Livingston. Yellowstone County, Billings and Columbus.

Sapphire. Fergus County, blue gems mined from dike of lamprophyre rock near Yogo Gulch. Granite County, varicolored stones for gems and mechanical purposes mined from placers on Rock Creek, 20 miles southwest of Philipsburg. Lewis and Clark County, mined with gold in placers of Missouri River, east and northeast of Helena, from Canyon Ferry 20 miles down the river. Powell County, varicolored stones for gems and mechanical purposes mined with gold in placers by dredging and sluicing in Dry Cottonwood Creek.

Scheelite. Park County, has been mined at Jardine with gold.

Silver (native). Cascade County, in oxidized veins in Neihart district. Granite County, in upper levels of Granite-Bimetallic mine, Philipsburg. Jefferson County, at Clancey, Elkhorn, and Ruby mines. Silver Bow County, common in silver veins and oxidized portions of copper veins at Butte.

Silver. Predominant metal value in following districts: Beaverhead County, Dillon, Hecla, and Vipond. Cascade County, Neihart. Granite County, Philipsburg. Jefferson County, Elkhorn. Lewis and Clark County, Greenhorn. Park County, Cowles. *See also* Argentite, Cerargyrite, Pearceite, Polybasite, Proustite, Pyrargyrite, and Stephanite.

Specularite. *See* Hematite.

Sphalerite (zinc blende). Broadwater County, mined in Beaver Creek district. Cascade County, occurs with galena in all veins in Neihart district. Deer Lodge County, rare at Cable. Granite County, in all silver-gold fissure veins near Philipsburg. Jefferson County, with galena and pyrite and lesser quantities with tetrahedrite in galena ores of Basin, Boulder, Clancey, Elkhorn, Gregory, and Lump Gulch districts. Lewis and Clark County, with galena in Bald Butte, Helena, and Rimini. Lincoln County, Cullahan Creek and Troy. Mineral County, Iron Mountain. Powell County, Elliston. Silver Bow County, common in Butte mines.

Spinel (pleonaste). Madison County, between South Meadows and Moore creeks, not mined.

Stephanite (brittle silver). Cascade County, rare in Neihart district.

Stibnite (sulphide of antimony). Granite County, abundant in primary ore of silver veins near Philipsburg.

Tennantite. Granite County, in lower portions of Granite-Bimetallic mine, Philipsburg. Silver Bow County, occurs sparingly associated with enargite in copper veins at Butte.

Tetradymite. Broadwater County, with gold and silver in Keating mine, Radersburg.

Tetrahedrite (gray copper ore). Granite County, Flint Creek district, with galena and sphalerite, argentiferous; was formerly mined; abundant in lower levels, Granite-Bimetallic mine. Jefferson County, with sphalerite in Elkhorn mine, argentiferous; also at Basin and Clancey. Lewis and

Clark County, formerly mined at Drumlummon mine, Marysville. Missoula County, Pleasant View and Slate Creek prospects, carries gold and silver. Silver Bow County, ore of minor importance in Butte mines in copper and silver veins.

Thorianite. Madison County, known at Norris, not mined.

Thorium. *See* Monazite and Thorianite.

Tungsten ore. *See* Hübnerite and Scheelite.

Turgite. *See* Hematite.

Vanadinite. Beaverhead County, reported 27 miles northwest of Dillon in Rothschild mine.

Vanadium. Silver Bow County, in the Mountain View and other mines at Butte; form of vanadium mineral unknown. *See also* Ægirite.

Volcanic ash. Gallatin County, deposits suitable for use as abrasives and polishing powder in vicinity of Bozeman. Granite County, South Drummond. Meagher County, at Castle Mountain. Missoula County, north of Missoula. Ravalli County, at many places on the east side of Clark Fork. Also in Silver Bow and other counties.

Wad. Jefferson County, with limonite in granite about 6 miles north of Wickes station, not mined. Silver Bow County, with silver ores of Butte district.

Wood (petrified). Found in many localities but not agatized.

Wurtzite. Silver Bow County, Gagnon mine, Butte.

Zinc. *See* Sphalerite and Wurtzite.

NEBRASKA.

Abrasive. See Diatomaceous earth and Pumice.

Agate (moss). Keith, Scotts Bluff, and Sioux counties; cut for jewelry.

Cement material. Carboniferous limestone and shale, suitable for cement material, outcrop in southeastern part of State in Cass, Douglas, Gage, Johnson, Lancaster, Nemaha, Otoe, Pawnee, Richardson, and Sarpy counties; not utilized. Cement formerly made from Carboniferous rock at Beatrice, Gage County. Cretaceous chalk rock and underlying shales, suited to the manufacture of cement, outcrop extensively in northeastern Nebraska along Niobrara and Missouri rivers in the following counties: eastern Boyd, Cedar, Dixon, Dakota, and northern Knox. Likewise along the southern line of Nebraska in the Republican Valley in the following counties: Franklin, Nuckolls, southern Harlan, and Webster. The cement material of the Cretaceous in Nebraska belongs essentially to the Niobrara formation, although a chalky layer (Inoceramus zone) about 20 feet thick constitutes the upper part of the Greenhorn limestone. A large plant is at Superior, Nuckolls County.

Chalcedony. Gage County, common vein filling in the Badlands.

Chalk. The Greenhorn limestone at Hebron, Thayer County, and the Niobrara formation of Knox County, notably at the town of Niobrara, furnish considerable quantities of building material. The chalk rock of these formations is soft enough to be sawed into blocks when "green" (fresh from the quarry); on drying it becomes harder and has good lasting qualities. The chalky Greenhorn rock of Endicott, Jefferson County, and at Pleasant Hill, Saline County, used to be burned into lime for local consumption.

Clay (brick). The great bulk of ordinary building and hollow brick is manufactured from loess and alluvium. The loess is found over about half the area of the State, but in many places it is poor in clay. Brick and tile made in the following counties: Adams, Antelope, Box Butte, Boyd, Buffalo, Burt, Butler, Cass, Cedar, Clay, Cuming, Dixon, Dodge, Douglas, Fillmore, Furnace, Gage, Greeley, Hall, Hamilton, Howard, Jefferson, Kearney, Knox, Lancaster, Loup, Madison, Nance, Nemaha, Nuckolls, Otoe, Pawnee, Phelps, Platte, Polk, Redwillow, Richardson, Saline, Saunders, Scotts Bluff, Seward, Sherman, Stanton, Thayer, Washington, Wayne, Webster, and York.

Clay (fire). Occurs in Pennsylvanian ("Coal Measures") in southeastern part of State.

Clay (kaolin). Cherry County, Prince Creek.

Clay (pottery). Cass County, has been dug at Louisville. Jefferson County, coarse pottery clay at Endicott. Washington County and elsewhere in southeastern Nebraska.

Coal (bituminous). Cass, Johnson, and Otoe counties, Nuckolls bed 8 to 18 inches thick, worked for local use. Nemaha County, working mine at Honey Creek, 4 miles south of Peru, in bed 33 inches thick. Otoe County, bed 15 inches thick in a boring at Nebraska City. Pawnee County, beds at Du Bois, Friezes Mill, and Turners Branch worked intermittently. Richardson County, has been mined at Rulo, and a bed 18 to 30 inches thick has been opened and worked for local use in southwest corner of county.

Coal (lignite). Dakota County, mined for local use near Homer. Dixon County, in bluffs near Ponca.

Diatomaceous earth. Greeley County contains the best beds. Thomas County, deposit of several acres near Thedford. Wheeler County, number of beds on Cedar Creek. Occurs in Blaine, Hooker, and other counties. Small quantity formerly sold for polishing powder.

Flint. Gage County, quarried and crushed for ballast at Blue Springs and Wymore.

Gold (placer). Occurs in sands of Platte River and in glacial drift; of no importance.

Halite. *See* Salt.

Infusorial earth. *See* Diatomaceous earth.

Limestone (building). Cass County, quarried at Cedar Creek, Louisville, and Meadow. Sarpy County, Nehawka and Weeping Water. Cheyenne County, Sidney. Gage County, Blue Springs, Holmesville, and Wymore. Greeley County, Scotia. Jefferson County, near Fairbury and Endicott. Johnson County, Elk Creek, Graf, and Tecumseh. Lancaster County, Roca. Nemaha County, Auburn, Brock, Glen Rock, and Johnson. Otoe County, Syracuse and Nebraska City. Pawnee County, Table Rock. Sarpy County, La Platte, Richfield, and Springfield.

Limestone (crushed stone). Cass County, quarried at Cedar Creek, Louisville, and elsewhere. Cheyenne County, Sidney. Gage County, Holmesville, Rockford, and Wymore. Nemaha County, Auburn, Brock, and Johnson.

Limestone (flux). Cass County, quarried at Nehawka.

Lithographic stone. Otoe County, occurs near Syracuse, has not proved of commercial quality.

Ocher. Known in many places in northeastern counties on Platte River and along Republican River; was mined at Indianola, Redwillow County.

Peat. Widely distributed. On Loup River and its tributaries; on the Logan; along tributaries at headwaters of Elkhorn, Blue, and Stinking rivers; not utilized.

Pumice. Produced in Furnas County; Harlan County, Orleans; Holt County, Atkinson; Jefferson County, Endicott; Lincoln County, Ingham; and in other counties; used as an abrasive.

Road metal. Cass County, gravel in Platte Valley and in glacial drifts, pits near Louisville. Gage County, large supply of flint, quarried in vicinity of Wymore and Blue Springs.

Salt (common). Previous to development of Kansas salt beds salt was made in considerable quantity in southeastern Nebraska from water of salt springs and deep wells. No longer produced, but artesian flow of salt water is used at Lincoln in sulphosaline baths.

Sand (building). Principal pits are at the following places: Antelope County, Oakville. Buffalo County, Ravenna, Kearney. Burt County, Tekameh. Cass County, Cedar Creek, Louisville. Cedar County, Hartington. Colfax County, Schuyler. Custer County, Ansley, Mason City, Sargent. Douglas County, Omaha, Valley. Dodge County, Fremont. Fillmore County, Geneva. Gage County, Beatrice. Hall County, Grand Island. Platte County, Lindsay. Polk County, Atkinson. Richardson County, Falls City, Salem. Sarpy County, Meadow. Saunders County, Ashland. Many small pits widely scattered through State. Dredges taking sand from lower Platte at Ashland, Cedar Creek, Louisville, Fremont, Meadow, Valley, and Oreapolis. Forty sand-shipping stations in State produced in one year 40,000 cars, equal to train over 300 miles long. Cass County is largest producer.

Sand (molding). Adams County, dug at Erickton.

Sand and gravel. Pits supplying local demand are widely distributed. Cass County, large production from Cedar Creek. Jefferson County, dug 2 miles west of Fairbury; shipped for cement, plastering, etc., also dug near Kesterson and elsewhere.

Sandstone. Cass County, quarried at Louisville. Cherry County, occurs at Valentine. Dawes County, Chadron. Greely County, Scotia. Nemaha County, Brownville. Sarpy County, Springfield.

Turquoise. Brown County, three stones, probably variety known as odontolite, have been found.

Volcanic ash. Abundant throughout the central and western parts of the State; quarried in Furnas, Harlan, and Lincoln counties.

NEVADA.

- Alum** (kalinite). Esmeralda County, prospected by roadside about 10 miles north of Silver Peak.
- Alunite.** Clark County, large deposit 32 miles southeast of Las Vegas. Esmeralda and Nye counties, abundant in volcanic rocks and with ores in Goldfield district. Mineral County, Bovard district, 17 miles south of Rawhide and 20 miles northeast of Thorne, as veins or tabular sheets, which have a maximum width of 2 feet, in volcanic rocks, at the Gold Pen mine, and in limestone in Valley View prospect, a mile south of the Gold Pen mine. Not utilized.
- Anglesite** (sulphate of lead). Clark County, mined with oxidized zinc ores at Goodsprings. Eureka County, important mineral in oxidized ores at Ruby Hill and in Eureka district, silver bearing.
- Anhydrite.** Clark County, Arden. Lyon County, Ludwig mine and Mound-house.
- Annabergite.** Humboldt County, important constituent of ore at Lovelock nickel mine, Cottonwood Canyon, Pahute Range.
- Antimony.** See Bindheimite, Goldfieldite, Jamesonite, Polybasite, Stibiconite, and Stibnite.
- Argentite** (silver glance). Churchill County, Fairview district, Nevada Hills, and other mines; Wonder district, Nevada Wonder, Jack Pot, and other mines. Elko County, at Columbia. Humboldt County, at Rosebud, Rochester district. Lander County, at Cortez. Nye County, important silver mineral of Tonopah district. White Pine County, Cherry Creek district.
- Arsenic.** Humboldt County, massive native near Rochester, with traces of bismuth. Washoe County, native arsenic, in considerable quantity, occurs at a prospect a few miles south of Pyramid Lake. See also Arsenopyrite and Mimeticite.
- Arsenopyrite.** Elko County, silver ore at Tuscarora. Eureka County, Ruby Hill, Eureka district. Humboldt County, with pyrite and quartz at Auld Lang Syne mine near Chafey. Washoe County, at Galena.
- Asphalt.** Eureka County, stringers and lenses up to 18 inches wide filling fractures in Carboniferous rocks 15 miles south of Palisade.
- Axinite.** Elko County, in the Contact district at the Brooklyn, Alice, Zetta, Blanchard, and other mines and prospects on the contact of granodiorite and limestone.
- Azurite.** Elko County, with silver ore in Mountain City. Esmeralda County, sparingly in Goldfield district, Montezuma and Cuprite mines. Eureka County, small quantity at Ruby Hill, Eureka district, and in Mineral Hill district. Humboldt County, small quantity in Red Butte copper district and Lovelocks cobalt-nickel mine in Cottonwood Canyon, Pahute Range. Lyon County, in Mason Valley mine, Yerington copper district, and other localities.
- Barite.** Clark County, Yellow Pine district, Boss, and other mines. Ormsby County, mined at Barium mine. Elko, Esmeralda, Eureka, Humboldt, Lander, Mineral, and Nye counties, gangue mineral in many veins. Esmeralda County, abundant with ore in Sandstorm and Kendall mines, Goldfield district. Humboldt County, a common gangue mineral in Humboldt Range.
- Basalt.** Churchill County, abundant in Stillwater or Carson Sink Range southeast of Stillwater and Fallon; also in northern part of State, as near Jarbidge, in Elko County.
- Bindheimite.** Esmeralda County, 15 miles east of Thorne. Humboldt County, Rochester district, in Nenzel Hill and Packard ores.

Bismite. Mineral County, near Candelaria.

Bismuth (native). Clark County, with bismutite near Sandy. Elko County, with oxidized minerals and scheelite near Ruby Valley post office. Mineral County, with bismite near Candelaria. White Pine County, 6 miles southeast of Joy post office in Ruby Mountain mining district, sec. 36, T. 24' N., R. 57 E., in Mayer's Gold King mine, 35 miles southeast of Union (switch) on the Eureka-Nevada Railway. *See also* Bismite, Bismuthinite, Bismutite, and Goldfieldite.

Bismuthinite. Esmeralda County, with rich gold ore at Goldfield.

Bismutite. Eureka County, pebbles of fairly pure bismutite occur in gold placer workings 20 miles north of Carlin.

Borax. Deposits of the marsh type were formerly extensively worked in Churchill County, in Salt Wells Valley. Esmeralda County, at Teals, Rhodes, and Columbus marshes, and Fish Lake Valley. Borax was also made from hot spring waters in Churchill County, east of Wadsworth. Washoe County, at Gerlach. *See also* Ulexite.

Bornite. Elko County, secondary ore in Tuscarora mines. Humboldt County, with chalcopyrite at Mazuma Hills mine, Seven Troughs district. Lander County, mined for gold and silver at Tenabo.

Bromine. *See* Bromyrite and Embolite.

Bromyrite. Elko County, silver ore in Mountain City, mined at Protection mine. Eureka County, Silver Hill and in quartz at Caribou Hill, Eureka district. Humboldt County, Rochester district.

Brown iron ore (limonite). Not mined as an ore of iron, but occurs abundantly in the oxidized portions of deposits worked for other metals and may carry gold and silver, as in the following districts: Esmeralda County, Cuprite and Goldfield districts, Old Camp, Gold Mountains district. Eureka County, carries free gold, principal component of Ruby Hill ores. Humboldt County, with argentite at Brown Palace mine, Rosebud district. Lander County, Mud Springs, 4 miles north of Lander. Lyon County, Mason Valley mine, Yerington district, also with hematite and magnetite near Dayton. Nye County, Bullfrog and Silverbow districts.

Calamine (zinc silicate). Clark County, mined with other zinc ores at Good-springs. Eureka County, in fine crystals with limonite at Ruby Hill, Eureka district.

Caliche. Common in hot arid regions.

Carnotite. Lincoln County, on joints in gold ores in Atlanta mine.

Cement material. Carboniferous limestone outcrops in east third of State; suitable for Portland cement; not used. Ormsby County, large bodies of limestone in shale several miles east of Carson City; analyses show that suitable mixture would make good cement.

Cerargyrite (horn silver). Churchill County, Fairview district, Nevada Hills, and other mines, Wonder district and Still Water Range. Elko County, secondary mineral in Gold Circle district. Esmeralda County, abundant in quartz at Great Western mine, Hornsilver district; in oxidized ore near Diamondfield, Goldfield district. Humboldt County, Durango Girl mine, Rosebud district; Rochester district, principal mineral in Packard and Nenzel Hill mines. Lincoln County, Atlanta district, Silver Park mine. Nye County, principal mineral of Bullfrog district, formerly mined at Montgomery-Shoshone mine; secondary mineral at Silverbow and Eden. White Pine County, Hamilton and Eberhardt.

Cerium. *See* Monazite.

Cerussite (carbonate of lead). Clark County, mined at Potosi and other mines, Goodsprings district. Elko County, silver ore in Mountain City, mined at Protection mine. Esmeralda County, Redemption mine near Horn-silver; Lone Mountain mines, South Klondike, and Montezuma; mined for silver. Eureka County, Ruby Hill, Eureka district; worked for silver at Mineral Hill. Humboldt County, mined for silver at Fairmont and Beaconsfield mines, Winnemucca district. Lander County, Mud Springs 4 miles north of Lander. White Pine County, has been mined in Ely (Robinson) district.

Chalcanthite. Lyon County, Bluestone mine, Yerington copper district. Formerly mined for use in amalgamating Comstock ores.

Chalcedony. Occurs in Esmeralda County, at Aurora. Mineral County, 2 miles southeast of Redlich. Nye County, Gold Mountain district between Tonopah and Klondike.

Chalcocite (copper glance). Elko County, important ore in Bullion district, Standing Elk principal mine. Esmeralda County, argentiferous in mines of Cuprite and Montezuma districts. Humboldt County, in a vein in gabbro at Red Butte. Lander County, mined for gold in Tenabo district. Lyon County, Yerington mine, Yerington copper district in small quantity. Nye County, sparingly in Original Bullfrog mine in Bullfrog district, with free gold. Ormsby County, at numerous localities, carries gold and silver. White Pine County, important ore in Ely district.

Chalcopyrite (copper pyrite). Clark County, with platinum in Copper King district. Elko County, important gold and silver ore at Big Four, Columbia, Jack Pot, and other mines. Esmeralda County, mined at Montezuma, carries silver. Eureka County, important silver ore at Mineral Hill, and in small mines and prospects in Safford district. Humboldt County, Adelaide mine, Seven Troughs district. Lander County, principal silver ore at Cortez, Little Gem, Phoenix, and Gold Quartz mines. Lyon County, Bluestone and other mines in Yerington district. Nye County, Silverbow district; small quantity at Tonopah mine, Tonopah. White Pine County, Nevada consolidated, Cumberland, and other mines in Ely district.

Chrysocolla. Elko County, important ore in Bullion district, Standing Elk principal mine. Esmeralda County, occurs in various prospects, Oriental Wash district. Humboldt County, sparingly at Red Butte and Munroe Hill, Chafey district. Lyon County, in Ludwig mine, Yerington district. Nye County, Bullfrog district; carries gold; in veins at Oak Spring.

Cinnabar. Esmeralda County, near Black Butte, Goldfield district, not mined. Eureka County, Lynn mining district. Humboldt County, near Fitting, in American Canyon, South American Canyon, and south of Rochester; also 35 miles northeast of Lovelocks, near Antelope Springs, Piute Range; in prospect on edge of Black Rock desert, few miles south of Red Butte; in Eldorado Canyon; in Winnemucca Mountain; and in gold ores at National, 65 miles southwest of Battle Mountain. Mineral County, Rand district, 18 miles south-southeast of Rawhide. Nye County, mined near Ione and Bonita; prospected on Bear Mountain; in old Barcelona silver mine at Belmont. Washoe County, very small quantity taken years ago near western margin of sinter at Steamboat Springs.

Clay (brick). Esmeralda County, dug at Goldfield. Lyon County, 1 mile west of Yerington. Washoe County, Reno.

Clay (fire). Ormsby County, deposit in Alumina mine, Delaware district, not used.

- Clay** (kaolin). Clark County, Muddy River valley, a few miles above St. Thomas (mined). Humboldt County, deposit under development 24 miles southeast of Lovelocks. Ormsby County, large deposit 4 miles from Carson.
- Coal.** Elko County, beds of shaly coal in Tertiary, Centennial Range, Bull Run Basin. Esmeralda County, extensive deposits of semibituminous coal in southern and western parts of county; between Silver Peak and Candelaria, four beds, 6 to 8 feet; 4 miles south of Coaldale, four beds.
- Cobalt.** *See* Erythrite.
- Copper.** Ores of copper are of chief importance in following districts: Churchill County, Whitecloud (Coppereid). Clark County, Bunkerville (Copper King); Great Eastern, Logan (St. Thomas). Douglas County, Spruce Mountains, Wellington. Elko County, Contact, Dolly Varden, Elk Mountain. Humboldt County, Jackson Creek, Red Butte. Lander County, Kimberley (Hill Top). Lyon County, Yerington (Mason). Mineral County, Sodaville (Pilot Mountain). White Pine County, Ely (Robinson), near Hamilton. *See* Azurite, Bornite, Chalcanthite, Chalcocite, Chalcopyrite, Chrysocolla, Covellite, Cuprite, Enargite, Goldfieldite, Malachite, Stromeayerite, and Tetrahedrite.
- Copper** (native). Esmeralda County, reported in surface panning in Goldfield district. Humboldt County, near Red Butte district. Lyon County, Nevada Douglas, Mason Valley, and Bluestone mines, Yerington district.
- Corundum.** Esmeralda County, reported from near Silver Peak.
- Covellite.** Humboldt County, occurs sparingly in Red Butte district. White Pine County, with copper ores of Ely (Robinson) district.
- Cuprite.** Elko County, important ore in Bullion district, Standing Elk principal mine. Humboldt County, occurs with covellite, chrysocolla, and iron oxides at Red Butte; was mined in Bolivia district. Lyon County, Mason Valley mine, Yerington district.
- Diatomaceous earth.** Churchill County, 8 miles southeast of East Gate on Skull Creek; large deposit several miles in extent and locally 300 feet in thickness. Esmeralda County, forms lenticular beds in the Seibert formation near Goldfield, Crown Spring, and Millers. Humboldt County, Lovelocks. Storey County, mined at Chalk Hills ranch, 9 miles northeast of Virginia City, for polishing powder. Washoe County, occurs in great quantity on banks of Little Truckee River between Pyramid and Winnemucca lakes, and in a railroad cut 4 miles west of Reno; also near Verdi. Reported also in Fossil Hills and along northeast edge of Kawich Hills. Common in other parts of State.
- Electrum.** Humboldt County, principal mineral at National, occurs also at Pole Canyon. Nye County, mined at Gibraltar mine, Bullfrog district.
- Embolite.** Churchill County, Wonder district, Nevada Wonder mine.
- Enargite.** Elko County, in Tuscarora and Good Hope districts. Esmeralda County, Gold Bar and Victor mines, Goldfield district.
- Erythrite** (cobalt ore). Churchill County, rich mines in northeast part of county. Humboldt County, has been mined at Lovelock mine, Cottonwood Canyon, Pahute Range.
- Famatinite.** Esmeralda County, with native gold in Goldfield mines.
- Ferberite.** Lincoln County, Panaca.
- Freibergite.** Elko County, silver ore in Good Hope district, was mined at Buckeye, Ohio, and other mines.
- Galena.** Clark County, Potosi and other mines in Goodsprings district, argenterous. Elko County, has been mined for gold and silver at Big Four, 27608°—Bull. 624—17—13

Columbia, and other mines in Aura (Columbia) district; in Dolly Varden, Ruby Valley, Spruce Mountains, Tecoma, and other districts. Esmeralda County, sparingly with rich gold ores at Goldfield, argentiferous; at Redemption mine near Hornsilver, in Buena Vista, Hornsilver, Lida, Lone Mountains, Palmetto, and other districts. Eureka County, important silver ore at Cortez, Mineral Hill, Safford, and Schroeder districts; Eureka district, at Ruby Hill, Tiptop, Richmond, and other mines. Humboldt County, Pfluger mine, Humboldt Range, and in Adar, Chafey, Pole Canyon, Seven Troughs, and other districts. Lander County, in Campbell, Cortez, Galena, Kimberley, and Reese River districts; worked for gold at Tenabo. Lincoln County, in Comet, Geyser, Highland Valley, Hiko, Jackrabbit, Lone Mountain, and Pioche districts. Lyon County, Pine Nut and Yerington districts. Washoe County, at Wedekind, and other mines 1 mile north of Sparks; formerly mined at Galena. White Pine County, Bunker Hill-Sullivan mine, Granite district, in Ward, Hunter, Hamilton, Ely, and Newark districts.

Garnet. Ruby Valley, some used for gems.

Gold (lode). Predominant in following districts: Churchill County, Bernice, Boyer, Eaglesville, Eastgate, Fairview, Jessup, Sunnyside, White Plains. Clark County, Crescent, Eldorado Canyon, Gold Butte, Lyons, Searchlight, Vincent. Douglas County, Gardnerville, Red Canyon. Elko County, Aura, Carlin, Centennial, Cornucopia, Cornwall Basin, Gold Circle (Widas), Good Hope, Jarbidge, Tuscarora, Van Dusen. Esmeralda County, Buena Vista, Cuprite, Dyer, Goldfield, Gold Mountains, Hornsilver, Lida, Montezuma, Oriental Wash, Palmetto, Silver Peak, Southern Klondike, Windypah. Eureka County, Mill Canyon, Lynn. Humboldt County, Central, Disaster, Fitting, Gold Banks, Kennedy, National, Pole Canyon district, Rochester district, Lincoln Hill mines, Spring Creek, Rebel Creek, Seven Troughs, Vicksburg, Winnemucca. Lander County, Battle Mountain, Washington. Lincoln County, Chief, Eagle Valley, Ferguson, Freiberg. Lyon County, Ramsey, Silver City, Tallapoosa. Mineral County, Aurora, Bovard, Granite, Pine Grove, Rawhide, Santa Fe, Silver Star. Nye County, Bare Mountain, Bellehelen, Benway, Berlin, Big Dune, Blakes Camp, Bullfrog, Cactus Spring, Cloverdale, Eden, Gold Bar, Gold Crater, Golden, Goldyke, Hannapah, Jefferson Canyon, Johnnie, Kawich, Manhattan, Millett, Monte Cristo, Oak Spring, Round Mountain, Silverbow, Stonewall Mountain, Wellington. Storey County, Comstock. Washoe County, Cottonwood, Deep Hole, Peavine, Sheepshead, White Horse. White Pine County, Black Horse, Gold Canyon, Osceola, Steptoe. Besides the districts named in which gold is the predominant metal produced, there are others, as Tonopah district, Nye County, in which there is a large annual production of gold. *See also* Electrum and Famatinite.

Gold (placer). In 1914 Humboldt (Spring Valley district), Lander, and Nye counties were chief producers. Smaller quantities were produced in Douglas, Esmeralda, Eureka (Lynn district), Mineral, Washoe, and White Pine counties. Value, \$377,262.

Goldfieldite. Esmeralda County, with gold, marcasite, and famatinite in Goldfield district.

Granite. Mineral County, Luning. Washoe County, Washoe and 5 miles west of Reno.

Graphite. Humboldt County, occurs in Sierra Mountains. Mineral County, Rand district, 15 miles north of Rand. Ormsby County, mined 3 miles from Carson for making paint.

Gypsum. Best-known deposits are in Clark County, in Spring Mountains near Las Vegas, Arden. Esmeralda County, large bodies near Hawthorne. Humboldt County, near Lovelocks. Lyon County, Moundhouse, and an extensive bed at Ludwig mine, Yerington district. Two plaster mills at Moundhouse, one at Reno, and one at Arden.

Hematite. Clark County, low-grade oolitic near Las Vegas, not mined. Eureka County, mined at Borth, shipped. Humboldt County, mined near Lovelocks; reported 30 miles south (?) of Golconda. Lyon County, high-grade hematite abundant in surface outcrops 12 miles northeast and 2 miles southwest of Dayton. Ormsby County, Bessemer mine.

Hübnerite. Esmeralda County, occurs near State line west from Lida. Humboldt County, occurs 15 miles south of Golconda, in Gold Run district; in Sonoma Mountains in silver ores. Mineral County, in Columbus district, 18 miles southwest of Mina, with scheelite; in placer with some scheelite 3 miles south of Redlich and 3 miles north of Rock Hill, along Tonopah & Tidewater Railroad; in North Canyon, 10 and 12 miles south-southeast of Hawthorne, with scheelite. Nye County, at Spanish Springs, 7 miles southeast of Manhattan; occurs with gold ore at Tonopah; mined at Ellsworth; both lode and placer at and 3 miles east of Round Mountain, 15 miles southwest of Manhattan, and 30 miles north-northeast of Tonopah. White Pine County, mined at Hub, on Mount Wheeler; prospected 12 miles southeast of Osceola, at Regan; Altaneda mine, Regan district, 35 miles northeast of Osceola.

Imposnite. Eureka County, T. 29 N., R. 52 E., near Evans.

Infusorial earth. See Diatomaceous earth.

Iodyrite. Lincoln County, Charles Ross mine, near State Line, Utah. Mineral County, Penglaze mine at Rawhide.

Iron. See Brown iron ore, Hematite, Magnetite, and Pyrite.

Jamesonite (antimonial lead ore). Esmeralda County, occurs 15 miles east of Thorne. Eureka County, in quartz at Hoosac mine, Eureka district; has been mined for silver. Humboldt County, abundant at Sheba and De Soto mines in Star Canyon; has been mined for silver at Sheba mine.

Kalinite. See Alum.

Kaolin. See Clay (kaolin).

Lead minerals. Lead is the principal metal produced in the following districts: Elko County, Ruby Valley, Spruce Mountains, and Tecoma. Eureka County, Cortez and Schroeder. Humboldt County, Cedar. Lincoln County, Comet and Highland Valley. Mineral County, Lucky Boy. Washoe County, Leadville and Washoe (Galena). White Pine County, Hunter and White Pine, near Hamilton; occurs less abundantly in other districts. See also Anglesite, Cerusite, Galena, Jamesonite, Massicot, Mimettite, and Pyromorphite.

Limestone (building). Clark County, Sloan. Humboldt County, abundant good building stone near Lovelocks. Lyon County, Dayton, Wabuska. Ormsby County, Carson City. Some of the abundant limestones of the eastern half of the State might yield good building stone.

Limestone (lime). Ormsby County, formerly quarried several miles south-east of Carson City. Limestone suitable for lime is common in eastern half of State; scattered occurrences in western half of State.

Limonite. See Brown iron ore.

Magnesite. Clark County, Muddy River valley, a few miles above St. Thomas, a large, massive deposit.

Magnetite. Clark County, with platinum in Copper King district. Eureka County, near Palisade. Humboldt County, in masses near Lovelocks; Pahute Range. Lyon County, with limonite and hematite near Dayton.

Malachite. Churchill County, Sunnyside district, Murphy mines. Elko County, prominent ore of Bullion district, Standing Elk mine, carries silver and gold. Esmeralda County, Cuprite, Goldfield, and Montezuma districts. Eureka County, in oxidized ore at Ruby Hill, Eureka district. Humboldt County, small quantities in Red Butte district; has been mined in Bolivia. Lyon County, Mason Valley mine, Yerington copper district. Mineral County, Rawhide district, Murphy mines; Laplatt mines. Nye County, Barway district; mined for gold at one mine in Bullfrog district; Silverbow district; carries gold and silver. Ormsby County, with copper ores 9 miles east of Carson City; carries gold and silver. White Pine County, Cumberland, Ely, Nevada Consolidated, Giroux, and other mines.

Manganese minerals. See Psilomelane, Pyrolusite, and Wad.

Marble. Clark County, 14 miles north of Las Vegas. Elko County, La Neville Valley. Mineral County, Luning and Mina. Nye County, quarried at Carrara; occurs in Bullfrog district. White Pine County, abundant near Grandy.

Massicot. Esmeralda County, Redemption mine $1\frac{1}{2}$ miles south of Hornsilver.

Mercury. See Cinnabar.

Mica. Lincoln County, 2 miles east of Gold Butte, has been mined and shipped.

Mimetite. Eureka County, in oxidized ore at Ruby Hill and in Eureka district.

Mineral paint. See Graphite and Ocher.

Molybdenite. Reported near head of Death Valley. Other localities are: Lyon County, in pegmatite in Yerington district. Mineral County, in quartz veins at Redlich. Nye County, prospected with powellite and scheelite at Oak Springs, 45 miles north of Johnnie Siding.

Molybdenum. See Molybdenite and Wulfenite.

Monazite. Ormsby County, occurs in black sands at Carson City.

Nickel. Clark County, occurs with pyrrhotite and chalcopyrite in Copper King district, 16 miles south of Bunkerville. Churchill County, with silicates and sulphides in Cottonwood Canyon, 40 miles southeast of Lovelocks. See also Annabergite and Pyrrhoite.

Obsidian. Occurs in regions of Tertiary volcanic rocks, small quantities cut for gems.

Ocher. Humboldt County, replacement deposits in limestone near Golconda.

Oil shale. See Shale.

Opal. Lander County, prospected near Austin. Humboldt County, is being mined in Virgin Valley, 25 miles southwest of Denio, Oreg.; some gems of exceptional color and fire have been obtained. Is prospected 20 miles south of Oregon and 40 miles east of California line. Nye County, reported in Ione district, and as milky opal with cinnabar on Bare Mountain.

Palladium. Clark County, Bunkerville.

Petrified wood. See Wood.

Platinum. Clark County, prospects with copper and nickel in Copper King district, 16 miles south of Bunkerville; Yellow Pine mining district in Boss mine, with gold and palladium in a quartz lode cutting Carboniferous dolomite; it is particularly abundant in pockets of plumbojarosite; also at Oro Amigo mine.

Plumbojarosite. Clark County, pockets in Boss mine, Yellow Pine district.

Polybasite. Esmeralda County, in Florence mine near Goldfield. Lander County, in Cortez silver deposits. Nye County, Tonopah mine, Tonopah.

Potash. See Alunite and Kalinite.

Potash alum. *See* Alum.

Proustite. Churchill County, Fairview district, Nevada Hills, and other mines. Elko County, silver ore at Protection mine in Mountain City. Esmeralda County, possibly in ore of Florence mine near Goldfield. Humboldt County, Dreamland mine; Rosebud district, in mines of Packard camp and Nenzel Hill. Lincoln County, Rich Hill mine. Nye County, Silverbow.

Psilomelane. Mineral County, 1 mile west of Sodaville, on Blackjack group of claims. Warren County, large deposit at Happy Creek.

Pyrargyrite. Elko County, important silver ore in Humboldt mine at Columbia; also mined at National. Humboldt County, Rochester district, Nenzel Hill mines, Pole Canyon. Nye County, Tonopah district, Tuscarora mines, Austin at Lander Hill; important localities.

Pyrite. Common and widely distributed in many mining districts. A few places where it has been mined for gold or silver are the following: Elko County, mined for gold at Dexter, Tuscarora, and Columbia mines. Esmeralda County, mined for gold at Goldfield. Eureka County, carries gold at Ruby Hill in quartzite and unoxidized ore; important silver ore at Mineral Hill. Humboldt County, mined for silver at Sheba mine, Humboldt Range; also at Seven Troughs district and Chafey, Piute Range. Lander County, principal silver ore at Cortez; worked for gold at Tenabo. Lyon County, principal mineral at Yerington mine. Nye County, at Trappmans, Oak Spring, and elsewhere; carries gold and silver. Ormsby County, Ozark mine, mined for sulphur and gold. White Pine County, small quantity in gold veins, Osceola district; important ore in Ely district, in Robinson, Cumberland, Ely, Nevada Consolidated, and Giroux mines.

Pyrolusite (manganese oxide). Humboldt County, small deposit near Golconda on Humboldt River. Warren County, large deposit at Happy Creek.

Pyromorphite. Elko County, surface mineral of Cornucopia mines at Tuscarora. Eureka County, mined for silver at Mineral Hill.

Pyrrhotite. Clark County, in peridotite dikes with platinum in Copper King district, probably nickeliferous.

Quartzite. Eureka County, Ruby Hill, has been used as siliceous flux.

Quicksilver. *See* Cinnabar.

Radium. *See* Carnotite.

Rhyolite. Churchill County, Fairview, Wonder. Esmeralda County, Goldfield. Humboldt County, Rochester. Mineral County, Rawhide. Nye County, Tonopah.

Road metal. *See* Basalt, Granite, Limestone, Sand and gravel, Sandstone, and Tuff.

Salt. Churchill County, brine pumped at Leete and Parran. Clark County, extensive bed at St. Thomas, used locally. Esmeralda County, found in various places, shipped for table and dairy uses. Eureka County, deposit in north part of Diamond Valley, has been mined extensively. Washoe County, brine pumped at Sheepshead.

Sand (glass). Ormsby County, in quantity 4 miles from Carson.

Sand and gravel. Dug in Clark County, at Rox. Humboldt County, at Perth.

Sandstone. Humboldt County, has been quarried near Winnemucca. Ormsby County, formerly at State Prison, Carson City.

Scheelite. Clark County, 20 miles west of Roach. Elko County, with bismuth minerals in limestone 10 miles southwest of Ruby Valley post office. Esmeralda County, Columbus Marsh. Humboldt County, small grains

through limestone, mines 4 miles from Browns; prospected in Paradise Mountains in New Goldfield district, at Browns and Rebel Creek; 15 miles north of Golconda, in Hot Springs Range; 10 miles north of Jessup; and 22 miles southwest of Lovelocks. Mineral County, near and 10 miles west of Sodaville in Gold Range district, on Silver Pike, Alma J., and Wild Rose groups, all in a large quartz "dikey;" in North Canyon, 10 and 12 miles south-southeast of Hawthorne, with hübnerite. Nye County, first discovery prospect with hübnerite at Ellsworth, with powellite near Oak Springs. Washoe County, near Reno, on Peavine Mountain near top. White Pine County, mined on east side of Snake Range, at Regan camp; small flakes with hübnerite at Hub; Camp Bonita, near Baker post office, on Snake Creek and 2 or 3 miles farther up the creek; at Osceola in old gold-silver mines and 6 and 12 miles south of Osceola; 25 miles south of Osceola at Scheelite; 10 miles north of Osceola at Sacramento Pass in old gold mines in quartz veins cutting limestone and in fractures in the limestone; Cherry Creek, 40 miles north of Ely; and Shoshone, in gold quartz veins.

Shale. Eureka County, has been quarried at New York Canyon, Eureka, for furnace brick.

Shale (oil). Elko County, Green River (Eocene) shale at Elko is rich in oil. White Pine County, near Hamilton, an area of more than 6 square miles is probably underlain by Green River shale.

Silver. Predominant metal in following districts: Churchill County, Alpine, I X L, Fairview, Terrell, West Gate, Wonder. Elko County, Bullion (Railroad). Esmeralda County, Lone Mountain. Eureka County, Eureka, Mineral Hill, Safford. Humboldt County, Humboldt, Lovelocks, Rochester, Rosebud, Star. Lander County, Bullion, Campbell, Cortez, Dean, Galena, Reese River (Austin), Skookum. Lincoln County, Bristol, Geyser, Hiko, Jackrabbit, Lone Mountain, Patterson, Pioche. Mineral County, Columbus (Candelaria), Rawhide. Nye County, Belmont, Benway, Lodi Valley, Reveille, Tonopah, Trappmans, Tybo. Washoe County, Wedekind. White Pine County, Aurum (Silver Canyon), Newark, Ward near Hamilton. Of less importance in ores of many other districts. For silver ore minerals see Argentite, Bromyrite, Cerargyrite, Electrum, Embolite, Freibergite, Iodyrite, Polybasite, Proustite, Pyrargyrite, Stephanite, Stetefeldite, and Stromeayerite.

Smithsonite (carbonate of zinc). Clark County, principal mineral of Goodsprings district, Potosi Rover, Monte Cristo, and other mines; mined and shipped. Eureka County, in oxidized ore at Ruby Hill and in Diamond mine, Eureka district.

Soda. Esmeralda County, near Hawthorne.

Sphalerite (zinc blende). Elko County, important silver ore at Columbia, has been mined. Esmeralda County, sparingly in principal mines of Goldfield district. Eureka County, important silver ore at Mineral Hill. Humboldt County, Pfluger mine, Humboldt Range, and Chafey mine, Piute Range, Adelaide mine, Sonoma Range. Lander County, principal silver ore at Cortez, also worked for gold at Tenabo. Nye County, small quantity in Tonopah mine and Oak Spring. Washoe County, Wedekind district, north of Sparks; formerly mined at Galena.

Stephanite. Churchill County, Fairview district, Nevada Hills mine. Elko County, silver ore mined at Protection mine in Mountain City. Humboldt County, Seven Troughs district. Lander County, in Cortez silver deposits. Lincoln County, Rich Hill mine, Eldorado Canyon. Nye County, Tonopah mine, Silverbow.

Stetefeldite. Esmeralda County, original sulphide ore of veins in Southern Klondike district, silver bearing; reported in other silver-producing districts.

Stibiconite. Humboldt County, Rosebud, Juniper Mountain.

Stibnite. Churchill County, Barnes' district, at Boyer and in Bernice district. Elko County, has been mined for silver at Columbia; also mined at Goodhope and 45 miles north of Elko in Burns Basin. Eureka County, mined for silver in Stafford district. Humboldt County, Antelope Springs mine, Winnemucca, Red Butte; deposits have been worked in Trinity Range, in Star Canyon, in Bloody Canyon 2 miles south of Star Canyon, in Jackson Canyon, 1 mile north of Unionville, Juniper Mountain, Rosebud district, and in Seven Troughs district. Lander County, has been mined in Battle Mountain district, 6 and 10 miles south of railroad, and in Big Creek Canyon in Toyabe Range 12 miles south of Austin. Mineral County, Aurora. Nye County, Hot Creek district, good prospect 16 miles west of Manhattan in the Toyabe Mountains and 45 miles north of Tonopah, the nearest railroad station; from stringers and veins a foot in maximum width pieces of pure stibnite weighing about 75 pounds each are taken out.

Stromeyerite. Lander County, in Cortez silver deposits.

Sulphur. Esmeralda County, large deposits near Luning and Cuprite, prospected with alum 10 miles north of Silver Peak. Humboldt County, extensively mined formerly at Rabbit Hole, 5 miles northeast of Rosebud. Lyon County, small quantity native sulphur in quartz at Mountain View mine, Yerington district. Washoe County, large deposit north of Pyramid Lake.

Tetrahedrite. Elko County, important silver ore at Columbia. Esmeralda County, with gold in Combination mine, Goldfield. Eureka County, Mineral Hill, argentiferous, and Safford district. Humboldt County, occurs in most of silver-gold deposits of Humboldt and Piute ranges. Lander County, mined at Pfluger mine, Humboldt Range; secondary ore at Cortez silver deposits.

Thorium. *See* Monazite.

Travertine. *See* Tufa.

Trona (carbonate of soda). Abundant in Churchill and Mineral counties.

Tufa. Washoe County, lake tufa abundant at Pyramid Lake; probably useful for lime and cement only (not used). Elko County, Contact. Also in other counties.

Tuff. Mineral County, used at Rawhide and elsewhere.

Tungsten minerals. *See* Hübnerite, Scheelite, and Wolframite.

Turquoise. Clark County, has been mined and prospected around Crescent Peak, near Crescent; reported at Searchlight. Esmeralda County, has been mined and prospected at Royal Blue mine, Crow Springs, and in Monte Cristo Mountains north and northwest of Millers, near Klondike Wells, 9 miles northeast of Blair Junction, near Candelaria, and 4 miles northeast of Coaldale. Lyon County, $1\frac{1}{2}$ and also 7 miles northwest of Yerington. Mineral County, $3\frac{1}{2}$ miles south of Redlich; 8 miles southwest and 12 miles northeast of Sodaville; Rand district, 17 miles south of Rawhide and 15 miles east of Rand.

Ulexite (borate of lime). *See* Borax.

Uranium. Lincoln County, occurs with vanadium in an unidentified mineral resembling carnotite, 50 miles north of Pioche.

Vanadinite. Clark County, with wulfenite, 4 miles east of Crescent.

Vanadium. *See* Carnotite and Vanadinite.

Variscite. Esmeralda County, mined and prospected 8 miles south of Redlich or 2 miles northwest of Columbus, 4 miles northeast of Coaldale, and 9 miles north of Blair Junction. Mineral County, 8 miles southwest of Sodaville. Nye County, near Manhattan, in fissure veins in metamorphosed slate, associated with vashegyite.

Vashegyite. Nye County, near Manhattan, in fissure veins in metamorphosed slate, associated with variscite.

Volcanic ash. Elko County, Contact. Esmeralda County, near Tonopah, Nye County. Ormsby County, unlimited quantity 5½ miles east of Carson City on Carson River, and at Merrimac. Washoe County, 1 mile north and 2 miles southwest of Reno.

Wad. Churchill County, Terrell district. Eureka County, Phoenix mine and elsewhere in Eureka district. Humboldt County, small undeveloped deposit 2 miles east of Golconda. Nye County, common in some veins of Bullfrog district, mined for precious metals.

Wolframite. Humboldt County, 20 miles west of Roach; with silver ore in Gold Run district, Sonoma Mountains, 15 miles south of Golconda; tungsten ore reported near Eagle Rock, 16 miles west of Seven Troughs. Lincoln County, in quartz veins with gold, silver, and copper, 12 miles southwest of Pioche.

Wood (silicified). Mineral County, 3 miles north of Rawhide.

Wulfenite. Clark County, with vanadinite, 4 miles east of Crescent. Elko County, Dolly Varden district, fine red. Eureka County, through oxidized ore at Ruby Hill and in Eureka district; very fine specimens have come from the Eureka district.

Wurtzite. Esmeralda County, Goldfield district, on the Mushett lease of Miss Jessie claim.

Zinc. *See* Calamine, Smithsonite, Sphalerite, and Wurtzite.

NEW HAMPSHIRE.

Almandite. *See Garnet.*

Aquamarine. *See Beryl.*

Arsenopyrite (arsenical pyrite, mispickel). Belknap County, occurs at Alton. Carroll County, with cassiterite at Jackson. Grafton County, at Groton, Haverhill, Lebanon, Lyman, and elsewhere. Hillsborough County, at Franconia and Weare, not mined.

Beryl. Common in pegmatite ledges of Cheshire, Grafton, Merrimack, and Sullivan counties. Cheshire County, large crystals found in Nim's mica mine, town of Sullivan; both gem aquamarine and golden beryl have been mined at Island mica mine in town of Alstead; gem and specimen beryl found in town of Roxbury. Grafton County, large crystals found at Standard mica mine near Orange; at De Mott mine, Kilton mine, and Alger Hill mine near Grafton Center; Horse Hill near Grafton; Whicher & Pillsbury mine in town of Wentworth; and at New Haven mica mine, town of Alexandria; gem aquamarine and golden beryl have been mined at Reynolds mine on Sanders Hill and at Playter mine in Springfield Mountains, south of Grafton. Merrimack County, plentiful on Stuart Hill, 2 miles west of Danbury. Sullivan County, crystals measuring 1 inch to 2 feet in diameter found at Beryl Mountain near South Acworth.

Bornite. Carroll County, with chalcopyrite and cassiterite at Jackson. Coos County, with copper and zinc ores at Shelburne and at Milan, mined at latter place. Grafton County, with chalcopyrite in White Mountain mine at Littleton, was formerly mined.

Brown iron ore. *See Limonite.*

Cassiterite. Carroll County, at Jackson, mined in small way in 1843 and 1864.

Cement materials (Portland). Limestones of satisfactory composition could probably be found, but difficulties with regard to fuel and market prevent development of cement industry.

Chalcocite (copper glance). Coos County, mined near Milan, with galena; carries gold and silver.

Chalcopyrite. Carroll County, has been mined with lead-silver ore near Ossipee. Coos County, near Gorham and Milan. Grafton County, at Warren and in mines at Bath, Monroe, Lyman, and Littleton (Gardners Mountain). Merrimack County, at Silverdale mine, near Pittsfield. Sullivan County, at Croydon and Unity.

Clay (brick). Brickyards are usually operating at the following places: Belknap County, The Weirs. Cheshire County, Keene. Coos County, Lancaster. Grafton County, Bath, Lebanon, and Plymouth. Merrimack County, Concord, and Hookset. Rockingham County, Epping, Kingston, Exeter, North Epping, and Plaistow. Strafford County, Dover, Dover Point, East Barrington, Farmington, Gonic, and Rochester.

Clay (pottery). Cheshire County, one pottery is operating at Keene.

Copper minerals. *See Bornite, Chalcocite, Chalcopyrite, and Malachite.*

Diatomaceous earth. In large quantities in northern part of State: Belknap County, small deposit at Laconia. Carroll County, Bemis Lake, Stamp Act Island, Tanworth, and Wolfborough. Cheshire County, Fitzwilliam. Coos County, Lake Umbagog and Stark. Grafton County, small deposits at Livermore and Littleton were formerly used; none is now mined on a commercial scale.

Essonite. Grafton County, found at Warren.

Feldspar. Grafton County, mined near Grafton Center.

Flagstone. Slates and schists quarried for local use at localities in the Connecticut Valley.

Fluorspar. Cheshire County, mined near Westmoreland.

Galena. Carroll County, has been mined near Ossipee and Madison. Coos County, near Shelburne, Gorham, and Milan. Grafton County, at Warren and Woodstock, and with copper ore at mines of Gardner Mountain. Merrimack County, at Loudon and at the Silverdale mine, Pittsfield.

Garnet. Merrimack County, deposit worked at North Wilmot for abrasive material. *See also* Essonite.

Gold. Coos County, minute quantities in alluvial sands, headwater of Indian Creek. Grafton County, free gold formerly mined in upper levels of Dodge mine near Lyman and at Bath; occurs in small quantity in quartzose conglomerate rock at Lisbon, Landaff, Lyman, and North Haverhill.

Granite. Quarried at the following places: Carroll County, Conway (3 quarries), Madison, and Redstone. Cheshire County, Fitzwilliam Township (four quarries), Marlboro, and Troy, formerly at Roxbury and Swanzey. Coos County, Groveton, Kilkenny, Shelburne, and Stark, formerly at Columbia. Grafton County, Benton, Canaan, Grafton, Hanover, Haverhill, Lebanon, and Warren. Hillsborough County, Amherst, Brookline (two quarries) and South Brookline, Manchester (two quarries), Milford (four quarries) and East Milford, and Nashua, formerly at Pelham and Mason. Merrimack County, Allenstown, Concord (nine quarries), Hookset, and Mount Sunapee. Rockingham County, Auburn, formerly at Salem and Portsmouth. Strafford County, Dover, Durham (two quarries), and Rochester, formerly at Farmington. Sullivan County, Sunapee (three quarries).

Graphite. Formerly mined in Cheshire County, at Nelson. Merrimack County, at Potter Place. Sullivan County, at Goshen.

Iron. *See* Limonite, Magnetite, Pyrite, and Pyrrhotite.

Lead. *See* Galena.

Limestone (lime). Grafton County, was burned at Haverhill, Lisbon, and Littleton.

Limonite. Small deposits in different parts of the State, not mined.

Magnetite. Formerly mined at Carroll County, Bartlett. Cheshire County, Winchester. Grafton County, Franconia, Piermont.

Malachite. Grafton County, occurs at Franconia, Hanover, Littleton, and Orford, with copper ores.

Marl. Coos County, Lime Pond, Columbia. Hillsborough County, Hollis, not used.

Mica (chiefly muscovite). Belknap County, has been mined at New Hampton. Cheshire County, mined intermittently (some large mines) near East Alstead, Gilsum, Sullivan, Keene, and Marlboro. Coos County, has been mined at West Milan. Grafton County, mined intermittently (some large mines) near West Rumney, North Groton, on Tugg Hill near Canaan and Orange, near Grafton, Grafton Center, and Alexandria. Merrimack County, was mined near Wilmot. Sullivan County, has been mined near Springfield, Acworth, and Claremont.

Muscovite. *See* Mica.

Ocher. Numerous small deposits of ochreous bog iron ore, not mined.

Peat. Numerous localities, especially in northern part of State. A bog in Rochester, Strafford County, was worked during the Civil War for manufacture of fuel.

Pyrite. Coos County, mined with copper ores of Milan; formerly mined with lead-silver ore near Shelburne. Grafton County, mined for manufacture of sulphuric acid at Lyman. Merrimack County, has been mined with galena at Silverdale mine, Pittsfield. Sullivan County, cupriferous pyrite has been mined at Croydon and Unity.

Pyrrhotite. Grafton County, formerly mined with copper ores of Bath, Monroe, Littleton, and Lyman. Sullivan County, known at Croydon and Unity, not mined.

Quartz. Hillsborough County, formerly quarried at Lyndeborough for glass making.

Road metal. See Granite and Sand and gravel.

Sand and gravel. Dug at several places for road material.

Silver. Coos County, has been produced as by-product from pyrite ores at Milan mine, West Milan.

Slate. Grafton County, formerly quarried at Hanover, Lebanon, and Littleton. Sullivan County, Croydon Mountain, Cornish.

Soapstone. Cheshire County, occurs but not now quarried at Richmond and Keehe. Coos County, Lancaster. Grafton County, slaty character at Orford, large bed at Haverhill. Hillsborough County, Frankestown and Weare. Merrimack County, Canterbury and Warner.

Sphalerite (zinc blende). Carroll County, formerly mined with silver-lead ores at Madison. Coos County, mined at Warren mine, and Milan mine (rare), Milan; formerly mined near Shelburne and near Gorham. Grafton County, formerly mined at Woodstock and Warren, and with copper ores of Gardner Mountain.

Syenite. Carroll County, Red Hill, east of Squam Lake.

Tin. See Cassiterite.

Topaz. Carroll County, Baldface Mountain, near North Chatham; specimens collected intermittently by prospectors.

Tungsten. See Wolframite.

Whetstone. Grafton County, mica schists or fine-grained micaceous sandstone quarried at Haverhill, Lisbon, Littleton, Piermont, and Pike.

Wolframite. Carroll County, small quantities in cassiterite veins at Jackson, not mined.

Zinc. See Sphalerite.

NEW JERSEY.

Agate. Hudson County, has been found at Hoboken. Somerset County, Boundbrook and Liberty Corner.

Amethyst. Hudson County, occurs in small quantity in Weehawken tunnel. Passaic County, at Little Falls. Somerset County, in geodes at Lyons station. Sussex County, at Franklin Furnace.

Apatite. Morris County, large quantity mixed with magnetite at Ferromonte, near Dover; also found at Hurdtown, Mount Pleasant, and Hibernia mines.

Azurite. See Copper minerals.

Braunite. Hunterdon County, occurs near Clinton, in small deposits.

Brown iron ore (limonite). Many old limonite mines were formerly worked: Cumberland County, Shiloh. Hunterdon County, Califon and Bird mines. Morris County, German Valley, Denmark mine, Copper and Chester mines, Hacklebarney. Sussex County, Andover mine, Edsall mine near Hamburg, Pochuck mine near McAfee. Warren County, Beatyestown, Marble Mountain, Fittz, and Shoemaker mines.

Brucite. At Hoboken, in serpentine.

Cement material (Portland). Three large producing plants, the Alpha, the Vulcanite, and the Edison in Warren County. Extensive deposits of limestone of suitable quality in several counties.

Chalcocite. Hudson County, occurs in Schuyler mine. Hunterdon County, Neshanic mine. Middlesex County, mines near New Brunswick. Somerset County, has been mined at American Copper mine, Somerville. Warren County, has been mined at Pahaquarry mine.

Chalcopyrite (copper pyrites). Occurs in Hudson County, Arlington mine. Hunterdon County, Flemington mine. Middlesex County, mines near New Brunswick. Somerset County, Griggstown and Somerville mines.

Chrysocolla. See Copper minerals.

Clay (ball). Burlington County, reported at Florence. Middlesex County, at Sayreville, South Amboy, and Woodbridge, and reported at Perth Amboy.

Clay (brick). Dug in Atlantic County, at Bakersville, Mays Landing, and Egg Harbor. Bergen County, Hackensack, Carlstadt, and Little Ferry. Burlington County, Crosswicks Creek at Crosswicks, and near Bordentown and Kinkora. Camden County, Collingswood and Delair. Cape May County, Belle Plain. Cumberland County, Bridgeton, Clayville, and Rosenhayn. Gloucester County, Woodbury. Hudson County, Homestead. Hunterdon County, Flemington. Mercer County, Trenton. Middlesex County, Woodbridge, South River, and elsewhere. Monmouth County, Cliffwood, Keyport, Lorillard, Matawan Creek, and West Asbury. Morris County, Logansville, Morristown, and Whippany. Ocean County, Herbertsville and Toms River. Passaic County, Little Falls, Mountainview, and Singac. Salem County, Penton station and Yorktown. Somerset County, east of Rocky Hill and at Somerville. Sussex County, small quantity dug at Newton. Union County, Berkeley Heights and Plainfield. Warren County, Brass Castle and Phillipsburg.

Clay (fire). Dug in Burlington County, at Bridgeboro, Florence, and Rancocas. Camden County, Morris station and near West Palmyra. Cumberland County. Gloucester County, Bridgeport and Billingsport. Mercer County, Mercer station and Dogtown. Middlesex County, Perth Amboy, Woodbridge, Milltown, South Amboy, and elsewhere. Ocean County, Waretown, Davenport. Warren County, Port Murray.

Clay (pipe). Middlesex County, dug at Burt Creek.

Clay (pottery). Dug in Camden County, at Delair and Haddonfield. Essex County, Newark. Mercer County. Monmouth County, Matawan. Morris County, Logansport. Union County, in vicinity of Linden.

Clay (slip). Middlesex County, Sayreville, South Amboy, and Woodbridge.

Copper minerals. Azurite, chrysocolla, cuprite, and native copper occur wherever copper has been mined in the State, but in very small quantity. Notably in Hudson County at the Schuyler and Arlington mines, which are well-known occurrences of native copper in sandstone. Middlesex County, mines near New Brunswick. Somerset County, at American Copper and Bridgewater mines at Somerville, at Franklin copper mine near Georgetown, and at Rocky Hill; at the Copperfield mines. *See also* Chalcocite, Chalcopyrite, and Malachite.

Cuprite. *See* Copper minerals.

Diabase. *See* Road metal.

Diatomaceous earth (infusorial earth, tripolite). Morris County, Drakeville. Sussex County, small quantities formerly used for manufacture of giant powder, near Andover. Not now mined.

Flagstone. Formerly quarried in Mercer County, at Woodsville. Sussex County, Bearfort Mountain, Flagstone Hill, and Quarryville.

Fluorspar. Sussex County, occurs in minor quantity throughout the zinc ore at Franklin Furnace.

Franklinite. Sussex County, most abundant ore mineral at Franklin Furnace and Sterling Hill, mined chiefly for zinc oxide.

Gabbro. *See* Road metal.

Garnet. Morris County, abundant at Nolands Point, Lake Hopatcong; also at Ironia. Passaic County, Hope mine, Ringwood. Warren County, Cummings iron mine.

Glauconite. *See* Marl.

Gneiss (crushed stone). Morris County, quarried at Montville, 2 miles north-east of Boonton, and at Morristown. Passaic County, near Pompton, and at Haskell.

Granite (crushed stone). Morris County, quarried at Boonton, near Dover, German Valley, Hibernia, Morristown, and near Stanhope, Mount Arlington, and elsewhere. Passaic County, near Pompton, Haskell, and Charlottetown. Sussex County, near Waterloo and Cranberry Lake.

Graphite. Hunterdon County, occurs at Califon and High Bridge. Morris County, occurs at Mendham and Morristown, has been mined at Bloomingdale. Passaic County, numerous places in Wanaque Valley. Somerset County, Pottersville and Peacock. Sussex County, Franklin and elsewhere.

Hematite (red iron ore). Sussex County, was formerly mined in Simpon and Cedar Hill mines near McAfee; Warren County, small quantity mined at Marble Mountain.

Heterolite. Sussex County, Franklin Furnace.

Ilmenite. Morris County, occurs in Dell and Fichtor mines.

Infusorial earth. *See* Diatomaceous earth.

Iron. *See* Brown iron ore, Hematite, and Magnetite.

Limestone (building). Hunterdon County, small quantities quarried at Clinton and Holland. Somerset County, Gladstone. Sussex County, Andover, Franklin, Newton, Ogdensburg, Sparta Junction, and Sussex. Warren County, Belvidere, Blairstown, Carpenterville, Changewater, Hackettstown, and Phillipsburg.

Limestone (crushed stone). Hunterdon County, quarried at Clinton, Califon, and Vernoy. Sussex County, Ogdensburg. Warren County, Finesville.

Limestone (flux). Hunterdon County, quarried at Annandale, Clinton, Califon, and elsewhere. Sussex County, at Franklin, Hamburg, McAfee, Ogdensburg, and elsewhere. Warren County, Bloomsburg, Carpentersville, Murry, and elsewhere.

Limestone (lime). Hunterdon, Somerset, Sussex, Warren, and other counties.

Limonite. *See* Brown iron ore.

Magnesite (carbonate of magnesia). Hudson County, occurs near Hoboken, with serpentine.

Magnesium. *See* Brucite.

Magnetite (magnetic iron oxide). Following is a list of mines formerly operated in Sussex County: Andover group, 4 miles south of Newton; Ford group, $3\frac{1}{2}$ miles southeast of Sparta; Ogden group, at Edison; Sherman group, 1 mile southeast of Sparta; Sickles mine, 3 miles south of Sparta; Franklin Furnace, group extending southwest from the zinc mines at Franklin Furnace. Morris County, has been mined at Mount Hope, Richard, Hoff, Hurd, and Hibernia mines, at Rockaway Valley mines near Taylorville, near Splitrock Pond, Montville, and Riverdale. Passaic County, at Ringwood mines. Sussex County, Stanhope and Ahles mines. Warren County, Oxford Furnace mine.

Malachite (green copper carbonate). Essex County, occurs in sandstone at Belleville and Bloomfield; has been mined at Belleville. Hudson County, occurs at East Belleville. Somerset County, has been mined at Somerville. Union County, occurs in Triassic sandstone at Chimney Rock, near Plainfield. Warren County, has been mined at Pahaquarry.

Manganese. Sussex County, Franklin Furnace, in franklinite (zinc-iron-manganese oxide). The zinc residues from these ores furnish next to the largest quantity of the manganese produced in the United States. *See also* Braunite and Tephroite.

Marble. Sussex County, small quantity formerly quarried near Andover and Roseville. Warren County, formerly quarried near Upper Harmony, Marble Mountain, and Jenny Jump Mountain near Danville.

Marl. Small quantities of greensand marls dug from Raritan Bay across Monmouth, Ocean, Burlington, Camden, Gloucester, and Salem counties to Delaware River; recently dug in quantity at Sewell, Gloucester County. Calcareous marls at Shiloh, Cumberland County, dug for local use.

Menaccanite. *See* Ilmenite.

Mineral paint. Zinc oxide is produced in large amount from the ores from the Franklin Furnace and Ogdensburg zinc mines. *See also* Ocher and Shale.

Molybdenite. Sussex County, occurs in Hude, Stanhope, and Ogden mines.

Ocher. Camden County, occurs at Camden. Middlesex County, Lincoln. Warren County, mined recently near Phillipsburg. *See also* Mineral Paint and Shale.

Peat. Beds of peat in many swamps. Morris County, was made into briquets near Lincoln Park in 1904-5. Plant for manufacturing peat into fertilizer and fertilizer filler at Great Meadows, Warren County, and near Hacketts-town. Peat is dug on a considerable scale for fertilizer in a number of other localities. Peat moss is shipped on some scale from Barnegat, Ocean County, and used by florists and in artificial stock foods.

- Pyrite.** Morris County, occurs in Old Copperas, Hibernia, and Hurdtown mines. Sussex County, with magnetite near Vernon, Waterloo. Warren County, Jenny Jump Mountain, Marble Mountain, Washington, Swaze, and other mines.
- Pyrrhotite** (magnetic pyrites). Morris County, occurs in Hurdtown mine. Sussex County, Longcore's mine.
- Road metal.** Baltimore gneiss quarried at Holland. Mica gneiss quarried near Byberry, Ford, Montville, Morristown, and Pompton. Diabase or trap rock quarried at Brookville, Lambertville, Marshalls Corners, Milburn, Moore, Mount Rose, Paterson, Plainfield, Springfield, Upper Montclair, and formerly along Palisades. Gabbro quarried extensively at Wayne. *See also* Granite, Limestone, and Trap rock.
- Sand** (building). Dug in Bergen County, at Hackensack and Wortendyke. Burlington County, Bordentown, Burlington, Florence, Palmyra, and elsewhere. Camden County, Morris station, Grenloch, and Wilton. Cumberland County, Millville. Essex County, South Orange. Gloucester County, Swedesboro. Middlesex County, Monmouth Junction, Metuchen, Sayreville, and Woodbridge. Morris County, Succasunna, Orelan, Ironia, and Montville. Passaic County, Hawthorne and Oak Ridge. Sussex County, Stanhope. Warren County, Phillipsburg. Also in small quantity at many other points.
- Sand** (fire). Middlesex County, fire sand and underlying Woodbridge fire clay dug at number of points for manufacturing fire brick. Dug also at Burlington, Bridgeton, and Millville.
- Sand** (filter). Atlantic County, dug at Absecon. Burlington County, dug extensively at Birmingham. Cape May County, large output from Cape May.
- Sand** (glass). Camden County, dug at Penbryn and Wilton. Cumberland County, Cedarville, Millville, and South Vineland. Gloucester County, Williamstown. Middlesex County, Jamesburg.
- Sand** (molding). Dug in Burlington County, at Bordentown, Brown Mills, Burlington, Lumberton, Palmyra, and elsewhere. Camden County, Blenheim, Grenloch, and Morris station. Cape May County, Belle Plain. Cumberland County, Millville and Cedarville. Gloucester County, Downer, Radix, and elsewhere. Middlesex County, Perth Amboy, South Amboy, and elsewhere. Morris County, Flanders. Passaic County, Little Falls. Sussex County, Stanhope. Warren County, Phillipsburg, and Great Meadows.
- Sandstone.** Quarries, many abandoned: Bergen County, Closter and Ridgefield. Essex County, Pleasantdale and West Orange. Hudson County, North Arlington. Hunterdon County, Byram, Raven Rock, and Stockton. Mercer County, Lawrenceville, Princeton, Trenton, and Wilburta. Passaic County, Passaic and Paterson. Somerset County, Kingston, Martinsville, and Watchung. Sussex County, Quarryville. Warren County, Belvidere.
- Sandstone** (brownstone). Quarries, many closed: Essex County, Pleasantdale. Hudson County, North Arlington. Passaic County, below Great Falls on east side of Passaic River, Paterson, and near Passaic. Somerset County, near Kingston.
- Sandstone** (conglomerate, pudding stone). Morris County, quarried at Green Pond. Passaic County, Bearport and Kanouse mountains, attractive building stone.

Serpentine. Hudson County, projects out into Hudson at Stevens Point, and formerly quarried for local use. Morris County, scattered through limestone at Montville. Warren County, quarried at Phillipsburg, for decorative use and sold as "verde antique marble."

Shale (paint). Somerset County, has been worked at Bound Brook.

Slate (roofing). Sussex County, quarried at Newton and Lafayette. Warren County, Port Murry, formerly quarried at Delaware Water Gap, and elsewhere.

Talc and soapstone. Sussex County, occur at Sparta, Lockwood, Andover, Franklin, and Newton. Warren County, quarried with serpentine near Phillipsburg.

Tephroite. Sussex County, occurs locally abundant at Franklin Furnace and Sterling Hill.

Titanium. *See* Ilmenite.

Trap rock. Quarried in Bergen County, at Bergen Hill, Cliffside, Cliffside Park, Edgewater, and Fairview. Essex County, Caldwell and Verona, Milburn, Montclair and Upper Montclair, South Orange and West Orange. Hudson County, Granton, Jersey City, and New Durham. Hunterdon County, Byram and Lambertville. Mercer County, Hopewell, Lawrenceville, Princeton, and Titusville. Middlesex County, Dunellen. Morris County, Hibernia, Middle Valley, Millington near Mountain View, Pine Brook, and Pompton. Passaic County, Great Notch, Little Falls, Passaic, and Paterson. Somerset County, Bernardsville, Bound Brook, Rocky Hill, and Somerville. Union County, New Providence, Springfield, and Summit.

Tripolite. *See* Diatomaceous earth.

Verde antique (marble). *See* Serpentine.

Vesuvianite. Sussex County, Newton.

Willemite (silicate of zinc). Sussex County, one of the abundant minerals at Franklin Furnace and Sterling Hill.

Zeolites. In the trap region in a belt extending from Paterson to Trenton in Passaic, Essex, Union, Middlesex, Somerset, and Mercer counties.

Zinc. *See* Franklinite, Hetaerolite, Willemite, and Zincite.

Zincite (red oxide of zinc). Sussex County, Franklin Furnace, and Sterling Hill.

Zircon. Sussex County, abundant in magnetite at Williams mine.

NEW MEXICO.

- Alum.** Colfax County, is reported southeast of Springer on the Abbott ranch. Grant County, in Alumina district, large supply of aluminum sulphate 25 miles north of Silver City on both sides of Gila River. Mora County, eastern part, about 25 miles from Wagon Mound. Sandoval County, northwest part in a 15 to 20 foot bed between sand rock. Taos County, in the Sangre de Cristo Mountains, west of Red River post office (reported). Union County, Ute Creek; not mined.
- Alunogen.** Grant County, in Alumina district, both sides of Gila River, secs. 19, 20, 29, 30, T. 13 S., R. 13 W.
- Amethyst.** Grant County, Black Range, Great Republic mine.
- Anglesite.** Dona Ana County, Organ district, Stephenson-Bennett mine. Luna County, Cooks Peak and Victorio districts, mined at Desdemona, Graphic, and Summit mines. Socorro County, in Magdalena district.
- Anhydrite.** Common in thick beds with gypsum.
- Anthracite.** Santa Fe County, mined at Madrid, south of Cerrillos.
- Antimony minerals.** *See* Cervantite and Stibnite.
- Argentite** (silver glance, silver sulphide). Has been mined in the following districts: Dona Ana County, Organ (rare). Grant County, Black Hawk, Chloride Flat, Georgetown, Granite Gap, Kimball, Lore Mountain, Steeplerock, Telegraph district, and Pyramid districts. Luna County, Florida Mountains district. Mora County, Tres Hermanas Mountains. Sandoval County, Cochiti. Sierra County, Kingston, Hermosa, Tierra Blanca, Lake Valley, Black Range, and Apache districts. Socorro County, Cooney (Mogollon), Socorro, and Wilcox, 15 miles southeast of Cooney.
- Aurichalcite.** Socorro County, Magdalena district.
- Azurite** (blue carbonate of copper). Mined with other copper ores in the following districts: Grant County, Burro Mountain and Sylvanite; old San Jose copper mines, Central district. Luna County, Fremont (a little). Rio Arriba County, Bromide, not important. Sandoval County, Nacimiento (red beds). San Miguel County, Tecolote. Sierra County, Chloride (Phillipsburg) and Caballos. Socorro County, Magdalena. Valencia County, Copperton (Zuni Mountains), red beds.
- Barite.** Valencia County, Zuni Mountains; 10-foot vein in Smelter Gulch prospected for silver.
- Basalt.** Rio Arriba County, northwest of Lumberton, along Colorado State line. Valencia County, near Grant, Mount Taylor and vicinity, 10 miles north-east of Grant. At many other places in the State.
- Beryl.** Santa Fe County, near Santa Fe, a few crystals of fine quality found in the gravels, not worked.
- Bismuth** (native). Luna County, Fremont, with silver ores, rare. Socorro County, mined in 1911 and 1912 about 25 miles southwest of Tularosa. Dona Ana County, frequently in commercial quantities in ores of the Organ district. *See also* Bismutite and Tetradymite.
- Bismutite.** Dona Ana County, at Organ, associated with lead, silver, and copper ores in workable amount in the Torpedo, Memphis, and Excelsior mines, in the fissure veins in the granite on San Augustine Peak, and from there to the north line of the county in the San Andreas Range. Otero County, mined 25 miles southwest of Tularosa. Socorro County, southeastern part in the fissure veins and copper and lead deposits in the San Andreas Range as far north as Salinas Peak. Bismuth ore has been shipped from the mines near Salinas Peak.

Bloedite. Torrance County, at Estancia Lakes.

Bornite. Mined in the following districts: Grant County, Kimball, small quantity; and Lordsburg, minor ore; Steeplerock district, Little Mack group. Lincoln County, Nogal Mountains. Rio Arriba County, Abiquiu. Sandoval County, Nacimiento (red beds). San Miguel County, Rociada and Tecolote. Sierra County, Caballos, Chloride (silver bearing), Hermosa (silver bearing), Kingston (silver bearing). Socorro County, Cooney (Mogollon), important ore. Taos County, Twining. Occurs also in Santa Fe County with other copper ores.

Brochantite. Dona Ana County, Organ district, not mined.

Bromine. See Bromyrite, Embolite, and Salt.

Bromyrite. Rio Arriba County, Bromide. Sierra County, with gold and silver ores in Tierra Blanca district; was formerly mined.

Brown iron ore (limonite, brown hematite). Common in all oxidized ores. Grant County, at Silver City, small quantity mined with magnetite near Fierro, Union mines; formerly mined in Glorieta district, Central district, Clarks Peak district. Lincoln County, occurs northeast of White Oaks, in Capitan Mountains, and at Lone Mountain, Jicarilla district, near Jack Mountain; Red Cloud (Gallinas) district, and at the Rock Island group of iron mines, 3 miles north of Tecolote station on the line of the El Paso & Southwestern System. Santa Fe County, east slope of Tuerfos Mountains, Limestone district, about midway between Hermosa and Chloride; Mount Spring district, midway between Estey and Jarvis, near Santa Fe; near Glorieta; Perry deposits near San Pedro. Sandoval County, Placitas district, in Sandia Mountains (of bog iron character). Socorro County, Jones district in north end of Sierra Oscura, Canyoncito, Wilcox, 15 miles southeast of Cooney. Sierra County, in Cuchillo Range, south of Chloride, large body of Iron Mountain group reported. Otero County, Jarilla. San Miguel County, Rociada, and reported near Las Vegas and on upper Rio Pecos. Torrance County, west of the Gran Quivira. Valencia County, prospected at head of Smelter Gulch, Zuni Mountains.

Caliche. Common in desert regions.

Cement material. Colfax County, Springer, natural cement formerly manufactured. Lincoln County, limestone suitable for cement in the mountains immediately northwest of White Oaks. Socorro County, limestone and shale suitable for Portland cement, near Carthage. Torrance County, in certain portions of Estancia plain along New Mexico Central Railroad.

Cerargyrite (horn silver, silver chloride). Has been mined with oxidized ores in the following districts: Dona Ana County, Organ, rare. Grant County, Apache No. 2, Black Hawk, Burro Mountains, Chloride Flat, Georgetown, Hachita, Kimball, Lone Mountain, Pyramid, Telegraph. Luna County, Fremont, Florida Mountains. Mora County, Tres Hermanas. Santa Fe County, San Ysidro Mountain. Sierra County, Apache; Black Range; Chloride (Phillipsburg); Hermosa; Hillsboro; Lake Valley, formerly an important ore; Kingston, in placers; and Tierra Blanca, rare. Socorro County, Cooney (Mogollon) and Socorro.

Cerium. See Monazite.

Cerussite (lead carbonate). Mined in the following districts: Dona Ana County, Organ, in Stephenson-Bennett lead-silver mines. Grant County, Granite Gap; Hanover, with zinc ores; Hachita; and Lordsburg. Luna County, Cooks Peak, Florida Mountains, and Fremont. Sierra County, Hillsboro, Lake Valley, very rich in silver, Macho district, south of Lake Valley district, and Chlorine (Phillipsburg). Socorro County, Magdalena, Pueblo, north of Magdalena.

Cervantite. Grant County, Central district, not mined.

Chalcocite (copper glance). Mined in the following districts: Dona Ana, Hembrello district. Grant County, Burro Mountain, with cupriferous pyrite, Hachita, Kimball, small quantity, Santa Rita; south of Hachita, toward Big Hatchet Mountains, large deposits reported; Silver City, a large manganiferous deposit adjoins the town. Otero County, Tularosa, Jarilla. Sandoval County, Nacimiento, principal ore of red beds, San Miguel district, 10 miles south of Sierra Nacimiento district. San Miguel County, Rociada and Tecolote, Mineral Hill, San Pablo, San Miguel. Sierra County, Caballos. Socorro County, Cooney (Mogollon), important ore. Taos County, Picuris. Known but not mined: Rio Arriba County, Hermosa prospects, Lily Belle mine, near Abiqui, "Copper Canyon district." Santa Fe County, Lunto Mountains, in small quantities. Sierra County, Pittsburg district, in Marion and other mines. Socorro County, small quantities at Sierra Oscura, Estey. Valencia County, in "Red Beds" in Copper Hill district and Zuni Mountains.

Chalcophanite. Socorro County, Magdalena, mined with smithsonite.

Chalcopyrite (copper pyrites). Has been mined in the following districts: Colfax County, Cimarroncito and Elizabethtown, small quantity. Dona Ana County, Organ, in copper deposits only, Torpedo mine. Grant County, Burro Mountains; Central, with galena; Fierro, with iron ore; Hachita, rare; Kimball, small quantity; Lordsburg; Pinos Altos; Santa Rita; Steeplerock; and Sylvanite. Lincoln County, Nogal. Luna County, Florida Mountains, Fremont. Otero County, Jarilla; Tularosa, very little. Rio Arriba County, Bromide; Hopewell, minor ore. San Miguel County, Cooper (Pecos), Rociada, Tecolote. Santa Fe County, Cerrillos, a little, argentiferous and auriferous; Lunto and Santa Fe Mountains; San Pedro, principal ore. Sierra County, Caballos, Chloride (Apache). Socorro County, not plentiful, Cooney (Mogollon); Estey; Mogollon Mountains, with chalcocite, bornite, and native silver, argentiferous. Taos County, Red River, not abundant, Twining.

Chalk. In northeastern part of the State.

Chrysocolla. Mined with other copper ores in the following districts: Dona Ana County, Organ, Torpedo mine. Grant County, Apache No. 2, not prominent; Burro Mountains; Lordsburg, not common. Otero County, Jarilla. Sandoval County, Nacimiento, red beds. Santa Fe County, Santa Fe Mountains. Socorro County Oscura Mountains, in large quantity; San Lorenzo. Taos County, Picuris.

Clay (brick). Dug in Bernalillo County, at Albuquerque, Old Albuquerque, and east slope of Sandia Mountains. Colfax County, Raton. Dona Ana County, Brickland, Las Cruces. Grant County, Silver City. Lincoln County, occurs near Capitan. McKinley County, Gallup. Sandoval County, from shales on the Tongue just north of Tejon land grant, on east slope of Sandia Mountains, in southeast part of county. San Juan County, Farmington, Aztec, and Kirtland. San Miguel County, Las Vegas. Santa Fe County, Santa Fe. Socorro County, at Socorro on east side of river, extensively used in making good fire brick, Lemitar Mountains, Escondido, Socorro Mountain at mouth of Blue Canyon. Taos County, Animas Valley. Nearly all the principal towns of the State make brick for their own use, chiefly from the alluvial and loess clays found near at hand.

Clay (fire). Bernalillo County, Gallup district. Grant County, and Sandoval County; good beds occur near the Sandia Mountains. Mines in McKinley County, Clarkville and Gallup. Socorro County, at San Antonio.

Coal (anthracite). *See* Anthracite.

Coal (bituminous and subbituminous). Bernalillo County, undeveloped bed along Rio Puerco near San Ygnacio. Colfax County, mined at Blasburg, Brilliant, Dawson, Koehler, Van Houten; on the Vermejo, Raton, Raton Mountains, near Maxwells, 6-foot vein, Van Houten. Lincoln County, mined at Capitan and White Oaks. McKinley County, mined at Gibson, Heaton, Allison, several places west of Fort Wingate and Gallup, Hosta Butte, not mined, Raton Springs, local use, and near Zuni, local use, San Mateo. Rio Arriba County, Gallina (not mined), Monroe (mined), Stinking Lake (not mined). Sandoval County, Chico Arroyo, 15 miles northwest of Cabezón and at Rio Puerco (not mined), Hagan (local use), 15 miles east of Bernalillo, Sierra Nacimiento (local use), east of San Felipe. San Juan County, Fruitland (local use), La Plata, Pendleton, Putnam (local use). San Miguel County, Rio Pecos, and on Purgatoire River, Las Vegas (not mined). Santa Fe County, Madrid, Omara, 18 miles southeast of Cerrillos, near and below Gravel Cabin, in the Cerrillos field, near Galisteo Creek, 10 miles south of Madrid. Sierra County, westerly from Engle. Socorro County, Carthage (mined); small quantity of coking coal about 25 miles northwest of Magdalena, Estey, 14-inch bed, Abbey district (coking), 18 miles northwest of Magdalena, near the Ladrone Mountains. Taos County, on the Pueblo Indian Reservation, near Taos, at the foot of Pueblo Mountains. Valencia County, in San Mateo Mountains. *See also* Anthracite.

Coke (natural). Santa Fe County, found with anthracite at Cerrillos Hills.

Copper (native). Socorro County, San Lorenzo, rare. Grant County, Pinos Altos, rare, and Santa Rita district, east of Silver City, important.

Copper minerals. Copper is the predominant or an important metal produced in the following districts: Bernalillo County, Hell Cañon, Placitas, Sandia, Tijeras Canyon, 18 miles northeast of Albuquerque. Dona Ana County, Hembrillo, Organ (Torpedo mine; Memphis mine; Charles Foy mine, with zinc). Grant County, Anderson (Apache No. 2), Burro Mountains, California (about 20 miles south of Rodeo), Central, Clarks Peak, Eureka, Fremont, Gold Hill, Hachita, Kimball, Pinos Altos, Pyramid, San Simon, Santa Rita (Hanover mine), Steeplerock, Virginia, White Signal (Cow Spring). Lincoln County, Estey, Eagle Creek, Jicarilla, Red Cloud (Gallinas Mountains), Rio Ruidosa, Sierra Blanca. Mora County, Coyote. Otero County, Highrolls, Tularosa. Rio Arriba County, Abiquiu, Bromide, Gallina, Headstone. Sandoval County, Cuba, Placitas. San Miguel County, Mineral Hill, Rociada, Tecolote. Santa Fe County, Cerrillos, New Placers, San Pedro, and near Santa Fe. Sierra County, Black Range, Caballos Mountains, Chloride (Apache No. 1), Hillsboro, Limestone, Pittsburg (Marion and other mines). Socorro County, Abbey (18 miles northwest of Magdalena), Cooney (Mogollon), Estey, Hansonburg, Jones, Magdalena, Mound Spring (midway between Estey and Jones), Oscura, Red Hill (15 miles west of Rosedale), San Andreas, San Lorenzo, Silver Mountain (Water Canyon). Taos County, Copper Mountain, Picuris, Red River, Twining. Union County, Block Mesa. Valencia County, Copperton in Zuni Mountains, Manzano. Occur also in the Guadalupe Mountains in Chaves, Eddy, and Otero counties, at the old Neumeyer copper mine, and many other properties. Occurs also commercially in Colfax County, Baldy Mountain, Cimarroncito, and Moreno district. Luna County, Florida Mountains, Tres Hermanas. *See*

- also* Azurite, Bornite, Brochantite, Chalcocite, Chalcopyrite, Chrysocolla, Cuprite, Malachite, Tenorite, and Tetrahedrite.
- Cuprite** (ruby copper). Dona Ana County, Organ district, Torpedo mine. Grant County, mined in Santa Rita district, east of Silver City, Hanover (formerly), and Burro Mountain district. Sierra County, Caballos. Socorro County, in limestone with zinc and lead ores at Magdalena and Mill Canyon; San Lorenzo. Taos County, Picuris.
- Descloizite**. Grant County, Commercial mine, Georgetown. Sierra County, Lake Valley district.
- Embolite**. Sierra County, mined to small extent in Grande, Bella, and Apache mines, Lake Valley.
- Endlichite**. Sierra County, Lake Valley and Hillsboro.
- Epsomite**. Torrance County, obtained at Estancia Lakes.
- Ferberite**. San Miguel County, Hermit Mountain, with scheelite.
- Fluorspar**. Bernalillo and Sandoval counties, plentiful in the Sandia Mountains. Luna County, mined near Deming and Cooks Peak. Grant County, formerly mined for flux in Burro Mountain district; large lode in Anderson district. Socorro County, Jones district, and San Andreas Range.
- Fossil wood**. *See* Wood, petrified.
- Galena** (generally argentiferous). Mined in the following districts: Bernalillo County, Soda Springs. Colfax County, Moreno, small amount. Dona Ana County, Organ, in Stephenson-Bennett mine, Modoc mine (argentiferous). Grant County, Burro Mountains, a little with gold ores; Central, principal ore; Granite Gap, with cerusite; Hachita; Hanover, very little with zinc ores; Kimball, small amount; Lordsburg, minor ore; Pinos Altos, with copper and gold ore; Steeplerock, small amount, formerly mined. Lincoln County, Nogal, not plentiful. Luna County, Florida Mountains; Fremont; Cooks Peak; Victorio, principal ore. Mora County, Tres Hermanas, with zinc ore. Rio Arriba County, Hopewell, sparingly. San Miguel County, Rociada, Cooper, rare. Sandoval County, Cochiti, rare. Santa Fe County, Cerrillos, prominent ore. Sierra County, Caballos, unimportant; Hermosa, principal ore; Kingston, principal ore; Lake Valley, very rich in silver; Tierra Blanca. Socorro County, Canyoncito, Jones, Magdalena, Silver Mountain (Water Canyon) district; Abbey district, 18 miles northwest of Magdalena. Taos County, Red River. Valencia County, Copperton, with copper ores.
- Garnet** (pyrope). San Juan and McKinley counties, found in Navajo and Zuni reservations, also in Santa Fe and Taos counties; of value as gem but not mined.
- Gas**. *See* Natural gas.
- Glauberite**. Torrance County, with epsomite and salt at Estancia Lakes, not mined.
- Gold** (lode). Mined in the following districts, chiefly in oxidized zone: Bernalillo County, Tijeras Canyon, Coyote Canyon, and Hall Canyon districts. Chaves, Eddy, and Otero counties, in the Guadalupe Mountains. Colfax County, Elizabethtown, Moreno, Cimarroncito, Red River district, and Ute Creek. Dona Ana County, Black Mountain, in Organ Mountains, Organ district, Texas Creek, Little Buck mine. Grant County, Burro Mountains, Central, California, Clarks Peak (30 miles west of Silver City), Cow Spring, Gold Hill, Kimball, Lordsburg, Malone (3 miles northwest of Gold Hill), Pinos Altos, Sylvanite, Steeplerock. Lincoln County, Jicarilla, Nogal, Red Cloud (Gallinas Mountains), Vera Cruz, White Oaks. Luna County, Tres Hermanas, Victorio, Stonewall; in southwest part, at

Hermanas on the line of the El Paso & Southwestern System. Otero County, Jarilla district and White Mountain district. Sandoval County, Cochiti. San Miguel County, Rociada, Cooper. Rio Arriba County, Bromide, Hopewell. Sandoval County, Placitas, Sandia. Santa Fe County, Old Placers; New Placers; Ortiz mine and many other lodes; San Pedro and near Santa Fe, near Monument Rock, 9 miles east of Santa Fe; large low-grade ledges in Santa Fe and San Miguel counties, along the Atchison, Topeka & Santa Fe Railway, between Santa Fe and Las Vegas, especially in Dalton Canyon. Sierra County, Fremont, Chloride, Hillsboro, Tierra Blanca. Socorro County, Cat Mountain (12 miles southwest of Magdalena), Cooney, Hanson, Mill Canyon, Mogollon, Mound Spring (midway between Estey and Jones), Rosedale, Red Hill (15 miles west of Rosedale), San Lorenzo, Silver Mountain (Water Canyon), Wilcox (15 miles southeast of Cooney). Taos County, Anchor, Keystone, and Midnight, north of Red River district; Picuris, Ojo, Caberite, Cieneguilla (Glen Woody) district; Red River; Rio Hondo.

Gold (placer). At many places in the State, especially along Rio Grande. Bernalillo County, Coyote, Star Hill Canyon district. Chaves County, on Rio Hondo. Colfax County, Elizabethtown, Moreno, Ponil, Uraca Creek, and Ute Creek, West Moreno (Hematite) district, Willow Creek district. Grant County, Pinos Altos, especially in Cleveland group; Pyramid district; Virginia district; Malone district, southwest of Hachita district. Lincoln County, Eagle Creek, Gallinas, Jicarilla, Nogal (Bonita, Parsons), Ruidoso, southeast of Nogal, White Oaks, and on Rio Hondo. Otero County, formerly mined at Jarilla, dry placers, and elsewhere. Rio Arriba County, Hopewell, Rio Chama above Abiquiu, and Ortiz Mountains. Sandoval County, Sandia district. San Miguel County, Cooper. Santa Fe County, Old Placers, New Placers, Galisteo, and along Galisteo River. Sierra County, Hillsboro, at Wicks Gulch; Pittsburg; Caballo Range, opposite Derry. Taos County, Red River, Rio Grande placers, Rio Hondo, Cieneguilla (Glen Woody) district, and above Cieneguilla.

Granite. Bernalillo County, quarries opened east of Albuquerque in Sandia Mountains. Grant County, Lordsburg and Steins. Santa Fe County, near Santa Fe. Valencia County, Sais.

Graphite. Bernalillo and Sandoval counties, in and near the Sandia Mountains, not mined; east of Albuquerque, at east end of Tijeras Canyon, near Whitcombs Springs. Colfax County, in mountains near Raton. Taos County, near Taos, in Taos Range, in Cretaceous sandstone. Valencia County.

Guano. Grant County, reported in Black Range. Luna County, formerly shipped from cave in Tres Hermanas Mountains. Otero County, once produced in Guadalupe Mountains. Sierra County, northeast of Engle in a volcanic crater in the plains of Jornada del Muerto, about 3,000 tons shipped to California in 1901 and 1902; Caballos Mountains, reported.

Gypsum. Occurs in Bernalillo, Chaves, Dona Ana, Eddy, Guadalupe, McKinley, Otero, Quay, Rio Arriba, Roosevelt, Sandoval, San Juan, San Miguel, Santa Fe, Sierra, Socorro, Torrance, and Valencia counties. Used locally, but on a commercial scale only in Chaves County at Acme, Eddy County at Oriental, Lincoln County at Ancho, Otero County at Alamogordo, gypsum sands, and Rio Arriba County at El Rito.

Halite. See Salt.

Halotrichite. Grant County, both sides Gila River, secs. 19, 20, 29, 30, T. 13 S., R. 13 W.

Hematite. Common in oxidized ores throughout the State. Colfax County, in Iron Mountain at Elizabethtown, large deposit. Grant County, mined at Fierro. Santa Fe County, formerly mined in Glorieta district. Socorro County, Iron Mountain (Tenmile) district, 10 miles west of Magdalena. Taos County, Twining (Rio Hondo) district. Some of good grade in dikes of diorite porphyry. *See also* Specularite.

Hübnerite. Grant County, Hachita district. Lincoln County, in quartz with gold ores in White Oaks district. Luna County, Victorio, 8 miles south of Gage.

Hydrozincite. Luna County, Tres Hermanas district, with willemite and smithsonite. Socorro County, in limestone at Magdalena, with smithsonite.

Iodyrite. Sierra County, with vanadinite, at Lake Valley.

Iron minerals. *See* Brown iron ore, Hematite, Magnetite, Pyrite, Pyrrhotite, and Specularite.

Jasper. Lincoln County, about 2 miles north of Ancho, small bed, good for ornamental work.

Lead minerals. Lead is the predominant or an important metal produced in the following districts: Bernalillo County, Coyote, Sandia. Dona Ana County, Hembrillo, Modoc and Organ, Bennett-Stephenson and Modoc mines. Grant County, California, Carpenter, Central, Chloride Flat, Eureka, Fremont, Granite Gap, Hachita, Kimball, Pinos Altos, Pyramid, Red Hill, San Simon, Virginia, White Signal (Cow Spring). Lincoln County, Eagle Creek, Ruidoso (southeast of Nogal), Sierra Blanca. Luna County, Cooks Peak, Florida Mountains, Fremont, Tres Hermanas, Victorio. Sandoval County, Placitas, Sandia. San Miguel County, Cooper, Hamilton. Santa Fe County, Cerrillos, New Placers. Sierra County, Bromide, Caballo (Pittsburg), Hermosa, Hot Springs, Iron Reef, Kingston, Lake Valley, Limestone, Macho, and near Palomas. Socorro County, Canyoncito, Hanson, Iron Mountain (Tenmile, 10 miles west of Magdalena), Magdalena, Mogollon Mountains, Oscura, San Andreas, Sandia Mountains. *See also* Anglesite, Cerusite, Galena, and Plumbojarosite.

Limestone (building and crushed stone). In many parts of the State. Bernalillo and Sandoval counties, in the Sandia Mountains; quarry opened in Soda Springs Canyon furnishes a superior quality used extensively for building in Albuquerque. Chaves County, 5 miles from Roswell. Dona Ana County, in mountains east of Las Cruces. Grant County, Silver City. Guadalupe County, Vaughan. Lincoln County, Tecolote. Mora County, quarried at Watrous. Otero County, abundant; not used. Santa Fe County, Cerrillos.

Limestone (lime). Bernalillo County, Tijeras, 20 miles east of Albuquerque. Here the Kemp plant is the largest producer of lime in the State; another plant is situated 2 miles farther up the Tijeras Canyon. San Miguel County, quarried, and large limekilns operated at Las Vegas near the Hot Springs. Socorro County, at Fraley, 8 miles east of San Antonio, at northwest edge of the Carthage coal field, lime was formerly made. Occurs also at many other places. Nearly all the principal towns of the State have a supply of lime in their immediate vicinity.

Limonite. *See* Brown iron ore.

Lithographic stone. Valencia County, near Bluewater. Other localities reported.

Magnetite (magnetic iron ore). Colfax County, common in contact-metamorphic deposits at Cimarron and Elizabethtown. Grant County, mined as iron ore at Fierro. Lincoln County, Red Cloud, in Gallina Mountains district 15 miles southeast of Quivira. Santa Fe County, at Old Placers, in gold quartz veins. Socorro County, mined as iron ore at Jones Camp; deposits occur at Blackington and Harris camp, 25 miles north of Jones camp, westward from Gran Quivira; occurs also in the copper and zinc ores of the Magdalena district.

Malachite. Mined with oxidized ores of the following districts: Grant County, Apache No. 2, Burro Mountains, Lordsburg, Pinos Altos, Santa Rita, Sylvanite, old San Jose copper mines, Central. Luna County, Florida Mountains, Fremont. Mora County, Coyote. Otero County, Jarilla. Rio Arriba County, Bromide. Sandoval County, Nacimiento (red beds), San Miguel, 10 miles south of Sierra Nacimiento district. San Miguel County, Tecolote, Mineral Hill, San Pablo, San Miguel. Sierra County, Caballos, Phillipsburg. Socorro County, Jones, Estey, Magdalena, San Lorenzo, Wilcox, 15 miles southeast of Cooney. Taos County, Picuris. Valencia County, Copperton, Zuni Mountains, in red beds.

Manganese minerals. See Chalcophanite, Manganite, Psilomelane, Pyrolusite, and Wad.

Manganite. Sierra County, mined at Lake Valley with silver ore.

Marble. Bernalillo County, in the Sandia Mountains east of Albuquerque. Dona Ana County, plains west of Las Cruces. Grant County, Silver City. Lincoln County, in the Capitan Mountains; occurs in White Oaks district, white and black, not quarried. Otero County, quarried at Alamogordo. San Miguel County, Las Vegas. Lima County, in the Tres Hermanas Mountains, at the zinc mines and at the great bat cave on the north and west sides of the range. Santa Fe County, near Santa Fe. Valencia County, in the Manzanos Mountains.

Marl. Torrance County, Estancia plain along the Santa Fe Central Railway.

Meerschauum. Grant County, small quantities shipped from prospects 12 miles northwest and 24 miles north of Silver City. Luna County, deposits at Gila River canyon and Bear Creek, not mined.

Mica. Luna County, Florida Mountains, southeast of Deming (reported). Mora County, mined or prospected in Talco. Rio Arriba County, several mines near Petaca (some of them large) and near Ojo Caliente. San Miguel County, Ribera, Glorieta Mountains. Santa Fe County, Nambe, Santa Fe Mountains. Socorro County, southeast part, in San Andreas Mountains, in first canyon north of Mocking Bird Spring. Taos County, Servilleta, near Taos, and 3 miles north of Ojo Caliente.

Mineral paint (ocher). Bernalillo County, in the Sandia Mountains immediately east of Albuquerque. Santa Fe County, near San Pedro, said to be of considerable value.

Molybdenite. Grant County, rare at Modoc mine, Fierro district, and with copper ores at Santa Rita. Rio Arriba County, Bromide, with copper ores. San Miguel County, mined at Porvenir, 18 miles northwest of Las Vegas, where it occurs with copper minerals. Rociada, with copper ores. Santa Fe County, in the mountains a few miles east of Santa Fe.

Molybdenum. See Molybdenite and Wulfenite.

Monazite. Sierra County, in black sands at Shandon, not mined.

Natural gas. Eddy County, two wells near Dayton, not used.

Ocher (mineral paint). Bernalillo County, near Coyote Springs, in the Sandia Mountains, east of Albuquerque, occurs in beautiful red and yellow beds, several feet in thickness. Santa Fe County, near San Pedro, large deposits with different tints.

Oil. *See* Petroleum.

Olivine. McKinley County, Zuni Indian Reservation.

Onyx marble. Grant County, reported near Silver City. Lincoln County, reported near White Oaks. Luna County, Columbus. Otero County, deposits worked near Alamogordo.

Opal. Grant County, near Fort Bayard, has been prospected; some good fire opals have been found near Santa Rita. Sandoval County, some fine opals found in the Cochiti district.

Petrified wood. *See* Wood, petrified.

Petroleum. Chaves County, occurs near Artesia. Colfax County, has been found south of Raton. Eddy County, field at Dayton produces for local use. McKinley County, near Gallup in several wells in Seven Lakes field. Guadalupe County, near Santa Rosa and Pecos River.

Petzite. Taos County, Red River district, in Independence mine (reported).

Plumbojarosite. Luna County, Cooks Peak, with lead ores.

Proustite (light ruby silver). Grant County, Georgetown. Sierra County, with other silver ores in Kingston district and in Lake Valley district.

Psilomelane. Dona Ana County, 2 miles north of Rincon. Sierra County, Lake Valley district, was mined for silver at Apache, Bella, and Grande mines. Near the southern end of the Caballos Mountains a promising deposit of high-grade manganese has been slightly developed.

Pumice. Socorro County, on opposite side of the Rio Grande, about 15 miles from Socorro, is large bed of fine quality locally called "tripolite." Valencia County, near Grant; at base of Mount Taylor is perhaps the most important deposit in the State. Other localities are reported.

Pyrargyrite. Grant County, Bullards Peak district, and Gold Hill near Silver City, formerly mined with sphalerite, argentite, and native silver. Sierra County, was formerly mined in Kingston and other districts. Socorro County, rare in Cooney (Mogollon) district.

Pyrite. Generally auriferous, mined in following districts: Colfax County, Elizabethtown (Moreno), Cimarron. Grant County, Burro Mountains; Fierro, with iron ore; Hachita, with silver ores; Hanover, with very little zinc ore; Kimball; Lordsburg, with chalcopyrite; Pinos Altos; Santa Rita; Steeplerock; Sylvanite. Lincoln County, Nogal, abundant; White Oaks; Jiracilla. Luna County, Cooks Peak, with lead ores; Tres Hermanas, small quantity with zinc ores; Victorio, with galena. Otero County, Jarilla; Tularosa, very little, cupriferous. Rio Arriba County, Bromide, with copper ores; Hopewell. Sandoval County, Cochiti, plentiful. San Miguel County, Tecolote, small quantity, with copper ores; Rociada. Santa Fe County, Cooper, with copper ore; San Pedro. Sierra County, Hermosa, silver-bearing. Socorro County, Cooney, with copper and silver ores; Magdalena, with zinc ores. Taos County, Ancho; Red River; Twining, cupriferous. Valencia County, Copperton, cupriferous.

Pyrolusite. Grant County, with hematite and ilmonite coating quartz at Wood mine, Sylvania district, Central district, Hanover Gulch at Fierro, with magnetic iron ore. Luna County, formerly mined in Tres Hermanas district. Sierra County, with silver ores in Lake Valley district and in Macho district, south of Lake Valley district. Socorro County, San Lorenzo.

Pyrrhotite. Colfax County, Elizabethtown (Moreno), locally with pyrite. Grant County, Fierro and Hanover district, with magnetite. Santa Fe County, San Pedro, small quantity with chalcopyrite.

Quartz. Common gangue mineral in many mining districts.

Quartzite. Sierra County in Caballos Mountains, about 15 miles west of Cutter.

Ricolite. Grant County, on Gila River, north of Red Rock, beautiful ornamental stone used in some large buildings in Chicago.

Road metal. See Basalt, Granite, Limestone, Marble, Sandstone.

Salt. Eddy County, east of the Pecos, are valuable saline lakes. Socorro County, Zuni Crater Salt Lake, 80 miles south of Gallup in western part of county. Torrance County, productive deposits in Big Salt Lake of Estancia plain and in Salt Lakes of the "White Sands" plain; brine evaporated at Estancia, for local use.

Sand (building). Common throughout the State. Is dug at Raton, Colfax County, and near other towns and cities.

Sand (molding). Bernalillo County, Albuquerque, used in foundry there.

Sandstone. Bernalillo County, near Albuquerque, quarries in Sandia Mountains. Chaves County, near Roswell. Colfax County, quarried at Cimarron and near Raton; building, curbing, etc. Lincoln County, near White Oaks; good building quality in Cretaceous sandstones. McKinley County, Gallup. San Miguel County, Las Vegas, fine paving quality; Tecolote. Santa Fe County, Lamy. Socorro County, Socorro Mountain. Valencia County, Belen. In the northwest part of the State occur large areas of sandstone, much of which seems to be suitable for building stone. Other places in eastern part of the State.

Sapphire. Santa Fe County, some found in gravels, rare.

Scheelite. Grant County, small quantity mined in Anderson-Apache copper mine at Hachita and Daisy mine. Otero County, Tularosa. San Miguel County, small deposit near Hermit Peak, not mined. Socorro County, has been mined with bismuth and copper ores on east side of San Andreas Range, 37 miles west of Tularosa.

Serpentine. See Ricolite.

Silver (native). In oxidized ores of the following districts: Grant County, Black Hawk, Bullard's Peak, Chloride Flat, Georgetown, Granite Gap, Lone Mountain, Pinos Altos (especially in Silver Cell mine), Pyramid. Luna County, Victorio. Sierra County, Apache, Black Range, Hermosa, Hillsboro, Kingston, Lake Valley (rare), Phillipsburg, Tierra Blanca. Socorro County, Cat Mountain, Cooney (Mogollon; an original mineral), Pueblo, north of Magdalena. Valencia County, Copperton.

Silver ores. Silver is the predominant or an important metal produced in the following districts; Grant County, Apache No. 2, Black Hawk, California, Camp Fleming, Carpenter (Beanie Lode), Central (at Lasse Mountain), Clarks Peak (30 miles west of Silver City), Chloride Flat, Georgetown, Gold Hill, Hachita, Kimball, Lone Mountain, Pinos Altos, Pyramid, San Simon, Steeplerock, Telegraph, Virginia, White Signal (Cow Spring). Lincoln County, Cedar Creek, Eagle Creek, Nogal (Bonita, Parsons), Rio Ruidosa. Luna County, Cooks Peak, Florida Mountains, Fremont, Tres Hermanas, Victorio. Rio Arriba County, Bromide. Sandoval County, Cochiti, Placitas, Sandia. Santa Fe County, Cerrillos and near Santa Fe. San Miguel County, Rociada. Sierra County, Bromide, Chloride, Hermosa, Iron Reef, Kingston, Lake Valley, Macho south of Lake Valley District, Tierra Blanca. Socorro County,

Socorro Mountain, Mogollon, Mound Springs (midway between Estey and Jones). Taos County, Twining, Ojo Caliente. Occur also in Bernalillo County, Tijeras Canyon. Colfax County, West Moreno. Dona Ana County, Hembrillo and Organ districts; Stephenson-Bennett and Torpedo mines. Socorro County, Hanson district in Sierra Ladrone, 35 miles northwest of Socorro; Magdalena; Pueblo, north of Magdalena; Iron Mountain (Tenmile), 10 miles west of Magdalena; Cat Mountain, 12 miles southwest of Magdalena; Silver Mountain (Water Canyon); Picuris. *See also* Anglesite, Argentite, Bromyrite, Cerargyrite, Embolite, Iodyrite, Petzite, Proustite, Pyrargyrite, Stephanite, and Xanthoconite.

Smithsonite. Grant County, Hanover, Carpenter district, Potosi group. Luna County, Cooks Peak and Tres Hermanas. Santa Fe County, Cerrillos. Socorro County, Iron Mountain (Tenmile) district, Kelly (cut as a gem), Magdalena.

Specularite. Mined with other ores in the following districts: Colfax County, Cimarroncito and Elizabethtown (Moreno), in contact-metamorphic deposits. Dona Ana County, Organ, in contact-metamorphic deposits. Grant County, Fierro, with magnetite; Burro Mountains; Central; Kimball, with silver; Pinos Altos, with copper and gold ores; Santa Rita, with copper ore sparingly; Santa Rosa, with copper ores, not abundant; Steeplerock, with auriferous pyrite, no longer mined. Luna County, Cooks Peak, Tres Hermanas. Otero County, Jarilla, in contact-metamorphic deposits. Rio Arriba County, Bromide, rare; Hopewell, sparingly with gold ores. Sandoval County, Cochiti, plentiful. Santa Fe County, Cerrillos, Old Placers. Sierra County, Lake Valley, in gold quartz veins, rare. Socorro County, Cooney, with copper ores, occasional; Magdalena. Taos County, Red River.

Sphalerite. Dona Ana County, Organ district, Black Prince and Merrimac mines. Grant County, Carpenter district, Potosi group. Luna County, Florida Mountains. Mora County, Tres Hermanas. Socorro County, Jones district, Magdalena, San Andreas.

Stephanite. Sierra County, Lake Valley district. Rio Arriba County, Bromide.

Stibnite (antimony sulphide). Grant County, small quantity mined with silver ores at American mine, Hachita district. Santa Fe County, Cerrillos district, not mined.

Sulphur (native). Lincoln County, near White Oaks in gypsum deposits. Sandoval County, Jemez Springs; formerly produced commercially at the Otero sulphur works, where the deposits are very considerable, in the north part of T. 19 N., R. 3 E.

Tenorite. Grant County, occurs in Santa Rita, not mined. Socorro County, San Lorenzo.

Tetradymite. Grant County, Golden Eagle and Hand Car mines, Sylvanite district; mined for gold.

Tetrahedrite (gray copper). Dona Ana County, found at Organ. Rio Arriba County, with calcite in schist at Bromide mine, carries silver. Socorro County, in silver veins at Cooney (Mogollon); near Pueblo Springs, in quartz veins with chalcopyrite, highly argentiferous. Sierra County, has been mined at Chloride, Hermosa, and Kingston.

Thorium. *See* Monazite.

Travertine. *See* Onyx marble.

Tuff (building stone). Dona Ana County, Las Cruces. Grant County, 12 miles southeast of Lordsburg, Silver City. Socorro County, Socorro Mountain, near Socorro, supplies an attractive and substantial building stone from gray trachyte flows, of which the School of Mines at Socorro is built.

Tungsten ores. *See* Ferberite, Hübnerite, Scheelite, and Wolframite.

Turquoise. Grant County, has been mined in Burro Mountain district in Little Burro Mountains, in White Signal (Cow Spring) district, and at old Hachita in Little Hachita Mountains. Lincoln County, Nogal (Bonita, Parsons). Otero County, has been mined near Brice in Jarilla Mountains, 4 miles northwest of Orogrande, between Jarilla and Las Cruces. Santa Fe County, mined extensively 6 miles north of Los Cerrillos.

Vanadinite. Dona Ana County, Organ Mountains, Black Mountain district, 30 miles northeast of Las Cruces, associated with galena and barite. Grant County, with silver ores at Mimbres and McGregor mines; also found on Red Horse and White Horse claims, Georgetown district; mined at Lucky Bill mine, Bayard station. Sierra County, has been mined in Caballos Mountains, and with lead ores in Hillsboro district; occurs also in Bella, Apache, and Grande mines, Lake Valley district. Socorro County, mined at Kelly mine and found on other claims, Magdalena district.

Vanadium minerals. *See* Descloizite, Endlichite, and Vanadinite.

Volcanic ash. *See* Tuff.

Wad. Sierra County, Lake Valley and other districts, was formerly mined.

Willemite. Luna County, Tres Hermanas district.

Wolframite. Grant County, Hachita, with argentiferous galena. Luna County, small quantity mined in Victorio district, near Gage. Rio Arriba County, Rinconada. Taos County, mined in Copper Mountain (Picuris) district, near Penasco.

Wood (petrified). Santa Fe County, about 3 miles east of Cerrillos.

Wulfenite. Dona Ana County, mined with silver ores in Organ district. Grant County, Lordsburg. Sierra County, mined at Hillsboro and reported from Caballos district.

Xanthoconite. Santa Fe County, Cerrillos district, was formerly mined.

Zinc minerals. Dona Ana County, Organ district, large bodies of high-grade ore in Black Prince and Merrimac mines. Grant County, Central, Carpenter, Eureka; Pinos Altos. Luna County, Cooks Peak, Florida Mountains, Tres Hermanas. Santa Fe County, Cerrillos, New Placers. Sierra County, Kingston, Limestone. Socorro County, Magdalena, Oscura, San Andreas. *See* Aurichalcite, Chalcophanite, Hydrozincite, Smithsonite, Sphalerite, and Willemite.

NEW YORK.

- Abrasive.** *See* Corundum, Garnet, and Millstone.
- Allanite.** Essex County, abundant in Smith mine, Mineville. Westchester County, occurs sparingly at Bedford feldspar quarries.
- Almandite.** *See* Garnet.
- Apatite** (phosphate of lime). Essex County, abundant in Old Red magnetite ores at Mineville, and obtained as by-product in their concentration, botryoidal and fibrous variety (eupyrchroite) near Crown Point. Jefferson County, Vrooman Lake. St. Lawrence County, with calcite at Hammond, also near Gouverneur. Saratoga County, Greenfield.
- Arsenopyrite** (mispickel). Orange County, occurs near Edenville. Putnam County, occurs near Boyds Corner, has been mined near Pine Pond.
- Asbestos.** Dutchess County, found near Pawling. Orange County, near Greenwood Furnace. Putnam County, Phillipstown and Patterson. Richmond County, near Tompkinsville, in Serpentine Hill, Staten Island. Rockland County, Stony Point. Warren County, Thurman.
- Barite** (heavy spar). Columbia County, occurs at Ancram. Herkimer County, near Little Falls and Fairfield. Jefferson County, has been mined at Pillar Point and near Chaumont. Onondaga County, near Syracuse. St. Lawrence County, Hammond, De Kalb, and Richville. Schoharie County, with strontianite in limestone near Schoharie, also at Carlisle.
- Bluestone.** *See* Sandstone.
- Brown iron ore** (limonite, brown hematite). Dutchess County, Amenia mine, the only producer in 1914. Was formerly produced in Columbia County, at Ancram, Boston Corner, Copake, Hillsdale, and Millerton. Dutchess County, at the Dover, Sylvan Lake, and other mines. Orange County, Townsend mine, Cornwall. Richmond County, Castleton, Four Corners, and New Dorp and Todt Hill, Staten Island.
- Brucite.** Putnam County, at Brewster, in the Tilly Foster iron mine, well crystallized, also pseudomorphic after dolomite and altered to serpentine. Richmond County. Westchester County, on the peninsula east of New Rochelle.
- Celestite.** Cayuga County, Auburn. Herkimer County, Starkville. Jefferson County, High Island, Brownville, Depauville, and Theresa. Monroe County, Rochester. Niagara County, Lockport. Oneida County, Clinton. Onondaga County, Syracuse. St. Lawrence County, Rossie lead mines. Schoharie County, Schoharie.
- Cement** (natural). Natural cement mills are largely being supplanted by those producing Portland cement. Former important producers: Erie County, Akron. Onondaga County, Syracuse, Fayetteville, Manlius, and Jamesville. Schoharie County, Howes Cave. Ulster County, Rosendale and Lawrenceville.
- Cement material** (Portland). Limestone and clays used: Cayuga County, Cayuga. Columbia County, at Greenport and Hudson. Greene County, Cementon and Alsen. Schoharie County, Howes Cave. Warren County, Glen's Falls. Marls and clay used: Livingston County, near Caledonia. Onondaga County, Jamesville. Steuben County, Wayland.
- Cerium metals.** *See* Allanite and Cyrtolite.
- Cerussite** (lead carbonate). Lewis County, occurs at Martinsburg. St. Lawrence County, sparingly in Rossie lead mines. Westchester County, near Ossining.

Chalcopyrite (copper pyrites). Columbia County, occurs in Ancram lead mine. Orange County, near Edenville. St. Lawrence County, was mined in connection with lead near Rossie and Canton. Sullivan County, abundant with galena near Wurtsboro. Ulster County, Ellenville and Red Bridge lead mines.

Chromite. Orange County, occurs in Clove mine. Putnam County, in serpentine near Peekskill. Richmond County, disseminated in serpentine of Staten Island. Westchester County, disseminated in serpentine at Rye and New Rochelle.

Chromium. *See* Chromite.

Chrysoberyl. Saratoga County, formerly found abundantly in Greenfield, of gem quality.

Clay (brick). Widely distributed and utilized in nearly every county of the State. Extensively dug in counties bordering Hudson River. Used for tile and terra-cotta ware by firms in Albany, Allegany, Cayuga, Erie, Kings, Livingston, Monroe, New York, Oneida, Orange, Queens, Rensselaer, Rockland, Schenectady, and Steuben counties.

Clay (fire). Richmond County, dug and shipped on Staten Island. Suffolk County, from Long Island.

Clay (kaolin). Dutchess County, dug at Shenandoah. Fulton County, Northville. Ontario County. Saratoga County, Corinth and Batchellerville. Schenectady County. Westchester County.

Clay (pottery). Dug intermittently in Chemung County, at Elmira. Dutchess County, Amenia. Monroe County, Chili. Oneida County, Utica. Onondaga County, Syracuse, Warner, and Amboy station. Richmond County, Staten Island. Suffolk County, Long Island.

Clay (slip). Albany County, mined and shipped near Albany.

Copper. *See* Chalcopyrite.

Corundum (emery). Westchester County, mined with spinel near Peekskill and used as abrasive.

Corundum. Orange County, blue and white varieties occur in limestone near Amity.

Cyrtolite. Westchester County, found at Bedford feldspar quarries, utilized.

Diabase. *See* Trap.

Diatomaceous earth. Herkimer County, dug at Wilmurt. Suffolk County, occurs at Cold Spring Harbor.

Diopside. Essex County, partly serpentinized in marble at Port Henry. St. Lawrence County, De Kalb township (used as a gem).

Emery. *See* Corundum.

Feldspar. Essex County, crushed pegmatite quarried for use in the manufacture of roofing material, and as poultry grit, at Crown Point and Ticonderoga. Fulton County, orthoclase and microcline for use in pottery mined near Northville. Saratoga County, has been mined at Batchellerville and Corinth. Westchester County, at Bedford and North Castle.

Flagstone. *See* Limestone (building) and Sandstone.

Fluorspar. Cayuga County, occurs sparingly at Auburn. Clinton County, abundant in Palmer Hill mine and occurs at Finch ore bed. Essex County, Burton Hill mines, Mineville. Jefferson County, Muscalonge Lake, Alexandria Bay. Lewis County, Lowville. Monroe County, Rochester. Niagara County, Lockport. Onondaga County, Fayetteville, and Manlius. Orange County, Amity and Edenville. Putnam County, Tilly Foster iron mine, Brewster. St. Lawrence County, De Kalb, Fine, Gouverneur, Hammond, and Macomb. Warren County, Johnsburg.

Galena. Columbia County, has been mined at Ancram. Lewis County, occurs at Martinsburg. Orange County, has been mined at Phoenix lead-zinc mine near Otisville. St. Lawrence County, has been mined at Rossie and vicinity, and occurs in limestone at Balmat mine between Edwards and Gouverneur, at Donovan mine at Macomb. Sullivan County, has been mined at Wurtsboro. Ulster County, has been mined at Ellenville and Red Bridge. Washington County, occurs at White Creek. Westchester County, has been mined near Ossining.

Garnet (almandite). Essex County, mined at Mount Bigelow, near Keeseville. St. Lawrence County, is an abundant constituent of many Adirondack gneisses; has been mined near Gouverneur. Warren County, the largest and most important production in the county is made near North River; mined also at Johnsburg and Riparius; used as abrasive material.

Gas. *See* Natural gas.

Granite. Abundant in eastern part of State; quarried at many places: Clinton County, Dannemora and West Chazy. Essex County, Ausable Forks and Keeseville. Franklin County, St. Regis Falls. Fulton County, Gloversville. Herkimer County, Little Falls. Jefferson County, Antwerp, Alexandria Bay, Clayton, Grindstone Island, Picton Island, Redwood, and Wellesley Island. Orange County, Cornwall, north end of Mount Adam, Pine Island, and Warwick. Putnam County, at Cold Spring, Garrison, Phillipstown, and at several places on southwest side of Breakneck Mountain north of Cold Spring. Rockland County, Piermont, Stony Point, Round Island. Saratoga County, Corinth, Hadley, Saratoga Springs. Warren County, Glens Falls. Westchester County, Ardsley, Glenville, New Rochelle, Peekskill, Scarsdale, Valhalla, Yonkers, and elsewhere.

Graphite (plumbago). Clinton County, occurs near Saranac River. Dutchess County, occurs south of Fishkill Landing. Essex County, has been mined at Bear Pond, town of Ticonderoga, $7\frac{1}{2}$ miles southwest of Crown Point Center, and at Lead Hill, near Ticonderoga. Orange County, occurs at Duck Cedar Pond. Putnam County, occurs near Carmel. Saratoga County, mined at Conklingville and at Porter Corners, town of Greenfield. Warren County, mined at Graphite. Washington County, has been mined on South Bay, town of Dresden. Westchester County, occurs near Peekskill.

Gypsum. Found throughout central and western parts of State, in the Salina formation of the Silurian. Used for calcined plasters, agricultural plaster, and for admixture in Portland cement. Quarries in Cayuga County, at Union Springs. Erie County, Akron. Genesee County, Oakfield. Madison County, Clockville. Monroe County, Wheatland, Garbutt, and Mumford. Onondaga County, Jamesville, Fayetteville, Manlius, and Camillus. Ontario County, Victor and Port Gibson. Small quarries for local use at other places.

Hematite (red iron ore). Hematite associated with schists and limestone has been mined. Jefferson County, near Philadelphia, and Antwerp. St. Lawrence County, near De Kalb, Rossie, Hermon, and Somerville. Iron ore of Clinton formation outcrops through Herkimer, Monroe, Niagara, Oneida, Orleans, Oswego, and Wayne counties; mined at Clinton, Oneida County, and at Ontario, Wayne County.

Ilmenite (titanic iron). Associated with gabbro-anorthosite intrusions in Clinton, Essex, Franklin, and Warren counties. Some attempts at smelting these ores have been made.

Infusorial earth. *See* Diatomaceous earth.

Iron. *See* Brown iron ore, Chromite, Hematite, Ilmenite, Magnetite, Pyrite, Pyrrhotite, and Siderite.

Labradorite (feldspar). Essex County, quarried for ornamental purposes near Keeseville.

Lead. *See* Cerusite and Galena.

Limestone (building). Limestones locally used for building. Producing quarries in Albany, Cayuga, Clinton, Erie, Genesee, Greene, Jefferson, Lewis, Madison, Monroe, Montgomery, Niagara, Onondaga, Rensselaer, St. Lawrence, Schoharie, Seneca, Ulster, and Warren counties.

Limestone (crushed stone). Quarried in Albany County, at Ravena. Cayuga County, Auburn. Clinton County, Chazy and Plattsburg. Columbia County, on east outskirts of Hudson. Dutchess County, New Hamburg and Stoneco. Erie County, Depew, Lancaster, and elsewhere. Essex County, Westport. Fulton County, Mayfield. Genesee County, North Leroy. Greene County, Catskill. Herkimer County, Jacksonburg and Jordanville. Jefferson County, Chaumont, Watertown, and near Clayton. Lewis County, small quantity at Lyon Falls. Madison County, Perryville and Blakeslee. Monroe County, Rochester. Montgomery County, Amsterdam and vicinity, and Cranesville. Niagara County, Lewiston, Lockport. Oneida County, Higginsville and Sauquoit. Orange County, Cedar Cliff. Onondaga County, East Onondaga, near Syracuse, Jamesville, and elsewhere. Ontario County, Canandaigua. Orleans County, Medina. Rensselaer County, Troy. Rockland County, Tompkins Cove. Saratoga County, Stillwater Center and near Saratoga. Schenectady County, Pattersonville. Schoharie County, Cobleskill and Schoharie. Seneca County, Waterloo and Seneca Falls. Ulster County, Kingston. Warren County, Glens Falls. Washington County, Sandy Hill, Smiths Basin, and Whitehall. Westchester County, Verplanck.

Limestone (flux). Quarried for flux in Cayuga County, at Auburn. Clinton County, Chazy. Erie County, Buffalo, Clarence, and Williamsville. Essex County, Port Henry. Genesee County, Leroy. Niagara County, Pekin. St. Lawrence County, Gouverneur. Suffolk County, Greenport.

Limestone (lime). Burned in Albany, Cayuga, Clinton, Dutchess, Erie, Fulton, Genesee, Herkimer, Jefferson, Lewis, Monroe, Niagara, Onondaga, St. Lawrence, Ulster, Warren, Washington, Westchester, and other counties.

Limonite. *See* Brown iron ore.

Magnesite (carbonate of magnesia). Orange County, occurs at Warwick. Richmond County, New Dorp. Rockland County, Stony Point. Westchester County, near Rye and New Rochelle.

Magnesium. *See* Brucite.

Magnetite (magnetic iron ore). Large deposits in Adirondack region. Principal producers are the Mineville, Port Henry, Lyon Mountain, Salisbury, and Benson mines. Workable bodies occur at many other places, as at Arnold mines, Clinton County. Lenticular ore bodies in gneiss mined in Orange County at Lake Montgomery.

Manganese. *See* Pyrolusite, Rhodonite, and Wad.

Marble. Clinton County, fossiliferous limestone has been quarried for ornamental work at Plattsburg and Chazy. Dutchess County, white marble quarried at South Dover and Wingdale. Essex County, Minerva. New York County, was formerly quarried at Kingsbridge and Tremont. Orange County, formerly quarried at Warwick. Putnam County, was quarried at Towners Four Corners. St. Lawrence County, Colton, white,

gray, and mottled marbles are quarried at Gouverneur. Warren County, black marble is quarried at Glens Falls. Westchester County, is quarried at Ossining and Tuckahoe; old quarries at Hastings and Sparta.

Marl. Large deposits in Onondaga and Madison counties. Deposits also found in Albany, Columbia, Dutchess, Greene, Orange, Ulster, and Wayne counties; used as fertilizer. Cayuga County, occurs at Montezuma. Onondaga County, Warner. Steuben County, used for Portland cement at Wayland.

Menaccanite. See Ilmenite.

Mica (muscovite). Generally present in pegmatites, of which several are listed under Feldspar (p. 222). Essex County, obtained as by-product of feldspar mines at Crown Point, used for roofing. Orange County, found at Edenville. Saratoga County, suitable for grinding at Batchellerville feldspar quarry and found at Greenfield. St. Lawrence County, has been mined near Oswegatchie. Westchester County, found at Pleasantville.

Millstone. Ulster County, Shawangunk conglomerate quarried at several localities.

Mineral paint. Manufactured from shales, iron ore, slate, and talc. Cattaraugus County at Randolph, from red shales of Chemung formation. Delaware County, red shales of Catskill formation at Roxbury. Oneida County, red iron ore mined at Clinton. Otsego County, hematite at Oneonta. St. Lawrence County, hematite. Washington County, Cambrian red slate. Wayne County, Clinton hematite at Ontario.

Molybdenite. Clinton County, occurs at Lyon Mountain. Orange County, West Point and near Warwick. Putnam County, Tilly Foster mine; sparingly in granite.

Natural gas. Produced in 15 counties of the State. Principal fields in Allegany, Cattaraugus, Chautauqua, and Erie counties. The number of producing gas wells at the close of 1910 was 1,411; at the close of 1914, 2,031 wells.

Oil. See Petroleum.

Oil shale. See Shale.

Peat. Occurs in bogs of various sizes throughout the State. Some of the larger bogs are the Montezuma marshes and Cowaselon swamp, in central New York, and the Drowned Lands of the Wallkill, in southeastern New York. Small production for fertilizer near Fishkill and at Hopewell Junction. Fuel plant formerly near Watertown but destroyed by fire.

Petroleum. The total production in the State in 1914 was 938,974 barrels, valued at \$1,760,868, the production being derived from 10,516 wells. Productive horizon in Upper Devonian sandstones. The principal producing fields are Allegany County, near Andover, Bolivar, Wirt, and other towns. Cattaraugus County, Allegany, Carrollton, and Olean townships. Erie and Steuben counties are minor producers.

Platinum. Clinton County, a nugget found at Plattsburg.

Pyrite. Erie County, occurs along Eighteenmile Creek. Essex County, associated with graphite in Ticonderoga mines. Franklin County, in large bed at Duane. Jefferson County, with hematite in serpentine at Philadelphia and with schist at Oxbow, Antwerp, and Keene station. Lewis County, at Martinsburg. Putnam County, Phillipstown, Patterson, and near Ludington Mill. St. Lawrence County, with crystalline limestones and schist, is mined at Hermon and Gouverneur. Sullivan County, with galena in Wurtsboro lead mine.

Pyrolusite. Cattaraugus County, small deposits near Randolph. Essex County, as coating on feldspar near Crown Point and Ticonderoga. Fulton County, in pegmatite near Northville. Saratoga County, in pegmatite at Corinth and Edinburg. Westchester County, in dolomite near Ossining.

Pyrrhotite. Large deposits in Jefferson County, at Oxbow; St. Lawrence County, at High Falls mine near Canton, and at Edwards; Westchester County, at Anthonys Nose.

Quartz. Essex County, has been quarried near Port Henry. Abundantly distributed in veins in the Adirondack region. Herkimer County, double-ended clear quartz crystals found in dolomite at Little Falls, sold for jewelry and curios. Washington County, quarried at Fort Ann. Westchester County, Bedford, for wood filler, paint, etc.

Rhodonite. Essex County, occurs near Keeseville.

Road metal. Albany County, limestone of the Helderberg group quarried at South Bethlehem. Rockland County, magnesian limestone quarried at Tompkins Cove, limestone and granite at Piermont and Iola Island. Schenectady County, sandstone at Duanesburg. Westchester County, granite and gneiss at Port Chester. Limestone and granite used at many localities in State. *See also* Trap.

Salt (brine). Pumped in Genesee County, at Leroy. Livingston County, Piffard. Onondaga County, Tully, piped to Syracuse. Schuyler County, Watkins. Tompkins County, Ithaca and Ludlowville. Wyoming County, Rock Glen, Saltvale, and Silver Springs.

Salt (rock). Livingston County, mined at Cuylerville and Retsof.

Sand (building). Dug in Albany County, at Albany. Cayuga County, Auburn. Chautauqua County, Dunkirk and Fredonia. Broome County, Deposit. Cattaraugus County, Gowanda. Erie County, Buffalo, Clarence, and Lancaster. Genesee County, Leroy and Oakland. Livingston County, near Mount Morris. Monroe County, Brighton, Pittsford, and Rochester. Nassau County, near Roslyn and at Port Washington. Onondaga County, Fairmont and Camillus. Ontario County, Fishers and Oaks Corners. Orange County, Otisville and Roseton. Oswego County, Fulton and Minetto. Rensselaer County, Rensselaer and Troy. Saratoga County, Cohoes and Waterford. Schenectady County, Rotterdam, Schenectady, and Scotia. Schuyler County, Watkins. Suffolk County, Northport. Ulster County, Marlboro. Washington County, Smiths Basin and elsewhere. Sand pits in many other places.

Sand (glass). Dug in Oneida County at Durhamville near Oneida Lake. Oswego County, Cleveland and Minetto. Schenectady County, Niskayuna. Ulster County, sandstone at Ellenville.

Sand (molding). Dug in Albany County at Cohoes, Delmar, Selkirk, and West Albany. Cayuga County, Auburn. Chautauqua County, Dunkirk. Dutchess County, Fishkill Landing. Erie County, North Collins. Greene County, Coxsackie. Oneida County, Boonville, Fish Creek, Forestport, and Rome. Oswego County, Fulton. Queens County, Rockaway Beach. Rensselaer County, Rensselaer. Saratoga County, Ballston, Burgoyne, Elnora, Jonesville, Round Lake, and Ushers. Schenectady County, South Schenectady. Wayne County, Sodus Point.

Sandstone. Quarried in Albany County, at Cohoes. Allegany County, Almond, Belfast, and Belmont. Cattaraugus County, Machias and Olean. Cayuga County, small quarries in Albion sandstone of Medina group at Sterling. Chautauqua County, quarried at Jamestown. Dutchess County, Poughkeepsie and Rhinebeck. Essex County, Keeseville, on Ausable River,

and Port Henry. Franklin County, Burke and Malone. Greene County, Catskill and New Baltimore. Herkimer County, sandstone of the Clinton formation quarried at Frankfort Hill and Little Falls. Jefferson County, Alexandria Bay and Theresa. Madison County, quarried at Munnsville. Monroe County, Greece, and small quarries at Brockport, Penfield, and Rochester. Montgomery County, St. Johnsville. Niagara County, Lewiston and Lockport. Oneida County, Higginsville, New Hartford, Oriskany Falls, Utica, Washington Mills, and elsewhere. Orange County, Otisville. Orleans County, Albion, Eagle Harbor, Fancher, Medina, and elsewhere. Oswego County, Granby and Oswego. Otsego County, Cherry Valley and Otego. Rensselaer County, intermittently quarried at Troy. Rockland County, Haverstraw, Nanuet, and Nyack. St. Lawrence County, Hammond, Hopkinton, Oakvale, South Hammond, and Potsdam. Schenectady County, Craig, Duanesburg, and Schenectady. Ulster County, Highland, New Paltz, and Rosendale. Washington County, Fort Ann. Wayne County, small quarries in Albion sandstone at Wolcott. Wyoming County, Arcade. Yates County, Himrod.

Sandstone (bluestone). Quarried in Albany County, at Berne, Reidsville, South Berne, and Voorheesville. Allegany County, Belmont and Scio. Broome County, Cartersville, Deposit, East Windsor, Gulf Summit, McClure Settlement, Sanford, and Windsor. Cattaraugus County, Franklinville and South Olean. Cayuga County, King Ferry. Chautauqua County, Fredonia. Chenango County, Afton, East Guilford, McDonough, Norwich, Oxford, and South Oxford. Delaware County, Deposit, Hancock, Lordville, and elsewhere. Greene County, Acra, Catskill, Haines Falls, Palenville, Platt Clove, and Tannersville. Livingston County, Oakland. Madison County, Canastota. Oneida County, Clinton and Fishcreek. Otsego County, Cooperstown, East Worcester, Middlefield, Milford, and Oneonta. Schenectady County, Duanesburg and Schenectady. Schoharie County, Esperance. Schuyler County, Watkins. Steuben County, Hornell. Sullivan County, Acidalia, Callicoon, Eddy, Livingston Manor, Long Eddy, Narrowsburg, Oakland Valley, Pond, Roscoe, Westbrookville, and Wurtsboro. Tioga County, Waverly. Ulster County, Allaben, Allaku, Brodhead, Olive, number of quarries at Saugerties, and elsewhere. Washington County, Comstock. Wyoming County, Portageville, Rock Glen, and Warsaw. Yates County, Himrod and elsewhere.

Serpentine. Occurs in Orange County, near Amity. Putnam County, Phillips-town. Richmond County, in large area on Staten Island. St. Lawrence County, Gouverneur, Fowler, Edwards, and Pitcairn Township. Warren County, Johnsburg and Warrensburg. Washington County, Shelving Rock, Lake George. Westchester County, near New Rochelle and Rye.

Shale (oil). Devonian, underlies most of the southern half of the State.

Siderite (spathic iron ore). Columbia County, occurs at Linlithgo. Greene County, occurs near Catskill station. Jefferson County, in hematite at Philadelphia and in crystals at Antwerp. St. Lawrence County, in serpentine northeast of Hermon. Ulster County, Napanock, has been mined.

Slate (roofing). Columbia County, occurs at New Lebanon. Rensselaer County, has been quarried near Hoosick. Washington County, quarried at Granville, Hebron, West Pawlett, near Whitehall, and elsewhere.

Sphalerite (zinc blende). Columbia County, with galena at Ancram lead mines. Herkimer County, Salisbury. Lewis County, Martinsburg and Lewisburg. Montgomery County, Flat Creek. Orange County, Phoenix

lead-zinc mine near Otisville. St. Lawrence County, mined at Edwards, occurs in serpentine limestone at Balmat mine between Edwards and Gouverneur. Saratoga County, Saratoga Springs. Sullivan County, with galena at Wurtsboro. Ulster County, with galena at Ellenville and Red Bridge.

Spinel. Orange County, is found at numerous places. Westchester County, mined with corundum near Peekskill. Used as abrasive.

Strontianite. Cayuga County, Auburn. Herkimer County, Starkville. Jefferson County, High Island, Brownville, Depauville, and Theresa. Monroe County, Rochester. Niagara County, Lockport. Oneida County, Clinton. Onondaga County, Syracuse. St. Lawrence County, Rossie lead mines. Schoharie County, in limestone near Schoharie; more of the strontium minerals have been taken from the vicinity of Schoharie than anywhere else in the State.

Strontium. See Celestite and Strontianite.

Sunstone. Essex County, Crown Point. Westchester County, Horace Greeley farm at Chappaqua.

Talc. Fibrous talc mined in Lewis County, near Natural Bridge. Richmond County, occurs with serpentine on Staten Island. St. Lawrence County, in towns of Fowler and Edwards. Used by paper, paint, and plaster manufacturers.

Titanium. See Ilmenite.

Trap. Palisades on lower Hudson River, formerly quarried. Rockland County, quarried near Haverstraw, Mount Ivy, Rockland Lake, and West Nyack. Saratoga County, Greenfield. Used for road material, etc. Trap dikes are very numerous in the northern and eastern Adirondack region.

Vesuvianite. Orange County, near Amity.

Verde antique. Essex County, occurs at Moriah, Port Henry, and Minerva. Warren County, Thurman.

Wad (earthy manganese). Columbia County, occurs at Austerlitz, Hillsdale, and Canaan Center. Dutchess County, small deposits at Unionvale. Essex County, near Keeseville. Lewis County, small deposits at Tug Hill near Houseville. Orange County, with iron ores near Warwick. Also in Albany, Allegany, New York, Rensselaer, and Warren counties.

Yttrium. See Allanite and Cyrtolite.

Zinc. See Sphalerite.

Zircon. Clinton County, found at Lyon Mountain. Essex County, occurs in few places near Crown Point and abundantly in pegmatite at Old Red mines, Mineville. Orange and St. Lawrence counties, occurs at numerous places.

NORTH CAROLINA.

Abrasive. *See* Corundum, Garnet, Millstone, and Novaculite.

Agalmatolite (pyrophyllite). In Algonkian rocks in a range crossing Chatham and Moore counties. Worked for use in making wall paper and soaps and in foundries.

Agate. Cabarrus County, near Concord and Harrisburg. Mecklenburg County, in small quantity. Orange County, moss agate near Hillsboro.

Allanite. Occurs in Henderson County, at zircon mines, near Zirconia. Iredell County, abundant near Bethany Church. Madison County, at Democrat. Mitchell County, Wiseman mica mine.

Almandite. *See* Garnet.

Amethyst. Iredell County, at several localities southeast of Statesville. Lincoln County, at Lincolnton, near Ironton station and Denver. Macon County, in veins cutting gneiss at several places in valley of Tessentee Creek, near Scaly Mountain, and south of Highlands. Wake County, near Raleigh. Warren County, near Inez, 10 miles south of Warrenton.

Aquamarine. Alexander County, mined at Hiddenite and Ellis mines, near Hiddenite. Burke County, has been found in South Mountain. Jackson County, mined several miles south of Cashiers. Macon County, mined at head of Tessentee Creek. Mitchell County, mined at Wiseman and other mica mines. Yancey County, in Ray and other mica mines.

Arsenopyrite (mispickel). Cleveland County, mined for gold at Kings Mountain mine. Occurs also in gold mines in Cabarrus, Gaston, Union, and Watauga counties, but only sparingly with other ores.

Asbestos. Burke County, occurs near Brindletown and Warlicks Mills. Caldwell County, near Baker mine. Jackson County, southern part; fine and fibrous. Macon County, Nantahala River. Mitchell County, near Bakersville. Wilkes County, near Wilkesboro and Brushy Mountains. Occurs in many other localities.

Auerlite. Henderson County, at zircon mine, in pegmatite 2 miles west of Zirconia.

Azurite (blue carbonate of copper). At copper mines in Cabarrus, Chatham, Gaston, Granville, Mecklenburg, and Moore counties in small quantity.

Barite. Principal deposits are: Gaston County, about 5 miles south from Bessemer City and in a belt extending southwest parallel with Kings Mountain Ridge. Madison County, near Hot Springs, Marshall, Sandy Bottom, and Stackhouse. Has also been mined in Orange County at Hillsboro.

Beryl. Alexander County, mined at Hiddenite-Emerald mine. Burke County, near Burkmont in South Mountains. In mica mines in Alexander, Iredell, Mitchell, and Yancey counties. *See also* Aquamarine.

Bornite (purple copper ore). Cabarrus, Rowan, and Stanly counties, with chalcocite in Gold Hill district. Granville and Person counties, important ore in quartz gangue in Virgilina district. Occurs also in Alleghany County, Peach Bottom mine. Ashe County, Gap Creek mine. Chatham County, Clegg's mine. Guilford County, Gardiner Hill mine.

Brown iron ore (limonite, bog iron ore). Many deposits in eastern part of State in Duplin, Jones, Nash, New Hanover, Pender, and other counties.

Brown iron ore (brown hematite). Ashe County, has been mined in upper part of Ore Knob copper mines, accompanying copper lodes. Burke County, many beds in a northeasterly direction from Jacobi Fork of Catawba River to Brushy Mountains in Wilkes County; large beds in

- Chatham County, at Ore Hill. Cherokee County, at Nottla, and along Valley River. Gaston County, Highshoals. Johnston County, near Smithfield. McDowell County, has been mined in Linville Mountains. Many localities have been worked in Buncombe, Burke, Caldwell, Catawba, Gaston, Lincoln, McDowell, Mitchell, Surry, Watauga, and other counties.
- Cassiterite** (tin ore). Tin belt extends from southeastern part of Cleveland County, through western part of Gaston County, to about 4 miles east of Lincolnton, Lincoln County. Cleveland County, has been mined at Jones, Foster, and Fairies mines near Kings Mountain; and in Lincoln County, near Lincolnton.
- Cement material.** Crystalline limestones in western part of State, and soft limestone in Eocene and Miocene in eastern part of State suitable for cement.
- Cerium.** See Allanite, Cyrtolite, Monazite, Polycrase, and Samarskite.
- Cerussite** (lead carbonate). Caldwell County, Baker mine. Cherokee County, Murphy. Davidson County, Silver Hill, with galena and silver ores. Rowan County, Gold Hill district.
- Chalcanthite** (blue vitriol, hydrous copper sulphate). Cleveland County, secondary mineral at Kings Mountain mine, mined for gold.
- Chalcocite** (copper glance). Cabarrus, Rowan, and Stanly counties, with bornite in Gold Hill district. Person and Granville counties, mined for copper in Virgilina district. Found also in Ashe County, at Ore Knob mine and Gap Creek mine. Cabarrus County, Pioneer Mills mine. Jackson County, Way Hutta and Wolf Creek mines. Swain County, Nichols.
- Chalcopyrite.** Ashe County, found in Ore Knob mine. Alleghany County, Peach Bottom mines. Chatham County, Clegg mine. In mines of Davidson, Gaston, Guilford, Mecklenburg, Rowan, and Union counties. Guilford County, Gardiner Hill mine. Haywood and Jackson counties, has been mined in Way Hutta, Cullowhee, Savannah, and other mines in copper belt. Lincoln County, Macpelah Church. Orange County, near Hillsboro and Chapel Hill. Wake County, near Raleigh. Watauga County, Elk Knob and Gap Creek mines.
- Chalcopyrite** (auriferous). Rowan County, Gold Hill district, principal copper ore.
- Chromite.** Buncombe County, near Democrat and Stockville. Jackson County, at many places in vicinity of Webster, between Willets and Balsam Gap. Yancey County, in vicinity of Burnsville, has been mined and shipped from Mine Hill.
- Chromium.** See Chromite.
- Chrysocolla** (silicate of copper). Found in many copper mines in western part of State.
- Clay** (brick). Common throughout the State. Bricks are made from local clay pits at one or more localities in each of 67 counties out of the 98 counties in the State. Product in 1914 valued at more than \$1,000,000.
- Clay** (fire). Semirefractory and siliceous clays mined for fire brick in Buncombe County, at Emma. Cleveland County, Grover. Guilford County, Pomona.
- Clay** (kaolin). Avery County. Gaston County, at Bessemer City (reported). Jackson County, at Sylva and near Webster, at Beta (reported). Macon County, near Franklin. Mitchell County, on Bear Creek, near Penland, at Spruce Pine. Swain County, at Almond and near Bryson City. Yancey County, Green Mountain. Occurs in decomposed pegmatite veins in Smoky Mountain region in western part of State.

- Clay** (pottery). Mined in Alamance County, at Liberty. Buncombe County, at Luthers. Burke County, at Morganton. Catawba County. Gaston County, Mount Holly. Lincoln County, Henry and Lincolnton. Randolph County, at Seagrove and Whynot Academy; also mined in Chatham, Johnston, Moore, Union, and Wilkes counties.
- Clay** (sewer pipe). Guilford County, at Pomona.
- Coal.** Dan River area, in Triassic rocks: Carbonaceous shale outcrops from Germanton, Stokes County, to Leaksville, Rockingham County; semi-anthracite was mined near Leaksville; beds too thin, irregular, and small in extent to be of value. Deep River area: Chatham and Moore counties, in Triassic rocks; bituminous, 3 feet thick, was formerly mined at Cumnocks.
- Columbite.** Occasional pieces found in Mitchell County, at Wiseman and other mines near Spruce Pine. Yancey County, at Ray mine and elsewhere.
- Copper.** See Azurite, Bornite, Chalcantinite, Chalcopyrite, Chrysocolla, Cuprite, Malachite, Melanconite, and Tetrahedrite.
- Corundum.** Alexander County, mined to limited extent at Acme mine, near Statesville. Clay County, in peridotite in Buck Creek, Herbert, and other mines. Jackson County, considerable quantity at Sapphire mine, abrasive. Macon County, in Corundum Hill mine near Franklin, and in Mincey mine, 2 miles northwest of Corundum Hill. Madison County, at the Carter Mine, near Democrat. Transylvania County, good quality in peridotite at Burnt Rock mine. Yancey County, with magnetite, menacanite, and staurolite, near Burnsville.
- Corundum** (emerald, oriental). Found sparingly in Clay County, at Cullakeenee mine, Buck Creek near Elf. Macon County, Corundum Hill mine.
- Corundum** (emery). Guilford County, occurs at McChristian place, 7 miles south of Friendship. Macon County, has been mined at Fairview mine near North Skeener Gap, for abrasive; mined sparingly at several places south of Franklin. Mitchell County, near Bakersville.
- Corundum** (ruby). Mined in Jackson County, Montvale. Macon County, at Corundum Hill mine, Cullasaja, Caler Fork of Cowee Creek.
- Corundum** (sapphire). Clay County, few found near Elf. Jackson County, Sapphire and Whitewater mines near Sapphire. Macon County, Corundum Hill mine.
- Cuprite** (red oxide of copper). Sparingly in copper mines of Alleghany, Ashe, Caldwell, Chatham, Guilford, Jackson, Swain, Lincoln, and Mecklenburg counties.
- Cyanite.** Mitchell County, summit of Yellow Mountain. Yancey County, green cyanite at north end of Black Mountains.
- Cyrtolite.** Henderson County, at Zirconia. Mitchell County, in pegmatites near Sprucepine.
- Diamond.** Ten authentic diamonds have been found in the State: Burke County, two at and near Brindletown Creek ford. Franklin County, two from Portis mine. Lincoln County, Cottage Home. McDowell County, headwaters of Muddy Creek and near Dysartville. Mecklenburg County, Todds Branch. Rutherford County, Twitty's mine.
- Emerald** (beryl). Alexander County, Hiddenite mine, near Hiddenite. Cleveland County, Turner mine, 5 miles southwest of Shelby. Mitchell County, Crabtree Mountain. See also Corundum (emerald).
- Feldspar.** Mitchell County, quarried at Penland. Found in nearly all mica mines of Mitchell and Yancey counties.

Galena. Cabarrus County, McMakin and other mines. Cherokee County, with gold ores, Murphy. Cleveland County, mined for gold at Kings Mountain mine in southern part of county. Davidson County, has been found at Silver Hill, with blende, native silver, etc. Gaston County, with blende in Causler, Shuford, and Long Creek mines. Randolph County, Hoover and Boss mines. Rowan County, Gold Hill district, for gold and silver, Union mine and others. Union County, Long mine. Watauga County, Beech Mountain, several localities. Wilkes County, Flinck Knob. Other localities in Alleghany, Burke, Caldwell, Chatham, Macon, Montgomery, Surry, Swain, and Union counties.

Garnet. Burke County, abrasive and gem formerly mined 8 miles southeast of Morganton, along Laurel Creek. Jackson County, abrasive, mined at Sugar Loaf Mountain, near Willets. Madison County, abrasive, mined at Marshall.

Garnet (rhodolite and almandite). Macon County, obtained with corundum and ruby near In Situ Hill, on Cowee Creek, and on Mason Branch, 5 miles north of Franklin.

Glauconite. *See* Marl.

Gneiss. Alexander County, ornamental stone at Rocky Face Mountain. Watauga County, Blowing Rock. Not quarried.

Gold. Gold has been produced in recent years in many localities. There were 12 placer mines and 9 deep mines operating in 1914. Production was valued at \$131,141. Burke County, principal production from placers near Bridgewater and Brindletown. Cabarrus County, from reworking dump of old Phoenix mine; also Gorman, Saunders, McMakin, and Reed mines. Catawba County, Catawba and England mines. Cherokee County, Middle branch of Tatham's Creek, near Andrews. Cleveland County, has been recovered as by-product in mining for monazite. Davidson County, several mines in Cid mining district. Franklin County, small amount produced at Portis mine. Gaston County, Kings Mountain and Burrell-Wells mines. Granville County, Blue Wing and Copper King mines. Jackson County, Cullowhee mine. Macon County, small amount from placer near Flats. McDowell County, small amount from placer near Marion, Dysartville, and Vein Mountain. Mecklenburg County, Catawba River, dredge near Charlotte, and Surface Hill hydraulic mines. Montgomery County, Iola mine, near Candor, most important producer in State, 650-foot vertical shaft and 450-foot incline shaft; small production from Old Coggin, Uwharra (old Montgomery), Martha Washington, and Golconda mines. Moore County, small prospects near old Cagle mine. Nash County, small output from Mann-Arrington mine; gold ore found in several prospects near Nashville. Orange County, small yield from North State placer. Polk County, Double Branch mine has five shafts. Randolph County, Scarlett, Talbert, Ashboro, Redding, and Southern Homestake mines. Rowan County, mines in Gold Hill district make small yield, mainly from old dumps; the Steele placer near Cleveland was a producer. Rutherford County, Biggerstaff hydraulic mine near Golden, large producer. Union County, Bonnie Doon and other mines near Indian Trail. *See also* Nagyagite.

Granite. About 40 quarries operating in 1914 produced granite valued at \$1,286,345, located in the following places: Buncombe County, near Asheville. Davie County, Lexington. Henderson County, Balfour. Mecklenburg County, near Charlotte. Polk County, Rockcliff. Rockingham County, Ruffin. Rowan County, at Faith; large quarry at Salisbury.

Surry County, Mount Airy, very large quarry. Vance County, Greystone. Wake County, near Raleigh. Warren County, 1 mile northwest of Wise siding. Wilson County, Elm City. Also in Anson, Gaston, and McDowell counties, and small quarries, to supply local demand, have been opened at many other places in western part of State.

Graphite. Amorphous, has been mined in Alexander County, at Taylorsville. Cleveland County, at Kings Mountain mine. Haywood County, Waynesville. McDowell County, Graphiteville. Wake County, Method, and in Yancey County. Impure beds in gneiss in Catawba, Cleveland, Gaston, Lincoln, and Rutherford counties; opened near Catawba, Catawba County.

Gummite. Mitchell County, Penland, Sprucepine, and other places.

Halite. *See* Salt.

Hematite. Has been mined in Chatham County, Ore Hill. Gaston County, Ormond mine. Harnett County, Buckhorn mine.

Hiddenite (spodumene). Alexander County, gems mined in veins in biotite gneiss at Hiddenite, associated with aquamarine and emerald.

Ilmenite. Caldwell County, was prospected north of Lenoir.

Iron. *See* Brown iron ore, Chromite, Hematite, Ilmenite, Magnetite, and Siderite.

Kaolin. *See* Clay (kaolin).

Lead. *See* Cerusite and Galena.

Lignite (brown coal). Common in marl beds in the eastern counties. In Triassic rocks in Anson County, on Brown Creek. Granville County, on Tar River.

Limestone. Produced mainly for burning into lime, and for road metal. Quarries in Craven County, at Newbern; Henderson County, at Fletcher and Hendersonville; Transylvania County, Brevard. Has been quarried in Beaufort, Buncombe, Jones, and New Hanover counties. Other localities known in Cleveland, Gaston, Lincoln, and Stokes counties.

Limonite. *See* Brown iron ore.

Magnetite (magnetic iron ore). Occurs in pre-Cambrian formations in central and western parts of State, at many localities. Mined for iron at Cranberry, Mitchell County. Has been mined in Ashe, Caldwell, Cleveland, Gaston, Stokes, Surry, and other counties.

Malachite (green copper carbonate). Occurs in small quantity in copper mines in western part of State.

Manganese ore. Caldwell County, reported from west of Lenoir. Chatham County, manganiferous iron ore occurs at the Buckhorn iron mine. Cleveland County, small veins and replacements in schists in Kings Mountain region; belt extends northeast into Catawba and Lincoln counties. Surry County, north of Dobson, manganiferous garnet. *See also* Psilomelane and Pyrolusite.

Marble. Cherokee County, quarried at Murphy. Occurs also in McDowell, Mitchell, and Swain counties.

Marl (calcareous). Occurs in limited patches in all the eastern counties throughout an area equal to one-fourth of State. Used locally in many places.

Marl (greensand or glauconitic). Occurs in southeastern counties, from Neuse River to Cape Fear River.

Melaconite (black oxide of copper). Occurs sparingly in copper mines in western part of State.

Menaccanite. *See* Ilmenite.

Mica (muscovite). Deposits have been opened in 18 or more counties in the western part of State, where the production of mica is an important industry. Has been mined and prospected extensively; probably have been over 100 good producing mines. Ashe County, near Jefferson, Beaver Creek, and Elk Crossroads. Buncombe County, near Balsam Gap, Black Mountain, Montreat, along North Fork of Swannanoa River. Burke County, near Burkemont, in South Mountains. Cleveland County, in Indian Town region and near Casar; several miles northwest of Shelby, near Belwood. Gaston County, in northwestern part of county. Haywood County, in Allen Creek basin south of Waynesville, and in Balsam Mountains, at head of Pigeon River. Jackson County, a large number of mines in a belt several miles wide, extending northeast across the county from Cowee Bald and Moss Knob, on the Cowee Mountain divide, to Balsam Gap and Richland Balsam Mountain; also near Sols Creek, along Tuckasegee River, near Pinhook Gap, Wolf Mountain, and at several places in southeastern corner of county. Lincoln County, in belt along west side of county. Macon County, in a belt several miles wide, extending northeast across county, from Nantahala River over Wayah Mountain to Cowee Bald and Moss Knob, on the Cowee Mountain divide; also near Higdonville, Scaly, and Highlands. Mitchell County, large number of mines in region between Bakersville, Crabtree Creek, Blue Ridge Mountain, Lineback, and Cranberry; Sprucepine central point to mica region. Rutherford County, Isinglass Hill, $3\frac{1}{2}$ miles north of Rutherfordton, and other localities. Stokes County, near Sandy Ridge. Transylvania County, Bee Tree Fork region and near Sapphire. Watauga County, north of Boone and 2 miles northwest of Elk Crossroads. Yancey County, many mines along South Toe River and westward across Black Mountains, near Burnsville and Green Mountain.

Millstone. Anson County, sandstone used as grindstones during the Civil War. Madison County, quartzite on Laurel River, used for millstone. Moore County, Triassic conglomerates, used for millstone, McLennans Creek. Rowan County, made from granitic rock at Salisbury.

Monazite. Found in gravels in area of about 3,000 square miles. Produced from placers in Burke County, around Bridgewater, Brindletown, Connellys Springs, and Morganton. Cleveland County, Belwood, Casar, Lawndale, Carpenters Knob region, Mooresboro, and elsewhere. Gaston County, Cherryville. Iredell County, north of Statesville. Lincoln County, western part. Madison County, in masses up to 60 pounds in weight near Mars Hills. Rutherford County, Ellenboro, Oak Springs, Rutherfordton, and elsewhere. Also in Alexander and Catawba counties.

Nagyagite. Cleveland County, mined for gold at Kings Mountain mine.

Novaculite (whetstone). Anson County, has been quarried near Wadesboro. Orange County, few miles west of Chapel Hill, quarried extensively. Person County, near Roxboro.

Peat. Abounds in the eastern part of State, particularly in the seaboard counties. Not used.

Pitchblende. See Uraninite.

Platinum. A belt of platinum-bearing rock is reported extending from Cedar Falls, N. C., to Danville, Va.

Polycrase. Henderson County, in gold washings with zircon, magnetite, etc., near Zirconia.

Psilomelane. Caldwell County, in gneissic rocks near Lenoir. Chatham County, with iron ore at Buckhorn iron mine. Gaston County, in schist 1 mile southeast of Kings Creek.

- Pyrite.** Cleveland County, mined for gold at Kings Mountain mine. Gaston County, has been mined as sulphur ore 5 miles north of Bessemer City. Rowan County, mined for gold in Gold Hill district. Union County, at Colossus.
- Pyrolusite** (black oxide of manganese). Chatham County, with iron ore at Buckhorn iron mine. Gaston County, in schist 1 mile southeast of Kings Creek, and elsewhere in small quantity.
- Pyrophyllite.** Moore County, produced by three mines at Glendon for use as talc.
- Pyrrhotite** (magnetic pyrites). Plentiful, generally with pyrite and chalcopyrite in copper deposits in Ashe, Jackson, Macon, and Swain counties. Cleveland County, mined for gold at Kings Mountain mine. Macon County, occurs in gravels of corundum mines.
- Quartz** ("rock crystal," clear and smoky quartz in crystals). Found in many counties. Fine crystals have been obtained from Alexander, Ashe, Cleveland, and Iredell counties. Cherokee County, quarried near Ranger for flux in copper smelting and in blocks as filler for acid towers. Gaston County, mined at Oliver mine.
- Radium.** See Polycrase, Samarskite, Uraninite, and Uranophane.
- Rhodolite.** See Garnet.
- Road metal.** See Granite, Limestone, Sand and gravel, and Sandstone.
- Ruby.** See Corundum.
- Rutile.** Clay County, in placer on Shooting Creek, east of Hayesville. Macon County, abundant with corundum in gravels of Mason Branch and Caler Fork of Cowee Creek. Fine specimens in Alexander and Iredell counties.
- Salt** (brine). Buckingham, Chatham, and Orange counties, formerly obtained from wells in Triassic beds.
- Samarskite** (yttria ore). Mitchell County, large masses have been found at Wiseman mica mine; sparingly at other mica mines.
- Sand and gravel.** Dug at following places: Anson County, Lilleville. Buncombe County, Asheville. Cleveland County, Shelby. Gaston County, Bessemer City. Guilford County, Greenboro. Henderson County, Balfour. Iredell County, Statesville. Mecklenburg County, Charlotte. Moore County, West End. Wilkes County, North Wilkesboro.
- Sandstone.** Only quarry operating is at Sanford, Lee County. Idle quarries in sandstone of Triassic period in Anson County, at Wadesboro. Chatham County, Chatham, near Egypt. Orange County, near Durham. Rockingham and Stokes counties, quarries in the Dan River belt.
- Sapphire.** See Corundum.
- Serpentine.** Very fine, dark-colored, takes fine polish. Buncombe County, Asheville. Caldwell County, Baker quarry. Clay County, Buck Creek. Also in Forsythe and Wake counties. Yellowish-green variety occurs in Caldwell, Orange, Stokes, Surry, Wake, Wilkes, and Yancey counties.
- Siderite** (black band ore and ball ore). Chatham County, beds in Triassic rocks of Deep River opened at Egypt, Farmville, and Gulf. Occurs also in Davidson, Granville, and Halifax counties. Common as gangue material in gold mines, also at some copper mines.
- Silver.** Recovered in refining gold and copper, produced mainly in Person and Rowan counties. Native silver at Silver Hill and Silver Valley mine, Davidson County.
- Soapstone.** Many undeveloped masses in western part of State. Ashe County, probable valuable deposits 2 miles west of Beaver Creek, quarried for local use.

Sphalerite (zinc blende). Cabarrus County, in McMakin mine with galena and silver ores. Cleveland County, mined for gold in Kings Mountain mine in southeastern part of county. Davidson County, has been found at Silver Hill with galena and silver ores. McDowell County, in Dobson mine, Cedar Grove, in limestone. Rowan County, small quantity in Gold Hill district. Union County, Lemmon, Long, Moore, and Stewart gold mines. Small quantities in Alleghany, Gaston, Macon, Madison, and Montgomery counties.

Spinel. Macon County, found in gravels in Cowee Valley. Mitchell County, gahnite variety in Chalk Mountain and other mica mines.

Spodumene. *See* Hiddenite.

Staurolite. Good single and double crossed crystals, have some commercial value as curios; found in Ashe County; Burke County, South Mountains; Cherokee County; Haywood County, near Waynesville; Iredell County, Belts Bridge; Macon County, near Corundum Hill; northern part of Wake County, and in many places west of Blue Ridge.

Sunstone. Iredell County, near Statesville.

Talc. Alleghany County, mined near Piney Creek. Cherokee County, was formerly mined at Tomotla. Jackson County, mined at Beta. Moore County, three mines at Glendon mining pyrophyllite. Swain County, mined at Hewitts.

Tetradymite. Burke, Cabarrus, Gaston, and McDowell counties, in minute scales at copper mines. Davidson County, occurs in Allen mine and in Beck's mine west of Silver Hill. Montgomery County, mined for gold at Asbury mine.

Tetrahedrite. Cabarrus County, has been found in McMakin mine with silver, zinc blende, and galena, and in Sudwick mine with copper pyrites. Cleveland County, mined for gold at Kings Mountain mine.

Thorium. *See* Auerlite and Monazite.

Tin. *See* Cassiterite.

Titanium. *See* Ilmenite and Rutile.

Tourmaline. Alexander County, black crystals at Stony Point. Yancey County, at Ray mine and many other localities.

Unakite. Madison County, in the Great Smoky Mountains of the Unaka Range in the slopes of the peaks known as The Bluff, Walnut Mountain, and Max Patch. Also in Yancey County.

Uraninite (pitchblende). Mitchell County, in Flat Rock mine, in Deake mine, in a feldspar quarry near Penland, and in Wiseman mica mine.

Uranophane. Mitchell County, Penland, Sprucepine, and other places.

Xenotime (yttrium phosphate). Burke County, from gold washings at Brindletown.

Yttrium. *See* Allanite, Cyrtolite, Polycrase, Samarskite, and Xenotime.

Zinc. *See* Sphalerite.

Zircon. Burke, McDowell, and Rutherford counties, in gravels of monazite mines. Henderson County, mined near Zirconia. Iredell County, occurs near New Sterling.

NORTH DAKOTA.

- Cement material.** Cretaceous limestone used for natural cement in Cavalier County, about 10 miles north of Milton. Pembina County, quarried along Tongue River. Niobrara chalk, suitable for Portland cement, occurs in State but is almost entirely concealed by glacial drift and Pierre shale.
- Clay (brick).** Dug in Bottineau County, at Halls Spur, 3 miles north of Omamee, and at Arnedo. Bowman County, Scranton. Burleigh County, Bismarck and Chapin. Cass County, south of Fargo. Cavalier County, Langdon and Milton. Grand Forks County, Grand Forks. McLean County, Wilton and 6 miles west of Coal Harbor. Mercer County, Plenty coal mine. Morton County, Mandan and Hebron. Pembina County, Drayton and near Walhalla. Stark County, Dickinson and Richardton. Walsh County, Park River. Ward County, Burlington, Kenmare, and Minot. Traill County, half a mile north of Hillsboro. Williams County, Williston.
- Clay (fire).** Cavalier County, Olga. Morton County, good quality, used near Hebron. Stark County, Dickinson.
- Clay (pottery).** Clay suitable for stoneware occurs in Billings County, near Sandcreek post office. Burleigh County, along Missouri River at Bismarck. Cavalier County, near Olga. Dunn County, near Oakdale. Mercer County, Plenty coal mine. Morton County, near Hebron. Stark County, near Dickinson and Gladstone. Ward County, Minot, and at other localities.
- Coal (lignite).** Extensive beds in Cretaceous and Tertiary formations underlie western half of State. Production in 1914 was 506,685 short tons. Principal mines and outcrops are in following counties: Adams County, four mines in vicinity of Haynes work a 12-foot bed. Billings County, vicinity of Yule, Great Bend, Medora, Sentinel Butte, East Rainy Buttes, and numerous other localities; mined at Medora, near Sentinel Butte, and elsewhere. Bowman County, outcrops along North Fork of Grand River, in southeastern part of county; also on Coyote Creek; mined 2 miles west of Haley and at Scranton. Burleigh County, McClelland mine, 7-foot bed, excellent quality; Washburn mine, near Wilton, largest in State. Emmons County, near Livona, 2½-foot bed, mined at Edick and Parkhurst mine. Hettinger County, outcrops at number of points on Coal Bank Creek, 8 miles south of New England, and in the southeastern corner of the county; small quantity mined for local use. McLean County, outcrops along banks of Missouri River, 30 miles above Bismarck; Satterlund mine, 6 miles northwest of Washburn, 9-10 foot bed, local use; Rose Hill mine, 5-foot bed; Coal Harbor district, Marion, Joe Mann, and Eskes mines, bed 7 feet 9 inches; Dogden Buttes, 16-foot bed; near Turtle Lake, 7-9 foot bed. Mercer County, along Missouri River near Mannhaven, 7-foot bed; also above and below Hazen, and in Big Bend district. Morton County, along valley from Sims to New Salem; mined at New Salem, 6-foot bed; also mined in vicinity of Sims (Feland mine), Glen Ullin, and Hebron, and at many localities south of railroad. Oliver County, abundant beds on east bank of Missouri River and at Square Butte Creek, and branches of Knife River, 6-7 foot bed; mined by stripping; 3 miles south of Hensler; also mined in southern part of county. Rolette County, on southern slope of hills near Dunseith, 3-4

foot bed, mines reopened. Stark County, extensively mined near Lehigh, 10-15 foot bed; abundant about Belfield, mined on south side of Heart, 6-foot bed, excellent. Ward County, along edge of bluffs of Des Lacs River to prairie; mined near Burlington, 9-13 foot bed; near Kenmare, 6-foot bed, Smith-Kenmare, Diamond, and many other mines. Williams County, considerable deposit about Williston along Missouri River, mined for local supply. Workable beds occur also in Adams, Burke, Divide, Dunn, McKenzie, Mountrail, and Renville counties.

Gas. *See* Natural gas.

Granite. Large drift boulders are abundant in all the counties of North Dakota except Adams, Billings, Bowman, and Hettinger; used locally for building material.

Lignite. *See* Coal.

Natural gas. Bottineau County, 12 wells in glacial deposits and underlying sand; gas piped to Westhope and Lansford for local use. Lamoure County, some gas produced from 7 artesian wells. Renville County, in blue clay and shale near Mohall; 2 wells, local use.

Road metal (sand and gravel). Dug in Grand Forks County, at Emerado Beach. Hettinger County, at Liberty. Pembina County, in Fremont Township and Walhalla. Walsh County, in "The Mountains" in Herman and Norcross beaches in vicinity of Edinburg, and in many other places. Along ancient shore lines of Lake Agassiz in Cass, Grand Forks, Pembina, Walsh, and Traill counties.

Sand (building). Small quantity dug for local use at many places.

Sandstone. Emmons County, quarried at Linton. McLean County, along Missouri River at Washburn. McHenry County, near Velva. Stark County, small quantities have been quarried at Dickinson.

OHIO.

Anhydrite. Cuyahoga County, in deep well at Newburg.

Asphalt (bituminous rock). Highland County, about 4 miles southwest of New Vienna; occupies an area of about 80 acres and extends locally to a depth of 30 feet; forms good road material and may be used for building material, roofing, flooring, etc.

Bromine. Meigs County, distilled from brines at Pomeroy and Minersville.
See also Salt.

Brown iron ore (limonite). Occurs in form of concretions known as "kidney ore," in thin beds as "block ores," and as "limestone ores." The "Lower Coal Measures," "Barren Measures," and "Upper Coal Measures" contain the ore-bearing horizons. Carroll, Columbiana, Gallia, Hocking, Jackson, Lawrence, Licking, Mahoning, Muskingum, Perry, Scioto, Trumbull, and Vinton counties have produced ore from these horizons; of little economic importance at present time.

Celestite (strontium sulphate). Lucas County, with calcite, at Whitehouse, and with gypsum at West Sister Island. Ottawa County, Green or Strontian Island, Put-in-Bay, Lake Erie, in fine crystals and in large masses, filling fissures in the water-lime rock.

Cement (natural). Columbiana County, at Lisbon. Defiance County, Devonian calcareous shale used at Defiance.

Cement material (Portland). Ferruginous limestone and shale used in Lawrence County at Ironton and Superior, and in Stark County at Middlebranch. Marl and clay used in Erie County at Baybridge and Castalia, and in Logan County at Rushsylvania.

Clay (brick). Widely distributed, used at one or more places in every county of the State.

Clay (brick, vitrified, and sewer pipe). Cuyahoga, Jefferson, Summit, and other counties.

Clay (fire). Abundant in State. Mined in Athens County, at Nelsonville. Columbiana County, East Liverpool and Washingtonville. Hamilton County, Delhi. Hocking County, East Clayton. Jackson County, Oak Hill. Jefferson County, Empire and Irondale. Lawrence County, Ironton and Steece. Morrow County, near Sparta. Muskingum County, South Zanesville and small quantity at Ellis station. Perry County, small quantity at Chalfants. Scioto County, Lilly and Sciotoville. Stark County, Beach City, Massillon, and $1\frac{1}{4}$ miles south of Magnolia, very small quantity at Limaville, also sagger clay at North Industry. Vinton County, sagger clay mined at Richland. Washington County, Newport.

Clay (pottery). Clays and shales dug in Columbiana County at East Liverpool. Darke County, Palestine. Delaware County, Delaware. Hamilton County, in Springfield Township. Hocking County, at Haydenville and near Logan. Jefferson County, Steubenville. Licking County, Hanover. Lorain County, Elyria. Muskingum County, Zanesville. Perry County, Crooksville and Roseville. Stark County, Canton and North Industry. Wayne County, Dalton.

Clay (slip). Muskingum County, at Dillon Falls, Ellis, and Zanesville.

Coal (bituminous). The Sharon, Wellston, Lower and Middle Kittanning, Upper Freeport, Pittsburg, Pomeroy, and Meigs Creek coal beds extensively mined in eastern part of the State in Athens, Belmont, Carroll, Columbiana, Coshocton, Gallia, Guernsey, Harrison, Hocking, Holmes, Jackson, Jefferson, Lawrence, Mahoning, Medina, Meigs, Morgan, Mus-

kingum, Noble, Perry, Portage, Scioto, Stark, Summit, Trumbull, Tuscarawas, Vinton, and Wayne counties. Athens, Belmont, Guernsey, and Jefferson counties produced more than 2,000,000 tons each in 1914; the total output of the State was over 36,000,000 tons in 1913.

Flagstone. Allen County, quarried in Lima. Clark and Greene counties. Cuyahoga County, formerly quarried at Berea. Geauga County, Thompson. Highland County, from "Helderberg" limestone at Greenfield. Logan County, Belle Center. Lorain County, Amherst and Lagrange. Preble County, Eaton. Trumbull County, magnesian limestone at Warren. Scioto Valley, Mississippian sandstones.

Gas. *See* Natural gas.

Grindstone. Is quarried in Cuyahoga County at Berea, Chagrin Falls, Independence, South Park, and West View. Erie County, Berlin Heights. Harrison County, Tippecanoe. Jefferson County, Empire. Lorain County, North Amherst, Elyria, Oberlin, and elsewhere. Scioto County, Portsmouth. Stark County, Massillon. Summit County, Peninsula. Washington County, Belpre, Briggs, Constitution, Marietta, and vicinity.

Gypsum. Occurs in places in the "Helderberg," encountered in most deep wells in north and central Ohio. Erie County, found near Castalia. Ottawa County, mined at Gypsum station and Port Clinton.

Hematite (fossil ore, dyestone). Occurs in Clinton County, at Todds Ford, near Wilmington. Highland County, at Sinking Springs, most important deposit of this ore in State. Muskingum County, near Zanesville.

Iron. *See* Brown iron ore, Hematite, Pyrite, and Siderite.

Limestone (building). Quarried in Adams County, at Manchester. Allen County, Allentown, Auglaize, Bluffton, Conant, Delphos, Elida, Harrod, Lafayette, Lima, and Spencerville. Belmont County, Bellaire and Martins Ferry. Butler County, College Corner, Hamilton, Jacksonboro, Woodsdale. Clark County, Enon, New Carlisle, Osborn (near), and Springfield. Clermont County, Williamsburg. Clinton County, Blanchester, Bloomington, New Vienna, Port William, Reesville, and Wilmington. Columbiana County, East Liverpool. Crawford County, Bucyrus and Lykens. Delaware County, Delaware. Erie County, Castalia, Sandhill, and Sandusky. Franklin County, Columbus, Dublin, and Marble Cliff. Gallia County, Gallipolis. Greene County, Jamestown, New Jasper, and Xenia. Guernsey County, Cambridge. Hamilton County, Bridgetown, Cincinnati, Glendale, Mount Healthy, Symmes, and Terrace Park. Hancock County, Arlington, Findlay, McComb, Mount Blanchard, and Rawson. Hardin County, Ada and Dunkirk. Highland County, Highland, Sinking Spring, Sugar Tree Ridge. Huron County, Bellevue. Jackson County, Jackson, Kitchen station, and Rocky Hill. Jefferson County, Rayland and Tiltonville. Lawrence County, Campbell, Culbertson, Eifort, Ironton, and Olive Furnace. Logan County, Belle Center, Bellefontaine, Big Springs, East Liberty, and West Liberty. Lorain County, Lagrange and Lorain. Lucas County, Holland, Sylvania, Waterville, and Whitehouse. Mahoning County, Lowellville. Marion County, Marion. Medina County, Spencer. Mercer County, Celina and Rockford. Miami County, Covington, Ludlow Falls, Piqua, Tippecanoe, and Troy. Montgomery County, Brookville, Centerville, Dayton, Farmersville, Phillipsburg, and Union. Ottawa County, Clay Center. Paulding County, Junction, Oakwood, and Roselms. Perry County, Maxville. Portage County, Atwater. Preble County, Camden, Eaton, and Lewisburg. Putnam County, Cascade. Cloverdale, Columbus Grove, Gilboa, Kalida, Ottawa, Ottoville, Pandora,

Rimer, and Vaughnsville. Sandusky County, Fremont and Lindsey. Seneca County, Bascon, Bettsville, Bloomville, Flat Rock, Kansas, Maple Grove, and Tiffin. Tuscarawas County, Mineral City. Van Wert County, Convo, Middlepoint, Scott, Van Wert, Wetzel, and Willshire. Vinton County, Oreton. Wood County, Bloomdale, Bowling Green, Grand Rapids, Lime City, North Baltimore, and Rising Sun. Wyandot County, Crawford and Marseilles.

Limestone (crushed stone). Carboniferous, Silurian, and Devonian limestones widely distributed except for barren area extending in a north-south direction in the central part of the State. Used extensively in Allen, Butler, Clark, Clay, Clermont, Clinton, Columbiana, Crawford, Delaware, Erie, Franklin, Greene, Hamilton, Hancock, Hardin, Highland, Lawrence, Logan, Lucas, Mahoning, Marion, Mercer, Miami, Montgomery, Ottawa, Paulding, Preble, Putnam, Ross, Sandusky, Seneca, Van Wert, Wood, and Wyandot counties.

Limestone (flux). Used as flux in iron and copper smelters and in the manufacture of glass. Quarried in Clark County at Cold Springs and Springfield. Crawford County, Bucyrus. Franklin County, Columbus and Marble Cliff. Lawrence County, Bartles station, Blackford, Eifort, and Ort. Lucas County, Silica. Mahoning County, Lowellville. Marion County, Marion. Miami County, Piqua. Ottawa County, Marblehead.

Limestone (lime). Burned in Belmont County at West Wheeling. Clark County, at Cold Springs and Springfield. Crawford County, Osceola. Delaware County, Delaware, Radnor, White Sulphur, and extensively elsewhere on the Scioto. Erie County, Kellys Island. Greene County, Cedarville. Hamilton County, Cincinnati. Hardin County, Patterson. Harrison County, Germano. Highland County, Greenfield and Hillsboro. Logan County, Middleburg. Marion County, Marion. Mercer County, Fort Recovery. Miami County, Covington. Montgomery County, near Dayton. Ottawa County, Clay Center, Genoa, and Marblehead. Preble County, New Paris. Sandusky County, Fremont and Woodville. Seneca County, Fostoria and Tiffin. Stark County, Marlboro and elsewhere. Wood County, Luckey and Sugar Ridge. Wyandot County, Casey.

Limonite. *See* Brown iron ore.

Marl. Erie County, used for Portland cement in Baybridge and Castalia. Fulton and Williams counties, occurs in lakes and marshes. Highland County, a marly magnesian limestone at Sinking Spring. Logan County, a marly magnesian limestone at Rushsylvania. Preble County, Camden. Sandusky County, dug in lakes and marshes. Summit County, Hudson.

Natural gas. The "Trenton," "Clinton," "Helderburg," and Berea are the productive beds. Many wells are located in Ashland, Ashtabula, Athens, Auglaize, Belmont, Carroll, Columbiana, Cuyahoga, Darke, Fairfield, Guernsey, Hancock, Hardin, Harrison, Hocking, Holmes, Jefferson, Knox, Lake, Licking, Logan, Lorain, Lucas, Medina, Mercer, and Monroe counties. Ohio is one of the three leading States in the production of gas.

Oil. *See* Petroleum.

Oil shale. *See* Shale.

Oilstones. Cuyahoga County, quarried at Chagrin Falls.

Peat. Lake County, near Painesville. Lorain County, Brighton and Camden. Summit County, large deposits. Trumbull County, Bloomfield township, several thousand acres. Many smaller deposits in Fulton, Williams, and other northern counties; not utilized.

Petroleum. Three important fields, the Lima or northwestern, the central, and the southeastern. Large production from Allen, Auglaize, Hancock, Lucas, Mercer, Ottawa, Sandusky, Seneca, Van Wert, and Wyandot counties of the northwestern field. Athens, Coshocton, Fairfield, Holmes, Knox, Lorain, Muskingum, Perry, and Vinton counties of the central field contain producing wells. Large production from wells in the southeastern field in Belmont, Carroll, Columbiana, Guernsey, Harrison, Jackson, Jefferson, Monroe, Morgan, Noble, and Washington counties. The production of the State from 31,763 active wells in 1914 was 8,536,352 barrels, valued at \$13,372,729.

Pyrite. Obtained as by-product in coal mining. Tuscarawas County, mined at Canal Dover, Midvale, New Philadelphia, Roswell, and Wainwright.

Road metal. *See* Limestone (crushed stone) and Sandstone.

Salt (brine). Produced in Cuyahoga County, near Cleveland. Medina County, Wadsworth. Meigs County, Pomeroy. Morgan County, Durant. Summit County, Akron and Barberton. Wayne County, Rittman.

Sand (building). Dug in Allen County, near Allentown. Ashtabula County, Ashtabula. Athens County, Broadwell. Butler County, Hamilton. Clark County, Springfield. Clermont County, Miamiville. Columbiana County, East Liverpool. Coshocton County, Coshocton. Cuyahoga County, Cleveland. Darke County, Greenville. Erie County, Sandusky. Fairfield County, Lancaster. Franklin County, dredged from Scioto River, Columbus. Gallia County, dug near Gallipolis and Vinton. Hamilton County, Cincinnati. Jackson County, Coalton. Jefferson County, Brilliant. Lawrence County, Ironton. Lorain County, Brownhelm station and Lorain. Lucas County, Toledo. Mahoning County, Austintown and Youngstown. Miami County, Pleasant Hill. Montgomery County, Dayton. Muskingum County, Gilbert, Philo, Trimway, and Zanesville. Pike County, Wakefield. Portage County, Garrettsville. Richland County, near Mansfield. Sandusky County, Fremont. Scioto County, Portsmouth. Stark County, Alliance and Canton. Summit County, Akron. Tuscarawas County, Canal Dover. Washington County, Marietta. Wood County, Perrysburg.

Sand (fire). Dug in Cuyahoga County, Bedford; Stark County, Massillon; Summit County, Akron; Trumbull County, Niles; Tuscarawas County, Dundee.

Sand (glass). Sandstones of Silurian or Carboniferous age quarried and crushed in Erie County at Sandusky. Hocking County, Rockbridge. Knox County, Howard. Licking County, near Toboso. Lucas County, 4 miles southwest of Sylvania. Mahoning County, Austintown. Muskingum County, Zanesville. Perry County, Chalfants. Stark County, Massillon. Summit County, Warwick. Trumbull County, 4 miles southwest of Niles. Tuscarawas County, Dundee.

Sand (molding). Dug in Ashtabula County at Conneaut and Kingsville. Belmont County, Bellaire. Butler County, Overpeck and Hamilton. Carroll County, Sherrodsville. Columbiana County, Leetonia. Coshocton County, Layland. Cuyahoga County, Cleveland and Collinwood. Erie County, Avery, Huron, Milan, Sandusky, and Shinrock. Fairfield County, Lancaster. Gallia County, Gallipolis. Hamilton County, Delhi. Jackson County, Coalton. Jefferson County, Steubenville. Knox County, Howard. Lucas County, Toledo. Mahoning County, Austintown. Muskingum County, Dresden, Ellis, Gilbert, and Zanesville. Perry

County, New Lexington. Portage County, Garrettsville. Stark County, Alliance, Canton, Crystal Springs, and Massillon. Summit County, Akron, Cuyahoga Falls, Everett, and Warwick. Tuscarawas County, Barrs Mills, Dundee, New Cumberland, and Somerdale. Washington County, Vincent.

Sandstone (building, crushed stone). Quarried in Allen County at Allentown. Ashland County, Ashland. Ashtabula County, Windsor Mills. Belmont County, Bellaire, McClainville, and Martins Ferry. Carroll County, Sherodsville. Columbiana County, East Liverpool and Wellsville. Crawford County, Crestline. Cuyahoga County, Berea, Bluestone, Chagrin Falls, Cleveland, Independence, South Euclid, Warrensville, and West View. Erie County, Berlin Heights. Fairfield County, Lancaster and Sugar Grove. Franklin County, Reynoldsburg. Geauga County, Thompson. Guernsey County, Cambridge and Tyner. Harrison County, Freeport and Tippecanoe. Highland County, Hillsboro. Holmes County, Wakeman and West Clarksfield. Jefferson County, Empire and Steubenville. Lawrence County, Coal Grove, Forestdale, and Olive Furnace. Licking County, Newark. Logan County, Pickrelltown. Lorain County, Amherst, Columbia station, Elyria, Grafton, Kipton, North Amherst, and Oberlin. Mahoning County, Brier Hill, Hastelton, and Youngstown. Meigs County, Pomeroy. Morrow County, Fulton, Iberia, and Mount Gilead. Muskingum County, Blackrun, Zanesville, and vicinity. Noble County, Sharon. Perry County, New Lexington. Pickaway County, Circleville. Pike County, Waverly. Richmond County, Bellville, Lucas, and Mansfield. Scioto County, Freestone, McDermott, Otway, and Portsmouth. Stark County, Massillon. Summit County, Peninsula, Twinsburg. Trumbull County, Mineral Ridge. Washington County, Briggs, Constitution, Fleming, Marietta, and Vincent. Wayne County, Wooster. Wood County, Grand Rapids.

Shale (oil). Devonian, underlies the eastern half and the northwest corner of the State, but throughout much of this territory it lies at considerable depth. Mississippian shale also contains oil.

Siderite. Occurs in Carboniferous limestones. Was formerly mined in Gallia, Jackson, Lawrence, Scioto, and Vinton counties.

Strontium. *See* Celestite.

OKLAHOMA.

Anhydrite. Blaine County, near Bickford, Southard, and Wilson. Woodward County, near Chimney Butte. Also at other localities with gypsum.

Asphalt. Occurs in large deposits impregnating sandstone and limestone in southern part of State, especially in and south of Arbuckle Mountains. Quarried for paving in Carter County in the Ardmore district; Comanche County at Elgin, near Lawton; Johnston County at Ravia in the Arbuckle Mountains; Murray County at Gilsonite, 3 miles south of Sulphur, and near Dougherty. Occurs in Atoka, Bryan, Craig, Caddo, Garvin, Jefferson, Le Flore, Love, McCurtain, Marshall, Ottawa, Pontotoc, and Stephens counties.

Azurite. Occurs in small quantities in Arbuckle Mountains.

Bituminous rock. See Asphalt.

Brown iron ore (limonite, brown hematite, bog iron ore, etc.). Johnson County, Hunton and Mill Creek. Some shipped.

Calamine. Ottawa County, mined at Quapaw and at Peoria.

Cement material (Portland). Limestones and shales suitable for cement in northeastern Oklahoma and elsewhere; utilized in Pittsburg County, at Hartshorne; Pontotoc County, Ada; and Washington County, Dewey. Shales underlying Caddo limestone in Red River region south of Arbuckle and Wichita Mountain uplifts, suitable for Portland cement.

Cerussite. Murray County, in the Arbuckle Mountains in the Davis zinc field. Ottawa County, occurs in Peoria mines and Quapaw mines.

Clay (brick). Dug in Beaver County, at Logan. Canadian County, 4 miles west of El Reno, Darlington (shale). Carter County, Ardmore. Choctaw County, Boswell. Craig County, Vinita. Creek County, Sapulpa. Garfield County, Enid. Grady County, Chickasha. Jefferson County, Addington and Hastings. Kay County, Blackwell. Kingfisher County, Hennessey and Kingfisher. Kiowa County, Gotebo. Le Flore County, Poteau. Logan County, Guthrie. Muskogee County, Muskogee. Nowata County, Nowata. Oklahoma County, Oklahoma City. Okmulgee County, Gaither. Pawnee County, Cleveland. Pittsburg County, McAlester. Pontotoc County, Ada. Pottawatomie County, South Beard. Rogers County, Claremore. Tulsa County, Broken Arrow, Red Fork, and near Tulsa. Washington County, Bartlesville. Woods County, Alva. Reported from Johnston County, Ravia.

Clay (fire). Large quantities occur in coal fields. Coal County, at Lehigh and Coalgate. Latimer County, Wilburton. Pittsburg County, Blocker, Hartshorne, and McAlester.

Clay (kaolin). Reported from Cherokee County, near Tahlequah, and from Arbuckle and Wichita mountains.

Clay (stoneware). Reported from Pontotoc County, Ahloso.

Coal (bituminous). Carter County, Ardmore coal, near Ardmore. Coal County, Lehigh district: Lehigh coal 4-7 feet, mined at Coalgate, Phillips, and Lehigh, good quality; Atoka coal 4 feet, mining limited. Craig County, good quality west of Blue Jacket, west and northwest of Welch, at Centralia and Catale. Latimer County, Wilburton district: Upper Hartshorne coal 4½ feet, mined; Lower Hartshorne 4 feet, mined in vicinity of Howe. Le Flore County, Howe-Poteau district, contains Hartshorne and McAlester coals; Lower Hartshorne mined and coked in vicinity of Howe, 4½ feet; Witteville coal around Cavanal Mountains, at Witteville, mined at Sutter, 4 feet; Panama coal mined at Panama. Muskogee County, near Boynton, Muskogee, and elsewhere; mined in considerable quantity on Dog Creek. Okmulgee County, Henryetta coal mined at Henryetta,

Schulter, and Morris. Pittsburg County, McAlester district: Hartshorne coal 3-6 feet, mined at Hartshorne and elsewhere, good quality; McAlester coal along southeast side of district, southwest from Savanna, mined at Krebs and McAlester mines, 3-4½ feet. Rogers County, mined at Catoosa, Dawson coal mined at Collinsville. Tulsa County, Henryetta coal mined at Broken Arrow; Dawson coal outcrops from near Bird Creek to southwest of Beggs, Okmulgee County, mined at Dawson, Mohawk, Tulsa, and Red Fork.

Copper. See Azurite, Copper (native), and Malachite.

Copper (native). Small nuggets scattered through clay shale in Blaine County, near Winnview. Cimarron County, near Kenton and along valley of Cimarron River. McClain County, vicinity of Byars. Noble County, near Perry.

Galena. Comanche County, near Lawton at several localities in the granite in the Wichita Mountains. Johnston County, at Ravia, 25 miles southeast of Davis. McCurtain County, eastern part on Buffalo Creek, and elsewhere. Also reported being developed in other counties to the north and northwest in the Wichita Mountains. Murray County, in Arbuckle Mountains, especially in the Davis zinc field. Ottawa County, mined with zinc ore at Miami, Peoria, Quapaw, and other districts. Pontotoc County, near Ada, in sandstone.

Gas. See Natural gas.

Gilsonite. Pushmataha County, occurs in veins near Tuskahoma.

Grahamite. Atoka County, occurs in fissure veins in Stanley shale on branch of Tenmile Creek, west side of Impson Valley. Le Flore County, near Page. Pushmataha County, in Carboniferous rock in Jackfork Valley, 10 miles west of Tuskahoma, and at Jumbo. Stephens County, in sandstone and shale near Loco.

Granite. Comanche County, Lawton. Greer County, quarried at Granite. Johnston County, near Mill Creek, Ravia, Tishomingo, Troy, and Wapanucka. Kiowa County, Cold Springs, Mountain Park, and Roosevelt. Mayes County, reddish granite dike occurs near Spavinaw.

Gypsum. In Permian rocks. Blaine County, mined at Homestead, Watonga, and elsewhere. Caddo County, Cement. Canadian County, Okarche. Grady County, Rush Springs. Jackson County, Eldorado. Kay County, Peckham. Woodward County, Quinlan. Workable beds of gypsum occur also in Custer, Harmon, Stephens, and Washita counties.

Impsonite (bitumen). Atoka County, in Impson Valley, 25 miles northeast of Atoka. Pushmataha County, Moulton mine in Impson Valley and on McGee Creek.

Iron. See Brown iron ore, Magnetite, Marcasite, and Pyrite.

Lead. See Cerussite and Galena.

Limestone. Atoka County, Chockie. Blaine County, Canton and Geary. Caddo County, Cement. Carter County, Ardmore. Craig County, Blue-jacket. Comanche County, Cache, Lawton, Meers, and Richards. Delaware County, Kansas. Greer County, Mangum. Jackson County, Creta, near Eldorado, Olustee. Johnston County, large plant quarrying oolitic limestone at Bromide. Kay County, Chilocco, Newkirk, Ponca City, and Uncas. Kiowa County, Gotebo, Hobart, and Homalty. Logan County, Guthrie. Major County, Cleo and Fairview. Murray County, Crusher and Dougherty. Muskogee County, Muskogee. Noble County, Perry. Nowata County, Nowata. Osage County, Pawhuska. Ottawa County, Boone limestone quarried to some extent at Wyandotte. Pawnee

County, Cleveland, Pawnee. Payne County, Ripley. Pittsburg County, Hartshorne. Pontotoc County, Fitzhugh. Tulsa County, Garnett, Lost City, Skiatook, and near Tulsa. Washington County, Dewey. Washita County, Colony.

Limestone (crushed stone). Quarried in Atoka County, at Chockie. Caddo County, Cement. Comanche County, along northeast side of Wichita Mountain uplift 30 miles northwest of Fort Sill, also at Richards Spur. Jackson County, Creta and Olustee. Kay County, Newkirk, Ponca, and Uncas. Murray County, Arbuckle Mountain uplift, quarried at Crusher. Nowata County, 2½ miles north of Lenapah. Osage County, Avant. Pawnee County, 1 mile east of Pawnee. Pittsburg County, Hartshorne. Tulsa County, Lost City, near Garnett, and Tulsa.

Limestone (lime). Burned in Delaware County, at Grove and at other localities, for local use. Johnston County, at Bromide, and Wapanucka.

Magnetite. Comanche County, considerable deposits occur in Wichita Mountains.

Malachite. Arbuckle Mountains in small quantities. Jackson County, in sandstone near Elmer.

Manganese ore. Coal County, has been mined near Lehigh and Hunton. Johnston County, Mill Creek.

Marble. Sequoyah County, pure white to pink marble is quarried near Marble City.

Marcasite. Ottawa County, occurs with lead and zinc ores at Miami, Peoria, and Quapaw mines.

Natural gas. Producing wells at close of 1914 numbered 1,205, but gas is given off also by most of the oil wells. The most productive areas of Oklahoma are: Carter County, Healdton and Ardmore. Creek County, Cushing. Kay County, Ponca and Newkirk. Marshall County, Madill. Nowata County, Alluwe, Coodys Bluff, California Creek, and Delaware. Okmulgee County, Baldhill, Morris, and Okmulgee. Osage County, Hominy. Pawnee County, Cleveland. Rogers County, Collinsville. Stevens County, Loco. Tulsa County, Tulsa. Washington County, Bartlesville, Copan, and Hogshooter Creek. Gas occurs also in Comanche County, in small quantity at Lawton. Creek County, Cushing field. Greer County, at Granite. Kiowa County, at Gotebo. Kay County, Blackwell. Muskogee County, Muskogee. Stephens County, Duncan.

Novaculite. Atoka County, exposures near Atoka. Le Flore County, Talihina. McCurtain County, exposed over large area in central and eastern parts.

Oil. See Petroleum.

Petroleum. The total production of the State in 1913 was 63,579,384 barrels, valued at \$59,581,948, the State ranking second in amount and first in value of petroleum production. At the close of 1913 there were 24,085 active wells in the State. In 1914 the marketed production was 73,631,724 barrels, valued at \$57,253,187. Most of the productive areas are in northeastern Oklahoma, at or near Bartlesville, Baldhill, Boston, Boynton, Cleveland, Copan, Coweta, Cushing, Dewey, Glenn Pool, Hamilton, Healdton, Henryetta, Morris, Muskogee, Ramona, Red Fork, Skiatook, Taneha, and Tulsa. Important producers at Coodys Bluff-Alluwe field: Carter County, Wheeler. Creek County, Kellyville. Marshall County, Madill. Okmulgee County, Haskell. Osage County, Hominy. Muskogee County, Muskogee. Tulsa County, Bixby, Broken Arrow, and Lost City. Small quantities found in Comanche County, at Lawton; Creek County, near Mounds; Greer County, Granite; Kiowa County, Gotebo; Mayes County, spring near Adair.

- Pyrite.** Comanche County, in the lead and zinc region. A few tons are shipped each year.
- Road metal.** *See* Asphalt, Granite, Limestone (crushed stone), Novaculite, Sand and gravel, and Sandstone (bituminous).
- Salt.** Alfalfa County, occurs in a plain 4 miles east of Cherokee. Beckham County, a plain on North Fork of Red River south of Carter. Blaine County, on Salt Creek 4 miles west of Ferguson. Harmon County, two plains on Elm Fork of Red River. Harper, Woods, and Woodward counties, two plains on Cimarron River. Jackson County, three plains on Sandy Creek 3 miles south of Eldorado. Small annual production from Harmon County.
- Sand** (glass). Arbuckle Mountains, sandstone of Simpson formation, and in southeastern Oklahoma north of Red River, Trinity sand. Cherokee County, St. Peter ("Bürgen") sandstone, occurs near Tahlequah.
- Sand and gravel.** Found in nearly every county of the State, and utilized for local building, concrete, ballast, and road metal.
- Sandstone.** Widely distributed in central and southern parts of the State, in Beckham, Blaine, Caddo, Cleveland, Creek, Garvin, Grant, Jackson, Jefferson, Kay, Le Flore, Lincoln, Logan, McClain, McIntosh, Muskogee, Noble, Oklahoma, Osage, Ottawa, Pawnee, Payne, Pontotoc, Pottawatomie, and other counties. Quarried mostly for local use.
- Sandstone** (asphaltic, bituminous). *See* Asphalt.
- Smithsonite.** Murray County, mined in Arbuckle Mountains near Davis.
- Sphalerite** (zinc blende). Johnston County, at Ravia, 25 miles southeast of Davis. McCurtain County, eastern part on Buffalo Creek and vicinity. Murray County, mined in the Davis zinc field, Arbuckle Mountain district. Ottawa County, mined at Miami, Peoria, and Quapaw districts.
- Tripoli.** Ottawa County, mined near Peoria.
- Vanadium.** Le Flore County, occurs in unknown combination in grahamite, near Page.
- Volcanic ash.** Occurs in beds in Beaver, Ellis, Harper, Woods, and Woodward counties.
- Zinc.** *See* Calamine, Smithsonite, and Sphalerite.
- Zircon.** Comanche County, 7 miles northwest of Cache in the Wichita Mountains, in the south edge of the Wichita National Forest, large crystals in pegmatite.

OREGON.

Actinolite. *See* Asbestos.

Agate. Lincoln County (moss, water, and banded varieties), gathered abundantly on the ocean beach and polished for ornaments; also in other coast and Willamette Valley counties.

Almandite. *See* Garnet.

Antimony. *See* Stibnite.

Aragonite. Grant County, Dayville, on South Fork of John Day River. Josephine County, Oregon Caves.

Argentite (silver glance). Baker County, mined in Cable Cove and Rye Valley districts.

Arsenopyrite (arsenical pyrite). Baker County, mined for gold in Elkhorn, Cable Cove, Granite, Sparta, Sumpter, and other districts. Grant County, Susanville district. Jackson County, Upper Applegate and Gold Hill districts. Josephine County, Braden mine and Maid of the Mist, Grants Pass district, and Silent Friend mine.

Asbestos (actinolite). Douglas County, near Roseburg.

Asbestos (chrysotile). Clackamas County, upper headwaters of Clackamas River. Curry County, in the serpentine rocks in small seams. Douglas County, Canyonville, Crow Creek, Perdue, Starvout. Grant County, Canyon City, Mount Vernon, Prairie City. Jackson County, Buncom; Gold Hill district, in small amount in serpentine; Kubli; Spikenard. Josephine County, reported at Brownston and 10 miles west of Kerby and at other points not definitely located in the Klamath and Blue mountains; no workable deposits discovered as yet. Lake County, Lakeview. Lane County, Meadow. Malheur County, Ontario, Watson. Wheeler County, Barite.

Asphalt. Coos County, in the coal of Coos Bay. Harney County, near Lake Alvord and near Drewsey. Jackson County, east of Medford. Wheeler County, small deposits near Clarno.

Azurite (blue carbonate of copper). Coos County, upper Rock Creek. Douglas County, occurs in Ball mine, on Cedar Springs Mountain. Josephine County, oxidized ore, Queen of Bronze mine, Waldo district, and Alameda copper mine, Galice district.

Barite. Josephine County, Galice district, about 26 miles below Grants Pass, as a gangue mineral in Alameda mine. Lane County, Bohemia district.

Basalt. Practically every county in the State has basalt or similar rock suitable for road metal; that in the eastern part of the State is mostly Columbia lavas. Quarried at Baker County, Baker. Benton County, Corvallis and Monroe. Clatsop County, Astoria. Columbia County, St. Helens. Hood River County, Hood River. Klamath County, Klamath Falls. Lane County, Cottage Grove, Eugene, and Springfield. Linn County, Lebanon. Marion County, Salem. Multnomah County, Portland, Rocky Butte, St. Johns, Warrendale. Polk County, Dallas. Tillamook County, Tillamook Bay (Miami). Union County, Lagrande. Wasco County, The Dalles and Mosier. Washington County, Cherry Grove, Forest Grove, and Hillsboro. Yamhill County, Amity, Carlton, Dayton, Lafayette, and McMinnville.

- Borax.** Curry County, a calcium borate mineral (priceite) has been mined 5 miles north of Chetco. Harney County, in southern part, immediately south of Lake Alvord, deposits of borax of the marsh type, formerly mined and shipped by way of Winnemucca, Nev. Lake County, in southeastern part in Warner Valley, ulexite deposits. *See also* Colemanite.
- Bornite.** Baker County, mined in Copper Butte and lower Snake River regions. Curry County, Collier Creek district and McKinley Copper group. Jackson County, Ashland and Gold Hill districts. Josephine County, less important ore of mines near Waldo; in Alameda mine, Galice district.
- Brown iron ore (limonite).** Baker County, has been mined for flux on Burnt River divide, South Sumpter. Clackamas County, has been mined at Oswego. Columbia County, Scappoose. Curry County, Wake-up-Riley Ridge. Jackson County, in sec. 3, T. 35 S., R. 3 W., in Gold Hill district. In black sand as follows: Baker County, Baker; Douglas County, Steamboat River; Wheeler County, Antone.
- Calcite.** Grant County, 15 miles west of Mitchell, on South Fork of Taylor Creek, a vein 3 feet wide.
- Celestite.** Josephine County, Alameda mine, Galice district.
- Cement material.** Baker County, a large deposit of limestone on Burnt River, 3 miles from Hutchinson, forms a possible source of Portland cement material; a cement plant is reported to be in operation near Durkee. Clackamas County, a company building a cement plant at Oswego has bought quarry locations near Roseburg. Douglas County, 5 miles east of Monitor and 4 miles southwest of Dallas, Polk County.
- Cerussite (carbonate of lead).** Douglas and Lane counties, secondary mineral in Bohemia district, has been mined.
- Chalcedony.** Common throughout the State. Baker County, Sumpter quadrangle. Grant County, John Day River near Dayville, John Day, and Basin. Harney County, in Harney desert at many localities. Jackson County, great quantity of white chalcedony occurs in the vicinity of Eagle Point. Lane County, Willamette and McKenzie River gravels. Wasco County, near Antelope.
- Chalcocite (copper glance).** Baker County, mined in Copper Butte and lower Snake River regions. Douglas County, occurs in Ball mine near Cedar Springs Mountain. Josephine County, Waldo and Galice districts.
- Chalcopyrite (copper pyrites).** Baker County, mined in Cable, Elkhorn, Greenhorn, Sparta, Sumpter, and other districts. Coos County, upper Rock Creek. Curry County, Mule Mountain district, with gold, and Illinois River 2 miles north of mouth of Collier Creek. Douglas and Lane counties, Bohemia and Blue River districts and many other localities. Grant County, Susanville district, and Copperopolis claims, Quartzburg district. Jackson County, Gold Hill, Upper Applegate and Ashland, Corporal G mine. Josephine County, Braden and Opp mines, Grants Pass district, and Queen of Bronze mine, Galice and Waldo districts, near Waldo. Wallowa County, near Lostine.
- Chromite (chromic iron ore).** Baker County, heavy float at Winterville placers of upper Burnt River and Bonanza districts, Durkee, Sumpter (in black sand). Clatsop County, Astoria, Carnahan station, Clatsop Beach, Elk Creek (in black sand), Fort Stevens, Gearhart Beach, Hammond, Morrison (in black sand), near Seaside, Warrenton. Coos County, Bullards, Marshfield, South Fork Coquille River, in elevated beach gravels between Threemile Creek and the Lagoons. Curry County, Chetco, Gold Beach, Port Orford and Toledo Beach, Rogue River Beach near Pistol River,

beach sand at Ophir and Cuneffs Beach (in black sand), Sixes River, three-fourths of a mile above mouth of Dry Creek. Douglas County, Nickel Mountain, near Riddle; mined at Glendale and Starvout (in black sand). Grant County, small masses in serpentine 7 miles south of Prairie City, Canyon district, and 2 miles south of Cummings ranch, Granite, Vincent Creek, and Big Creek (in black sand), west of Mount Vernon, a large mass accumulated with serpentine. Jackson County, Ashland, Birdseye Creek (in black sand), Gold Hill, Jacksonville, Medford, Watkins (in black sand). Josephine County, Lower Applegate and Waldo districts in serpentine; Grants Pass, mined; was used at Takilma smelter; Galice, Holland, Josephine Creek near Kerby, Sucker Creek, Wolf Creek, Placer (in black sand). Lincoln County, Coos Bay (in black sand). Linn County, Foster (in black sand). Multnomah County, Columbia River (in black sand). Polk County, Falls City (in black sand). Umatilla County, Weston (in black sand). Wallowa County (in black sand). Wasco County, Hood River Beach at entrance to Columbia (in black sand). Wheeler County, Antone (in black sand).

Chrysocolla (silicate of copper). Coos County, head of Rock Creek. Curry County, Collier Creek, Copper district. Josephine County, oxidized ore in Queen of Bronze mine, Waldo district.

Chrysotile. See Asbestos.

Cinnabar. Baker County, occurs in Sumpter district. Crook County, until recently mined at Howard. Curry County, Sixes River, in placers. Douglas County, formerly mined at two places southeast of Oakland and recently mined at Drew, Elkhead, 6 miles west of Black Butte, South Umpqua River, and Cow Creek. Grant County, occurs in Granite and Susanville districts. Jackson County, small prospect on Palmer Creek, near Ashland, and in Gold Hill district, near Brownsboro, Meadows district. Josephine County, Picket Creek. Lane County, at Black Butte in volcanic tuff.

Clay (brick). Has been dug near almost every important town in the State. Benton County, Corvallis and Monroe. Douglas County, Roseburg and Sutherlin. Jackson County, Tolo. Lane County, Elmira. Linn County, reported from Waterloo. Polk County, Buena Vista, Dallas, Falls City, and Monmouth. Washington County, Tualatin (plastic red and buff burning).

Clay (fire). Clackamas County, Park Place. Lane County, occurs 3 miles west of Eugene. Multnomah County, used at Portland.

Clay (kaolin). Josephine County, at Three Pines (reported). Lane County, Elmira. Yamhill County, Willamina.

Clay (medicinal). Linn County, reported from Waterloo.

Coal (bituminous). Coos County, Eden Ridge and Squaw Basin fields. Crook County, prospect southeast of Prineville. Morrow County, the Willow Creek prospects. Wheeler County, Dry Hollow and south of Fossil.

Coal (lignite). Baker County, lignite beds occur north of Goose Creek, along Powder River. Columbia County, upper Nehalem field. Curry County, Eckley and Shasta Costa fields. Jackson County, Rogue River Valley field, Medford and Ashland prospects. Lincoln County, Yaquina field. Impure lignite is found at many places in Willamette Valley and in the Coast Mountains.

Coal (subbituminous). Clackamas County, near Wilhoit Springs. Clatsop, Grant, and Tillamook counties, lower Nehalem field. Coos County, Coos Bay field, Newport bed, 6 feet, extensively mined at Newport; Beaver

Hill bed, 6 feet, mined at Beaver Hill; coal-bearing rocks of Eocene age.

Cobaltite. Grant County, occurs with smaltite, chalcopyrite, and gold in the Standard mine, Quartzburg district, near Prairie City. Josephine County, float pieces near Kerby.

Copper. See Azurite, Bornite, Chalcocite, Chalcopyrite, Chrysocolla, Cuprite, Malachite, Tenorite, and Tetrahedrite.

Copper (native). Baker County, in Sumpter district. Curry County, occurs on lower Illinois River and Collier Creek district. Douglas County, occurs in Ball mine, near Cedar Springs Mountain and in Dodson Butte district. Josephine County, Alameda mine, Galice district.

Corundum. Josephine County, small ledge found at Grants Pass, little development; not worked at present.

Cuprite (red oxide of copper). Douglas County, occurs in Ball mine, Cedar Springs Mountain. Josephine County, oxidized ore of Queen of Bronze mine, Waldo district.

Diabase. See Trap rock.

Diatomaceous earth. Abundant in lake beds in Baker and Grant counties. Baker County, near Whitney and in Tps. 13 and 14 S., R. 37 E. Crook County, near Terrebonne; promising deposits Lower Bridge. Grant County, near Austin and between Dayville and Mount Vernon, 20 miles north of Dayville, on John Day River. Klamath County, found near Linkville. Wasco County, was mined at Mosier. Occurs also in Baker, Lake, Malheur, Union, and Wheeler counties. Union County, 4 miles southeast of Elgin on Indian Creek.

Dolomite. Baker County, Sumpter district.

Epidote. Curry County, in placers of Sixes River. Douglas County, Roseburg district.

Freibergite. See Tetrahedrite.

Galena. Baker County, mined in Baker, Cable Cove, Cornucopia, Elkhorn, Greenhorn, Sparta, and Sumpter districts. Grant County, Alamo, Susanville, and Quartzburg districts, and in mining districts in Cascade Mountains. Jackson County, Ashland, Gold Hill and Upper Applegate districts. Josephine County, Alameda mine, Galice district. Lane County, Blue River and Bohemia districts. Linn County, Santiam.

Garnet. Baker County, handsome garnets resembling rhodolite reported from point near Pleasant Valley; no production during recent years. Almandite garnets found in Sutter Creek district south of Baker, Durkee, Anthony, and Richland (in black sand). Clatsop County, Astoria, Carnahan station, Clatsop Beach, Clatsop Spit (in black sand), Elk Creek (in black sand), Fort Stevens, Gearhart Beach, Hammond, Morrison, Seaside, Warrenton. Coos County, in elevated beach gravels between Threemile Creek and the Lagoons, Bullards, Coquille, Marshfield, Randolph district (old and present beaches), South Fork, Whiskey Run, and Johnson Gulch (in black sand). Curry County, Cuneffs Beach (in black sand), Gold Beach, Port Orford, Rogue River Beach (in black sand), in elevated beach gravels between Threemile Creek and the Lagoons. Douglas County, Roseburg district, South Umpqua River (in black sand). Grant County, Big Creek and Vincent Creek (in black sand). Jackson County, Gold Hill (in black sand). Josephine County, Holland, Kerby, Waldo, Wolf Creek (in black sand). Lincoln County, Coos Bay, Newport and Toledo (in black sand), Yaquina Bay. Linn County, Foster

(in black sand). Malheur County, Snake River (in black sand). Multnomah County, Latourell Falls (in black sand). Polk County, Falls City (in black sand). Tillamook County, Oretown (in black sand). Umatilla County, Weston (in black sand). Wallowa County (in black sand). Wasco County, Hood River (in black sand).

Garnierite (nickel ore). Douglas County, occurs at Nickel Mountain, 3 miles west of Riddle.

Gas. See Natural gas.

Genthite (nickel ore). Douglas County, occurs at Nickel Mountain, near Riddle.

Geodes. Wheeler County, containing asphalt.

Gold (lode). Baker County, 6 producing mines at Baker and Virtue; Bonanza district, 1 mine at Geiser; Canner Creek, Cornucopia Creek, 4 deep mines operating; Cracker Creek district, 6 deep mines at Bourne and Sumpter; Durkee, Granite, Mormon Basin, 4 deep mines near Rye Valley, Pine Creek, Unity, Weatherby, and Whitney districts. Clackamas County, Chena Creek district. Curry County, Mule Creek district. Douglas County, Bohemia, Canyonville, and Cow Creek districts, deep mines at Booth, Glendale, and Nugget. Grant County, in Alamo, Canyon, Canyonville, Crane Creek, Granite, Quartzburg, and Susanville districts. Jackson County, deep mines in Applegate, Ashland, Blue Ledge, Draper, Foots Creek, Galls Creek, Gold Hill, Jacksonville, and Pleasant Valley districts. Josephine County, 10 deep mines in Althouse, Davidson, Galice, Grave Creek, Jumpoff Joe Creek, Louse Creek, Sucker Creek, Waldo, and Wolf Creek districts. Lane County, 4 deep mines in Blue River and Bohemia districts, also in Fall Creek district. Malheur County, 2 deep mines at Rye Valley and Malheur, Mormon Basin. Marion County, near Detroit, in Santiam district. Wheeler County, 1 small mine in Spanish Gulch district. See also Sylvanite.

Gold (placer). Baker County, dredged at Sumpter by large plant; small amount of sluicing in Baker, Buck Gulch, and Cracker Creek districts; Mormon Basin, Deep Creek, and Rye Valley, hydraulics; Bridgeport district, 3 hydraulic, 2 drift, and 2 sluicing mines; also in Sanger, Stice, and Weatherby districts; occurs also in Burnt River, Canner Creek, Cornucopia, Durkee, Greenhorn, Pine Creek, Unity, and Whitney districts, and in black sand at Anthony, Baker, Huntington, and Sparta. Coos County, Eden, Myrtle Point, and Randolph districts, Flanagan Bar, Johnson Creek, Whiskey Run, and in black sand of Bandon Beach and South Fork of Coquille River. Crook County, in black sand at Howard. Curry County, at Chetco, Corbin, Eckley, Elk Creek, Gold Beach, Marial, Mule Creek, Ophir, Port Orford, Rogue River, Selma, and Sixes River districts, and near Pistol River. Douglas County, hydraulics at Booth and Glendale; sluicing at Dillard; occurs also in Canyonville, Cow Creek, Green Mountain, Myrtle Creek, Olalla, Perdue, and Poker Flat districts, and in black sand at Drain, Riddle, Rogue River, Starvout, South Umpqua River, and Steamboat River. Granite County, mined by hydraulic at North Fork. Grant County, hydraulic at Austin, Poker Flat district, and 2 miles from Beach Creek post office; 4 hydraulics at Canyon City, 1 at Galena; dredge at Granite; hydraulic at Sawmill Gulch, Quartzburg district; Bull Run, Canyon Mountain, Elk Creek, and Susanville districts; in black sand at Big Creek, Homer, and Vinson. Harney County, 2 small sluicing properties at Harney. Jackson County, 3 dredges at Gold Hill and Woodville, Foots Creek

district; 9 hydraulic mines at Applegate, Draper, Rockpoint, Jacksonville, and Weimer; Evans Creek; Forest Creek; in black sand at Birdseye, Medford, and Watkins. Josephine County, 26 hydraulic mines, 2 dredges, 1 drift, and 7 sluicing mines, in following districts: Althouse, Galice, Grave Creek, Josephine, Picket Creek, Williams, Winona, and Wolf Creek; in black sand in Applegate, Briggs Creek, Illinois, Jumpoff Joe Creek, Louse Creek, Picket Creek, Rogue Creek, Sucker Creek, Sweat Basin, Waldo. Lincoln County, Yaquina Bay and Toledo (in black sand). Linn County, Foster (in black sand). Malheur County, Quartz Gulch and Mormon Basin, hydraulic and a few sluicing mines; Snake River (in black sand). Marion County, Detroit (in black sand). Multnomah County, Latourell Falls and Portland, found sparingly in black sand. Polk County, Falls City (in black sand). Umatilla County, Weston (in black sand). Union County, La Grande (in black sand). Wallowa County, Wallowa (in black sand). Wasco County, Hood River (in black sand). Washington County, Hillsboro (in black sand). Wheeler County, 2 hydraulic mines in Spanish Gulch district. Yamhill County, North Yamhill (in black sand). Placer gold found in many other places in small quantity.

Granite. Quarried in Baker County, at Haines. Jackson County, Ayers, near Medford, and near Ray Gold. Josephine County, Grants Pass. Union County, Elgin and La Grande.

Graphite. Jackson County, near Buncom, Upper Applegate district at the Blue Ledge mines, and on the hillside east of Sterling. Josephine County, Mayflower and Golden Wedge mines in Galice district.

Gypsum. Baker County, white and crystalline gypsum occurs on east border of State on ridge between Burnt and Snake rivers, mined and milled at Gypsum, near Huntington. Crook County, deposit near Bend, undeveloped; Crooked River. Grant County, John Day. Jackson County, Alton or Baron mine, Ashland district. Josephine County, Alameda mine and Galice district (as a gangue mineral). Wheeler County, Bridge Creek.

Halite. *See Salt.*

Hematite (red iron ore). Baker County, specular variety in argillite on Burnt River divide near Sumpter. Douglas and Lane counties, intermingled with sulphides in Bohemia and Blue River districts; mined for gold. Jackson County, in sec. 9, T. 38 S., R. 1 E., where it occurs in a clay bank; also in Gold Hill district. In black sand at the following places: Baker County, Sparta, Sumpter district, Rye Valley, and New Bridge. Crook County, Howard. Curry County, Eckley. Douglas County, South Umpqua River, Steamboat River, Starvout, and Riddle. Grant County, Granite. Josephine County, Josephine Creek near Kerby, Waldo, Sucker Creek, and Browntown. Lane County, Cottage Grove. Linn County, Foster. Washington County, Hillsboro.

Hematite (specularite). Baker County, occurs in argillite on Burnt River divide, near Sumpter.

Hessite. Baker County, occurs in Sumpter district.

Ilmenite. Coos County, in elevated beach gravels between Threemile Creek and The Lagoons. Curry County, in placer gravels of Sixes River. In black sand as follows: Baker County, Baker, Durkee, Richland, Sparta, and Sumpter. Benton County, Alsea. Clatsop County, Hammond, near Seaside, and Warrenton. Coos County, Bandon beach, Bullards, Marshfield, and Whiskey River. Crook County, Howard. Douglas County,

Drain, Glendale, Riddle, Rogue River, South Umpqua, Steamboat River. Grant County, Big Creek and Vinson Creek. Jackson County, Ashland, Foote Creek, Gold Hill, Watkins, and Weimer. Josephine County, Galice, Josephine Creek, Kerby district, Placer, Sucker Creek, Waldo, and Wolf Creek. Lincoln County, Newport, Toledo, and Yaquina Bay. Linn County, Foster. Malheur County, in Snake River. Marion County, in southeast corner. Multnomah County, Columbia River sand, Fulton, Latourell Falls, Portland. Tillamook County, Oretown. Union County, La Grande. Wheeler County, Antone. Yamhill County, North Yamhill.

Infusorial earth. See Diatomaceous earth.

Iridium. Found native in most crude platinum and with osmium as iridosmine in the gold placers and beach sands of Coos, Curry, Jackson, and Josephine counties; also recovered in small quantities during the refining of copper matte and gold bullion from different sources.

Iridosmine. Curry and Coos counties, with platinum in the beach sands.

Iron. See Brown iron ore, Chromite, Hematite, Ilmenite, Magnetite, Mineral paint, Pyrite, Pyrrhotite, and Siderite.

Jasper. In gravels along Willamette River.

Josephinite (nickel ore). Josephine County, occurs in placers of Josephine Creek.

Kaolinite. Coos County, Arago. Harney County, south of Lake Harney. Jackson County, 10 miles east of Ashland. Malheur County, 28 miles southwest of Huntington. Wasco County, 5 miles above The Dalles.

Lead. See Galena and Cerusite.

Limestone (flux). Baker County, Lime and Sumpter. Douglas County, near Roseburg. Grant County, Prairie City. Jackson County, near Rock Point on Rogue River. Lane County, Cottage Grove and near Eugene. Marion County, Salem. Polk County, 4 miles southwest of Dallas. Union County, La Grande.

Limestone (lime). Baker County, burned near Huntington, Durkee, and Lime; near Marble Point; three quarries three-fourths mile north of Pleasant Valley; 8 miles north of Homestead; near Winslow station on the Huntington-Homestead branch of the Oregon-Washington Railroad is a north-south ridge of crystalline limestone extending for about 4 miles between Connor and Soda creeks. Clackamas County, Marquam. Coos County, Coos Bay, Coos River, 10 miles above Marshfield. Douglas County, 3½ miles from Green station, near Drain, near Oakland, and Roseburg. Gilliam County, 2 miles south of Arlington. Grant County, 4 miles east of Canyon City, near Dayville. Jackson County, on Rogue River near Rock Point and on Kane Creek, south of Gold Hill, Galls Creek, and Wilson Creek, and on Upper and Little Applegate rivers. Josephine County, near Williams and farther down Applegate River on Cheney and Oscar creeks, Elder Creek, and near Takilma. Lane County, Eugene. Wallowa County, at Lostine.

Limonite. See Brown iron ore.

Magnetite. Coos County, in elevated beach gravels between Threemile Creek and The Lagoons. Curry County, in Sixes River, three-fourths of a mile above the mouth of Dry Creek and one-half mile northeast of Horse Sign Butte. Occurs in black sand in the following places: Baker County, Anthony, Baker, Durkee, New Bridge, Rye Valley, Richland, Sparta, and Sumpter. Benton County, Alsea. Clatsop County, Astoria, Carnahan station, Clatsop Beach, Clatsop Spit, Columbia River, Elk Creek, Fort Stevens, Gearhart Beach, Hammond, near Seaside, and Warrenton.

Coos County, Bandon Beach, Bullards, Johnson Gulch, Marshfield, Randolph district, South Fork Coquille River, Whiskey River, and Whiskey Run. Crook County, Howard. Curry County, Chetco, Cuneffs Beach, Eckley, Gold Beach, Ophir, Port Orford, and Rogue River Beach, near Pistol River. Douglas County, Drain, Glendale, Riddle, Rogue River, South Umpqua River, Starvout, and Steamboat River. Grant County, Big Creek, Comer, Granite, and Vinson Creek. Jackson County, Ashland, Birdseye Creek, Foote Creek, Gold Hill, Jacksonville, Medford, Watkins, and Weimer. Josephine County, Browntown, Coyote Creek, Galice, Greenback, Holland, Illinois River near Kerby, Kerby, Josephine Creek near Kerby, Placer, Sucker Creek, Sutler Creek, Waldo, and Wolf Creek. Lane County, Cottage Grove. Lincoln County, Newport, Toledo, and Yaquina Bay. Linn County, Foster. Malheur County, Snake River, Marion County, in southeast part. Multnomah County, Columbia River, Fulton, and Latourell Falls. Polk County, Falls City. Tillamook County, Oretown. Umatilla County, Weston. Union County, La Grande. Wallowa County, Wallowa. Wasco County, Hood River Beach. Washington County, Antone. Yamhill County, North Yamhill.

Malachite (green carbonate of copper). Baker County, considerable quantity at Copper Queen mine, Copper Butte district; also Sumpter district. Coos County, upper Rock Creek. Douglas County, small quantity in Ball mine. Grant County, Copperopolis claims, Quartzburg district. Jackson County, Alton or Baron mines, Ashland district. Josephine County, oxidized ore in Queen of Bronze mine, Waldo district; Alameda mine, Galice district.

Manganese. See Pyrolusite, Rhodonite, Rhodochrosite, and Wad.

Marble. Douglas County, exposed in a series of six or more outcrops extending interruptedly from a point 4 miles east of Dillard 15 miles northeastward to the northwest base of Lane Mountain, near Drain. Josephine County, near Williams and farther down Applegate River on Cheney and Oscar creeks, Elder Creek, and near Takilma. Wallowa County, black marble is quarried 5 miles north of Enterprise.

Marcasite. Baker County, Sumpter district. Grant County, in quartz-gold veins in Granite and Quartzburg districts. Jackson County, Ashland district.

Mercury. See Cinnabar and Schwartzite.

Mica. Douglas County, Roseburg district. Jackson County, in Gold Hill district on upper Evans Creek, in pegmatite dikes.

Mineral paint. Iron ore for making paint has been dug in Columbia County, at Scappoose. Lane County, near Creswell.

Mirabilite (Glauber salt). Lake County, in ponds and lakes.

Molybdenite. Baker County, Copper Creek in the Eagle Mountains, and Deer Creek, near Sumpter, in granodiorite. Jackson County, Ashland district south of Ashland. Josephine County, Blue Bell mine, Galice district. Wallowa County, Wallowa district near Aneroid Lake.

Monazite. In black sands in Clatsop County, at Astoria, Carnahan station, Clatsop, Clatsop Beach, Clatsop Spit, Elk Park, Fort Stevens, Gearhart Beach, Gearhart Park, Hammond, Morrison, Seaside, Warrenton, and elsewhere. Coos County, South Fork Coquille River, Randolph district. Curry County, Eckley, Gold Beach, and Port Orford. Josephine County, Holland, Placer, Sucker Creek, and Wolf Creek. Linn County, Foster. Multnomah County, Fulton and Latourell Falls. Polk County, Falls City. Umatilla County, Weston. Wallowa County, Wallowa. Wasco County, Hood River. Wheeler County, Antone.

Natron. In Lake County, in lakes and ponds.

Natural gas. Malheur County, occurs in several wells near Vale and Ontario; not commercially developed.

Nickel. See Garnierite, Genthite, and Josephinite.

Niter (saltpeter). Lane County, ledge near Mount June; also in marsh deposits of southeastern Oregon.

Olivine. In black sand in Baker County, Durkee. Clatsop County, Astoria, Carnahan station, Clatsop Spit, Elk Creek, Fort Stevens, Gearhart Beach, Hammond, Morrison, Seaside, and Warrenton. Coos County, Johnson Gulch, Randolph district (in old and present beach sand), and Whiskey Run. Curry County, Chetco, Eckley, Gold Beach, Port Orford, and Rogue River beach. Josephine County, Holland, Kerby, and Wolf Creek. Multnomah County, Fulton and Latourell Falls. Polk County, Falls City. Umatilla County, Weston. Wasco County, Hood River beach. Also in other places.

Opal. Baker County, abundant in tuff a few miles below Durkee; has been mined. Clackamas County, in seams in trap rock forming falls at Oregon City. Gilliam County, Hay Creek. Grant County, Grub Creek, near Canyon City. Umatilla County, 4 miles above Weston, on Pine Creek. Wasco County, The Dalles, and near Antelope.

Platinum. Principal production from beach sands in Coos County, near Bulards, and at Bandon, Randolph district, and Whiskey River, and in Curry County, near Port Orford, Cape Blanco, and Ophir, upper Sixes River, Gold Beach, and in placers of Rogue River. Occurs in black sands in Baker County, at Buck Gulch and Durkee. Douglas County, Drain, Glendale, and Riddle. Grant County, at Griffith mine. Josephine County, Galice, Waldo, and Greenback districts, and elsewhere; in black sand at Browntown, Grants Pass, Illinois River, and Kerby district. Linn County, Foster. Union County, La Grande. Wheeler County, Antone.

Priceite. Curry County, on coast 5 miles north of Chetco.

Proustite. Baker County, Sumpter district.

Pumice. Klamath County, abundant west of Crater Lake.

Pyrargyrite. Baker County, mined in Elkhorn, Sumpter, and Rye Valley districts. Grant County, Granite district.

Pyrite. Found in nearly all mining districts of Baker, Grant, and Union counties. Curry County, in gold veins of Mule Mountain district, Wake-up-Riley Ridge, and Illinois River 2 miles north of mouth of Collier Creek. Douglas County, Roseburg district; has been mined in Bohemia district. Jackson County, mined for gold at Ashland, Gold Hill, Jacksonville, and Upper Applegate district, and Braden, Opp, and Tin Pan mines, Grants Pass district. Josephine County, Queen of Bronze mine near Waldo; Greenback, Baby, Silent Friend, and Orofino mines, Alameda mine, Galice district, Grants Pass, and Lower Applegate district. Lane County, has been mined in Bohemia and Blue River districts. Occurs in all districts of the Cascade Mountains north of Bohemia.

Pyrolusite. Baker County, occurs in Sumpter district; Jackson County, Ashland and Gold Hill districts; Josephine County, Cave Creek in Waldo district.

Pyrrhotite. Baker County, Sumpter district; Virtue district, carries gold. Douglas County, Cow Creek Canyon. Jackson County, Braden and Jewet mines, Grants Pass district, and Corporal G mine, Upper Apple-

gate and Gold Hill districts. Josephine County, Queen of Bronze mine near Waldo; Galice and Grants Pass districts.

Quicksilver. *See* Cinnabar.

Rhodochrosite. Josephine County, Waldo district on Cave Creek, 3 miles below Oregon Caves on trail down Cave Creek.

Rhodonite. Josephine County, Waldo district on Cave Creek, 3 miles below Oregon Caves on trail down Cave Creek.

Road metal. *See* Basalt and Sand and gravel.

Salt. Douglas County, Salt Springs, north of Roseburg. Lake County, reported abundant in numerous marshes and lakes.

Sand and gravel. Dug at following places: Benton County, Corvallis; Klamath County, Klamath Falls; Lane County, Eugene; Linn County, Albany; Marion County, Salem; Multnomah County, Portland and St. Johns.

Sandstone. Has been quarried locally in Benton, Clackamas, Coos, Curry, Douglas, Jackson, Lane, Lincoln, Polk, Union, Washington, and Yamhill counties. The use of cement has led to the suspension of operations in many places. The largest quarries are at Oakland, Douglas County, and at Pioneer, Lincoln County.

Sapphire. Harney County, secs. 1, 6, and 17, T. 25 S., R. 35 E.

Schwartzite. Baker County, Sumpter district.

Siderite. Josephine County, Galice district. Grant County, Sumpter district.

Silver. Baker County, predominant metal produced at Iron Dike (Homestead) district. Occurs in most lode gold districts, and is widely distributed in placers. The principal producers of lode and placer silver are Baker, Douglas, Grant, Jackson, Josephine, Lane, and Malheur counties. *See also* Argentite, Hessite, Pyrargyrite, and Sylvanite.

Sphalerite (zinc blende). Baker County, Baker, Cable Cove, Elkhorn, Greenhorn, Sparta, and Sumpter districts. Curry County, Mount Emery. Grant County, Alamo, Quartzburg, and Susanville districts. Jackson County, mined for gold in Corporal G mine, Upper Applegate and Gold Hill districts. Josephine County, Alameda mine, Galice district. Lane and Douglas counties, occurs in Bohemia district. Lane County, Blue River mining district. Linn County, Santiam.

Stibnite. Baker County, occurs in Sumpter and Virtue districts. Crook County, Trout Creek mines. Jackson County, in fractures of greenstone 2 miles north of Watkins, Ashland district in Baron mine, and 30 miles east of Medford. Lane and Douglas counties, in Bohemia district.

Sylvanite. Baker County, occurs in quartz vein at Bryan mine, Cornucopia district. Josephine County, Grants Pass district.

Talc. Clackamas County, Eagle Creek. Jackson County, near Woodville. Josephine County, Grants Pass.

Tenorite. Josephine County, oxidized ore in Queen of Bronze mine, Waldo district.

Tetrahedrite. Baker County, Cable Cove, Greenhorn, Sumpter, and Virtue districts. Grant County, Susanville district, small quantity in Badger mine.

Tetrahedrite (mercurial, schwartzite). Baker County, occurs in Sumpter district.

Thomsonite. Lane County, in road cut 100 yards west of Deerhorn.

Thorium. *See* Monazite.

Titanium. *See* Ilmenite.

Trap rock. *See* Basalt.

Tuff (rhyolitic). Common in lake beds and a recent surface cover in Baker and Grant counties. Baker County, quarried for building stone at Pleasant Valley; also in Grant County and many other places in eastern Oregon.

Volcanic ash. *See* Tuff.

Wad. Baker County, Sumpter district.

Wood (silicified). Of some use for ornamental work. Abundant in Willamette River valley counties and in eastern counties.

Zinc. *See* Sphalerite.

Zircon. Baker County, upper Burnt River in black sands and Bonanza placers, and in black sands at Durkee, Anthony, Sumpter, and Rye Valley. Clatsop County, Astoria, Carnahan station, Clatsop, Clatsop Beach, Clatsop Spit, Elk Creek, Fort Stevens, Hammond, Morrison, Seaside, and Warrenton. Coos County, in elevated beach gravels between Threemile Creek and the Lagoons, Bullards, Johnsons Gulch, Marshfield, Randolph district (old and present beaches), South Fork Coquille River, Bandon Beach, Whiskey River, and Whiskey Run, in black sand. Curry County, Sixes River in placer gravel and in black sand at Chetco, Cuneffs Beach, Gold Beach, Port Orford, and Rogue River Beach, near Pistol River. Douglas County, Riddle and South Umpqua River. Grant County, Granite. Hood River County, Hood River. Jackson County, Ashland, Gold Hill, Jacksonville, and Weimer. Josephine County, Greenback, Holland, Josephine Creek, near and at Kerby, Placer, Sucker Creek, Sutler Creek, Waldo, and Wolf Creek. Lincoln County, Coos Bay, Yaquina Bay, and Newport. Linn County, Foster. Malheur County, Snake River, Multnomah County, Fulton and Latourell Falls. Polk County, Falls City. Umatilla County, Weston.

PENNSYLVANIA.

Allanite. Chester County, at Bethlehem, in East Bradford and Coventry townships. Lawrence County, Princeton. Lehigh County, at Allentown. Philadelphia County, Frankford. Nearly all localities are granitic rock.

Almandite. *See Garnet.*

Amethyst. Bedford County, reported at East Bedford. Chester County, Pocopson, Sadsbury, and East Bradford townships. Delaware County, $1\frac{1}{2}$ miles northeast of Media, at other localities in Upper Providence, Middletown, and Astor townships. Huntingdon County, Birmingham. Philadelphia County, Falls of Schuylkill, Rolandsville; a few stones suitable for gems.

Anthracite. *See Coal.*

Apatite. There are no commercial workings, but some of the chief localities are: Chester County, at Penn's Meetinghouse. Delaware County, at Leiperville, near Chester. Philadelphia County, in several quarries in Frankford, Germantown, and West Philadelphia.

Asbestos (amphibole). Delaware County, formerly mined near Rockdale, occurs at Mineral Hill, near Media.

Asbestos (chrysotile). Adams and Franklin counties, small veins in greenstone in the South Mountains. Delaware County, has been found in Marble, Radnor, Upper Providence, and other townships. Northampton County, at Easton.

Azurite (blue carbonate of copper). Berks County, Fritz Island, near Reading, sparingly with copper ores and magnetic iron ore; Chester County, Wheatly mine near Phoenixville. Lebanon County, Cornwall, with chalcopyrite and malachite in magnetic iron ore. Montgomery County has been mined at Perkiomen and Eaton mines, at Audubon (formerly Shan-nonville), Upper Salford Township, near Sumneytown.

Barite (heavy spar). Bucks County, occurs west of New Hope, in several old mines. Chester County, in small quantity in Wheatley, old Jug Hollow, and other mines near Phoenixville, Schuylkill Township. Franklin County, mined to a small extent near Chambersburg and Waynesboro. Fulton County, formerly mined at Fort Littleton. Montgomery County, at the Perkiomen and Eaton copper mines, Marble Hall, Mogeess, North Wales, Sanatoga. Other small occurrences. Barite is not mined on a commercial scale in Pennsylvania at present.

Beryl. Chester County, Union Township, near Northrop and Unionville, has yielded hundreds of pounds of crystals. Delaware County, Deshong's quarry at Leiperville; the Shaw-Ezra quarry at Chester; Avondale quarry near Media; many localities in Concord, Marble, Middletown, and Upper Province townships; Linwood, occasionally found. Philadelphia County, Fairmount Park, Germantown, Logan, Mount Airy, and Shawmont have all produced gem specimens.

Bluestone. *See Sandstone.*

Bornite. Montgomery County, formerly mined at Ecton mine, near Audubon, at Hendricks, Schwenksville, and Sumneytown. Philadelphia County, found at Frankford and quarries in Germantown.

Bromine. Allegheny County, concentrated from brine at Pittsburgh. *See also Salt.*

Brown iron ore (limonite). Extensively developed in the Great Valley from Delaware River to the Maryland line. Many scattered ore banks have been worked out in Berks, Cumberland, Dauphin, Franklin, and Lebanon counties. Occurs in Chester and Montgomery counties in a narrow belt

crossing the Schuylkill at Spring Mill. Bedford, Huntingdon, and Mifflin counties, occurs in Juniata region. Blair County, in Yellow Creek district. Lancaster County, in the Chestnut Hill and other ore banks. Middle Pennsylvania, in Kishacoquillas, Nittany, Morrisons Cove, and Sinking Canoe valleys. Juniata and Perry counties on the affluents of the Juniata. York County, irregular masses scattered through clay near Dillsburg, mined at Heck mine. Western Pennsylvania: Armstrong County, formerly worked in West Franklin Township; also occurs in Beaver, Butler, Clarion, Center, Clearfield, Jefferson, Indiana, and Lawrence counties. *See also* Mineral paint.

Brucite. Berks County, at Fritz Island, near Reading, and near Sinking Spring, Spring Township. Lancaster County, southern part, at New Texas, in Wood's mine, near Lyles post office, in large plates or masses, and in crystallizations several inches across; at Low's mine, with hydro-magnesite.

Cadmium. *See* Greenockite.

Calamine (zinc silicate). Chester County, Wheatley and other mines near Phoenixville. Columbia County, Espy. Lancaster County, Lancaster. Lehigh County, Friedensville, Saucon Valley, with blende in limestone. Montgomery County, Eaton mine at Audubon.

Carnotite. Carbon County, in conglomerate on Mount Pisgah, three-fourths of a mile north of Mauch Chunk.

Cement material. Pennsylvania leads all the States in production of Portland cement. Its output in 1914 was 26,570,151 barrels. There are 20 or more plants in the Lehigh district and other plants at York, Pittsburgh, Newcastle, and Wampum. Limestone and shale suitable for cement making are abundant throughout the State. Rock is quarried for cement in Berks County, at Evansville and was long quarried at Molltown. Lawrence County, at Newcastle and Wampum. Lehigh County, Allentown, Cementon, Coplay, Egypt, and Fogelsville. Northampton County, Bath, Martins Creek, Nazareth, Northampton, Siegfried, and Stockertown. Blast-furnace slag and limestone are used at Pittsburgh, Allegheny County, for Portland cement. Clay dug at Mines, Blair County, Mount Holly Springs, Cumberland County, and at Saylorsburg, Monroe County, is used for white cement.

Cerium metals. *See* Allanite.

Cerussite (lead carbonate). Bradford County, in Carpenter mine, near New Albany. Chester County, in small quantities at Phoenixville lead mines, Schuylkill Township. Lancaster County, Lancaster. Montgomery County, Ecton copper mines, Lower Providence Township.

Chalcocite (copper glance). Chester County, in small quantity at Phoenixville lead mines, Schuylkill Township. Lancaster County, Woods mine, Little Britain Township. Montgomery County, Perkiomen copper mines, Lower Providence Township, near Sanatoga and many other places in the Triassic shale. Philadelphia County, Frankford and Rolandsville.

Chalcopyrite (copper pyrites). Berks County, formerly mined at Jones mine and at Fritz Island mine near Reading. Chester County, Wheatley lead mine, Phoenixville, French Creek iron and copper mines, Warwick Township. Found only in small quantity in Delaware County, Avondale quarries. Lancaster County, Gap nickel mine. Lebanon County, occurs with other copper ores and is mined with magnetite at Cornwall, elsewhere unimportant as an ore. Montgomery County, in Lafayette soapstone quarry; has been mined in Sassamansville, Sumneytown, Ecton, and

Perkiomen mines at Audubon; occurs and is frequently prospected at many points throughout the area of Triassic rocks. Philadelphia County, in gneiss at Frankford and on Wissahickon Creek.

Chromite (chromic iron ore). Chester County, has been mined in Elk, East Nottingham, and West Nottingham townships. Delaware County, occurs in serpentine near Ox Run in Newton Township; near Palmers Mill, Marple Township, and elsewhere in the serpentine. Lancaster County, occurs in serpentine at Woods mine on Octoraro Creek and elsewhere in the "State line" serpentine, Lancaster and Chester counties. Reported at many other localities but is not produced commercially.

Chromium. See Chromite.

Clay (brick). Occurs in most counties of the State and is dug in at least 44 of them. The production of common brick in 1914 was valued at more than \$4,500,000. Allegheny and Philadelphia counties are largest producers.

Clay (fire). Mined in many places in connection with coal in Allegheny, Armstrong, Beaver, Bedford (Buffalo Mills), Berks, Bucks (West Winfield), Cambria, Carbon, Clarion, Center, Clearfield, Clinton, Cumberland (Dee-Armstrong), Elk, Fayette, Huntingdon, Indiana, Jefferson, Juniata, Lackawanna, Lawrence, Lehigh, Luzerne, Lycoming, McKean, Mercer (Grove City), Montgomery, Perry, Snyder, Somerset, Tioga (Morris Run), Union, and Westmoreland counties. Fire brick produced in 1914 were valued at more than \$5,750,000.

Clay (flint). Blair County. Cambria County, Johnston district and Mineral Point. Center County, Moshannon Creek and Sandy Ridge. Clarion County, Rimersburg. Clearfield County, Anderson Creek, Bigler, Burly, Chase, Clearfield Creek, Curwensville, Faunce, Hogback Run, Stronach, Wallacetown. Indiana County, Deckers Point, Dilltown, Glen Campbell, Little Mahoning Creek, and south side of Bear Run. Jefferson County, Frostburg.

Clay (kaolin). Pits in Berks County at Blandon and Mertztown. Chester County, at East Nottingham, Kaolin, Kennett, and New Garden. Cumberland County, Mount Holly Springs, Toland. Delaware County, pits at Brandywine Summit, Hockessin. Huntingdon County, Birmingham Township. Franklin County, Concord Township. Montgomery County, Plymouth Township. White kaolin, plastic, Mountain Creek and Henry Clay valleys in South Mountain region.

Clay (paper). Cumberland County, near Mount Holly Springs. Pure white siliceous clay used as a filler in the manufacture of paper, paint, and light-colored brick; also in other parts of the South Mountain region and Monroe County, Saylorsburg.

Clay (pottery). Beaver County, New Brighton and Vanport. Lancaster County, Narvon.

Clay (sewer pipe). Beaver County, Blockhouse Run. Also Allegheny, Cambria, Clearfield, and Montgomery counties.

Clay (terra cotta). Near Pittsburgh.

Coal (anthracite). Anthracite region covers part of Carbon, Columbia, Dauphin, Lackawanna, Luzerne, Northumberland, Schuylkill, Sullivan, Susquehanna, Wayne, and Wyoming (not mined) counties. Of these the most important are Carbon, Lackawanna, Luzerne, Northumberland, and Schuylkill. Total production in 1914 was 81,090,631 long tons.

Coal (bituminous). Coal-bearing rocks cover practically the whole of Allegheny, Armstrong, Blair, Butler, Beaver, Cambria, Clearfield, Cumberland, Greene, Indiana, Jefferson, Lawrence, Washington, and West-

moreland counties; the greater portion of Clarion, Elk, Fayette, Mercer, and Somerset counties; parts of Bedford, Bradford, Cameron, Center, Clinton, Crawford (not mined), Forest (not mined), Fulton (not mined), Huntingdon, Lycoming, McKean (not mined), Tioga, and Venango (not mined) counties. Chief producers are Allegheny, Butler, Cambria, Clearfield, Fayette, Indiana, Jefferson, Somerset, Washington, and Westmoreland counties. Total production in 1914 was 147,983,294 short tons.

Copper (native). Formerly mined in Adams County, at South Mountain. Cumberland County, at South Mountain. Also found in small quantity in Adams County, Millerstown; Berks County, Jones iron mine near Morgantown; Chester County, French Creek mines and Phoenixville lead mines; Franklin County, at South Mountain; Lebanon County, at Cornwall; Lehigh County, Ironton; Montgomery County, Perkiomen copper mine.

Copper minerals. Delaware County, pits at Brandywine Summit, Hockessin. Localities listed are well-known sources of museum specimens. *See also* Azurite, Bornite, Chalcocite, Chalcopyrite, Cuprite, Malachite, and Melanconite.

Corundum. Generally with serpentine or pegmatite in Bucks, Chester, Delaware, Lancaster, Lehigh, and Montgomery counties. Chester County, has been mined northeast of Unionville. Lehigh County, formerly mined near Shimerville, not associated with serpentine. Not produced at present in Pennsylvania.

Cuprite (red oxide of copper). Adams and Franklin counties and in small quantities elsewhere in South Mountain copper mines near Maryland line. Lebanon County, Cornwall. Montgomery County, sparingly at Perkiomen mine. Northampton County, Chestnut Hill near Easton.

Cyanite. Delaware County, on Darby Creek.

Dolomite. Montgomery County, worked by Keasby-Mattison Co. for magnesia, which is used in making magnesium carbonate.

Feldspar (albite). Chester County, mined in town of West Nottingham, near Sylmar station, Md.

Feldspar (orthoclase, microcline). Chester County, mined at Chatham, Toughkenamon, and Pomeroy; has been mined at Baker station, Avondale, Embreeville, and Unionville. Delaware County, mined at Brandywine Summit; has been mined at Chester Heights, Glen Mills, and between Chelsea and Boothwyn in Middletown.

Flagstone. *See* Sandstone.

Fluorspar. Chester County, Wheatley mine, Schuylkill Township. Columbia County, Newlin. Franklin County, Lancaster station. Lebanon County, Cornwall. Lehigh County, Ironton and many other places in the limestone. Northampton County, Bethlehem and Nazareth. Monroe County, Delaware Water Gap. Montgomery County, Swenksville and elsewhere in the Triassic. Philadelphia County, Frankford, Falls of Schuylkill and Holmesburg, in gneiss.

Gabbro. *See* Trap rock.

Galena. Blair County, Sinking Valley, accompanying zinc ores. Bucks County, New Britain. Chester County, Phoenixville lead mines. Lancaster County, Pequea mine, argentiferous. Montgomery County, Perkiomen and Ecton mines. Schuylkill County, near Pottsville.

Ganister. Extends through mountain region of central Pennsylvania. Mined for silica brick in Bedford County at Pattonville. Blair County, McKee

Gap and Point View. Huntingdon County, Water Street Gap. Lancaster County, mined at Beartown. Montgomery County, Edge Hill, near Bowmans. Carbon County and many other places.

Garnet. Adams County, near Fairfield and elsewhere, associated with magnetite in metamorphic Triassic limestone, conglomerate and sandstone; used as an abrasive. Delaware County, formerly mined 1 mile southwest of Chelsea, abrasive. Found in small crystals in the Wissahickon mica gneiss of Chester, Delaware, and Montgomery counties along the serpentine contact and at many other places. Fine large gem crystals occur in the pegmatites in Delaware County at Avondale, Leiperville, and elsewhere, and in Chester and Philadelphia counties.

Gas. See Natural gas.

Gold. Bucks County, New Britain in galena, near Rock Hill in diabase, near Sassamansville in chalcopryrite. Chester County, Phoenixville lead ores in copper pyrites. Montgomery County, in lead ores of Perkiomen and Ecton mines; Franconia and Douglas townships, sparingly in quartz and pyrite. Philadelphia County, near Philadelphia and in clays along Delaware River. A good-sized sheet extracted from a few tons of the clay is in the Philadelphia mint. Reported in many other localities but not in workable amount.

Goslarite. Lehigh County, in the zinc mines at Friedensville.

Granite (including gneiss, diabase, etc.). Berks County, quarried at Seisholtzville. Bucks County, Langhorne, Neshaminy Falls, Quakertown, Rist Hill, and Trevoise. Chester County, St. Peter, West Chester, and Westgrove. Delaware County, Ardmore, Burmont, Cardington, Chester, Clifton Heights, Darby, Lansdowne, Leiperville, Lima, Media, Trainer, and Upper Darby. Lancaster County, Willow Street. Lehigh County, Vera Cruz. Montgomery County, Conshohocken, Edge Hill, Glenside, Haverford, Ogontz, Spring Mill, Sumneytown, West Conshohocken, and Wynnewood. Philadelphia County, Holmesburg, Philadelphia, Chestnut Hill, Overbrook, and Olney.

Graphite. Berks County, has been mined at Boyertown and at Mertztown. Chester County, mined at Byers (Uwchland post office), Coventryville, and Chester Springs; has been mined at Anselma, Charlestown, and Kimberton. Lehigh County, deposits near Vera Cruz have been prospected; has also been mined and prospected at a number of other places.

Greenockite. Lehigh County, found at Friedensville.

Halite. See Salt.

Hematite (fossil iron ore, dyestone ore). In the Clinton formation, from Bloomsburg, Columbia County, and Danville, Montour County, traceable through Center, Fulton, Juniata, Mifflin, Northumberland, Perry, Snyder, Union, and Huntingdon counties of middle Pennsylvania, and thence through Bedford County to the State line on the south. Berks County, mined at Manatawny. Fossil ores were also mined in the north in Bradford, Lycoming, and Tioga counties.

Hematite (specular iron ore). Adams County, small quantities in South Mountain. Bucks County, occurs near Durham. Chester County, with magnetite at Warwick. Franklin County, small quantities in South Mountain, near Chambersburg. Lebanon County, mined with magnetite at Cornwall. York County, near Hanover, at Dillsburg and Wellsville, and in the Codorus region.

Iron. See Brown iron ore, Chromite, Hematite, Magnetite, Pyrite, and Siderite. **Jefferisite.** See Vermiculite.

Kaolin. *See* Clay.

Lead. *See* Cerusite, Galena, and Wulfenite.

Limestone. Extensively quarried over a large part of the State for building stone, cement making, crushed stone, and flux. *See also* Cement material.

Limonite. *See* Brown iron ore.

Magnesium. *See* Brucite and Dolomite.

Magnetite. Adams County, has been mined near Cashtown; occurs in small quantities elsewhere in metamorphosed Triassic sandstone. Berks County, formerly mined at Boyertown, Fritz Island, near Jacksonwald, near Joanna station, near Seisholtzville, and Rittenhouse Gap, near Reading and Wheatfield. Bucks County, mined extensively for more than a hundred years at Durham. Chester County, formerly mined at falls of French Creek, at the Hopewell mine, near Elverson, and at Warwick. Dauphin County, formerly mined at Hummelstown. Lebanon County, mined at Cornwall and formerly mined near Mount Pleasant. Lehigh County, near Vera Cruz. York County, mined at Dillsburg.

Malachite. Adams County, in copper mines near Maryland line. Berks County, Jones mine near Morgantown and Fritz Island mine near Reading. Bradford County, formerly mined with other copper ores at Carpenter mines near New Albany. Chester County, found in small quantity at the French Creek and Phoenixville mines. Lebanon County, Cornwall mines. Lehigh County, prospected at several places in the Triassic shales. Montgomery County, Perkiomen mine. Perry County, Millers-town. Found in at least a hundred places and is often prospected throughout the Triassic rocks.

Manganese ore. In Berks, Blair, Center, Huntingdon, and Northampton counties. Cumberland County at Mount Holly Springs. Dauphin County, at several places on Broad Mountain. Lehigh County, in small quantities in iron-ore deposits at Iron-ton; a little has been mined with iron ores. *See also* Psilomelane, Pyrolusite, and Wad.

Marble. Chester County, quarried at Avondale, Bakers Station, and Westgrove. Luzerne County, Lehigh Tannery. Montgomery County, Bridgeport, King of Prussia, and other localities. Northampton County, Easton. York County, Delta.

Melaconitë. Bradford County, formerly mined with other copper ores at Carpenter mine, near New Albany. Chester County, found in small quantity at Phoenixville lead mines. Montgomery County, Perkiomen mines.

Mica. Lehigh County, has been prospected in several places on South Mountain.

Millerite (capillary pyrites, nickel sulphide). Lancaster County, small amount in Gap nickel mine, with copper-bearing pyrrhotite, chalcopyrite, etc.

Millstones. Lancaster County, East Earl and Lincoln.

Mineral paint. Berks County, mined at Blandon, Fleetwood, Hancock, Reading, and Topton. Cambria County, at Johnstown. Carbon County, belt 7 miles southeast of Mauch Chunk extends in southwest direction 20 miles; mined at Hazard and Millport. Lawrence County, Pulaski. Lehigh County, mined at Breinigsville and Alburdis. Luzerne County, has been mined at Moosehead, 5 miles north of Whitehaven. Northampton County, has been mined at Camels Hump, $3\frac{1}{2}$ miles northeast of Bethlehem, and near Easton. *See also* Shale and Vermiculite.

Molybdenite. Bucks County, Paper Mills. Delaware County, Avondale, Chester, and Morton. Lehigh County, near Vera Cruz. Philadelphia

County, formerly found in considerable amount in Frankford (the axial ratio for the mineral given in Dana's Mineralogy was measured on crystals found here); also found in Germantown.

Molybdenum. See Molybdenite and Wulfenite.

Moonstone. Chester and Delaware counties, found in several localities.

Natural gas. Immense quantities, chiefly from Elk, Greene, McKean, Warren, and Washington counties, and to a less extent from Armstrong, Beaver, Butler, Fayette, Indiana, Lawrence, Venango, and Westmoreland counties. There were 13,023 productive wells in the State at close of 1914. Pennsylvania was for many years the leading State in gas production, but has now been surpassed by West Virginia.

Nickel. Lancaster County. For many years the only nickel produced in the United States came from the mines at Gap. See Millerite, Pentlandite, and Pyrrhotite.

Ocher. See Mineral paint.

Oil. See Petroleum.

Oil shale. See Shale.

Peat. Small deposits rather common in the northern and northeastern parts of the State, especially in the Pocono region. There is a plant producing dry peat powder for fertilizer filler at Espy.

Pentlandite. Lancaster County, in Gap mine, associated with pyrrhotite.

Petroleum. The oil regions in western Pennsylvania include pools scattered from the New York boundary to the West Virginia and Ohio boundaries. These pools have passed their prime, but all are still productive. Produced in immense quantities in Allegheny, Armstrong, Beaver, Butler, Clarion, Crawford, Elk, Fayette, Forest, Greene, Jefferson, Lawrence, McKean, Mercer, Potter, Tioga, Venango, Warren, and Washington counties. There were 58,330 producing wells at the close of 1914. The total production of the State in 1914 was 8,170,335 barrels, valued at \$15,573,822.

Psilomelane. Most abundant manganese mineral in the State. Occurs in many of the old iron-ore banks of the Lehigh-Northampton-Berks district.

Pyrite. Chester County, at French Creek, mined with magnetite. Lancaster County, has been mined at Gap mine, nickeliferous. Lebanon County, Cornwall, cupriferous and cobaltiferous. Lehigh County, near Emans and near Macungie. Luzerne County, from Wilkes-Barre region used as a gem. York County, with magnetite in James iron mine, Dillsburg. The only commercial output of pyrite reported during the last few years is the small quantity obtained in connection with the mining of bituminous coal in Mercer County.

Pyrolusite (black oxide of manganese). Montgomery County, Edge Hill, and near Spring Mill. Lehigh County, associated with limonite, especially in Saucon Township.

Pyrrhotite (magnetic pyrites). Berks County, in Alsace township, near Reading. Lancaster County, at Gap mine, nickeliferous; in small quantities at several other localities.

Quartz. Adams County, mined near Bendersville and at several places in South Mountain. Chester County, mined at Cornog station and on North Valley Hills, for pottery and abrasives. Franklin County, formerly mined near Fayetteville. Monroe County, quartz suitable for gems found at Stroudsburg.

Radium. See Carnotite.

Road metal. See Granite, Limestone, Sandstone, and Trap rock.

Rutile. Chester County (formerly supplied the entire United States demand, and still produces some, although now surpassed by the Virginia deposits), Coatesville, Parkesburg, Pomeroy, and elsewhere in Chester Valley; also near Doe Run, Glenhall, Willowdale, and many other places in the limestone valleys throughout the southern part of the county. Delaware County, Howard House, Dismal Run. Lancaster County, near Quarryville and elsewhere in southern part of county. Philadelphia County, Overbrook and Rolandville.

Salt (brine). Allegheny County, produced in Pittsburgh. Armstrong County, has been made at Bayard salt works, Long Run. Beaver County, New Brighton, Bellowsville, and Industry. Bradford County, oil district. Fayette County, on Youghiogheny River. Indiana County, at Saltsburg. Bromine and calcium chloride are also obtained from the natural brine.

Sand (building). Local deposits utilized in majority of the counties.

Sand (fire). Chester County, produced at Exton and Honeybrook by crushing quartzite.

Sand (glass). Dug in Clearfield County, at Falls Creek. Elk County, Daguschahonda. Fayette County, at Dunbar, and along Monongahela River near Belle Vernon. Huntingdon County, Mapleton. Mifflin County, Vineyard. Venango County, Kennerdell and Rockmere station near Oil City.

Sand (molding). Dug in Allegheny County, at Pittsburgh. Beaver County, Koppel. Berks County, Berne and Hamburg. Blair County, Hollidaysburg. Bucks County, Tullytown. Butler County, Cabot. Carbon County, Ashfield and Bowmanstown. Clearfield County, Falls Creek. Columbia County, Catawissa, Mifflinville, and Rupert. Dauphin County, Harrisburg. Elk County, Ridgway. Erie County, Erie and Fairview. Fayette County, Dunbar, West Masontown, Perryopolis, and Republic. Franklin County, Waynesboro. Huntingdon County, Mapleton Depot and Mill Creek. Lancaster County, Marietta, Beartown, and elsewhere. Lawrence County, Moravia and Newcastle. Lehigh County, Cementon. Lycoming County, Linden and Nisbet. Mercer County, Carlton. Mifflin County, Burnham and Lewistown. Montgomery County, Edge Hill and William Penn. Northampton County, South Bethlehem and Freemansburg. Northumberland County, Milton and Riverside. Philadelphia County, Philadelphia. Perry County, Newport. Somerset County, Rowena. Sullivan County, Lopez. Venango County, Utica and South Oil City. Westmoreland County, New Stanton. York County, near Weigels-town.

Sandstone. Quarried at many localities in most of the counties of the State.

Sandstone (bluestone). Allegheny County, Pittsburgh. Bradford County, Sugar Run, Towanda, and Wyalusing. Fayette County, Upper Middletown, Waltersburg. Luzerne County, Hunlock Creek. Lycoming County, Jersey Mills, Trout Run, and Waterville. McKean County, Port Allegheny. Mercer County, Greenville. Pike County, Lackawaxen, Pond Eddy, Millrift, Kimble, and elsewhere. Potter County, Burtville. Susquehanna County, Dimock, Hallstead, Lanesboro, and elsewhere. Venango County, Franklin. Westmoreland County, Hillside, Ligonier, and Penns station. Wyoming County, Blackwalnut and Laceyville. York County, Hanover.

Sandstone (brownstone). Quarried in Berks County, at Birdsboro and Mohrsville. Bucks County, Grenoble station, Lumberville, Neshaminy, Newton, and Yardley. Chester County, Phoenixville and Valley Forge. Dau-

phin County, Hummelstown. Lebanon County, Mount Gretna and Schaefferstown. Mercer County, near Jackson Center. Montgomery County, Morristown, Port Kennedy, and Fort Washington. Formerly quarried in Dauphin County at Middletown and in York County at Goldsboro (Etters).

Sandstone (flagstone). Bradford County, New Era. Monroe County. Pike County, near Delaware River and Lackawaxen Creek, numerous quarries in grits and sandstones in Shohola and Lackawaxen. Schuylkill County, Auburn. Sullivan County, Dushore. Wyoming County, Nicholson. In northwestern and western counties, flagstone quarried for local use in many places.

Sauconite. Lehigh County, zinc mines at Friedensville.

Scheelite. Philadelphia County, several pounds found at Hoffman's quarry, Frankford. Franklin, Adams, and other counties in southern Pennsylvania, in South Mountain, with piedmontite and aporhyolite.

Schist (quartz schist, micaceous, sericitic). Montgomery County, at Edge Hill and Glenside, abundant, quarried for the manufacture of cupola blocks, furnace bricks, silica bricks, fire mortar, etc.

Serpentine. Berks County, precious serpentine on Fritz Island, near Reading. Chester County, serpentine occurs in West Nottingham and Westtown townships, and in Lancaster County, precious serpentine (probably williamsite) at Low's mine, Fulton Township. Delaware County, near Media, in Radnor Township and many other places. Northampton County, verdolite, an ornamental stone essentially serpentine, is quarried at Easton. Serpentine occurs but is not worked in Lancaster, Lebanon, Montgomery, and York counties.

Shale (paint). Principal colors, as follows:

Black shale.—Berks County, mined for pigment at Fritz station. Clinton County, Rauchtown. Lycoming County, Muncy. Northampton County, Nazareth, formerly mined. Schuylkill County, Pottsville.

Yellow shale.—Berks County, occurs at Shoemakersville. Carbon County, formerly mined at Lehigh Gap and Slatington. Luzerne County, mined for pigment at Moosehead station.

Red shale.—Berks County, mined for pigment at Albany, formerly mined at Lenhartsville. Lawrence County, mined at Pulaski. Luzerne County, at Hudsonale. Tioga County, at East Charlestown. Westmoreland County, mined for pigment at Greenwald. Wyoming County, formerly mined at Factoryville, for cement. (*See also* Cement material.)

Shale (oil). Devonian, underlies the northwestern half of the State but is generally too far below the surface to be of value.

Siderite (black band ore). Black band ores also occur throughout the northern coal field but are not persistent, though occurring at the same horizon; not now mined.

Siderite (iron carbonate). Occurs in association with the limonite ores in different parts of the State. An important ore formerly mined in eastern Pennsylvania with limonite. Now mined only in Carbon County, at Lehigh Gap, for paint. Formerly mined in Bedford, Clearfield, Cambria, Fayette, Fulton, Huntingdon, Mifflin, and Somerset counties; in the Lackawanna Valley and at Scranton; in Lycoming County, at Ralston.

Sienna. Berks County, 1 mile east of Reading.

Slate. Adams County, formerly quarried near Pine Grove Furnace. Quarried in the following localities: Lehigh County, Slatington. Northampton County, Bangor, Bath, Berlinsville, Chapman, Danielsville, Heimback, Nazareth, and Pen Argyl. York County, Delta and Peach Bottom.

Smithsonite (zinc carbonate). Blair County, Sinking Valley. Lancaster County, Lancaster zinc mines. Lehigh County, Friedensville zinc mines, with calamine and blende. Not worked alone as an ore.

Sphalerite (zinc blende). Blair County, Sinking Valley, with galena and smithsonite. Bucks County, New Britain, with galena. Chester County, Phoenixville mines, with lead ores and in considerable quantity. Columbia County, Espy, in limestone. Lancaster County, Lancaster zinc mines and Pequea mine, with galena. Lehigh County, Friedensville zinc mines, Saucon Valley, with blende and smithsonite in limestone. Montgomery County, Perkiomen and Ecton mines near Audubon. Philadelphia County, Falls of Schuylkill. No longer worked.

Talc. Chester County, was formerly obtained in West Goshen township, near Unionville. Montgomery County, formerly quarried at Gladwyne and Lafayette. Northampton County, quarried at Easton.

Titanium. *See* Rutile.

Trap rock. Triassic diabase or trap occurs in a number of the eastern counties. It occurs near and may be quarried in Adams County, near Gettysburg. Montgomery County, Greenlane, Perkiomenville, and Pottstown. York County, Yorkhaven. The term trap rock is used as a trade name incorrectly in Pennsylvania for indurated shale and sandstone, which are quarried at the following places: Berks County, Birdsboro. Bucks County, Bridge Valley, Cressman, Point Pleasant, Rock Hill, and Rushland. Chester County, Downingtown, Kennett Square, and West Chester. Dauphin County, Rockville. Delaware County, Glen Mills, Lenni Mills, Locksley, Radnor, and Wayne. Luzerne County, Wapwallopen. Montgomery County, Bethayres, Sumneytown, Northumberland County, Dalmatia. Perry County, Marysville. York County, Hanover.

Tungsten minerals. *See* Scheelite.

Umbur. Berks County, Bethel. Bucks County, Buckingham Mountain. Northampton County, Quaker Hill.

Vanadium. *See* Carnotite.

Vermiculite (jefferisite). Chester County, Westtown Township, Brinton's quarry.

Vesuvianite. Bucks County, near Hope.

Wad (bog manganese). Berks, Lehigh, Northampton, and other counties with limonite.

Wavellite. Chester County, formerly mined at Whitehouse. Cumberland County, formerly mined in vicinity of Moores Mill, 4 miles west of Mount Holly Springs, and used in the manufacture of phosphorus. In small quantities in white clay pits in South Mountain, associated with limonite ores in some residual iron-ore deposits, in Lehigh and Northampton counties. Northampton County, at Hellertown, good crystals in considerable quantity.

Whetstone. Lehigh County, made from Cambrian sandstones from South Mountain near Allentown.

Williamsite. Lancaster County, at Lom's mine near New Texas. Some was also found at Wood's mine in same vicinity.

Wulfenite (molybdate of lead). Chester County, Wheatley lead mines, Phoenixville. Lancaster County, Pequea mines. Montgomery County, Perkiomen and Ecton mines, near Audubon.

Yttrium. *See* Allanite.

Zinc. *See* Calamine, Goslarite, Sauconite, Smithsonite, and Sphalerite.

RHODE ISLAND.

Agate. Providence County, occurs with chalcedony and quartz in southern portion of Diamond Hill, town of Cumberland.

Anthracite. *See* Coal.

Brown iron ore (limonite, brown hematite). Providence County, was mined at Cranston during Revolutionary times.

Brown iron ore (bog iron ore). Providence County, occurs 3 miles west of Foster Center, near State line.

Cement material (Portland). Limestone quarried in Providence County carries too much magnesia, and other areas of limestone are too small to be workable.

Chalcopyrite. Providence County, was prospected extensively, probably over a hundred years ago, near Sneece Pond, town of Cumberland.

Clay (brick). Bristol County, dug at Barrington and Nyatt. Providence County, old clay pits at Pawtuxet, town of Cranston, and west of Diamond Hill, town of Cumberland.

Clay (pottery). Newport County, reported on Block Island and at Newport Neck.

Coal (anthracite). Newport County, has been mined intermittently for a century at Portsmouth; three beds 1 to 3 feet thick, high percentage of ash, made impure by pyrite and quartz veinlets; hard to ignite, holds fire poorly; adapted for smelting but not successful steaming or domestic fuel. Has been mined also at Bristol, at Portsmouth station on western side of northern part of Aquidneck Island, Cranston, and Pawtucket. Attempts have been made to briquet coal produced at Portsmouth in recent years. Was once mined at Cranston for graphite, where most of this coal is graphitic.

Copper. *See* Chalcopyrite.

Dolomite. Providence County, was quarried from several small occurrences and burnt for lime in towns of Lincoln, Johnston, North Providence, and Providence.

Flagstone. Sandstone suitable for flagging has been quarried at Pawtucket.

Galena. Washington County, was once mined at Tower Hill, in Kingston, for molding dust for iron foundries; 30 tons taken.

Granite. Newport County, has been quarried at Newport. Providence County, has been quarried at Ashton, near Providence, and Pascoag. Washington County, large quarries at Niantic and Westerly, for building and ornamental stone and paving blocks.

Graphite. Newport County, 200 tons mined about 4 miles south of Tiverton as basis for paint. Providence County, largest mine at Fenner Ledge, Cranston, near Providence, has produced several thousand tons; has been mined at Bridgeton, Pawtucket, and Valley Falls; several hundred feet of underground workings at latter place now full of water. Washington County, has been mined at Saunderstown.

Hematite. Providence County, occurs at Diamond Hill and Cranston.

Iron. *See* Brown iron ore, Hematite, and Magnetite.

Lead. *See* Galena.

Limestone. Providence County, is quarried and burned for lime at Limerock, town of Lincoln, and formerly near Centerdale.

Limonite. *See* Brown iron ore.

Magnetite. Providence County, occurs with copper ore in veins in ancient mine at Sneece Pond and in Iron Mine Hill, $2\frac{1}{2}$ miles east of Woonsocket, as a prominent constituent of the gabbroid rock; beach sands on south shores; magnetite ore of Iron Mine Hill is very high in titanium.

Manganese ore. Providence County, resembles knebelite; occurs in bed 40 feet thick, near Sneece Pond, town of Cumberland. *See also* Rhodonite and Wad.

Molybdenite. Providence County; occurs in manganese ore near Sneece Pond, town of Cumberland.

Peat. In fresh and salt swamps in many parts of State, including Block Island, where it was much used for fuel.

Quartz. Providence County, constitutes southern portion of Diamond Hill, town of Cumberland; mainly milky quartz, but commonly banded; used for road material, for concreting, and for chicken grit.

Rhodonite. Providence County; occurs at Pawtucket and Sneece Pond.

Road metal. Glacial bowlders of quartzite conglomerate, quartzite, green schist, and diorite are most commonly hauled to crusher or quarried direct from conglomerate occurrences. Scattered trap dikes from 1 foot to 10 feet wide along east slope of hills west of Smithfield station (not used), Snake Den, Woonsocket, north of Moosup Valley, Iron Mine Hill, Ironstone Reservoir. *See also* Quartz.

Sand and gravel. Large quantities utilized in concrete work in cities. Abundant throughout State.

Sandstone. For building (dimension stone), several quarries near Providence.

Serpentine. Newport County, occurs at Newport. Providence County, occurs at Smithfield, Johnston, and North Providence.

Talc. Providence County, quarried and ground at Manville.

Wad (bog manganese). Providence County, occurs at Sneece Pond, town of Cumberland.

Whetstones. Providence County, have been made in large quantities from mica slate at Smithfield and Woonsocket and from quartz-mica schist in Smithfield.

SOUTH CAROLINA.

Amethyst. Has been found in Abbeville County near Lowndesville; Anderson County near Moffettsville.

Aquamarine. Anderson County. *See also* Beryl.

Asbestos. Narrow veins occur in Anderson County, 8 miles southwest of Anderson. Cherokee, Newberry, and Pickens counties. Oconee County, near Seneca. Spartanburg County, near Spartanburg. Not worked.

Barite. Cherokee County, mined at Kings Creek.

Beryl. Anderson County, a few crystals sufficiently clear to be cut for gems have been found at McConnel Place, 3 miles north of Anderson. Occurs at numerous points along the Anderson-Spartanburg zone. Cut for gems.

Cassiterite (tin ore). Cherokee County, occurs in pegmatite veins near Gaffney and in residual placers which have been worked. Many attempts have been made to mine the deposits of Cherokee County and neighboring counties in North Carolina.

Cement material (Portland). Many beds of marble in the western part of the State seem to be suitable for cement; but fuel, local market, and cheap transportation are lacking. Soft limestones (so-called "marls"), abundant in Coastal Plain, might make satisfactory cement material.

Cerium. *See* Monazite and Polycrase.

Chalcopyrite (copper pyrites). Was formerly mined in Abbeville County near Calhoun Falls; Saluda County, in Culbreath mine, 6 miles northeast of Saluda courthouse; York County, Big Wilson mine, near Yorkville, and Mary mine, 4 miles northeast of Yorkville.

Clay (brick). Widely distributed. Dug in Abbeville County, at Abbeville. Aiken County, Hamburg and North Augusta. Anderson County, on Oconee side of Eighteen Mile Creek, near Pendleton. Beaufort County, Haresville. Cherokee County, Gaffney. Chester County, Leeds. Chesterfield County, Cheraw and Chesterfield. Darlington County, Society Hill. Dorchester County, Badham and Summerville. Florence County, Florence. Greenville County, Greenville, Woods Crossing, and Greer. Greenwood County, Greenwood and Wareville. Horry County, Conway. Kershaw County, Camden. Lancaster County, Van Wyck. Laurens County, Laurens. Lee County, Bishopville. Lexington County, Casey. Marion County, Dillon and Mullins. Newberry County, near Newberry. Oconee County, Richland and near Westminster. Orangeburg County, Orangeburg. Pickens County, Pickens. Richland County, 1 mile west and 4 miles north of Columbia. Saluda County, Saluda. Spartanburg County, Cedar Spring and Spartanburg. Sumter County, Sumter. Williamsburg County, Greelyville and Kingstree. York County, Grallay station, Rock Hill, and Yorkville.

Clay (fire). Richland County, at Killian and near Columbia.

Clay (paper). Aiken County, dug at Bath, Langley, and Warrensville; Lexington County, Steedman; Richland County, Horrell Hill (Columbia).

Clay (pottery). Aiken County, dug at Langley and Wagener; Lexington County, Steedman; Richland County, Horrell Hill (Columbia).

Coal. *See* Lignite.

Cobalt. Aiken County, cobalt-bearing manganese exposed in placer bed at base of alluvial deposit at Silber Bluff, Savannah River.

Copper. *See* Chalcopyrite, Covellite, and Enargite.

Corundum. Occurs more or less abundantly in Archean gneisses and later rocks in Anderson, Cherokee, Laurens, Oconee, Spartanburg, and York counties. Cherokee County, prospected 2 miles north of Gaston Shoals. York County, found in belt 200–300 feet wide in northeastern part of county, between Allison and Crowder creeks, mined 1 mile north of summit of Nannies Mountain. Valuable “oriental emerald” reported in Cherokee County, Bowen River region, in Archean gneiss.

Corundum (sapphire). Cherokee County, some gem sapphires have been found in the Bowen River region.

Covellite. Chesterfield County, occurs in Brewer gold mine as a secondary mineral.

Diatomaceous earth. Williamsburg County, dug at Salters Depot.

Enargite. Chesterfield County, small crystals occur in Brewer mine.

Feldspar. Abbeville County, large masses occur in pegmatites near Iva. Anderson County, near Easley. Greenville County, in mica mine $8\frac{1}{2}$ miles southeast of Greenville. Oconee County, near Central and Walhalla. Pickens County, high-grade feldspar near Pickens.

Fuller's earth. The lower Eocene deposits consist largely of this material which is exposed along their marginal line extending across portions of Aiken, Calhoun, Clarendon, Lexington, Sumter, and Williamsburg counties. Mined near Salters, Williamsburg County.

Galena (argentiferous). Was formerly mined in Cherokee County, at Cameron mine, and in Oconee County, 15 miles north of Walhalla.

Gold (lode). Small production maintained or intermittent from numerous quartz mines in Abbeville, Anderson, Cherokee, Chesterfield, Edgefield, Greenville, Kershaw, Lancaster, Laurens, Newberry, Oconee, Saluda, Union, and York counties.

Gold (placer). Considerable gold has been obtained from placers in Cherokee, Chesterfield, Greenville, Pickens, York, and other counties, but production now is small.

Granite. Quarried: Chesterfield County, 9 miles west of Ruby, Pageland. Edgefield County, Edgefield. Fairfield County, Alston, Blairs, Rion, Rockton, and Strother. Greenville County, near Greenville and Travelers Rest. Greenwood County, Greenwood, Quarry, Ware Shoals. Lancaster County, near Heath Springs. Laurens County, Clinton, Cold Point, near High Point, and at Gray Court. Lexington County, Cayce, Lexington, and near Batesburg. Newberry County, near Newberry. Pickens County, Beverly station and Easley. Richland County, Columbia. Spartanburg County, Pacolet. Was formerly quarried at localities in Anderson, Kershaw, Oconee, Union, and York counties.

Graphite (plumbago). Local occurrences of graphite in slates of Anderson, Cherokee, Oconee, and other counties. Anderson County, Rocky River valley to Savannah River near old Crafts Ferry.

Hematite (specular iron ore). Occurs in highly metamorphosed Archean and later rocks. Cherokee County, in zone crossing Broad River at mouth of Doolittle Creek and thence along west side of Peoples Creek. Deposits have been worked to small extent but are not of immediate importance.

Ilmenite. Abbeville County, occurs near Calhoun Falls and in gold quartz veins.

Iron. See Hematite, Ilmenite, Magnetite, Pyrrhotite, and Siderite.

Lead. See Galena and Pyromorphite.

Lignite (brown coal). Chesterfield County, Whortleberry Branch, north of Cheraw, and near Mount Croghan. Edgefield County, Savannah River. Pickens County.

- Limestone** (building and lime). Occurs at many points in State, especially in western part. Cherokee County, quarried regularly at Limestone Springs near Gaffney, chiefly for lime, but in part for building stone; has been quarried intermittently near Blacksburg and Grover. Greenwood County, has been quarried near Ware Shoals. Oconee County, 10 miles northwest of Fort Madison, and 4 to 9 miles northwest of Walhalla.
- Magnetite** (magnetic iron ore). Cherokee County, occurs associated with hematite in metamorphosed Archean and later rocks along Broad River above Cherokee Ford. Of possible economic importance. Found also in gold quartz veins.
- Manganese ore** (mined). Deposits of economic importance occur in Abbeville County, near McCormick. Greenwood County, 2 miles west of Breezewood, and 5 miles south of Greenwood. The McCormick deposit is composed of nodular concretions of psilomelane and pyrolusite. *See also* Psilomelane, Pyrolusite, and Wad.
- Marble**. Laurens County, quarried for local use 4 miles east of Ware Shoals. Union County, small quantity quarried 12 miles southwest of Union. Occurs also in Cherokee County and in Westminster, Oconee County.
- Marl**. Dug for local use in Aiken, Bamberg, Barnwell, Berkeley, Charleston, Clarendon, Colleton, Darlington, Dorchester, Florence, Georgetown, Hampton, Horry, Marlboro, Orangeburg, Sumter, and Williamsburg counties. Extensively quarried at Ingleside, Dorchester County, and calcined for the agricultural trade.
- Mica** (muscovite). Anderson County, occurs near Anderson, Barnes, Denver, and Iva; was formerly mined near Anderson. Greenville County, mined at Reedy River; also $8\frac{1}{2}$ miles southeast of Greenville. Oconee County, occurs near Seneca.
- Molybdenite**. Lancaster County, occurs in Haile mine.
- Monazite**. Deposits of commercial value in Anderson, Cherokee, Greenville. Laurens, Oconee, Pickens, and Spartanburg counties. Mined near Gaffney, Cherokee County, and south of Greenville, Greenville County.
- Nickel**. Saluda County, occurs associated with chalcopyrite and gold at Culbreath mine.
- Peat**. Horry County, exposed at Myrtle Beach. Laurens County, exposed on Sharpe property, 3 miles northeast of Ware Shoals. Extensive beds along estuarine region of Combahee and Edisto rivers and elsewhere. Not used.
- Phosphate rock**. Mined with dredges in Coosaw River tributaries; also mined extensively in the Ashley and Edisto river basins. Occurs in Wando and Copper river basins and at Johns Island, Charleston County.
- Platinum**. Cherokee and Laurens counties, occurs in Cambrian grit.
- Polycrase**. Greenville County, found 4 miles from Marietta.
- Psilomelane** (manganese ore). Abbeville County, in mica schists near McCormick. Greenwood County, 2 miles west of Breezewood and 5 miles south of Greenwood. Spartanburg County, 8 miles south of Glenn Springs.
- Pyrite** (iron pyrites). Mined for gold in Chesterfield County, Brewer mine. Lancaster County, at Haile and Blackburn mines. Spartanburg County, Thompson mine. Union County, West mine. York County, Big Wilson, Ferguson, Magnolia, and other mines.
- Pyrolusite** (oxide of manganese). Abbeville County, in mica schists near McCormick. Cherokee County, Smith Mountain. Edgefield County, Hard Labor Creek. Greenwood County, near Breezewood and 5 miles south of Greenwood.

Pyromorphite (phosphate of lead). Cherokee County, was found in Cameron mine, 3 miles southwest of Gaffney.

Pyrrhotite. York County, was mined on Nannies Mountain, 11 miles northeast of Yorkville, and is found at several gold mines.

Radium. *See* Polycrase.

Road metal. *See* Granite, Limestone, and Sand.

Rutile. Occurs chiefly in Archean gneisses. Newberry County, crystal masses from vicinity of Prosperity.

Sand (building). Dug in Barnwell County at Blackville. Richland County, Columbia. The main source of supply to Charleston is found in bed of Edisto River above Dawkes Creek. Common in fresh-water streams.

Sand (glass). Dug in Barnwell County at Blackville and Ulmers. Clarendon County, at Pee Dee area.

Sand (molding). Dug in Charleston County at Charleston, and in Richland County at Columbia.

Siderite (spathic iron ore). Cherokee County, found at Cameron mine, 3 miles southwest of Gaffney.

Silver. Lancaster County, very small annual production, mostly from siliceous gold ores of Blackmon and Haile mines.

Soapstone. Formerly quarried to limited extent in Cherokee County, near Gaffney; Chester County, near Halsellville and Chester; Laurens County, near Laurens; Oconee County, Fair View Church, 6 miles northeast of Seneca, and Soapstone Hill, 4 miles northwest of Tomassee; Pickens County, near Central; Spartanburg County, Cedar Springs; York County, at Nation Ford.

Thorium. *See* Monazite.

Tin. *See* Cassiterite.

Titanium. *See* Ilmenite and Rutile.

Wad (bog manganese). Chester County, occurs in northeastern part of county.

York County, 4 miles southeast of Catawba Junction; extensive exposure.

Yttrium. *See* Polycrase.

SOUTH DAKOTA.

- Amblygonite.** Custer County, Bond mine, $4\frac{1}{2}$ miles south of Custer, mined. Pennington County, Bob Ingersoll mine, 4 miles northwest of Keystone, mined; Hugo mine, half a mile south of Keystone, is the most important producer; has been mined for lithium on the Peerless and other claims, 1 mile south of Keystone, and the Tin Queen claim, $1\frac{1}{2}$ miles east of Oreville; occurs also on the Christiansen claim, near Keystone. Hand County, near Hayward. Occurs in large masses in pegmatite.
- Amphibolite.** Pennington County, quarried 3 miles west of Rapid City, used for ornamental work.
- Anglesite.** As a rule an important constituent in the lead carbonate ores of the Black Hills. Custer County, at Spokane. Lawrence County, at Carbonate and Galena.
- Apatite.** Custer, Lawrence, Pennington, and other counties as large nodules in nearly all pegmatites. There is good possibility for recovery as a by-product.
- Aragonite.** Fall River County, in Wind Cave, at Hot Springs.
- Arsenopyrite.** Custer County, of common occurrence, as at Custer and Spokane, nearly always auriferous. Lawrence County, mined for gold at Lead, Central City, and Terraville. Pennington County, at Hill City, Keystone, Mystic, and Rochford. Large quantities go to waste in tailings from Homestead and other mines.
- Autunite.** Occurs in pegmatites of Black Hills, near Keystone, as at Custer and Spokane.
- Azurite.** Occurs in copper mines and prospects in Black Hills.
- Barite.** Is of common occurrence as a gangue mineral in most of the mines of the Black Hills.
- Bentonite.** Fall River County, half a mile west of Ardmore, being developed.
- Beryl.** Large crystals and masses occur in Custer County, in pegmatites with tin and mica. Pennington County, in pegmatites near Keystone.
- Bismuth.** *See* Tetradymite.
- Bornite.** Occurs in copper mines and prospects in Black Hills.
- Brown iron ore.** *See* Limonite.
- Calcite.** Custer County, near Custer. Fall River County, at Hot Springs, in Wind Cave. Lawrence County, in Homestake mine. Meade County, in Crystal Cave near Piedmont, in the Badlands. Washington County, in Indian reservation at Devils Hill.
- Cassiterite (tin ore).** Custer County, found in pegmatites near Custer. Lawrence County, has been mined in pegmatite at Tinton, and stream tin was mined and shipped from Bear Gulch and other streams near Nigger Hill. Pennington County, has been mined in pegmatites and quartz veins at Hill City and Keystone.
- Cement material.** Niobrara chalk in eastern and southeastern part of State, furnishes excellent Portland cement material; used at Yankton, Yankton County.
- Cerargyrite (horn silver).** Custer County, at Spokane. Lawrence County, in Cambrian quartzites and shales, mined at Carbonate, Galena, and in Trojan and other mines near Portland (Trojan post office). Pennington County, at Silver City.
- Cerussite (carbonate of lead).** Lawrence County, in Paleozoic rocks at Carbonate; abundant at Galena; has been mined. Custer County, at Spokane.

- Chalcocite** (copper glance). Custer, Lawrence, and Pennington counties, occurs in copper mines and prospects in Black Hills.
- Chalcopyrite**. Lawrence County, occurs in Lead, Terraville, and Central City gold mines, prospects near Nemo and Deadwood. Pennington County, auriferous on Box Elder Creek, prospects near Sheridan and Rochford.
- Chalk**. In nearly all parts of the State in Cretaceous limestone formations.
- Chert**. Lawrence County, about Deadwood, in red and gray layers in Carboniferous limestones and resultant gravels; takes high polish and is used for ornaments.
- Cinnabar**. Pennington County, reported on Victoria Creek, a few miles above Rapid City; also was prospected near Pactola and Rochford.
- Clay** (brick). Loess abundant in extreme southeastern part of State; excellent brick material. Brick clay dug in Brown County, near Aberdeen, Clay County, Vermilion. Grant County, Bigstone. Hughes County, Pierre. Kingsbury County, De Smet. Lawrence County, Deadwood, Spearfish, Englewood, and Lead. Meade County, Sturgis. Minnehaha and Moody counties. Pennington County, Hill City. Union County, near Rapid City.
- Clay** (fire). Pennington County, dug near Rapid City.
- Clay** (kaolin). Custer County, occurs near Custer, in close proximity to marble.
- Coal** (bituminous). Fall River County, thin beds exposed in Coal and Bennett canyons, north of Edgemont. Not workable.
- Coal** (lignite). Lignite beds having a maximum thickness of 10 feet underlie portions of the northern half of Harding and Perkins counties, north and east of the Black Hills. Harding County, mined especially near Buffalo and Karinen in Cave Hills. Perkins County, in Slim Buttes, and at Strool, Bison, and Lodgepole.
- Columbite**. Custer County, has been mined near Laughing Water Creek, north of Custer. Lawrence County, Tinton area, and abundant in gold placers in Nigger Hill district, in the Yolo and Centennial claims. Pennington County, in pegmatites near Hill City, Oreville, and in the Etta, Bob Ingersoll, Hugo, Advance, Peerless, Sarah, and First Find mines, all near Keystone, and in gold placers in Black Hills.
- Copper**. *See* Azurite, Bornite, Chalcocite, Chalcopyrite, Cuprite, Enargite, Malachite, and Tenorite.
- Cuprite** (red oxide of copper). Custer, Lawrence, and Pennington counties, occurs in copper mines and prospects in Black Hills, as at the Queen mine west of Fairburn.
- Diatomaceous earth**. Custer County, extends from high slopes of hills west of Fairburn and Hermosa, east into badlands; has been mined at Argyle and Fairburn.
- Enargite**. Occurs in copper mines and prospects in Black Hills.
- Feldspar** (orthoclase). Pennington County, in Harney Peak district; occurs massive in pegmatites.
- Ferberite**. Custer County, Hermosa. Pennington County, Hill City. *See also* Wolframite.
- Fluorspar**. Lawrence County, occurs in mines near Portland (Trojan post office), Maitland district, and in considerable quantity in Ulster mine.
- Fuller's earth**. Custer County, deposits have been worked near Fairburn. Common in the badland beds of Mellette, Pennington, Stanley, Washa-baugh, and Washington counties.
- Gabbro** (black granite). Minnehaha County, quarried near Sioux Falls, takes high polish, and many excellent tombstones and pillars are made.

Galena. Custer County, occurs at Spokane, gold and silver bearing. Lawrence County, small quantity mined in Galena, Perry, Portland, Carbonate, and Iron Hill districts. Pennington County, in limestone on Box Elder Creek, gold bearing; also in quartz veins near Hayward and Silver City.

Garnet. Custer County, near Elephant Gulch, west of Custer. Fine, clear crystals of almandite garnet, suitable for gems, are occasionally found.

Gas. See Natural gas.

Glauconite. Common as cementing material in limestone, conglomerates, and the shale beds of the Deadwood formation.

Gold (lode). Custer County, free in quartz in Algonkian rocks in Chilkoot mining district near Custer. Lawrence County, mined at Lead, Central City, and Terraville, formerly mined in limestone near Ragged Top Mountain. Homestake mines at Lead produced three-fourths of the gold output of the State. Pennington County, mined in Holy Terror, Keystone, and other mines.

Gold (placer). Custer County, former workings in bed of French Creek, Custer. Lawrence County, Deadwood, Whitewood, Gold Run, and elsewhere in Deadwood district and in Nigger Hill district. Pennington County, Rockerville, Hill City, and Keystone. Dredge formerly in operation on Castle Creek, three-fourths mile west of Mystic, closed down in 1914.

Granite. Custer and Pennington counties, immense quantities exposed in Black Hills. Grant County, quarried extensively in Bigstone City and Milbank, near lower end of Big Stone Lake.

Graphite. Custer, Lawrence, and Pennington counties, occurs with cassiterite and tourmaline in Black Hills. Custer County, small quantity ground and shipped from Custer. Pennington County, amorphous graphite on Castle Creek and near Hill City, prospecting near Rochford.

Grindstone. Fall River County, excellent grindstones and burrstones quarried from Dakota sandstone near Edgemont.

Gypsum. Especially common on the outer border of the Black Hills proper. Plaster mills in Fall River County, at Hot Springs. Lawrence County, Spearfish. Pennington County, Rapid City. Extensive deposits in Butte, Custer, Fall River, Lawrence, Meade, and Pennington counties.

Hematite (red iron ore). Custer County, occurs at Iron Mountain. Pennington County, northwest of Hayward mine, 4 miles south of Keystone, contains gold and silver; abundant on Box Elder Creek, and in slates and quartzites near Rapid City and at and near Hot Mound, 10 miles northwest; occurs at Iron Mountain; oolitic hematite occurs in the Deadwood formation, at the top of the Cambrian.

Hübnerite. See Wolframite.

Iron. See Arsenopyrite, Hematite, Limonite, Ocher, Pyrite, and Pyrrhotite.

Jamesonite. Pennington County, occurs in lead-silver ores near Silver City and Rochford.

Jasper. Minnehaha County, a thick deposit susceptible of high polish; worked to a large extent, especially at Sioux Falls and Dell Rapids; shipped to Omaha, St. Paul, Chicago, and other cities for buildings, pavements, and ornaments. Outcrops locally also in Hanson, McCook, and Turner counties.

Kaolin. Lawrence County, in Ruby district, between layers of the Deadwood formation. Pennington County, in Harney Peak district, derived from pegmatites.

Lead. See Anglesite, Cerusite, Galena, Jamesonite, and Pyromorphite.

Lepidolite (lithium mica). Custer County, near Custer on the Beecher or Bond, the Christiansen, and other claims. Pennington County, occurs in many pegmatite dikes near Keystone, especially fine deep lilac in the Bob Ingersoll mine, 4 miles northwest of Keystone, weak lavender, green, grayish white and pinkish; common, especially on the Etta, Peerless, Hugo, and other mines south of Keystone; and Wood Tin lode, 4 miles east of Keystone.

Lignite. *See* Coal.

Limestone (building, crushed stone). Quarried in Custer County, near Argyle, for railroad ballast, and Loring. Lake County, Chester. Lawrence County, at Spearfish. Meade County, Sturgis.

Limestone (chalkstone). Bonhomme County, has been used locally for building in Scotland and Springfield. Davison County, Mitchell. Minnehaha County, Brandon.

Limestone (lime, flux). Excellent lime made from purple limestone in Black Hills region; quarried at Deadwood, Lawrence County, and near Rapid City, Pennington County.

Limonite (brown hematite). Occurs with gold quartz veins in Black Hills, with other iron ores in Iron Mountain on Pennington-Custer county line, carries gold and silver; near Rochford, secondary deposits in swamps and ponds along the creeks, and called "bog ore" and "yellow ocher" ore; mined for mineral paint; similar deposits occur near Nahant.

Lithiophilite (mined as a source of lithia). Pennington County, at the Lost Bonanza, Hugo, and Peerless mines near Keystone, and at the Dyke lode near Bismuth. Occurs as large nodules in pegmatites.

Lithium minerals. *See* Amblygonite, Lepidolite, Lithiophilite, and Spodumene.

Lithographic stone. Custer County, fine-grained limestone occurs 10 miles west of Custer; also in vicinity of Loring; not used.

Malachite (green carbonate of copper). Custer, Lawrence, and Pennington counties; occurs in copper prospects of Black Hills, for example, near Pactola, Sheridan in the Blue Lead claim, Fairburn, in the Queen mine, Pringle, Custer Peak, Bald Mountain, and the Bear Lodge Mountains.

Manganese. *See* Pyrolusite.

Marble. Custer County, extensive deposit occurs in Algonkian schist, 4 miles northeast of Custer, was formerly quarried; also 8 miles northwest of Custer in Algonkian schists, beautiful dolomitic and saccharoidal marble; also serpentinous marble, mottled, yellow, and green; suitable for ornamental work but not used at present. In Lawrence and Fall River counties. Pennington County, in schist at Box Elder, in vicinity of Black Buttes.

Mica (muscovite). Custer County, has been mined and prospected at numerous places near Custer; some of the mines have been very large producers. Pennington County, formerly mined near Keystone; scrap mica continuously produced at Keystone, especially from Hugo mine south of Keystone and Everley mica mine east of Keystone.

Mineral paint. *See* Limonite and Ocher.

Natural gas. Considerable quantities are found in boring artesian wells. At the close of 1914, 29 artesian wells in the State were yielding varying quantities of natural gas, the total production, however, being small. Hand County, at Miller. Hughes County, at Pierre; used locally. Small quantity in Lyman County. Potter County, near Gettysburg. Spink County, at Ashton. Stanley and Sully counties. Turner County, at Dolton. Walworth County, at Selby.

Ocher (mineral paint). Occurs with iron ores on Iron Mountain on Pennington-Custer county line 4 miles south of Keystone.

Oil. *See* Petroleum.

Onyx marble (Mexican onyx). Lawrence, Pennington, and Custer counties, as stalactites and stalagmites, many of them large and beautifully banded, in Crystal Cave and many other caves in the Black Hills.

Peat. Tripp County, reported at head of Cottonwood Creek.

Petroleum. Small amounts in sandstones of Minnelusa and Graneros formations on the western border of the Black Hills. Some wells last two years, but others are shorter lived.

Pumice. Occurs at Argyle, Custer County, and in Washington County.

Pyrite. Lawrence County, principal gold-bearing mineral of Black Hills. Mined at Lead, Central City, and Terraville; also used as flux in smelting siliceous ores. Large deposits carrying very small quantities of gold, silver, and copper occur on Whitewood Creek near Deadwood and Mystic.

Pyrolusite. Custer County, disseminated in sandstone at Argyle, has been mined and shipped. Pennington County, occurs also in Algonkian rocks.

Pyromorphite. Lawrence County, at Carbonate and Galena. Custer County, Spokane and many other lead deposits of the Black Hills.

Pyrrhotite (magnetic iron pyrites). Custer County, near Custer. Lawrence County, in gold quartz veins at Lead, Central City, and Terraville; contains gold; mined with pyrite for use as flux. Pennington County, near Keystone, Mystic, Pactola, Rochford, Sheridan, Silver City.

Quartz (rose). Custer County, mined at Red Rose mine, 6½ miles southeast of Custer. Pennington County, many veins on Harney Peak, and in the vicinity. These localities afford some of the most beautiful rose quartz known, and with other localities in the Black Hills are the chief source of rose quartz produced in the United States.

Quartzite. Minnehaha County, quarried at Sioux Falls and Dell Rapids.

Radium. *See* Autunite, Torbernite, and Uranocircite.

Road metal. *See* Granite, Limestone, Marble, Sand and gravel, and Sandstone.

Rose quartz. *See* Quartz (rose).

Sand and gravel. Abundant along streams near Black Hills and in eastern part of State. Dug extensively in Beadle County at Wessington; Brown County, near Aberdeen; Codington County, Watertown; Hanson County, near Mitchell; Lincoln County, near Hudson; Minnehaha County, Sioux Falls.

Sand (filter). Codington County, Watertown.

Sand (glass). Meade County, Unkpapa sandstone on Elm Creek. Suitable for making glass but not utilized.

Sandstone. Quarried for local use in Butte County near Bellefourche; Davison County, on Firesteel and Enemy creeks; Fall River County, near Hot Springs; Harding County, an excellent building sandstone occurs in North Cave Hills; Hutchinson County, 3 miles north of Milltown; Lawrence County, Deadwood and Spearfish; McCook County, Spencer; Meade County, Doyle; Minnehaha County, Dell Rapids, East Sioux Falls, Garretson, Rowena, Sioux Falls, and West Sioux Falls; Pennington County, near Rapid City.

Scheelite. Custer County, Hermosa. Lawrence County, occurs with cassiterite and wolframite in Nigger Hill district. Pennington County, in small quantity with cassiterite and wolframite in quartz veins near Hill City.

- Silver.** Lawrence County, small quantities recovered from gold bullion. Argenterous lead ores at Galena and Carbonate Camp. Custer County, Spokane. *See also* Cerargyrite.
- Sphalerite** (zinc blende). Lawrence County, occurs with gold quartz veins in Uncle Sam mine near Perry and with lead-silver ores at Galena.
- Spodumene.** Custer County, occurs near Custer and in Tin Mountain claim, 5 miles west of Custer. Hand County, in vicinity of Glendale. Pennington County, best in quality and most abundant about Keystone, where the Etta, Bull Con, Swanzey, Dyke Lode, and Wood Tin claims are especially noteworthy; near Oreville, at the northwest base of Harney Peak; in the Etta claim, $1\frac{1}{2}$ miles south of Keystone; on the Wood Tin, the Boomerang, and the Sunday Traction, south and southeast of Keystone; also near Hill City and in Palmer Gulch, 5 miles southeast of Hill City. A considerable quantity has been mined and shipped from the Etta claim for the manufacture of lithium salts. The crystals at this place are immense, attaining a length of 42 feet.
- Talc.** Pennington County, in relatively large and pure masses in the Harney Peak district, a mile west of Hayward, also on Squaw Creek and Box Elder Creek, near Jim Creek. As an impure decomposition product it is common in schists and amphibolites.
- Tantalite.** Pennington County, in placers near Keystone.
- Tantalum.** *See* Columbite and Tantalite.
- Tenorite.** Pennington County, Harney Peak, Sheridan in Blue Lead Mine, also on Lighting Creek and in Bear Lodge district.
- Tetradymite.** Custer County, occurs associated with quartz near Custer. Lawrence County, near Pluma, Portland, Terry.
- Tin.** *See* Cassiterite.
- Torbernite.** Pennington County, found near Keystone. Lawrence County, at the Ross Hannibal mine, about $1\frac{1}{2}$ miles southeast of Terry.
- Travertine.** *See* Onyx marble.
- Tungsten.** *See* Ferberite, Scheelite, and Wolframite.
- Uranocircite.** Pennington County, found near Keystone.
- Volcanic ash.** Occurs in workable quantities in the upper badland beds in several counties, especially Mellette, Shannon, and Todd.
- Wolframite** (tungstate of iron and manganese). Custer County, near Custer. Lawrence County, in gold ores at Lead and on Yellow Creek; has been mined and shipped near Deadwood. Pennington County, occurs in quartz veins and pegmatites, near Hill City, where it is being mined and milled; and at Oreville and Keystone. In Pennington County, part of the mineral is ferberite and part is hübnerite, but the largest part is probably wolframite.
- Wood** (petrified). Found in Custer, Fall River, Lawrence, Pennington, and other counties.
- Zinc.** *See* Sphalerite.

TENNESSEE.

- Alum.** Abundant in caverns (rock houses) in Cannon, Coffee, Dekalb, Franklin, Giles, Jackson, Lincoln, Overton, and Putnam counties. Sevier County, Alum Cave.
- Aluminum.** *See* Bauxite.
- Asbestos.** Johnson County, in small quantity.
- Asphalt** (bitumen). Hickman County, Perrys, on fork of Blue Buck Creek, in seams in limestone.
- Azurite.** Polk County, Ducktown copper mines.
- Barite.** Common in most of the limestone areas of east and middle Tennessee. Cocke County, has been mined at Delrio. Davidson County, gangue of lead mine near Haysborough. Greene County, 12 miles from Greeneville in veins in dolomite. Monroe County, mined at Sweetwater. Smith County, has been mined near Trousdale Ferry and Lebanon road. Has been mined also in Bradley, Greene, Jefferson, Loudon, McMinn, Monroe, and Washington counties.
- Bauxite.** Carter County, mined at Elizabethton. Hamilton County, mined at Missionary Ridge, near Chattanooga, and used chiefly in the manufacture of aluminum salts and compounds.
- Brown iron ore.** Widespread and extensively mined in east Tennessee.
- Brown hematite.*—Eastern iron-ore region across State from Virginia to Georgia, in Blount, Carter, Cocke, Greene, Johnson, Monroe, Polk, Sevier, Sullivan, and Washington counties. The ores occur in matrix of clay, sand, chert, and debris of disintegrated rocks, mostly in Knox dolomite. Blount and Monroe counties, almost inaccessible. Carter County, Dove River Cove banks. Cocke County, Whitehall, Pecks Mountain, and elsewhere. Greene County, several banks of manganiferous ore near Unaka Furnace. Johnson County, Crockett's, Sharp's, and other banks, south foot of Holston Mountain, Laurel Creek valley, and Butler Furnace banks. McMinn County, Tellico Plains, several deposits. Polk County, in gossan at Ducktown copper mines. Sevier County. Sullivan County, at Crockett bank and other places in eastern part of county. Washington County, deposits in Bumpass Cove and Greasy Cove.
- Limonite.*—Widespread in middle Tennessee and is produced in the region west of the Central Basin. Occurs in Benton, Decatur, Dickson, Hardin, Hickman, Houston, Humphreys, Lawrence, Lewis, Montgomery, Perry, Stewart, and Wayne counties; mines at Allens Creek, Ferro, Iron City, Pinkney, Riverside, and West Point.
- Calamine.** Claiborne County, occurs in Knox dolomite, near Tazewell. Hancock County, in many places, with smithsonite. Jefferson County, associated with smithsonite and blende in Knox dolomite at Mossy Creek. Union County, near New Prospect, and at Stiner's zinc mine; Powell River, with smithsonite in irregular veins in Knox dolomite. Occurs at other localities in Bradley, Cocke, Jefferson, Knox, Loudon, Monroe, and Moore counties in valley of east Tennessee.
- Calcite.** Polk County, Ducktown mines. Smith County, Foley mine. 8 miles west of Carthage.
- Cement** (natural). Hardin County, argillaceous limestone mined at Clifton, good grade natural cement. Knox County, calcareous shales used for natural cement.
- Cement material** (Portland). Limestone along east front of Cumberland Plateau, in Sequatchie Valley, and on west front of plateau; quarried at Richard City, Marion County. Limestone and shale suitable for Portland cement abundant in eastern and middle Tennessee.

- Cerussite.** Blount, Bradley, McMinn, Union, Washington, and other counties, secondary mineral of lead ore, not mined; occurs as accessory mineral with galena.
- Chalcanthite** (blue vitriol). Polk County, small quantity in ores of Ducktown district.
- Chalcocite** (copper glance). Polk County, small quantity in ores of Ducktown district.
- Chalcopyrite** (copper pyrites). Polk County, in massive pyrrhotite of Ducktown ore bodies, carries gold and silver.
- Chert.** Abundant in Knox dolomite in the valley of east Tennessee and in Fort Payne formation and St. Louis limestone (Carboniferous) on edge of basin of middle Tennessee; mined for road metal at Centerville, Hickman County, and elsewhere.
- Chert** (Camden, novaculite). Benton County, near Camden. Used for road making throughout west Tennessee.
- Clay** (ball). Campbell County, Newcomb. Carroll County, McKenzie. Henry County, Henry, India, Puryear, and Whitlock. Also reported at Moscow, Fayette County.
- Clay** (brick). Brick and tile clays occur in all parts of the State. Clays of fine variety are mined at several points in the west part. Mined in Bedford County, at Shelbyville; Blount County, Maryville and Scottsville; Bradley County, Cleveland; Carroll County, McKenzie; Carter County, Elizabethton; Cheatham County, Ashland City; Coffee County, Tullahoma; Crockett County, Gadsden; Davidson County, Nashville; Dekalb County, near Smithville; Dickson County, small quantity, Dickson; Dyer County, Dyersburg; Franklin County, Winchester; Gibson County, Brownsville, Eaton, Humboldt, Milan, and elsewhere; Giles County, Pulaski; Greene County, Greeneville and Mohawk; in Grundy County; Hamblen County, Morristown; Hamilton County, Chattanooga; Harde-man County, Bolivar and Whiteville; Henderson County, Lexington; Henry County, Paris and Puryear; Jefferson County, Jefferson City; Knox County, Byington, Dedie, Edgewood, Knoxville, and elsewhere; Lauderdale County, Gates, Halls, and Ripley; Lawrence County, Lawrenceburg; Lewis County, Hohenwald; Lincoln County, Fayetteville; McMinn County, Englewood; Madison County, Gilmore; Macon County, small quantity near Lafayette; Marshall County, Lewisburg; Maury County, Columbia; Monroe County, Sweetwater; Montgomery County, Clarksville; Obion County, Obion, Rives, and Union City; Polk County, Benton; Putnam County, Cookeville; Rhea County, Dayton; Rutherford County, Eagleville and Murfreesboro; Scott County, Robbins; Sevier County, Sevierville; Shelby County, Memphis and New South Memphis; Sullivan County, Bristol; Sumner County, Portland; Tipton County, Covington; in Van Buren County; Warren County, McMinnville; Weakley County, Gleason, Greenfield, and Martin; White County, Sparta; Wilson County, Lebanon.
- Clay** (fire). Has been mined in Bradley County at Cleveland; Campbell County, Newcomb; Carroll County at McKenzie; Hamilton County, St. Elmo; Henry County, Puryear; Houston and Stewart counties; in district between Central Basin and Tennessee River; Knox County, Powell station; Madison County, Gilmore and Pinson; Putnam County; Rhea County, near Evansville; Roane County, Oliver Springs.
- Clay** (kaolin). Carroll and Carter counties, small quantities. Henry County, Sparta. Stewart County, has been mined at Tennessee kaolin mines.

Clay (pottery). Carroll County, near Hico and Hollow Rock and at McKenzie. Fayette County, La Grange. Hardeman County, Grand Junction. Henry County, Puryear and Henry. James County, Summit. Madison County, Pinson. Rhea County, Graysville.

Clay (stoneware). Carroll County. Cocke County, has been mined at Delrio, Hardeman County, Grand Junction. Putnam County, small quantity formerly mined at Silver Point. Weakley County, formerly mined near Gleason.

Coal (bituminous). Occurs extensively over the Cumberland Plateau. The State is divided into two districts, the northern and southern, by the Tennessee Central Railroad. These districts are also known as the Jellico and Chattanooga districts. The Jellico coal district is divided into the northeastern and northwestern fields by the line of the Queen & Crescent Route. In the northeastern field, between the Queen & Crescent line and the Cumberland Mountain escarpment, coal is mined at the following places: Anderson County, Briceville, Coal Creek, and Windrock. Campbell County, Anthras, Black, Careyville, Chaska, Cotula, Cupp, Elk Valley, Jellico, Kimberley, LaFollette, Morley, Newcomb, Peabody, Red Ash, Remy, Rich Mountain, Turley, Westbourne, Wynn. Claiborne County, Clairfield, Eagan, Fonde, Fork Ridge, Hartranft, Nicholson, and Pruden. Morgan County, Coalfield, Petros, and State mines. Roane County, Oliver Springs and Rockwood. Scott County, Almy, Glenmary, Helenwood, Laxton, and Le Moyne. In the northwestern field, which lies north of the Tennessee Central Railroad and west of the Queen & Crescent line and includes parts of Cumberland, Fentress, Morgan, Overton, Pickett, Putnam, and Scott counties, coal is mined at the following places: Cumberland County, Isoline; formerly mined at Fall, Millstone, and Mammys creeks, east side of Crab Orchard Mountain, and attempted at Crab Orchard but abandoned because too badly crushed. Fentress County, Wilder. Overton County, Crawford, Obey City, and old Murdock opening, 1 mile south of Cook place. Scott County, Bear Creek. The southern district, south of the Tennessee Central Railroad, includes nearly all of Bledsoe, southern Cumberland, Grundy, Marion, Sequatchie, and Van Buren counties, eastern part of White County, and western Hamilton, Rhea, and Roane counties. Some of its coals are coking. In Bledsoe County coal is mined at Atpontley and on Stephen Gap road, and openings have been made at numerous places along the west boundary of the county. Cumberland County, coal worked only for local use at small banks. Franklin County, formerly mined at Sewanee; worked out. Grundy County, mined at Coalmont, Clouse Hill, and Tracy City. Hamilton County, mined at Montlake, Sale Creek, Soddy, and every few miles on Walden Ridge. Marion County, mined at Orme and Whitwell; large body of coal undeveloped by lack of transportation. Rhea County, mined at Dayton, Grand View, and Graysville. Sequatchie County, mined at Dunlap. Van Buren County, mined at Gillantine, Olio, Roverton Springs, Spencer, and at many small banks for local use. White County, mined at Bon Air, Eastland, and Ravenscroft.

Coal (lignite). *See* Lignite.

Cobalt. Hickman County, in wad at numerous points near Centerville.

Copper. *See* Azurite, Chalcantinite, Chalcocite, Chalcopyrite, Cuprite, Malachite, Melanconite, and Tetrahedrite.

Cuprite. Polk County, small quantity in ores of Ducktown district.

Dolomite. Common rock of the Central Basin and the valley of east Tennessee.

Epsomite. At many places with alum and copperas. Sevier County, Alum Cave.

Flagstone. *See* Limestone and Sandstone.

Fluorspar. Carter County, Watauga Point. Smith County, Foley mine, about 8 miles west of Carthage. Trousdale and Wilson counties, small quantities mined.

Galena (lead ore). With zinc ores in vicinity of Powell River and other parts of east Tennessee, and sparingly at several places in middle Tennessee. Bradley County, 20 miles east of Chattanooga and also at Blue Springs, 6 miles south of Cleveland, where it has been mined. Claiborne County, Straight Creek, 5 miles southwest of New Tazewell, has been mined with zinc. Davidson County, has been mined. Polk County, in minute quantities in ore bodies of Ducktown mines. Washington County, disseminated in grains in rock of Bumpass Cove. Williamson County, has been mined near Nolansville. Also found in Blount, McMinn, and Union counties.

Gas. *See* Natural gas.

Glauconite. *See* Marl.

Gold. By-product from copper ores.

Gold (lode and placer). Monroe County, Whippoorwill Branch of Tellico River, has been mined.

Gold (placer). Blount County, has been mined in Montvale Springs and back of Chilhowee Mountain. Monroe County, Coker Creek. Polk County.

Granite. In all the counties along the eastern border of the State. Max Patch and Cranberry granites in Carter, Cocke, Greene, Johnson, and Unicoi counties. Carter County, Ripshin Mountain on Doe River.

Graphite. Knox County, with zinc ores, in small quantities. Polk County, associated with copper ores, Ducktown.

Gravel. Along most of the streams of the State as stream and terrace gravel. Also in the clays of Highland River and in abundance on the hills between Highland and Tennessee rivers. Wayne County, enormous quantity of chert gravel (Tuscaloosa formation) on crests of hills and along streams. Used on Clifton-Waynesboro pike.

Gypsum. In small quantities in many caves. Grays Cave, northern part of Sumner County.

Halite (common salt). Salt has been worked in White County, 3 miles from Sparta. Overton County, at Obey River. Brine has been found in most of borings for petroleum in middle Tennessee, in Anderson, Jackson, Overton, Van Buren, and Warren counties.

Hematite. Occurs in Bledsoe, Bradley, Campbell, Claiborne, Cocke, Grainger, Hamilton, Hancock, Henderson, James, Loudon, Marion, McMinn, Monroe, Rhea, Roane, Sequatchie, and Sullivan counties. Mined in Carter County, Stony Creek Valley; McMinn County, east of Athens.

Iron. *See* Brown hematite, Brown iron ore, Hematite, Magnetite, Mineral paint, Oriskany brown ore, Pyrite, Pyrrhotite, and Siderite.

Lead. *See* Cerusite, Galena, and Mineral paint.

Lignite. In Eocene deposits of west Tennessee; extensive in Dyer, Johnson, Lauderdale, Obion, Shelby, and Tipton counties.

Limestone. Important building stone. Also used for lime, cement, flux, concrete, road metal, and fertilizer. The most common rock of the east Tennessee Valley and of middle Tennessee. Quarries: Blount County, Maryville. Bradley County, Charleston. Campbell County, Lafollette. Carter County, Milligan. Cumberland County, Crab Orchard. Davidson County, Newsoms station, Fullers siding, and Nashville. Decatur

County, Perryville. Dickson County, Iron Hill. Franklin County, Sherwood and Winchester. Giles County, Aspen Hill, Harwell, and Riversburg. Hamilton County, Chattanooga, Chickamauga, and Shepherd. Hickman County, Bon Aqua, Centerville, and Warner. Houston County, Erin. Jefferson County, Jefferson City and Straw Plains. Knox County, Bearden and Knoxville. Lawrence County, quarried at Lawrenceburg and Iron City. Loudon County, Lenoir City. Marion County, Guild, Hales Bar Dam near Chattanooga, and Richard City. Marshall County, Chapel Hill. Maury County, Carters Creek, Columbia, and Culleoka. Montgomery County, Clarksville. Overton County, Windle. Rhea County, Dayton. Roane County, Harriman and Rockwood. Robertson County, Adams and Springfield. Rutherford County, Murfreesboro. Smith County, Rome. Stewart County, Carlisle. Sullivan County, Bluff City and Elkanah. Sumner County, Gallatin, near Goodlettsville, and Hendersonville. Trousdale County, Hartsville. Union County, Maynardville. Wayne County, Allens Creek, argillaceous limestone (Hermitage limestone) has been quarried at Clifton and yields good grade natural cement. White County, Doyle. Wilson County, Lebanon.

Limestone (flagging). Quarried: Knox County, near Knoxville, blue flags. Morgan County, near Montgomery. Wilson County, Lebanon.

Limestone (flux). Quarried: Carter County, Milligan. Claiborne County, Cumberland Gap. Hickman County, Bon Aqua. James County, Ooltewah. Lawrence County (Brassfield limestone), reported to contain 17 per cent metallic iron; formerly quarried at Iron City. Lewis County (Niagaran limestone); formerly quarried at Riverside. Montgomery County, Clarksville. Rhea County, Dayton. Roane County, Rockwood. Washington County, Embreeville. Wayne County (Niagaran strata), on Forty-eight Creek (St. Louis limestone), southeast of Waynesboro on head of Hurricane Creek.

Limonite. See Brown iron ore.

Lithographic stone. Clay, Jefferson, McMinn, and Overton counties. Putnam County, at Algood. Not used commercially.

Magnetite. Blount County, float found in eastern part of county. Carter County, in older rocks of mountain spurs near Crab Orchard Valley. Cocke and Unicoi counties.

Malachite. Monroe County, Buck Miller mine. Polk County, small quantities in ores of Ducktown district.

Manganese. Bradley County, 9 miles from Cleveland. Cocke County, in vicinity of Newport and Delrio. Johnson County, Shady Valley. Unicoi County, Unicoi. Small deposits reported from Carter, Greene, and Sevier counties, and in Hamblen County near Morrison; has been mined at Whitfield, Hickman County; occurs also in Lawrence and Wayne counties. See also Psilomelane, Pyrolusite, and Wad.

Marble. Abundant in State and of excellent quality in the valley of east Tennessee. Occurs in Anderson, Blount, Claiborne, Coffee, Cumberland, Franklin, Grainger, Greene, Hamblen, Hancock, Hawkins, Knox, Lincoln, Loudon, McMinn, Monroe, Roane, Sevier, Union, and Washington counties. Quarried in Blount County at Friendsville, near Knoxville and Meadow. Knox County, Caswell, Concord, Hercules, Knoxville, McMillan, and at confluence of French Broad and Holston rivers. Hawkins County, has been quarried at Galbraith Springs and Rogersville. Union County, Luttrell.

Marble (onyx). Small quantity found in caves, especially in Anderson and Claiborne counties.

Marl. Greensand associated with Selma chalk and clays in western part of State, in Chester, Henderson, and McNairy counties.

Melaconite (black copper). Polk County, mixed with chalcocite in Ducktown copper mines.

Mineral paint. Oxides and carbonates of iron, lead, and zinc ore are so used. Supply from Bradley, Cheatham, and James counties.

Natural gas. Bedford, Cumberland, southwestern Davidson, Dickson, Franklin, Lincoln, Marshall, Maury, Sumner, and White counties; production small.

Niter (saltpeter). In caves in limestone region. Large quantities mined during War of 1812 and Civil War.

Novaculite. *See* Chert.

Oil. *See* Petroleum.

Oil shale. *See* Shale.

Onyx marble. *See* Marble (onyx).

Oriskany brown ore. Northeastern part of State near Cumberland.

Peat. Hardin, Henry, and Tipton counties. Not used.

Petroleum. Has been procured from several points in middle Tennessee. Dickson County, in black Chattanooga shale on Jones Creek. Overton County, Netherland, Spring Creek, and Eagle Creek. Putnam County, near Algood. Scott County, near Glenary. Fentress and Pickett counties, in Spurrier-Riverton district. Also in Clay, Franklin, and other counties. Production negligible.

Phosphate rock. Davidson County, near West Nashville. Decatur County, Parsons. Giles County, Wales. Hickman County, Centerville, Fogg, and Swan Bluff. Lewis County, Big Swan. Maury County, Mount Pleasant, near Columbia, Ewell station, Kleburne, near Scott Mill, and elsewhere. Perry County, Lick Creek. Putnam County, Boma. Sumner County, Gallatin and Rogana. Williamson County, Brentwood and near Franklin. Occurs also around the edge of the Central Basin.

Potash. *See* Niter.

Psilomelane. Cocke County, Yellow Springs mine, near Newport.

Pyrite. Carter County, in black shale on Stony Creek, 12 miles northeast of Elizabethton; has been mined. Cheatham, Greene, and Moore counties, large quantities have been found. Polk County, as stringers and particles in ore bodies of Ducktown mines, bearing gold and silver.

Pyrolusite. Has been mined in Carter County, near Elizabethton. Cocke County, near Newport and Delrio. Johnson County, in iron and manganese ores at Shady Valley. Monroe County, irregular masses with iron ores near Sweetwater. Unicoi County, near Unicoi in limestone.

Pyrrhotite. Polk County, principal sulphide of Ducktown district, bears gold and silver.

Quartz. Found in many parts of Tennessee in cavities and as veins in many rocks. In the southeastern part it is used in copper smelting. Polk County, near Ducktown. *See also* Silica.

Road metal. *See* Chert, Granite, Gravel, Limestone, Marble, Sand and gravel, and Sandstone.

Salt. *See* Halite.

Sand (building). In flood plains, beds, and bars of many of the streams of the State. Especially common in west Tennessee, where it occurs also in beds and lenses. Dug in Carter County at Elizabethton and Watauga. Davidson County, Mackie. Fayette County, La Grange. Franklin County, Estell Springs. Hamilton County, Chattanooga and St. Elmo. Hardeman County, Saulsbury. Knox County, Knoxville. Lincoln

County, near Fayetteville. Loudon County, Lenoir City. Roane County, Harriman and Rockwood. Shelby County, Memphis. Sullivan County, West Bristol.

Sand (glass). Great quantities of sandstone suitable for crushing. Anderson County, Coal Creek. Benton County, saccharoidal sandstone. Blount County, Chilhowee. Hardeman County, Saulsberry. Knox County, Knoxville. Montgomery County. Sullivan County, 20 miles from Bristol.

Sand (molding). Davidson County, near Nashville. Franklin County, Estell Springs. Hamilton County, Chattanooga. Hardeman County, Saulsberry. Henry County, Paris. Knox County, Knoxville. Loudon County, Lenoir City. Madison County, 4 miles west of Jackson. Rhea County, Dayton.

Sand and gravel. From bottom of Mississippi, Tennessee, and Cumberland rivers, in Benton, Carter, Davidson, Decatur, Hamilton, Johnson, Knox, Rhea, Roane, and Shelby counties.

Sandstone. In many parts of middle and east Tennessee, and is common in the Cumberland Plateau. Bledsoe County, near Pikeville. Blount County, Chilhowee. Franklin County, Sewanee and side of Lookout Mountain. Hawkins County, Clinch Mountain. White County, along west side of plateau.

Sandstone (flagging stone). Abundant in counties of eastern Highland Rim. Macon County, at Lafayette. Sometimes used for buildings. Used for foundations in west Tennessee.

Shale. Common in the Cumberland Plateau and less common in east Tennessee and around the rim of the central basin. For paving and other brick. Has been mined in Anderson County at Donovan. Roane County, Rockwood. For wood-fiber plaster, in Campbell County, at Jellico Plains.

Shale (oil). Devonian, underlies the greater part of middle Tennessee and minable throughout a considerable area.

Siderite (clay ironstone, carbonate of iron). Anderson County, below Wiley coal bed. Grundy County, Beersheba Springs and other localities. Houston County, Coal Creek and Caryville, Wells Creek basin.

Silica (amorphous). A fine, soft, porous, friable silica, resulting from weathered chert. Bradley County, at Black Fox, 4 miles west of Cleveland, is a large deposit, used in the manufacture of white silex and "tripoli." Hickman County, about 4 miles west of Bon Aqua, and in other counties west of Central Basin.

Silver. By-product with copper and lead ores.

Slate. Vast supply of metamorphosed slates in extreme eastern counties. Quarries along Little Tennessee River, Knox County. Blount, Cocke, McMinn, Monroe, Polk, Sevier, Sullivan, and Washington counties. No production since 1910.

Smithsonite (carbonate of zinc, "dry bone"). Mined with sphalerite and calamine in northeastern Tennessee. Claiborne County, occurs in Knox dolomite near Tazewell. Hancock County, occurs with calamine; abundant. Jefferson County, Mossy Creek and New Market; mined extensively. Union County, near New Prospect. Other localities in valley of east Tennessee.

Sphalerite (zinc blende). Important ore mineral, mined with smithsonite and calamine in northeast Tennessee. Claiborne County, in Knox dolomite near Tazewell. Jefferson County, mined at New Market. Knox County, mined extensively near Mascot. Smith County, with calcite and fluor-spar near Trousdale Ferry and Lebanon road. Union County, in Knox dolomite near New Prospect.

Sulphur. Polk County, obtained from reduction of copper. Used for sulphuric acid. *See also* Pyrite and Pyrrhotite.

Tetrahedrite (gray copper ore). Monroe County, Buck Miller mine, mouth of Coco Creek, on Hiwassee River; argentiferous.

Tripoli. Johnson County, Butler. Sullivan County. Has been mined.

Unakite. Cocke County, in the Great Smoky Mountains of the Unaka Range, on the slopes of the peaks known as The Bluff, Walnut Mountain, and Max Patch.

Wad. With manganese ore in Cocke County, near Newport and Delrio. Hickman County, with cobalt near Centerville. Johnson County, in Shady Valley. Unicoi County, near Unicoi.

Zinc. *See* Calamine, Mineral paint, Smithsonite, and Sphalerite.

TEXAS.

- Agate.** Brewster County, at many localities north and south of Alpine, especially at Agate Hill, on the Terlingua road, 20 miles south of Alpine, and on the Kokernut ranch, northeast of Alpine. Presidio County, on the Bogel ranch, 12 miles south of Marfa, many beautiful colors.
- Alabaster.** In King, Knox, and Stonewall counties there are beds of alabaster 4 feet in maximum thickness, and these beds, although not so thick, outcrop on Colorado River northwest of Robert Lee in Polk County. *See also Gypsum.*
- Allanite.** Llano County, at Barringer Hill and near Kingsland. Some specimens contain much occluded hydrogen.
- Alum (native).** Brewster County, near Ash Spring, western foothills of the Chisos Mountains, not in commercial quantities. Presidio County, Fresno Canyon, 80 miles south of Marfa.
- Amethyst.** In Burnet, El Paso, and Llano counties.
- Anhydrite.** Dickens County, in deep well at Spur.
- Asbestos.** El Paso, Gillespie, and Llano counties. Has not been found in commercial quantities.
- Asphalt.** Asphaltic sandstones and limestones in the following counties: Anderson, Angelina, Brewster, Burnet, Coke, Cooke, Hardin, Hunt, Jack, Jasper, Martin, Montague, Nacogdoches, Panola, Pecos, San Augustine, Stephens, Travis, Uvalde. The asphaltic limestone from Uvalde County has been used for paving in San Antonio and also as a source of lithocarbon (a bitumen extracted from the rock with naphtha); the bituminous sandstone from Montague County also has been used for paving. The principal source of asphalt in Texas now is the residuum from the distillation of crude petroleum.
- Barite.** Llano County. Also reported from Burkeville, Newton County.
- Bituminous rock.** *See Asphalt.*
- Borax.** El Paso County, small quantity as incrustations in old shallow lakes.
- Brown iron ore (brown hematite, limonite).** There are many localities in eastern and northeastern Texas which afford an excellent limonite for blast-furnace use. The principal counties are: Anderson, Cass, Cherokee, Gregg, Harrison, Henderson, Marion, Morris, Nacogdoches, Panola, Rusk, Shelby, Smith, Upshur, and Wood. A special iron-ore dock was built at Port Bolivar, Galveston Bay, in 1912, for handling ocean shipments of iron ore, and a good deal of active prospecting work is in progress.
- Caliche.** Common under gravelly plains of arid regions.
- Cassiterite.** El Paso County, in Franklin Mountains 14 to 16 miles north of El Paso, where it is worked for tin in aplite dikes cutting granite. Mason County, reported from Herman and Willow creeks and near Streeter.
- Celestite.** Burnet County, at Strickling, large deposit reported. Lampasas County, 5 miles north of Lampasas, in large crystals filling pockets in Glen Rose limestone. Mason County, reported associated with topaz from Herman and Willow creeks. San Saba County. Travis County, on Mount Bonnell, Colorado River, near Austin.
- Cement material.** Limestones and shales widely distributed over the State. Eagle Ford shale and Austin chalk used near Dallas and San Antonio; Cretaceous limestone and shale used at El Paso. Calcareous clay occurs in Grimes County.
- Cerium metals.** *See Allanite, Cyrtolite, Gadolinite, and Polycrase.*

Chalcocite. In clays of the Permian formation, nodules of chalcocite and pseudomorphs of malachite after wood occur in Archer, Foard, Hardeman, Haskell, Jones, King, Knox, Llano, and Stonewall counties. Llano County, prospect in Baby Mountains northeast of Llano.

Chalcopyrite. Burnet County, 9 miles west of Burnet, associated with galena and sphalerite in a gangue of fluorspar in gneissoid granite. Culberson County, Sierra Diablo, also old Hazel mine north of Van Horn. El Paso County, west side of Quitman Mountains; ore shipped from John Gilcrease claims.

Cinnabar. *See* Quicksilver.

Clay (brick). Widely diffused over the State. Used for brick in the following counties: Atascosa, Bastrop, Bexar, Bowie, Brown, Cameron, Coleman, Cooke, Dallas, Denton, Ellis, El Paso, Erath, Falls, Fort Bend, Gonzales, Grayson, Grimes, Guadalupe, Hall, Harris, Harrison, Henderson, Hidalgo, Hopkins, Hunt, Johnson, Jones, Lamar, Lee, Leon, Limestone, McLennan, Matagorda, Medina, Milam, Montgomery, Nacogdoches, Navarro, Panola, Parker, Potter, Rains, Robertson, Shelby, Smith, Tarrant, Taylor, Titus, Tom Green, Travis, Upshur, Van Zandt, Webb, Wharton, Wichita, Wilson, Wise, Wood. The clay in Brewster County is used in a yard 130 miles from the railroad for making brick for the quicksilver furnaces in the Terlingua district.

Clay (fire). Bastrop County, Butler Spur and Elgin. Bexar County, Adkins and Elmendorf. Bowie County, 7 miles south of New Boston. Denton County, Denton. Henderson County, Athens and Malakoff. Hopkins County, Crush. Limestone County, near Headsville. Milam County, near Milano Junction. Robertson County, near Bremond. Reported in Stephens County, and in Lampasas County at Lampasas.

Clay (kaolin). Brazos County, Caldwell, plastic. Burleson County, near Somerville. Fayette County, Lena; also plastic at Lena and Plum. Lee County. Real County, about 6 miles west of Leakey is a considerable deposit of high-grade kaolin. Washington County, near Burton. Kaolinite has been reported from Nueces County, but very little is known about the locality. China and porcelain wares have been made successfully of Texas clay.

Clay (pottery). Bexar County. Denton County. Grimes County, Courtney. Henderson County, Athens. Morris County, Omaha. Rusk County, near Henderson. Wood County.

Clay (slip). Bexar County, near San Antonio. Grimes County, 13 miles north of Navasota. Polk County, near Carmona. Wise County, Bridgeport.

Coal. Bituminous coal is mined in the following counties: Eastland, Erath, Jack, Palo Pinto, Parker, Wise, and Young in the north-central coal field, and in Maverick and Webb in the Rio Grande coal field. The coals of the north-central fields are true Carboniferous coals (Pennsylvanian); the Rio Grande coals have been regarded as late Cretaceous or early Tertiary. Besides the counties enumerated as producing coal at the present time in the north-central field, workable beds also occur in Brown, Coleman, Comanche, Eastland, McCulloch, Montague, and Stephens counties. The total workable coal area is about 8,200 square miles, with an additional area of 5,300 square miles which may contain workable beds. *See also* Lignite.

Copper ores. *See* Chalcocite and Chalcopyrite.

Cyrtolite. Llano County, occurs sparingly in pegmatite at Baringer Hill, mined with other yttrium minerals.

Eglestonite. Brewster County, occurs sparingly, with other quicksilver minerals, in the Terlingua district.

Feldspar. Llano County, at Baringer Hill, massive orthoclase (not quarried).

Fergusonite. Llano County, occurs sparingly at Baringer Hill.

Fluorspar. Brewster County, sparingly, in association with quicksilver deposits. Burnet County, Spring Creek drainage basin. Gillespie County, near Enchanted Rock. Llano County, at Baringer Hill.

Fuller's earth. Extensive deposits of excellent fuller's earth are found in Burleson, Cherokee, Fayette, Gonzales, Grimes, Shelby, Smith, Walker, and Washington counties, and the deposits in Smith County extend also into Cherokee County; some of the deposits in Fayette County are worked. Newton County (reported).

Gadolinite. Burnet County, in small quantity, except in one locality; is found in red granite area. Llano County, at Baringer Hill. Used in making the glower in the Nernst electric lamp.

Galena. Brewster County, in the Solitario, excellent material. Burnet County, in calcareous sandstone on Silver Creek. Coleman County, in a conglomerate near Santa Ana. El Paso County, on both sides of the Quitman Mountains, and in the Sierra Blanca, at the old McKinney property and elsewhere, associated with ores of copper and zinc. Knox County, associated with ores of copper and zinc in the Permian. Presidio County, at Shafter, with silver ores in San Antonio Canyon and southwest of the Chinati Mountains, good material.

Gas. *See* Natural gas.

Gold. Occurs sparingly in certain silver-lead ores in trans-Pecos Texas. Brewster County, in association with quicksilver ores and in quartz veins. In quartz veins in Blanco, Burnet, Gillespie, Llano, and Mason counties.

Granite. Brewster County, Marathon. Burnet County, quarried at Burnet, Fairland, Granite Mountain, and Marble Falls. El Paso County, El Paso (also Sunset Heights). Gillespie County, quarried. Llano County, quarried at Kingland, Llano, and vicinity. Opaline granite or llanite (granite porphyry) occurs near Llano; it is a most beautiful and attractive stone but has not been placed on the market. Crushed granite is used for concrete.

Graphite. Burnet and Llano counties, prospected to some extent but not mined commercially; in schist at Lone Grove, 7 miles east of Llano.

Gypsum. At many localities in the State, especially in the Permian rocks west of the area of Pennsylvanian rocks. Brewster County, curious forms of gypsum, curved and twisted like a ram's horn, occur in association with quicksilver deposits in the Terlingua district. Culberson County, great plain east of Guadalupe Mountains. El Paso County, notable deposits in Malone Mountains. Hardeman County, mined at Acme and Quanah; much Keenes plaster is made from the gypsite beds. Jones County, mined at Hamlin. King and Knox counties. Stonewall County, extensive deposits of good alabaster are reported from the northeastern corner of the county at Kiowa Peak in beds whose maximum thickness is 4 feet. Nolan County, rose gypsum occurs near Sweetwater in beautiful forms and colors. The eastern border of the Permian area contains extensive beds of gypsum, and gypsum has been found in deep borings along the Gulf of Mexico.

Hematite. Llano and Mason counties, associated with the magnetite ores. *See also* Magnetite.

Ilmenite. Llano County, at Baringer Hill and east of Cold Creek. Mason County, at Fly Gap and north of Pontotoc.

Iron. *See* Brown iron ore, Hematite, Ilmenite, and Magnetite.

Jasper. Brewster and Presidio counties, occurs with agate and chalcedony. Jeff Davis County, near Fort Davis. Llano County, on Pennington and Sandy creeks. Uvalde County, near Montell.

Kaolin. *See* Clay (kaolin).

Kleinite. Brewster County, occurs very sparingly in association with rare quicksilver minerals, montroydite, eglestonite, terlinguaite, in the Terlingua district.

Lead. *See* Galena.

Lignite. The lignite area in Texas is probably about 60,000 square miles. The lignite deposits are, for the most part, confined to the Tertiary and they occur on the Gulf slope, from the Red River to the Rio Grande, in an area 650 miles in length and 200 miles in width. In thickness the beds run to 15 feet and more. The counties in which workable beds of lignite occur are the following: Anderson, Angelina, Atascosa, Bastrop, Bowie, Brewster, Caldwell, Camp, Cass, Cherokee, Dimmit, Fayette, Freestone, Grimes, Harrison, Henderson, Hopkins, Houston, Jasper, Lee, Leon, Limestone, McMullen, Marion, Medina, Milam, Morris, Nacogdoches, Newton, Panola, Rains, Robertson, Rusk, Sabine, San Augustine, Shelby, Smith, Titus, Upshur, Van Zandt, Webb, Wood, and Zavalla. The lignite-producing counties are: Bastrop, Fayette, Henderson, Hopkins, Houston, Lee, Leon, Medina, Milam, Rains, Robertson, Titus, Van Zandt, and Wood. The chief producing county is Wood, at Hoyt and Alba, 75 miles west of Dallas. During the last few years there has been a marked increase in the use of lignite for making producer gas. The total engine horsepower thus generated is about 13,000, one establishment alone having 4,400 horsepower obtained from lignite gas. There are no establishments in the State making briquets from lignite, but the matter is now under serious consideration. Some of the Texas lignites make a good briquet without a binder.

Limestone. Limestones in great variety of texture and composition occur in many localities, and in practically every county, with the exception of some of the counties in the Gulf Coastal Plain and in northeast Texas. The principal quarries are in the following counties: Bell, Bexar, Bosque, Brown, Coleman, Collin, Comal, Comanche, Coryell, Dallas, El Paso, Erath, Garza, Grayson, Guadalupe, Jack, Jones, Kaufman, Lampasas, McCulloch, Navarro, Nolan, Palo Pinto, Runnels, San Saba, Smith, Stephens, Tarrant, Tom Green, Travis, and Williamson. These localities also afford lime, but the chief lime-producing counties are Bexar, Comal, Coryell, El Paso, San Saba, Travis, and Williamson. The pure white limestones of Bexar and Williamson counties are much used for building, and have the advantage of being easily sawed into shape by hand.

Limonite. *See* Brown iron ore.

Mackintoshite. Llano County, occurs sparingly at Baringer Hill, in association with other rare minerals, such as yttrialite, nivenite, fergusonite, and gadolinite.

Magnetite. Llano and Mason counties, the iron ores are principally magnetite with some hematite. Some of these ores are of good quality, but a commercial quantity has yet to be proved. The principal localities are Iron Mountain, the Boder tract, and the Olive mine, Llano County, and places between Iron Mountain and Llano River. At the old Olive mine

there is a shaft 300 feet deep and some shipments were made many years ago to the Birmingham district, Ala., and to the State Furnace, Rusk, Cherokee County. High-grade magnetite is to be seen on the surface at Iron Mountain and some work has been done in prospecting the underground ore.

Malachite. *See* Chalcocite.

Manganese. *See* Pyrolusite.

Marble. Brewster County, south of the Southern Pacific Railroad, and about 14 miles from Alpine, beds of white, faint bluish-white, black, and black and white marble of superior quality. This deposit has been prospected to some extent. De Witt County, Yoakum. El Paso County, at Marble Canyon in the Eagle Mountains. Kinney County, Brackettville. Llano County, some work has been done on several ledges near the town of Llano, and recent reports indicate the existence of workable beds in other parts of this county. Presidio County, Marfa. San Saba County, near the town of San Saba, some development work has been done on ledges of pale-gray and reddish marble and a small production reported in 1914. In association with the gray and reddish marble of San Saba County there occurs a beautiful silver, black, and golden onyx; polished slabs of this material have been prepared. Marble is produced in Texas only in small quantity.

Mercury. *See* Quicksilver.

Mica. El Paso County, north of Dahlberg, there is a deposit of mica which has been developed to some extent. Mason County, reported from the eastern part of the county.

Montroydite. Brewster County, occurs sparingly in association with other rare quicksilver minerals, eglestonite, terlinguaite, and kleinite, in the Terlingua district.

Natural gas. Bexar County, near San Antonio. Brown County, on Holloway Mountain, near Brownwood. Clay County, chief supplies from Petrolia (Henrietta) field, from which it is piped to Fort Worth, Dallas, Wichita Falls, and many other north Texas cities and towns, through distances of 25 to 125 miles. Coleman County, near Coleman. Limestone County, Mexia gas field. McMullen County, much gas near Crowther. Maverick County, gas has been prospected. Navarro County, gas at Corsicana is used locally. San Patricio County, near Corpus Christi. Shackelford County, wells at Moran supply local demand, and this gas will probably be piped to Cisco and Albany. Webb County, wells at Reiser supply Laredo. Zapata County, near Zapata. Texarkana and Marshall are supplied from Caddo, La. Gas fields occur also in Gonzales, Houston, Presidio, and Trinity counties. The natural gas, in association with petroleum, is used locally in many of the oil-producing districts, Spindletop, Sour Lake, Saratoga, Humble, Markham, Goose Creek. An important feature of the natural-gas industry in Texas is its competition with producer gas made from lignite. At the close of 1914 there were 197 productive wells.

Niter. Brewster County, as incrustation on sandstone, 6 to 12 miles east of Terlingua between Maverick and Chisos mountains (in sec. 120, block G-4). El Paso County, reported. Presidio County, as thin veins in dense hard trachyte, $2\frac{1}{2}$ miles east-northeast from Candelaria, a small settlement on the Rio Grande, 45 miles south of Valentine, a station on the Southern Pacific Railroad. Val Verde County, on Devils River, under an overhanging cliff of limestone, about five-eighths of a mile from the place where Indian Creek flows into it.

Nivenite. Llano County, occurs sparingly with other rare minerals at Baringer Hill. *See also* Fergusonite, Gadolinite, and Mackintoshite.

Oil. *See* Petroleum.

Onyx marble. San Saba County, silver, black, and golden onyx occurs with gray and red marble.

Opal. Brewster County, near Haley Peak, fire opal reported.

Petroleum. Widely distributed in Texas, the producing counties being Clay, Duval, Hardin, Harris, Harrison, Jefferson, Liberty, Marion, Matagorda, McCulloch, McMullen, Navarro, Orange, and Wichita. Oil is known to exist in many other counties, but producing wells have not yet been brought in; these counties are Angelina, Archer, Bexar, Brazoria, Brewster, Brown, Coleman, Gonzales, Jack, Nacogdoches, Reeves, Robertson, Shackelford, Smith, Walker, Wood. The Coastal Plain oils in the counties of Hardin, Harris, Jefferson, and Matagorda are generally of heavier gravity than the interior oils, such as those in Navarro and Wichita counties. It is likely that the country south, southwest, and west of Wichita County will be found to be oil bearing in localized anticlines. Texas produced 15,009,478 barrels of petroleum in 1913, and in 1914 the total production was 20,068,184 barrels valued at \$14,942,848.

Polycrase. Llano County, at Baringer Hill, in pegmatite.

Pyrite. In a great many localities, but so far as known not in commercial quantities. It is widely distributed in Cretaceous limestones and in clays associated with beds of lignite. An interesting occurrence of this mineral is with cinnabar, in the Terlingua district, Brewster County, where some of it carries a little gold. In the Cretaceous bituminous shales of that district pyrite sometimes forms the greater part of the ore-carrying quicksilver, and this is particularly the case with the cinnabar in Maverick Mountain, where the veins are in trachyte and andesite. Llano County, prospected at the eastern base of Riley Mountain; also disseminated in pre-Cambrian schists and quartz in Llano and Burnet counties.

Pyrolusite. Dickens County, some high-grade material has been found, but the locality has not been developed. Mason County, Spiller mine, 15 miles northeast of Mason, not developed.

Quartz. Abundant all over the State. Fayette County, in fine but small crystals. Llano County, at Baringer Hill, a fairly well developed crystal weighing 700 pounds was found. Rose quartz has been used for ornament. *See also* Agate.

Quicksilver. Brewster County, Terlingua district, in Cretaceous limestones and shales, as cinnabar, terlinguaite, montroydite, eglestonite, kleinite, and native quicksilver. A single cavity in limestone yielded 150 pounds of native quicksilver; has also been observed as a sort of quicksilver sponge in hard limestone. With the exception of terlinguaite, none of the rare quicksilver minerals has been found outside of the limestone area. The bituminous shales have not been found to carry any of these minerals except terlinguaite, nor has any native quicksilver been found in them. The quicksilver localities are from 90 to 130 miles from rail, the Southern Pacific Railroad at Marathon, Alpine, and Marfa being the nearest. The Terlingua district has yielded about 47,000 flasks of quicksilver, valued at about \$2,000,000, and active operations are still carried on. In Presidio County, immediately west of Brewster County, quicksilver ores have also been found, and some prospecting was carried

on for a while; but all of the production of this metal in Texas is to be credited to Brewster County. *See also* Eglestonite, Kleinite, Montroydite, and Terlinguaites.

Radium. *See* Fergusonite, Mackintoshite, Nivenite, Polycrase, Thorogummite, and Yttrialite.

Road metal. Generally throughout the granite area, in the counties of Blanco, Burnet, Gillespie, Llano, and Mason, there are extensive deposits of granite gravel which makes a good road material. Much of the limestone also, which is abundant in nearly every county in the State, is believed to be suitable for road metal.

Rowlandite. Llano County, occurs sparingly at Baringer Hill with nivenite, fergusonite, yttrialite, and gadolinite.

Salt. Produced from brines in Anderson, Mitchell, and Van Zandt counties. Heavy beds of salt occur at Spur, Dickens County; near Amarillo, Potter County, and elsewhere, as revealed by deep borings. There are old lake beds in Crane, El Paso, and other counties which afford a certain amount of crude salt used for stock. A bed of coarse rock salt at the old Brooks Saline, southwestern part of Smith County, has been used as a source of brine for many years; no operations there now. At this locality a water has been found which contained 1,275 grains of potassium chloride per gallon—a much larger proportion than has been found in any deep well water in the United States. Some of the oil wells in the Coastal Plain have shown the presence of salt deposits, but no salt is obtained in Texas from such localities. During the Civil War and previous thereto a good deal of salt was made at the old Brooks Saline, previously referred to, as also at the Steen Saline, 14 miles north of Tyler, Smith County. From the records of those days it has been ascertained that the Brooks Saline water yielded a bushel of salt from 300 gallons, and that the yield from the Steen water was a bushel of salt from 190 gallons of water.

Sand (glass). Grayson County, dug at Denison.

Sand (molding). Dug in Liberty County, at Liberty; Tarrant County, at Fort Worth.

Sand and gravel. The producing counties are Bastrop, Bexar, Bowie, Coleman, Colorado, Dallas, Ellis, El Paso, Erath, Fayette, Galveston, Grayson, Gregg, Harris, Jefferson, McLennan, Milam, Navarro, Tarrant, Travis, Waller, Webb, and Wilson. Coleman County, at Santa Anna there is a large deposit of pure sand under Cretaceous limestone. Walker County, 8 miles northwest of Huntsville, fine deposit of white quartz sand from disintegration of a ledge of coarse sandstone; the greater part of this deposit is composed of transparent and translucent particles of quartz, the grains ranging in size from $\frac{1}{8}$ to $\frac{1}{4}$ inch. By far the greater part of the sand produced is used in making concrete and mortar, and a large part of the gravel produced is used for road metal and railroad ballast.

Sandstone. The producing counties are Bexar, Burleson, Burnet, Eastland, Fayette, Grimes, Jasper, Lampasas, Lavaca, Mills, Montague, Palo Pinto, Polk, Tom Green, Tyler, and Ward. Lampasas County, one of the best undeveloped properties is a gray stone at Chadwicks Mill. Ward County, red sandstone near Barstow has been used extensively for building.

Serpentine. Gillespie County, in the northeastern part there is an excellent serpentine, affording many varieties of color and texture; polished slabs, spheres, columns, lamp stands, have been prepared from this material, but it is not on the market.

- Silver.** Brewster County, argentiferous galena has been mined near Altuda. A piece of silver ore from the Chisos Mountains carried 1,100 ounces of silver per ton, but the locality from which it came has not been revealed by the finder. El Paso County, silver-bearing copper ores have been mined in the Sierra Diablo, and a maximum content of 2,000 ounces of silver per ton has been recorded (old Hazel mine); also in galena, associated with ores of copper and zinc in the Quitman Mountains. Presidio County, The Presidio Mining Co. has been mining and milling silver ore for nearly 30 years; the ore carries silver chloride, and with it is associated a galena which carries silver and a little gold. A little native silver has been found at Shafter in thin sheets accompanying silver chloride. In a galena from the San Antonio Canyon, south of the Chinati Mountains, and from the vicinity of Candelaria.
- Smithsonite.** Brewster County, Boquillas district (reported). El Paso County, near Eagle Flat, shipments have been made. Presidio County, in considerable quantities about 2 miles west of Shafter.
- Sphalerite.** Burnet County, occurs sparingly with fluorite. El Paso County, east side of the Quitman Mountains with galena and chalcopryite in old Bonanza mine, has been mined and concentrated. Montague County, small but excellent pieces have been found near St. Jo, in calcite.
- Strontianite.** Travis County, on Mount Bonnell, Colorado River, near Austin.
- Strontium.** See Celestite and Strontianite.
- Sulphur.** From many of the deep borings in the Coastal Plain. Brazoria County, in 1914 was being obtained from deep wells at Bryan Heights, near Freeport, at and near the mouth of Brazos River. A large quantity is now being shipped. The sulphur occurs in pockets and cavities and as streaks impregnating gypsum, or a bed in which gypsum predominates, approximately 1,000 feet below the surface. The area underlain by the sulphur-bearing portion of the bed is large, and the deposits seem likely to become one of the world's largest producers. Culherson County, in the eastern and central parts (cut off from El Paso County) there are extensive deposits of native sulphur in gypsum and decomposed limestone; two carloads of this sulphur have been melted out of the containing rock by means of superheated water, and the quality is excellent. This area has been prospected by means of open cuts, pits, boreholes, and sulphur has been found to a depth of 40 feet; 30 feet of this material carries 25 per cent of sulphur. Pecos County, deep wells 15 miles north-east of Fort Stockton. Smith County, a sand containing 10 per cent of native sulphur was found at a depth of about 200 feet at the old Brooks Saline in the southwestern part of the county.
- Talc.** Llano County, an impure variety of talc (soapstone) occurs east of Valley Springs; it has been used locally but has not been marketed to any extent.
- Tengerite.** Llano County, occurs at Baringer Hill, with nivenite, yttrialite, fergusonite, and gadolinite.
- Terlinguaite.** Brewster County, with montroydite, eglestonite, and kleinite in the Terlingua quicksilver district. It is the only one of the rare mercury minerals found outside of the limestones.
- Thorium.** See Mackintoshite, Nivenite, Thorogummite, and Yttrialite.
- Thorogummite.** Llano County, occurs at Baringer Hill.
- Tin.** See Cassiterite.
- Titanium.** See Ilmenite.

Topaz. Mason County, has been prospected near Streeter, Grit, and Katemcy. Much colorless and some bluish-green topaz has been found; some fine crystals have been cut and polished. A little cassiterite has been found associated with some of the topaz.

Tungsten. *See* Wolframite.

Turquoise. Culberson County, has been mined on a small scale 6 miles west of Van Horn.

Wolframite. Culberson County, near Figure 2 ranch, 32 miles north of Van Horn; prospect samples of the material have carried as much as 17 per cent of tungstic oxide. El Paso County, occurs with cassiterite 12 to 15 miles north of El Paso.

Yttrialite. Llano County, at Baringer Hill, with nivenite, fergusonite, and gadolinite.

Yttrium. *See* Allanite, Cyrtolite, Gadolinite, Polycrase, Rowlandite, Tengerite, and Yttrialite.

Zinc. *See* Smithsonite and Sphalerite.

UTAH.

Agate. Grand County, near Agate switch. *See also* Chalcedony.

Alum minerals. Kane County, Alum Hills. Piute County, Deer Creek. Utah County, near O'Driscoll's ranch, Provo River.

Alunite. Several veins southwest of Marysville. Low-grade deposits at Sheep Rocks, northeast of Beaver. Found in small quantities as gangue mineral in Tintic and several other mining districts.

Andradite. Juab County, Tintic district. Salt Lake County, Cottonwood, American Fork region.

Anglesite. Beaver County, Frisco, Horn Silver, and Talisman mines. Box Elder County, Sierra Madre and Newfoundland districts. Cache County, Blacksmith Fork and La Plata. Emery County, Summerville district. Juab County, occurs in mines of the Tintic district. Millard County, Leamington. Morgan County, Carbonate Hill mine near Peterson. Piute County, Mount Baldy. Salt Lake County, Big and Little Cottonwood canyons. Summit County, abundant in Park City mines.

Anhydrite. Beaver County, Cactus mine. Juab County, Nephi.

Antimony. *See* Bindheimite, Cervantite, Jamesonite, and Stibnite.

Argentite (silver glance). Beaver County, Frisco and Horn Silver mines. Iron County, State Line mine. Juab and Utah counties, some of the mines of the Tintic district. Piute County, Pluto Mine, Mount Baldy, occurs in small quantities in Annie Laurie vein and in other gold-silver veins in the Tushar Range. Salt Lake County, Bingham. Summit County, Washington County, Silver Reef.

Arsenic. *See* Arsenobismite, Arsenopyrite, Orpiment, Realgar, and Scorodite.

Arsenobismite. Juab County, Tintic district, in the silver-copper-gold ores of the Mammoth mine associated with barite; forms yellow cryptocrystalline aggregates.

Arsenopyrite. Juab County, Scotia mine, in West Tintic district.

Asphalt. Box Elder County, occurs in Rozel Hills, a few miles west of Promontory. Uinta County, asphalt-saturated sandstone is exposed in Asphalt Ridge, a few miles west and south of Vernal; prospected and some mined for use in paving the streets in Vernal. *See also* Gilsonite, Nigrite, Ozokerite, Uintaite, and Wurtzilite.

Aurichalcite. Beaver County, Bradshaw district, Cave mine, Star district. Juab County, Tintic district, May Day, Uncle Sam, Yankee, Ridge, and Valley mines. Salt Lake County, Carbonate and Keeler mines, Kesler Peak. Tooele County, Dry Canyon, Hidden Treasure, Ophir. Washington County, Dry Canyon.

Autunite. Kane County, 9 miles south of Pahreah. Washington County, Silver Reef, in sandstone formerly worked for silver.

Azurite (blue carbonate of copper). Occurs in Beaver County. Cache County, La Plata. Davis County, in prospects east of Farmington and Wandering Jew mine. Emery County, Castle Valley and Summerville district, in sandstone. Grand and Garfield counties. Juab County, in mines of Tintic district. Morgan County, Copper Mountain mine. Salt Lake County, Little Cottonwood. Sevier County, Ball mine, Sevier Canyon, in sandstone. Summit County, in Park City mines. Tooele County, Clifton district, Dry Canyon, Dutch Mountain, and Gold Hill. Uintah County, Dyer mine. Utah County, American Fork. Washington County, Dixie and Silver Reef. Weber County, New Azurite and Ogden Boiler Maker mines.

Azurmalachite. Juab County, Tintic district. Washington County, Dixie.

- Barite** (heavy spar). Occurs in Juab County, common as gangue mineral of Tintic district. Piute County, Deer Creek, American Fork Canyon. Salt Lake County, Bingham and Alta. Tooele County, Dugway district, with galena.
- Basalt**. Abundant in central and southern parts of State; little used.
- Beaverite**. Beaver County, Horn Silver mine, near Frisco, in oxidized ores. Salt Lake County, at Little Cottonwood district, Alta mine. Tooele County, Hidden Treasure mine in Dry Canyon.
- Bentonite**. Garfield County, head of Crescent Creek, Henry Mountains.
- Beryl**. Tooele County, about 35 miles southwest of Simpson Springs, Ibapah Mountain.
- Bindheimite**. Beaver County, Horn Silver mine. Summit County, Park City mines, oxidized zone. Juab County, West Tintic district, Scotia mine.
- Binnite**. Salt Lake County, Tiewaukee mine, Bingham, formerly mined.
- Bismite**. Beaver County. Juab County, Tintic district, in ores of the Mammoth, Boss Tweed, Eagle, Blue Bell, and other mines as earthy yellow crusts.
- Bismuth** (native). Juab County, Emerald mine, Boss Tweed mine, Tintic district, is reddish silvery white; Clifton district, Deep Creek. *See also* Arsenobismite, Bismite, Bismutite, Cosalite, Mixite, and Tetradyomite.
- Bismuth arsenate**. *See* Arsenobismite and Mixite.
- Bismutite**. Beaver County, occurs sparingly as bismuthinite at Beaver. Box Elder County, near Lucin. Juab County, occurs in Tintic district with silver-lead ores as yellow earthy bodies in Boss Tweed and Carissa mines, and as yellow crusts on rich hornsilver and argentite ores in the Victoria, Eagle, and Blue Bell mines. Salt Lake County, recovered from smelter bullion, Bingham Junction. Tooele County, has been found as bismuthinite and carbonate in Clifton district in Deep Creek Mountains.
- Bituminous rock**. *See* Asphalt.
- Bornite**. Beaver County, O. K. mine. Box Elder County, Henry Mountains, near Promontory Point. Davis County, east of Farmington. Salt Lake County, secondary ore mined in Bingham district; Sierra Madre district. Tooele County, Gold Hill.
- Brochantite**. Beaver County, Horn Silver mine, Frisco. Juab County, Tintic district. Summit County, Park City. Tooele County, Dry Canyon.
- Brown iron ore** (limonite). Beaver County, important ore mineral in Cave mine, Mineral Range. Box Elder County, large body at Copper Mountain mine, Lucin district. Iron County, occurs near Modena, containing silver, lead, and gold. Extensive deposits in Iron, Juab, Morgan, and Uinta counties; used as flux in lead smelting. Piute County, iron mines in Antelope Range.
- Calamine**. Beaver County, Star district, in Cedar-Talisman mine, Frisco district, Horn Silver mine. Juab County, Tintic district, Boss Tweed and several other mines. Salt Lake County, Emma mine in Little Cottonwood district. Tooele County, Scranton and New Bullion mines in North Tintic district.
- Calciovolborthite**. Grand County, mined with carnotite at Richardson.
- Caliche**. Common under gravelly plains in southern deserts.
- Carnotite**. Emery County, is mined on the east flank of San Rafael Swell, 13 miles west of Greenriver, in Upper Jurassic (?) sandstone; occurs in Temple Rock and along South Temple Wash, with uranite, metahe-wettite, and other uranium and vanadium minerals, and with asphaltite on

the southeast side of the swell and along San Rafael River. Garfield County, on the east and southwest flanks of the Henry Mountains, particularly on Crescent and Trachyte creeks. Grand County, is mixed near Richardson in sandstone with calciovolborthite and copper minerals, and 15 to 20 miles southeast of Thompsons with tyuyamunite, calcium vanadate; occurs in numerous places in the La Sal Mountains, particularly on Pack Creek, where it is mined. San Juan County, many deposits in Dry, Big Indian, and Lisburne valleys north of Monticello. Washington County, near Washington, Silver Reef. Wayne County, north end of the Henry Mountains, of mineralogic importance only.

Celestite. Emery County, 50 miles southwest of Green River.

Cement material. Box Elder County, plant at Bakers Spur using marl and clay. Morgan County, plant at Devils Slide using limestone and shale. Limestone from quarry in Parleys Canyon used for Portland cement at Salt Lake City.

Cerargyrite (horn silver). In the ore of different mines, especially those in Beaver, Juab, Salt Lake, and Summit counties. Beaver County, Horn Silver, and other mines in the Frisco and Star districts. Iron County, Gold Springs, State Line, in oxidized ores. Juab County, abundant in mines of the Tintic district. Piute County, Tushar Range in gold-silver veins. Tooele County, in mines of the Ophir district, Lion Hill area. Washington County, abundant in Silver Reef district; Silver Reef in sandstone, formerly worked for silver.

Cerium. See Monazite.

Cerussite (lead carbonate). Beaver County, Frisco and Star districts, Mineral Range, in Cave and other mines. Box Elder County, Sierra Madre and Newfoundland districts. Cache County, Blacksmith Fork and La Plata. Emery County, Summerville. Juab County, Tintic district, abundant, some in large masses. Millard County, near Leamington. Morgan County, Carbonate Hill mine near Peterson. Piute County, Ohio district and Mount Baldy. Salt Lake County, Little Cottonwood district and West Mountain district in lead mines at Bingham. Summit County, Park City, abundant. Uinta County, Silver King mine. Wasatch County, Blue Ledge, Snake Creek, and Elkhorn districts.

Cervantite. Salt Lake County, Emma mine, Little Cottonwood Canyon.

Chalcedony. Weathers out of part of the Mancos and perhaps other shales so that in places the ground is nearly covered with nodules, most of which are spongy and worthless. It is of many colors, and attractive pieces of agate and jasper are cut for ornaments. Emery County, San Rafael River, some used for gems. Grand County, near Agate switch. Juab County, Thomas Mountains, Deep Creek region.

Chalcocite (copper glance). Piute County, Ohio district. Salt Lake County, secondary ore at Bingham. San Juan County, Big Indian mine, sandstone ores. Uinta County, Dyer mine, Uinta Range, and in sandstone at Ouray.

Chalcopyrite (copper pyrites). Beaver County, principal ore in Cactus mine, in O. K. mine, Beaver Lake district. Box Elder County, Newfoundland district. Garfield County, Henry Mountains. Juab County, primary ore mineral of Tintic district, gold bearing. Piute County, Ohio district. Salt Lake County, with pyrite at Bingham, mined for copper, gold, and silver. San Juan County, near San Juan River below Bluff. Summit County, Park City. Tooele County, Clifton district, Dry Canyon and Ophir. Utah County, American Fork Canyon.

- Chalcotrichite.** Cache County, east of Logan. Tooele County, Dry Canyon.
- Chrysocolla** (copper silicate). Beaver County, Horn Silver mine. Box Elder County, Copper Mountain mine, Lucin district. Juab County, found in abundance in Tintic district.
- Cinnabar.** Tooele County, occurs in ores of Mercur district; was formerly mined.
- Clay** (brick). Dug in Box Elder County, north of Brigham. Cache County, Logan and Smithfield. Davis County, Bountiful, Kaysville, and Woods Cross. Emery County, Ferron. Iron County, Cedar City. Salt Lake County, Murray, Salt Lake, and West Jordan. San Juan County, Monticello. Sanpete County, 3 miles south of Manti. Sevier County, Richfield. Summit County, Coalville. Uinta County, Vernal. Utah County, Lehi Junction, Pleasant Grove, and elsewhere. Weber County, Harrisville and Roy.
- Clay** (fire). Dug in Salt Lake County near Salt Lake and Fort Douglas; Utah County, Lehi Junction, Pleasant Grove, Cedar Fort, Clay Canyon, and Fairfield station. Weber County, in small quantity at North Ogden.
- Clay** (kaolin). Utah County, Cedar Valley and Lake Range; plastic in Juab County, Silver City.
- Clay** (sewer pipe). Salt Lake County, Murray. Summit County, Owen Canyon.
- Coal** (bituminous and subbituminous). *Blacktail Mountain field.*—Wasatch County, occurs near Blacktail (Tabby) Mountain, in Mesaverde and Mancos formations; thoroughly prospected; very little mining done.
- Book Cliffs field.*—Includes portions of Carbon, Emery, Grand, and Sevier counties; Mesaverde formation; mined at Sunnyside, coked; Scofield, Castlegate, and Winterquarters, Carbon County.
- Colob-Harmony field.*—Garfield, Iron, Kane, and Washington counties; from Cedar City, Iron County, to Mount Carmel, Kane County, bituminous; mined near Kanarraville, Cedar City, Coal Creek Canyon; locally called black lignite; coal in Upper Cretaceous deposits.
- Emery coal field.*—Emery County, occurs in Mancos shale south and east of Emery in Coal Cliffs; prospected and some mined for local use.
- Henry Mountain coal field.*—Garfield and Wayne counties, occurs west and northwest of Mount Ellen, Henry Mountains; prospected.
- Sanpete County.*—Wales mine, Wasatch bed (Eocene); Sterling coal (Upper Cretaceous) mined at Momson mine east of Sterling; bituminous.
- Vernal field and Henrys Fork field.*—Uinta County, bituminous coal mined in the Upper Cretaceous (Mancos shale) near Vernal.
- Weber River or Coalville field.*—Summit County, coal in Upper Cretaceous rocks of Benton age; mined at Wasatch and Dexter mines, Coalville; subbituminous.
- Coke** (native). Carbon County, Winterquarters mine.
- Conichalcite.** Juab County, characteristic of the Tintic district, very common, in bright yellowish-green mammillary crusts and small spheres.
- Copper.** See Azurite, Azurmalachite, Beaverite, Binnite, Bornite, Brochantite, Chalcantite, Chalcocite, Chalcopyrite, Chalcotrichite, Chrysocolla, Conichalcite, Covellite, Cuprite, Enargite, Lettsomite, Malachite, Tenorite, and Tetrahedrite.
- Copper** (native). Juab County, common in Carissa and other mines, in Tintic district. Tooele County, Dry Canyon. Washington County, Dixie mines, Bingham Canyon.
- Corkite.** Beaver County, Harrington, Hickory, and Wild Bill mines.
- Cosalite.** Beaver County, Frisco district.

Covellite. Beaver County, Horn Silver and O. K. mines. Juab County, Tintic district, common. Salt Lake County, Bingham district, Highland Boy mine.

Cuprite (copper oxide). Beaver County, Imperial mine, Frisco district. Box Elder County, Copper Mountain mine, Lucin district. Juab County, occurs in mines of Tintic district. Kane County, Pahreah Mining Co. mine. Salt Lake County, Bingham district, Highland Boy mine. Uinta County, Dyer mine. Washington County, Dixie mines.

Diatomaceous earth. Beaver County, was formerly mined at Milford.

Dufrenoyite. Salt Lake County, Winnamuck mine, Bingham district, and Little Cottonwood Canyon.

Elaterite. *See* Wurtzillite.

Enargite. Juab County, Tintic district, abundant, principal primary copper mineral in large quantities in the Centennial, Eureka, Mammoth, Ajax, Golden Chain, Opohongo, Carissa, and other mines. Salt Lake County, Highland Boy, Commercial, and other mines in Bingham district; Oxford and Geneva mines in Little Cottonwood Canyon district.

Epsomite. Emery County. Sanpete County, near Manti, considerable deposit.

Feldspar. Millard County, Rock Corral, east of Milford. Salt Lake County, porphyritic crystals in granite of Little Cottonwood Canyon.

Galena. Important ore of many mines in Beaver, Juab, Salt Lake, Summit, Tooele, and Utah counties; mined at Tintic, Bingham, Park City, and elsewhere. Beaver County, in Horn Silver mine, Imperial mine, Frisco and Star districts. Box Elder County, Copper Mountain mine, Lucin district, Sierra Madre and Newfoundland districts, Vipont mine. Cache County, Blacksmith Fork, La Plata, and east of Richmond. Davis County, Wandering Jew mine. Emery County, Summerville district and Temple Rock. Juab County, Fish Springs district, important argentiferous ore mineral; Detroit district. Millard County, near Leamington. Morgan County, Carbonate Hill mine near Peterson. Piute County, Ohio district. Sevier County, Ball mine, Salina Canyon, in sandstone. Wasatch County, Blue Ledge and Snake Creek. Weber County, Standard Mining Co., New Azurite, Consolidated Group, Louise Con, and Ogden Boiler Maker mine. Iron and Washington counties.

Garnet. Beaver County, near Copper Gulch, Star and Frisco districts. Iron County, near Gold Springs, in rhyolite. Juab County, Thomas Mountains, in rhyolite; near Carissa mine, Tintic district, in limestone. Piute County, Deer Creek. Salt Lake County, Big and Little Cottonwood districts in metamorphic limestone. San Juan County, gem pyrope ("Arizona ruby") is produced in the Navajo Reservation, in the Moses Rock and Mule's Ear fields, about 6 miles north of the Arizona and 35 miles west of the Colorado State lines. Summit County, some Park City mines. Tooele County, Lucy mine, Clifton district. Utah County, American Fork Canyon. Wasatch County, Bonanza Flat. Washington County, Lucero claim, Orizaba Mining Co. Weber County, Strongs Canyon. *See also* Andradite.

Gas. *See* Natural gas.

Gilsonite. Uinta County, mined at Dragon and elsewhere. *See also* Uintaite.

Gold (lode). Predominant ore in Beaver County, Bradshaw and Newton districts. Box Elder County, Park Valley district. Garfield County, Henry Mountains. Piute County, Tushar Range. Tooele County, Clifton district, contact gold deposits; Gold Hill, State Line, gold-silver veins. Grand County, Miners Basin. Iron County, Gold Springs and State Line. Juab County, Spring Creek and Tintic. Piute County, Kimberley

and Ohio. San Juan County, Blue Mountains. Tooele County, Mercur. Uinta County, Carbonate. Wasatch County, North Fork and Snake Creek.

Gold (placer). Emery County, La Sal Mountains, on Colorado and Green rivers. Garfield County, Henry Mountains; small production from black sands in White Canyon district, and in Kane and San Juan counties. Grand County, at Wilson Mesa. Iron County, at Sand Springs. Salt Lake County, in Bingham Canyon. San Juan County, Bluff. Uinta County, Green River.

Granite. Small quantities quarried in Box Elder County, at Willard. Salt Lake County, Claytons Peak, Little Cottonwood Canyon, Draper. Utah County, Alpine City and Provo City. Wasatch County, Midway. Weber County, Ogden.

Gypsum. Rock gypsum occurs abundantly in the following counties: Emery County, enormous deposits along west margin of San Rafael Swell. Garfield County, north-central part near Water Pocket Canyon. Grand County, between Grand River and La Sal Mountains. Iron County, enormous deposits southeast of Kanarraville. Juab County, large deposits quarried near Nephi and formerly near Levan. Kane County, occurs near Kanab. San Juan County, Monticello. Sanpete County, from Mayfield southwest to county line. Sevier County, from Sigurd northeast to county line; quarried near Sigurd. Washington County, in northeastern part, very thick bed. Wayne County, near Caineville and Notom. Crystalline gypsum and gypsum sand in Millard County, vast deposit at White Mountain, near Fillmore. Wayne County, huge crystals in South Wash.

Hematite (red iron ore). Iron and Washington counties, immense quantities in Iron Mountain district, has been mined at Iron City. Summit County, near North Fork of Provo River. Wasatch County, large deposits at the head of Duchesne River, in the Uinta Range, mined for flux.

Hematite (specular). Box Elder County, bed in pre-Cambrian strata on Sierra Madre Mountain, at head of Eldorado Canyon.

Hübnerite. Tooele County, with scheelite in mines of Clifton district, Deep Creek, associated with copper, gold, silver, lead, and bismuth ores.

Hyalite. Beaver County, large deposit, banded in different colors, some used. Juab County, Thomas Mountains. Piute County.

Hydrozincite. Juab County, Tintic district. Tooele County, Dry Canyon.

Infusorial earth. See Diatomaceous earth.

Iron. See Brown iron ore, Hematite, Magnetite, Pisanite, and Pyrite.

Jamesonite. Beaver County, Frisco, Park City mines. Juab County, Scotia mine in West Tintic district. Utah County, Live Yankee mine of American Fork district.

Jarosite. Is common in many of the mines of the State, and in some it is abundant. Juab County, Tintic district in American Eagle, Chief, Colorado, Iron Blossom, and other mines.

Jasper. See Chalcedony.

Kaolinite. Beaver County, Frisco. Juab County, Granite Mountain. Salt Lake County, near Draper.

Lead. See Anglesite, Cerussite, Corkite, Cosalite, Dufrenoy'site, Galena, Jamesonite, Leadhillite, Linarite, Mimetite, Minium, Plumbojarosite, Pyromorphite, and Wulfenite.

Leadhillite. Juab County, Tintic district, rare.

- Lettsomite.** Juab County, Ajax and Carissa mines, Tintic district, as capillary crystals in druses.
- Limestone (building).** Quarried in Beaver County, at Beaver and Greenville. Box Elder County, Deweyville. Carbon County, on Tie Forks of Soldier Creek, 7 miles northwest of Clearcreek. San Juan County, Grayson. Sanpete County, Ephraim.
- Limestone (crushed stone).** Quarried in Morgan County, at Devils Slide. Salt Lake County, Salt Lake City. Weber County, Ogden.
- Limestone (flux).** Juab County, Mammoth. Salt Lake County, at Salt Lake City. Tooele County, Doremus, Rush Valley, and Topliff. Weber County, Hot Springs.
- Limestone (lime).** Burned in Beaver County, at Beaver. Iron County, Cedar City. Salt Lake County, Salt Lake City. Sevier County, Richfield. Utah County, near Provo. Weber County, Ogden.
- Limestone (used in manufacture of sugar).** Box Elder County, Deweyville. Utah County, Lehi, Provo, and Santaquin.
- Limonite.** *See* Brown iron ore.
- Linarite.** Beaver County, Horn Silver mine, in oxidized ores.
- Magnetite.** Iron and Washington counties, large deposits with hematite in Iron Mountain district. Beaver County, Mineral Range; Old Hickory, Skylark mine, and other contact deposits. Emery, Garfield, Kane, and San Juan counties in placer sands of Colorado and Green rivers. Salt Lake County, Little Cottonwood district, abundant as a contact mineral. Tooele County, Clifton district, in tourmaline veins.
- Malachite** (green carbonate of copper). Occurs in Beaver County, Cactus mine. Box Elder County, Sierra Madre, Newfoundland, Silver Island, Promontory Point. Cache County, Blacksmith Fork and La Plata. Davis County, east of Farmington and at Wandering Jew mine. Emery County, Castle Valley and Summerville district. Juab County, Detroit district, in many Tintic mines. Kane County, Pahreah Mining Co. Morgan County, Copper Mountain mine. Piute County, Ohio district. Salt Lake County, Big and Little Cottonwood districts and Bingham. San Juan County, below Bluff, San Juan River. Sevier County, Ball mine, Salina Canyon. Summit County, Park City mines. Tooele County, Clifton, Gold Hill, Dry Canyon, Dutch Mountain, Ophir. Uinta County, Uinta Range, Dyer mine. Utah County, American Fork Canyon. Washington County, Dixie, Paymaster, and Silver Reef mines, Tutsagebut district. Weber County, Standard Mining Co., New Azurite, and Ogden Boiler Maker mines.
- Manganese ore.** Grand County, south of Denver & Rio Grande Railroad, collected on surface and shipped, also in ledges. Juab County, Tintic district, chiefly manganiferous silver ores, also near Joy. Summit County, Beaver Creek, 8 miles from Kamas. Weber County, 10 miles east of Huntsville. *See also* Pyrolusite, Rhodochrosite, and Rhodonite.
- Marble.** Beaver County, quarried near Newhouse. Occurs also in Juab, Salt Lake, Sanpete, Summit, Tooele, Utah, and several other counties.
- Marl.** Box Elder County, at Bakers Spur; used for making Portland cement.
- Mercury.** *See* Quicksilver.
- Metahewettite.** Emery County, occurs sparingly with uraninite and carnotite and has been mined with them at Temple Rock and along South Temple Wash, 45 miles southwest of town of Greenriver. Grand County, mined with carnotite on claims 15 to 20 miles southeast of Thompsons and on Pack Creek, in La Sal Mountains. Garfield County, occurs with

carnotite on Trachyte Creek, on the east side of the Henry Mountains. San Juan County, with carnotite in East (Pintado) Canyon and South Fork of Big Indian Creek.

Mimetite. Iron County, Holt mine, near Modena. Juab County, Tintic district. Tooele County, near Gold Hill.

Minium. Juab County, Godiva mine, Tintic district.

Mirabilite. Shores of Great Salt Lake in winter.

Mixite. Juab County, Tintic district, Ajax, Boss Tweed, Carissa, Mammoth, and other mines, forming bunches of bluish-green needles.

Molybdenum. See Molybdenite and Wulfenite.

Molybdenite. Box Elder County, Sierra Madre district. Juab County, West Tintic district. Millard County, near Saw Tooth, 45 miles southwest of Desert. Salt Lake County, occurs in canyon on south side of Little Cottonwood Canyon and elsewhere. Tooele County, Midas mine, with gold ores in Ibapah Mountains. Utah County, American Fork Canyon.

Monazite. Uinta County, in black sands in Green River, Jensen district.

Natural gas. Salt Lake County, small quantity found in valley of Jordan River and in vicinity of Salt Lake City has been exploited.

Nigrite. Utah County, occurs at Soldier Summit and vicinity. Small quantity has been mined.

Niter (saltpeter). Iron County, several small beds near Parowan. Millard County, occurs near Fillmore.

Obsidian. Occurs in regions of Tertiary volcanic rocks. Millard County, Twin Peaks, small quantity cut for gems.

Oil. See Petroleum.

Oil shale. See Shale.

Olivenite. Juab County, at mines of Tintic district. Tooele County, Gold Hill mines, and Deep Creek region.

Onofrite. Piute County, at Lucky Boy mine, 6 miles southwest of Marysville, formerly mined.

Onyx marble. Tooele County, very large deposit, 4 miles south of Low station on Western Pacific Railway and 60 miles west of Salt Lake City; quarried for the new State capitol in Salt Lake City. Utah County, has been quarried at Pelican Point in Carboniferous limestone and used in the interior of the City and County Building, Salt Lake City. Sevier County, prospects reported from Redmond. Washington County, Bull Valley.

Opal. Beaver County, occurs near Milford. Sevier County, near Fish Lake. Salt Lake County, Old Jordan mine, Bingham. See also Hyalite.

Orpiment (yellow sulphide of arsenic). Garfield County, occurs in irregular seams in shale in Coyote Creek valley, Hampton antimony mine. Salt Lake County, small quantity in one silver mine in Bingham Canyon, Butterfield Canyon. Sevier County, in clay. Tooele County, in good crystals in Mercur district.

Ozokerite (mineral wax). Utah County, occurs at Soldier Summit and near Colton; mined and milled.

Pearceite. Juab County, in ores of Tintic district.

Petroleum. Found in small quantities in Grand County near Green River. Millard County, near Fillmore. San Juan County, San Juan field. Uinta County, Vernal field.

Phosphate rock. Morgan County, occurs in Carboniferous limestone in upper canyon, Weber River, between Morgan and Devils Slide station; little

- prospecting. Rich County, in Crawford Mountains near Randolph, mined and shipped; also at other points. Salt Lake County, in foothills east of Salt Lake City. Weber County, in limestone in Shepherd Valley, 6 miles southeast of Huntsville, east of Beaver Creek, and in Ogden Canyon.
- Pisanite.** Salt Lake County, Old Jordan mine, Bingham.
- Pitchblende.** *See* Uraninite.
- Platinum.** Garfield County, occurs sparingly in black sands of terrace placers along Colorado River below Hite. Salt Lake County, in blister copper from Bingham.
- Plumbojarosite.** Beaver County, Horn Silver, Hub, Moscow, Red Warrior, Star district, Harrington-Hickory mines and prospects. Juab County, Fish Springs district, Tintic district. Tooele County, Clifton district, Gold Hill mine, and south end of Clifton Mountain. Washington County, Dixie and Paymaster mines, Tutsagebut district.
- Porphyry.** Beaver County, Beaver; used for building stone.
- Potash.** Piute County, potash salts have been produced on commercial scale at Marysvale from alunite since October, 1915. Tooele County, brines and muds underlying the salt body which covers Salduro Marsh at a depth of 8 to 12 feet contain 2 to 3½ per cent of potash. *See also* Alunite and Niter.
- Proustite.** Beaver County, Frisco, Horn Silver mine.
- Pumice.** Millard County, some used.
- Pyrargyrite.** Beaver County, Frisco, Horn Silver mine. Box Elder County, Vipont mine. Salt Lake County, Winnamuck mine, Bingham.
- Pyrite.** Beaver County, principal ore of Cactus mine, Frisco district. Box Elder County, Century mine, Promontory Point, Salt Lake, Vipont mine. Garfield County, Henry Mountains. Iron County, State Line. Juab County, original mineral of Tintic and West Tintic districts. Salt Lake County, massive and in grains disseminated through monzonite in Bingham district, in ore bodies mined for gold and silver in Cottonwood district. Summit County, Park City mines. Tooele County, Gold Hill mines, Dry Canyon, Ophir, and Stockton. Utah County, American Fork Canyon.
- Pyrolusite.** Juab County, Tintic district, common especially in the copper mines. Grand County, Little Grand district, manganese ore in sandstone. Millard County, Detroit district. Piute County, near Belknap. Salt Lake County, Emma mine, Little Cottonwood, Big Cottonwood.
- Pyromorphite.** Juab County, Scranton mine, near Delmonte. Wasatch County, Blue Ledge and Snake Creek.
- Pyrope.** San Juan County, Navajo Reservation. *See* Garnet.
- Quicksilver.** Piute County, mercury ores, onofrite, and tiemannite have been mined 6 miles southwest of Marysvale. *See also* Cinnabar, Onofrite, and Tiemannite.
- Radium.** *See* Autunite, Carnotite, Torbernite, Tyuyamunite, Uraninite, Uranospinite, and Zeunerite.
- Realgar.** Garfield County, occurs in irregular seams in shale in Coyote Creek valley. Salt Lake County, Butterfield Canyon, in some mines of the Bingham district. Tooele County, in Mercur district, in gold ores. Washington County, Beaver Dam Mountains.
- Rhodochrosite.** Piute County, Dalton mine, near Marysvale. Salt Lake County, Butterfield Canyon and Bingham. Summit County, Park City.
- Rhodonite.** Summit County, Ontario mine, Park City.
- Road metal.** *See* Asphalt, Granite, Limestone (crushed stone), Sand and gravel, and Sandstone.

- Salt (brine).** Produced in Juab County, at Nephi. Millard County, Clear Lake. Salt Lake County, Saltair. Sanpete County, near Gunnison. Weber County, Ogden and Whithie Junction.
- Salt (rock).** Juab County, near Nephi. Sanpete County, near Gunnison. Sevier County, Redmond and near Salina. Tooele County, Salduro, immense bed about 60 miles long and 8 miles wide. Washington County, Virgin River.
- Sand and gravel.** Dug in Box Elder County, at Brigham and Pigeon; Salt Lake County, Salt Lake City and Sandy; Tooele County, Stockton; Utah County, Point Mountain.
- Sandstone.** Quarried in Beaver County, at Beaver. Cache County, Paradise. Grand County, Moab. Iron County, near Buck Horn, Cedar City, and Parowan (Kane Springs). Juab County, Cooper (Mount Nebo). Salt Lake County, Emigration Canyon, Salt Lake City. Sanpete County, Manti. Summit County, Park City. Uinta County, Vernal. Utah County, near Colton (3 miles east of Kyune station), Diamond Fork Canyon (Castilla), Thistle, and Thistle Junction.
- Sandstone (asphaltic).** *See* Asphalt.
- Scheelite.** Box Elder County, sec. 14, T. 9 N., R. 17 W., also 15 miles north of Lucin in contact-metamorphosed limestone in Grouse Creek Mountains. Tooele County, with hübnerite in mines of Clifton district, Deep Creek Mountains, associated with copper, gold, silver, lead, and bismuth ores.
- Scorodite.** Tooele County, occurs in Gold Hill mine, Clifton district.
- Shale.** Shale suitable for use in Portland cement is abundant in many counties, including Cache, Garfield, Grand, Kane, Salt Lake, Tooele, Wayne, and Weber.
- Shale (oil).** Green river formation (Eocene), some rich in oil. Large areas in northeastern part of the State on Green River and its tributaries in southern Uinta, northeastern Carbon, southern Duchesne, and eastern Wasatch counties. Small areas in Sanpete and Juab counties.
- Silver.** Yield principally from lead-ore mines in following districts: Beaver County, Beaver Lake, North Star, Washington, in Silver Reef district. Juab County, Fish Springs, West Tintic. Summit County, Park City. Tooele County, Ophir, Rush Valley, Willow Springs. Utah County, American Fork, Silver Lake, Santaquin. Predominant ore in several other districts. Little silver in copper ore of Cactus mine, Beaver County, and in copper at Bingham, Salt Lake County. *See also* Argentite, Cerargyrite, Pearceite, Proustite, and Pyrargyrite.
- Silver (native).** Box Elder County, Vipont mine. Juab County, Gemini mine, Tintic district. Salt Lake County, Old Jordan mine, Bingham. Washington County, Silver Reef, with other ores formerly mined for silver.
- Slate.** Utah County, occurs 2 miles southeast of Provo.
- Smithsonite.** Beaver County, Cedar-Talisman mine, Star district, Harrington and Hickory mines. Juab County, May Day, Uncle Sam, Ridge, and Valley mines, Tintic district. Tooele County, Scranton and New Bullion mines, North Tintic district; Dry Canyon in Ophir district.
- Specularite.** *See* Hematite (specular).
- Sphalerite.** Beaver County, Frisco district in Horn Silver mine and in Star district. Juab County, Swansea Con mine, near Silver City, Tintic district. Salt Lake County, Bingham and Little Cottonwood district. Sevier County, Ball mine, Salina Canyon. Summit County, mined with argentiferous lead ores in Park City district. Tooele County, Dry Canyon, Dugway district, Four Metals mine, Rush Valley (Stockton) district, abundant in some ores. Utah County, American Fork. Wasatch County, Blue Ledge and Snake Creek.

Stibnite (sulphide of antimony). Garfield County, occurs with antimony oxide at Coyote Creek; ore has been shipped. Salt Lake County, Bay State mine, in American Fork district.

Strontium. *See* Celestite.

Sulphur. Beaver County, mined at Sulphurdale. Emery County, occurs along San Rafael River in the San Rafael Swell, and on Cedar Mountain.

Tabbyite. Wasatch County, 60 miles southeast of Heber.

Tenorite. Salt Lake County, occurs as secondary ore at Bingham.

Tetradymite. Salt Lake County, American Fork Canyon, small, very pure streak.

Tetrahedrite (gray copper ore). Beaver County, South Utah Mining Co. Piute County, Ohio district. Salt Lake County, secondary ore at Bingham, plentiful with lead ores, main ore mineral in some mines of Little Cottonwood district. Summit County, principal copper ore in silver mines at Park City, abundant. Tooele County, Deep Creek region and Ophir.

Thorium. *See* Monazite.

Tiemannite. Piute County, Lucky Boy mine, near Marysville, with onofrite.

Topaz. Juab County, occurs at Topaz Mountain, 8 miles northwest of Joy. Has been cut for gems.

Torbernite. Kane County, Virgin River. San Juan County, La Sal Mountains.

Travertine (Utah onyx). Deposits in Box Elder, Millard, Tooele, and Utah counties; has been quarried and used in interior work.

Tufa. Beaver County, quarried near Beaver City.

Tungsten ores. Juab County, West Tintic district. *See also* Hübnerite, Scheelite, and Wolframite.

Tyuyamunite. Emery and Garfield counties, with carnotite. Grand County, prominently crystallized at Richardson, with carnotite and other vanadium minerals, and on Pack Creek, La Sal Mountains, with carnotite and other vanadium and chromium minerals. San Juan County, in East Canyon and Big Indian Creek, with carnotite and other vanadium minerals. Uinta County, small deposits in pre-Cambrian (?) quartzite, on Red Creek, Browns Park, with copper minerals.

Uintaite (gilsonite). Uinta County, Uinta Basin, in eastern Utah, mined at Fort Duchesne, and in Bonanza and Cowboy claims, near Utah-Colorado line, on White River; many other small veins in Uinta County.

Uraninite. Weber County, Ogden Canyon, small amount.

Uranium. Wayne County, uranium sulphate occurs in a fine-grained sandstone with copper carbonates near Fruita. *See also* Carnotite, Torbernite, and Uranospinite.

Uranospinite. Kane County, 9 miles south of Pahreah.

Uvanite. Emery County, mined on Temple Rock and South Temple Wash, 45 miles southwest of town of Greenriver.

Vanadium. Very little vanadium ore as such has been mined in Utah, but vanadium is in excess of uranium in much the larger part of the uranium ores mined. The principal vanadium-bearing mineral appears to be a micaceous substance occurring in minute scales between the grains of the carnotite-bearing sandstone. It has not yet been segregated and its composition is unknown, though it is thought to be related to roscoelite. There are also darker vanadium-bearing minerals interstitial in the sandstones, but they are even less understood. *See also* Calciovolborthite, Carnotite, Metahewettite, and Uvanite.

Variscite. Box Elder County, prospected 5 miles north of Lucin. Tooele County, amatrice variety, mined 14 miles southwest of Tooele, and

occurs 2 miles from Mercur, Mercur and Hillside mines. Utah County, utahlite and chlorutahlite, variety mined in Clay Canyon, $1\frac{1}{2}$ miles west of Fairfield. Washington County, 15 miles from St. George, considerably used.

Volcanic ash. Small production in Sevier and Tooele counties.

Whetstone. Box Elder County, Dove Creek and Park Valley.

Wiedgerite. Wasatch County, near Myton.

Willemite. Beaver County, Cedar-Talisman mine.

Wolframite. Tooele County, found as float in Simpson Mountains, near Indian Springs.

Wood (silicified). Very abundant on San Rafael Swell and Henry Mountains.

Wulfenite (molybdate of lead). Beaver County, Harrington-Hickory and Horn Silver mines; Adelia mine, Rocky district. Box Elder County, Lucin district, Empire and Tacoma mines. Piute County, Bully Boy and Webster mines. Salt Lake County, occurs in limestone with lead ores in Alta district, small quantity, Little Cottonwood district, in City Rock, Alta-Consolidated, and Woodlawn mines. Summit County, Silver King Con mine, Park City. Tooele County, Dugway and Clifton districts.

Wurtzilite (elaterite). Wasatch County, found in an area embracing about 100 square miles in region of Indian, Lake, Avintequin, and Sams canyons, little northeast of Grey Head Mountain and about 50 miles southwest of Fort Duchesne; three or four promising veins; mined and shipped from Sams and Avintequin canyons.

Wurtzite. Beaver County, Horn Silver mine, near Frisco.

Zeunerite. Juab County, Tintic district, found occasionally in the ore of the Centennial Eureka mine as minute yellowish-green crystals in barite.

Zinc. See Aurichalcite, Calamine, Hydrozincite, Smithsonite, Sphalerite, and Willemite.

VERMONT.

- Arsenopyrite** (mispickel). Brookfield, Stockbridge, Vershire, and Waterbury, with pyrite and chalcopyrite; not mined.
- Asbestos**. Mined in Lamoille County, at Eden; Orleans County, near Chrysotile and Lowell.
- Braunite**. Bennington, Brandon, Chittenden, and Plymouth, in small quantities; not mined.
- Brown iron ore** (brown hematite, limonite). Bennington County, Bennington, formerly dug to some extent. Rutland County, with manganese ores at Brandon and South Wallingford. Windsor County, Plymouth, was formerly mined in connection with ocher and kaolin.
- Cement material**. Limestone suitable for Portland cement in many counties, not used.
- Chalcopyrite** (copper pyrite). Orange County, has been mined at Corinth, in Ely mine at Copperfield, and in Elizabeth mine at South Strafford.
- Chrysotile**. *See Asbestos*.
- Clay** (brick). Pits in Caledonia County, at East Ryegate. Chittenden County, Champlain and Essex Junction. Rutland County, Rutland. Washington County, Waterbury. Windham County, Putney. Windsor County, Wilder.
- Clay** (fire). Rutland County, mined at Rutland.
- Clay** (kaolin). Addison County, deposit at Monkton. Bennington County, mined at Shaftsbury; at South Shaftsbury the waste kaolin is used for fire clay. Rutland County, mined at Brandon and Forestdale.
- Copper**. *See Chalcopyrite and Malachite*.
- Diatomaceous earth**. Caledonia County, Peacham, and many other places, not mined.
- Feldspar**. Orange County, deposits at Corinth and Strafford, not worked. Windham County, deposits at Newfane and Saxtons River, not worked. Windsor County, quarried at Chester, deposit at Norwich, not worked.
- Flagstone**. Windsor County, gneiss at Cavendish. Small quarries in slate between Hartford and Rockingham, not working.
- Fuchsite** (chrome mica). Rutland County, in mica schist, $3\frac{1}{2}$ miles southeast of Rutland, on Round Mountain. Bed several feet thick, suitable for ornamental work.
- Galena**. Lamoille County, in small vein in talcose slate at Morristown. Orange County, has been mined in quartz vein in talcose slate at Thetford. Rutland County, small occurrence at Chittenden. Windsor County, found at Bridgewater, Carter, and Plymouth; formerly mined at Carter.
- Gold** (lode). Formerly mined in small way in Bennington County at Readsboro and in Windsor County at Bridgewater Center.
- Gold** (placer). Windsor County, formerly mined to small extent at Plymouth. Found in very small quantities in many places.
- Granite**. Caledonia County, Burke, Groton, Hardwick, Kirby (3 quarries, mail, Lyndon), Newark, and South Ryegate (6 quarries). Essex County, was formerly quarried at Brunswick, Concord, Island Pond, and Victory. Orange County, Chelsea, Randolph, Topsham, and Williamstown (3 quarries). Orleans County, Albany, Barton, Derby, Lowell, Newport, and North Derby. Washington County, Barre (34 quarries) and East Barre, Cabot, Calais (3 quarries), Graniteville (7 quarries), Websterville (10 quarries), and Woodbury (10 quarries). Windham County, West Dummerston (3 quarries). Windsor County, Bethel (2 quarries), Rochester, and Windsor (2 quarries).

Graphite. Has been found in Addison County, at Hancock. Chittenden County, Huntington. Franklin County, Swanton. Orange County, Newbury. Rutland County, Brandon and Pittsford. Windham County, Halifax. Windsor County, Norwich.

Hematite. Chittenden County, Milton, near Lake Champlain; formerly worked to slight extent. Windsor County, small deposit at Weathersfield.

Infusorial earth. *See* Diatomaceous earth.

Iron. *See* Brown iron ore, Hematite, Magnetite, Ocher, Pyrite, and Siderite.

Kaolin. *See* Clay (kaolin).

Lead. *See* Galena.

Limestone. Quarried for building stone: Chittenden County, Winooski. Grand Isle County, Isle La Motte. Quarried chiefly for lime: Addison County, Leicester Junction and New Haven. Bennington County, North Pownal. Chittenden County, Burlington, Colchester. Franklin County, Highgate, Highgate Springs, St. Albans, and Swanton. Rutland County, Brandon and West Rutland. Windham County, Sherman. Windsor County, Amsden.

Limonite. *See* Brown iron ore.

Magnetite. Orleans County, Troy, a titaniferous ore in small beds, formerly mined. Windsor County, Bridgeport and at Rochester, sparingly in chlorite slate.

Malachite (green carbonate of copper). Orange County, copper mines at Corinth, Copperfield, and South Strafford; not mined.

Manganese ore. Reported in Addison County from Bristol and Monkton; Bennington County from Bennington and Stamford; Chittenden County, Colchester; Orange County, Topsham; Orleans County, Irasburg and Coventry; Rutland County, Chittenden and Pittsford, near South Wallingford and Brandon, in Otter Creek valley; Windsor County, Plymouth. Nowhere mined. *See also* Braunite, Psilomelane, and Pyrolusite.

Marble. Quarried in Addison County at Beldens, Bristol, Middlebury, Monkton, North Ferrisburg, and Vergennes; Bennington County, Dorset, East Dorset, and South Dorset; Chittenden County, Burlington; Franklin County, St. Albans and Swanton; Grand Isle County, Fisk and Isle La Motte; Orange County, Waits River and Washington; Rutland County, Brandon, Clarendon, Clarendon Springs, Danby, Fowler, Pittsford, Proctor, Rutland, and West Rutland; Washington County, Roxbury.

Marl. Caledonia County, deposits at Sutton, not worked. Abounds in most of towns bordering Lake Champlain, also in Orange and Windsor counties.

Mica (muscovite). Rutland County, at North Sherburne. Windsor County, at Chester, has not been mined.

Ocher. Bennington County, formerly mined at Bennington, occurs at North Dorset, not mined. Rutland County, formerly mined at Brandon.

Peat. Numerous localities, Champlain Valley and elsewhere, not utilized.

Psilomelane (black manganese). Rutland County, was formerly mined near South Wallingford and at Brandon.

Pyrite. Orange County, has been mined in Copperas Hill mine at Strafford, large deposit interstratified with mica schist, associated with chalcopyrite; also at Brookfield, Corinth, and Vershire. Rutland County, Cuttingsville.

Pyrolusite (manganese dioxide). Rutland County, was formerly mined near South Wallingford and at Brandon.

Pyrrhotite. Orange County, with copper ores of Ely mine, Copperfield, Elizabeth mine, South Strafford, and Union and Eureka mines.

Quartz diorite. Orleans County, quarry at Charleston (post office, Derby Line).

Road metal. *See* Granite, Limestone, Sandstone, Schist, and Trap rock.

Sand (building). Dug in Rutland County, Rutland, and at many other localities.

Sand (glass). Bennington County, East Dorset, disintegrated quartz rock once used for glass. Windsor County, Plymouth, associated with kaolin, not mined.

Sand (molding). Dug in Rutland County, Rutland. Windsor County, Springfield.

Sandstone. Quarried locally for building stone at Burlington, Chittenden County, and elsewhere.

Schist (mica). Formerly quarried at Halifax, Windham County. Abundant in many localities but quarried only as needed locally.

Serpentine (verde antique marble). Washington County, quarried at Roxbury. Deposits in Orleans County at Troy and Westfield. Windham County, Marlboro. Windsor County, Cavendish and Windsor.

Siderite (spathic iron ore). Windsor County, Plymouth, in talcose slate, with magnetite and pyrite; not mined.

Slate. Principal quarries in Rutland County, at Blissville, Brandon, Castleton, Fair Haven, Granville, Hydeville, North Poultney, Pawlet, Poultney, Wells, West Castleton, and West Pawlet. Washington County, Montpelier and Northfield.

Soapstone and talc. Quarried: Addison County, at East Granville. Lamoille County, Johnson. Washington County, Moretown. Windham County, Hammondsville and Windham. Windsor County, Chester, Perkinsville, Rochester, Stockbridge, and Weatherfield. Deposits not utilized: Orleans County, at Lowell. Washington County, Roxbury. Windham County, Newfane. Windsor County, Bridgewater.

Sphalerite (zinc blende). Lamoille County, sparingly with galena at Morris-town. Orange County, small quantity mined with copper ores, occurs in lead mine, Thetford. Windsor County, at Norwich, sparingly with galena at Bridgewater; contains cadmium; not mined.

Syenite. Windsor County, Mount Ascutney, near Windsor. Rutland County, Mount Holly.

Talc. *See* Soapstone and talc.

Trap rock. Occurs in dikes in some of the marble quarries.

Umbel. Rutland County, formerly obtained at Brandon.

Whetstone (scythestone). Orleans County, quartz-mica schist, quarried at Evansville; formerly quarried near Canada line, Lake Memphremagog, Fitchs Island quarry, honestones. Washington County, Northfield, talc schist, scythestones. Windsor County, Ludlow and Stockbridge, scythestones.

Zinc. *See* Sphalerite.

VIRGINIA.

- Allanite.** Amelia County, masses weighing several pounds in mica mines. Amherst County, iron allanite carrying nearly 17 per cent ceria in mica-free pegmatite with blue quartz, sipylite, and zircon at Massie mine on Little Friar Mountain. Bedford County, allanite with 33 per cent ceria near Thaxton. Page County, iron allanite, Owen prospect, 3 miles southeast of Marksville.
- Alum.** Small accumulations in caves or sheltered spots have been used.
- Aluminum.** See Bauxite.
- Amazon stone.** Amelia County, Rutherford mine near Amelia.
- Amethyst.** Amherst County, has been mined $2\frac{1}{2}$ miles northeast of Lowesville. Campbell County, good specimens found near Brookneal. Charlotte County, good specimens 2 miles west and 4 miles south of Charlotte.
- Anhydrite.** See Gypsum, with which it occurs.
- Anthracite.** See Coal.
- Apatite.** Amelia County, with mica and beryl in mica mines. Nelson County, with nelsonite and rutile near Roseland.
- Arsenic.** Floyd County, refined from arsenopyrite mined at Brinton.
- Arsenopyrite** (arsenical pyrite). Buckingham County, associated with pyrite, in gold veins near Arvonla, Dillwyn, and elsewhere. Carroll County, Southern copper lode. Culpeper County, 18 miles west of Fredericksburg, on Rapidan River. Fauquier County, near Morrisville. Floyd County, in mica-quartz schists 4 miles from Lick Fork, mined for arsenic at Brinton. Goochland County, associated with pyrite, in gold veins west of Caledonia and elsewhere. Grayson County, Southern copper lode. Orange County, near Rapidan River and along narrow-gage railroad between Fredericksburg and Orange. Rockbridge County, with cassiterite in quartz veins in Irish Creek area. Spotsylvania County, in northwest corner. Stafford County, in western part.
- Asbestos** (amphibole). Albemarle County, in thin platy masses in the soapstone at Alberene. Amelia County, has been mined near Appomattox River, 7 miles north of Mattox station. Bedford County, 12 miles south of Bedford City. An asbestos mill was built at Bedford City some years ago. Buckingham County, Anaconda (formerly Eldridges Mill), $5\frac{1}{2}$ miles northwest of Dillwyn. Fauquier County, Barnets Mill. Floyd County, Bartons and Singers. Franklin County, was mined 2 miles east of Rocky Mount. Grayson County, near northern copper lode; on Little River below Hampton mine. Wythe County, lead and zinc mines, Painters Branch; also in Goochland, Pittsylvania, and Powhatan counties.
- Azurite** (blue carbonate of copper). Madison County, small quantities in prospects near Fishers Gap. Mecklenburg County, fine crystals filling small cavities in quartz and epidote at Pontiac mine, 8 miles north of Virgilina. Page County, mines and prospects southeast of Luray near Ida. Rockingham County, mines and prospects near High Knob, southeast of Elkton, small quantities. Warren County, near Bentonville, Front Royal, and Linden; has been mined at Bentonville.
- Barite** (heavy spar). Bedford County, near Thaxton, between Bedford and Roanoke, was mined and shipped. Campbell County, occurs east of Evington, near Otter River station, and at Leesville. Louisa County, in schists near Mechanicsville, has been mined. Pittsylvania County, occurs at Toshes, near Motleys and Hurt. Prince William County, occurs with red shales 4 miles east of Catlett station. Russell County, extensive deposits near Honaker and Lebanon, mined and shipped. Smyth County, near Marion, was extensively mined and shipped. Tazewell County,

near North Tazewell and Richlands, not used. Washington County, near Glade Spring and Saltville Branch of Norfolk & Western Railway, in clays. Wythe County, with metallic ores in zinc and iron mines near Ivanhoe and elsewhere in southern part of county.

Bauxite. Botetourt County, at Old Houston iron and manganese mines 2 miles east of Troutville.

Beryl. Amelia County, Amelia mica mines. Henry County, in pegmatite near Axton. Rockbridge County, with cassiterite in Irish Creek area.

Bismuth. *See* Tetradyomite.

Bornite (purple copper ore). Amherst County, with actinolite in old Folly mine, 4 miles south of Amherst. Charlotte County, in quartz near Keysville, has been mined. Grayson County, in schist in southwestern part of county, prospects. Greene County, near Elkton. Halifax County, in quartz at Virgilina copper mines. Loudoun County, has been mined near Leesburg. Madison County, one of primary copper minerals near Fishers Gap, prospects. Page County, near Ida, southeast of Luray, one of original copper minerals. Rappahannock County, Manassas Gap copper mine near Front Royal. Rockingham County, disseminated ore in mines and prospects near High Knob, southeast of Elkton. Warren County, has been mined near Bentonville.

Brown iron ore. *See* Mountain brown ore, Oriskany brown ore, and Valley brown ore.

Calamine (silicate of zinc). Pulaski County, oxidized ore of Delton mines near Delton, has been mined. Russell County, principal ore of prospects on Copper Creek, 10 miles north of Castlewood. Wythe County, secondary ore of lead and zinc mines at Austinville.

Cassiterite (tin ore). Clarke County, reported at Capon Springs. Nelson County, at Nellysford. Rockbridge County, in Irish Creek area.

Cement (natural). Rockbridge County, Cambrian limestone used in natural cement at Glasgow and near Balcony Falls; mills also in Botetourt County.

Cement material (Portland). Augusta County, limestone and shale abundant at several places; plant at Fordwick. Clarke County, limestone in vicinity of Wadesville. Frederick County, limestone near Winchester and Middletown. Giles County, limestone and shales in Copper Creek area and near Lurich. Lee County, limestone and shale abundant near Wallen Ridge and Cumberland Mountain, also at Big Stone Gap and Pennington Gap. Norfolk County, plant at Norfolk using shell marl from Smithville and Chuckatuck. Rockingham County, limestone and shale exposed at several places in vicinity of Harrisonburg. Russell County, along west slope of Clinch Mountain. Scott County, Copper Creek, Clinchport, and Gate City. Shenandoah County, abundant in vicinity of Strasburg and near Woodstock. Smyth County, along western foothills of Walker Mountain. Tazewell County, between Cedar Bluff and Tiptop station, through Clinch River valley and elsewhere. Warren County, shales and limestone at Riverton and vicinity, extensively quarried. Washington County, near Walker Mountain, Bristol, and Abingdon.

Cerium metals. *See* Allanite, Monazite, and Sipylite.

Cerussite (lead carbonate). Wythe County, occurs in residual clays derived from limestone and on galena at Austinville.

Chalcocite (copper glance). Carroll County, copper lodes west and northwest of Hillsville. Charlotte County, in quartz near Keysville, has been

mined. Floyd County, Toneray mine, with magnetite and pyrite. Halifax County, in quartz at Virgilina copper mines. Smyth County, Mount Airy. Wythe County, near Max Meadows.

Chalcopyrite (copper pyrite). Albemarle County, was mined for gold near Stony Point. Botetourt County, small quantity near Bonsack station. Buckingham County, near Dillwyn, Arvonja, and elsewhere. Carroll County, in Gardner and Goad mines in northeastern part of county. Culpeper County, has been mined for gold 18 miles west of Fredericksburg on Rapidan River. Fairfax County, has been mined near Herndon. Floyd County, large quantity with pyrrhotite near Floyd; has been mined. Franklin County, small quantities with pyrrhotite at Howell mine near Rocky Mount. Goochland County, mined for gold 2 miles west of Caledonia. Grayson County, near Troutdale. Greene County, small quantity near Stanardsville and Elkton. Loudoun County, has been mined at Guilford. Louisa County, has been mined; common in small quantities of pyrite in mines near Mineral. Madison County, one of the original copper minerals in prospects near Fishers Gap. Orange County, near Rapidan River and between Fredericksburg and Orange, carries gold. Page County, mines and prospects southeast of Luray near Ida. Patrick County, carrying small quantity of gold along western boundary in the Blue Ridge, in the vicinity of Vesta and elsewhere. Prince William County, mined with pyrite in considerable quantities at Cabin Branch mine near Dumfries; matte produced. Rockingham County, at mines and prospects near High Knob, southeast of Elkton. Warren County, has been mined near Linden.

Chromite (chromic iron ore). Fairfax County, Dranesville, in serpentine near the Potomac.

Chromium. See Chromite.

Chrysocolla. Warren County, has been mined near Front Royal, in epidote rock.

Clay (brick). Clay dug and brick made: Albemarle County, Charlottesville. Alexandria County, around Alexandria, Arlington, Addison, Riverside. Alleghany County, Covington. Caroline County, near Milford. Charles City County, Sturgeon Point, Oldfield, about 4 miles south of Sturgeon Point. Chesterfield County, Bermuda Hundred, much clay exposed in this general vicinity, Manchester, Ettricks. Dinwiddie County, near Petersburg. Elizabeth City County, Hampton. Essex County, along Rappahannock River, near Layton, at Occupacia. Greenesville County, around Belfield, adjoining Emporia. Henrico County, Rocketts (suburb of Richmond), Fort Lee, Fulton, near Stagg's mill on Williamsburg road, near Curles Neck, near Cotman post office. King George County, along Rappahannock River near Wilmot. Nansemond County, general vicinity of Suffolk, along Nansemond River. Prince George County, Broadway area along Appomattox River below Petersburg, in bluff along James River near City Point. Princess Anne County, Princess Anne Road near Godfrey Avenue. Spotsylvania County, near Fredericksburg. Warwick County, Morrison. Also in other counties. Brick is made from the residual clays at one or more principal towns in most of the Piedmont counties.

Clay (fire). Mined and used in Botetourt County, at Catawba Furnace. In Appomattox, Buckingham, and Cumberland counties. Chesterfield County, at Bon Air. Montgomery County, near Christiansburg. Orange

County, Madison Run. Pittsylvania County, Danville. Powhatan County, Clayville. Rockbridge County, Buena Vista. Wythe County, under coal seams in Lick Mountain.

Clay (kaolin). Amelia County, derived from decay of feldspar at Pinchback mine, shipped for pottery. Reported from Amherst County. Augusta County, near Cold Spring; Kaolin or Sherando station. Bedford County, Lowry station. Area of crystalline rocks in Cumberland and Prince Edward counties. Fauquier County, near Warrenton. Henrico County, at Bon Air, 9 miles from Richmond. Henry County, mined and shipped at Oaklevel. Nelson County, near Roseland. Similar occurrences in other counties of the Piedmont province. Reported from Nottoway County. Smyth County, near Rye Valley. Wythe County, near Wytheville.

Clay (pottery). Miocene clays suitable for pottery occur in Hanover, Henrico, King William, and other counties.

Coal (anthracite). Frederick County, small field of semianthracite undeveloped. Montgomery and Pulaski counties, small basin developed.

Coal (bituminous). Produced more than 7,900,000 tons in 1914. Field in southwestern part of State includes Buchanan, Dickenson, Lee, Russell, Scott, Tazewell, and Wise counties. The coal is of high quality, and there are several thick beds. Buchanan County, large quantity of bituminous coal, undeveloped for lack of railroad. Dickenson County, considerable area; several beds of fine bituminous coal prospected; has not been mined for lack of railroad, but railroad has just been completed. Lee County, north of Pennington Gap, several mines. Russell County, Dante, Dumps Creek, large mines. Tazewell County, Pocahontas, Big Creek, large mines. Wise County, Toms Creek, Norton, and north of Bigstone Gap, several large mines. Farmville area, including Cumberland, Buckingham, and Prince Edward counties; thin seams. Richmond area, Chesterfield, Goochland, and Henrico counties; Triassic coal, mined at Midlothian and at Winterpock. Chesterfield County, Gayton. Henrico County, bed 4 feet 8 inches; shipped. Pocket coal district between Cumberland and Little Black Mountains, north of Pennington Gap, of Pottsville (early Pennsylvanian) age; 12 workable beds; mined from small banks for local supply.

Coke (natural). Chesterfield County, Chesterfield (Triassic) coal basin.

Columbite. Amelia County, occurs sparingly with microlite in Amelia mica mines. *See also* Fergusonite, Sipylite, and Tantalite.

Copper (native). In small quantities at many localities along Blue Ridge region; Carroll County, native copper lode near Hillsville. Floyd County, Toncray mine. Greene County, near Stanardsville and Elkton. Halifax County, small quantity in Virgilina copper mines. Madison County, secondary ore at Fishers Gap, prospects. Page County, small quantities in mines and prospects southeast of Luray, near Ida. Rappahannock County, near Front Royal, has been mined. Rockingham County, at mines near High Knob, 7 miles southeast of Elkton. Warren County, near Linden, with cuprite and melaconite.

Copper minerals. *See* Azurite, Bornite, Chalcocite, Chalcopyrite, Chrysocolla, Cuprite, Malachite, and Melaconite.

Corundum. Patrick County, near Stuart, in mica schist on knob of Bull Mountain.

Cuprite (red oxide of copper). Greene County, near Stanardsville and Elkton. Halifax County, as alterations of original sulphides in Virgilina copper mines. Madison County, important ore of mines near Fishers Gap. Page

County, at mines and prospects southeast of Luray, near Ida. Rockingham County, near High Knob, 7 miles southeast of Elkton. Warren County, near Linden and Bentonville.

Diabase. Excellent quality widely distributed through the crystalline area and through several of the middle valley counties west of the Blue Ridge; quarried in Fauquier County, near Catlett. Loudoun County, near Goose Creek, 3 miles from Leesburg.

Diamond. Chesterfield County, found at Manchester in 1855.

Diatomaceous earth (infusorial earth, tripolite). King George County, has been mined at Wilmont. An extensive deposit traceable from Her-ring Bay, Md., on the Chesapeake, to Petersburg, Va.; exposed along numerous streams near Richmond and Petersburg.

Diorite. Less abundant than diabase. Occurs penetrating crystalline rocks east of Blue Ridge; quarried only near Annandale and Falls Church, Fairfax County.

Dufrenite (iron phosphate). Rockbridge County, South Mountain, 10 miles east of Lexington.

Emery. Pittsylvania County, with magnetite or hematite near Whittles.

Feldspar. Abundant, but few mines. Amelia County, was mined as accessory mineral to mica near Amelia and at Jetersville; amazon stone variety found in Rutherford mine near Amelia. Bedford County, was mined about 1 mile south of Bells on Otter River. Price Edward County, mined near Prospect.

Fergusonite. Amelia County, occurs sparingly in mica mines at Amelia.

Flagstone. Buckingham County, slate was quarried on Hunts Creek. Franklin County, schist quarried near Rocky Mount.

Fluorspar. Albemarle County, gangue mineral at Faber lead and zinc mine, near Faber, Nelson County. Rockbridge County, Irish Creek. Russell County, with barite in mines near Gardner and Honaker. Shenandoah County, near Woodstock. Smyth County, with lead and zinc in prospects in Rye Valley.

Fluorspar (chlorophane). Amelia County, in pegmatite at Amelia mica mines.

Gabbro. Limited to crystalline area of Blue Ridge. Found in Amherst County, near Lynchburg, and in northwest corner of Floyd County.

Galena. Albemarle County, principal mineral in fluorspar lenses near Faber, argentiferous. Bedford County, disseminated through barite near Thaxton. Bland County, has been mined near Sharon, also in Garden and Flat Top Mountains. Buckingham County, near Arvon, Dillwyn, and elsewhere, has been mined for gold, with copper ore near New Canton. Culpeper County, 18 miles west of Fredericksburg on Rapidan River, has been mined for gold. Fauquier County, near Morrisville, 8 miles east of Bealeton, has been mined for gold. Floyd County, on west side Blue Ridge along Brush and Laurel creeks, mined for gold. Goochland County, mined for gold 2 miles west of Caledonia, and elsewhere. Halifax County, in Virginiana copper district. Louisa County, common in small quantities with pyrite near Mineral. Montgomery County, on west side Blue Ridge along Brush and Laurel creeks, mined for gold. Orange County, near Rapidan River and along railroad between Fredericksburg and Orange. Prince William County, locally in pyrite in Cabin Branch mine near Dumfries. Pulaski County, New River, near mouth of Reed Island Creek, with other lead and zinc minerals, Tract Mountain, and Big Walker Mountain. Russell County, on Copper Creek 7 miles south of Castlewood, has been mined. Smyth County, along south fork of Holston River in Rye

Valley, has been mined. Spotsylvania County in northwest corner of county, near Rappahannock River, and elsewhere, has been mined for gold. Wythe County, in association with sphalerite in zinc mines at Austinville.

Garnet (spessartite). Amelia County, gem hyacinth found in pegmatite in mica mines near Amelia.

Glauconite. See Marl (greensand).

Gneiss. Alexandria and Fairfax counties, extensively quarried along Potomac River. Amherst County, quarries on north side of James River. Bedford County, exposed along Norfolk & Western Railway at Bellevue. Campbell County, along streams, local use. Fluvanna County, has been quarried at Columbia. Pittsylvania County, has been quarried near Chatham on Cherrystone Creek.

Gold. In a belt 200 miles long and 15 to 25 miles wide, from Stafford County on Potomac River to Halifax County, gold-bearing quartz veins and lenses in crystalline rocks; many mines and prospects opened, principally in Buckingham, Culpeper, Fauquier, Fluvanna, Louisa, Orange, Spotsylvania, and Stafford counties. Culpeper County, Culpeper gold mine and several localities in eastern part. Fauquier County, has been mined in Franklin, Liberty, and other mines. Fluvanna County, Snead mines. Fluvanna and Goochland counties, Tellurium gold mine. Halifax County, in Virgilina copper district. Louisa County, mines. Orange County, Chicago & Virginia mine. Spotsylvania County, Rappahannock mine, Randolph mine, Whitehall mines, Pocahontas mine at Andrews. Stafford County, Eagle mine.

Gold (placer). Has been mined in Buckingham County, in vicinity of Turpins Creek. Floyd and Montgomery counties, along Brush and Laurel creeks on western side of Blue Ridge. Goochland County, near Lantana. Louisa County, Tinder Flats. Spotsylvania County, along Pigeon Run. Stafford County, western part near Rappahannock River.

Granite. Production valued at more than \$800,000 in 1914, more than half used for road metal. Very abundant. Principal producing areas are Fredericksburg, Petersburg, and Richmond. Quarries in Alexandria County, on bank of Potomac River. Bedford County, Clevilas tunnel. Campbell County, several quarries at Lynchburg. Chesterfield County, near Granite and Manchester. Fairfax County, quarried near Falls Church and Annandale. Goochland County, several quarries at Boscobel, Lee, and Lassiter. Greenville County, Emporia. Henrico County, several large quarries near Richmond. Lunenburg County, was quarried for crushed stone near Kenbridge. Nottoway County, for ballast near Jennings. Page County, near Luray. Prince Edward County, Farmville. Prince William County, Occoquan. Roanoke County, Roanoke. Spotsylvania County, large quarry 3 miles northwest of Fredericksburg. Granite is quarried in small way at other places, and occurs undeveloped and widely distributed in mountain district of Loudoun County, in Blue Ridge area and crystalline area eastward to the "fall line."

Graphite. Albemarle County, between Free Union and Boonsville, near Buck Mountain, blocks weighing several hundred pounds have been obtained; prospected but no production; occurs also at Charlottesville. Occurrences noted also in Amelia, Buckingham, Charlotte, Loudoun, Nelson, Orange, and Powhatan counties.

Gypsum. Mined extensively in Smyth County, formerly at Chatham Hill and near Saltville, now at North Holston. Washington County, mined extensively at Plasterco.

Halite. *See* Salt.

Hematite (specular). Occurs in workable quantity along Blue Ridge in Bedford, Botetourt, and Roanoke counties. Bedford County, Ironville and Dewey mines, near Montvale. Botetourt County, Arcadia and Wood mines, about 4 miles southeast of Buchanan, Lemon, Grubb-Specular, and Edith mines, about 3 miles northwest of Blue Ridge Springs. Roanoke County, Griffin-Specular mine, 5 miles south of Roanoke. Smyth County, in the Blue Ridge near Marion. Washington County, in the Blue Ridge near Abingdon.

Hematite (fossil ore). Occurs in workable quantity in Alleghany, Lee, and Wise counties. Alleghany County, has been mined on southeast slope of Horse Mountain, 3 miles southeast of Low Moor, and in bluff northeast of Jackson River at Iron Gate. Lee County, southwest of Pennington Gap along Poor Valley Ridges, includes Pennington, Lavine, Ben Hur, Truro, Noes Siding, Grabill, Boones Path, and Ewing mines. Wise County, south of Big Stone Gap, on Wallen Ridge, and in Powell Valley; fossil ore is mined at Yeary, Irondale, Keystone, and Oreton mines.

Ilmenite. Nelson County, with white apatite in dike-like masses (nelsonite) near Roseland, by-product mined with rutile. Roanoke County, with apatite near Roanoke. Rockbridge County, similar but small dikes at Monte Bello. *See also* Nelsonite.

Infusorial earth. *See* Diatomaceous earth.

Iron ore. *See* Arsenopyrite, Brown iron ore, Chromite, Dufrenite, Hematite, Ilmenite, Magnetite, Mountain brown ore, Ocher, Oriskany brown ore, Pyrite, Pyrrhotite, Siderite, and Valley brown ore.

Kaolin. *See* Clay (kaolin).

Lead. *See* Cerusite, Galena, and Massicot.

Limestone. Abundant west of the Blue Ridge. Quarried in many localities from Frederick County to Wise County; also in Piedmont counties.

Limestone (building). Quarried in Alleghany County, at Clifton Forge, Longdale, and Lowmoor. Botetourt County, Compton Bridge, Salt Peter Cave, and Springwood. Giles County, Pembroke. Loudoun County, Leesburg. Montgomery County, Christiansburg. Roanoke County, Roanoke. Rockbridge County, Bells Valley. Rockingham County, Hinton and Timberville. Russell County, Fugates Hill. Smyth County, Marion. Tazewell County, Tazewell. Washington County, Abingdon and Bristol. Wise County, Big Stone Gap. Wythe County, Barren Springs, Ivanhoe, and small quantity at Wytheville.

Limestone (crushed stone). Quarried: Botetourt County, at Eagle Rock, Indian Rock, and Springwood. Campbell County, Lynchburg. Loudoun County, Leesburg. Roanoke County, Roanoke. Washington County, Abingdon.

Limestone (flux). Quarried: Alleghany County, at Longdale, Low Moor, and Clifton Forge district. Botetourt County, Buchanan, Eagle Rock, and elsewhere. Pulaski County, Ardway. Rockbridge County, Bells Valley and Glasgow. Wise County, Big Stone Gap. Wythe County, Ivanhoe.

Limestone (hydraulic). Orange County, has been quarried at Madison Run. Rockbridge County, Balcony Falls on James River (a gray magnesian stone, noted "Balcony Falls cement").

Limestone (lime). Quarried: Augusta County, at Staunton. Botetourt County, Eagle Rock and Indian Rock. Frederick County, Stephens City and Winchester. Giles County, Ripplemead. Loudoun County, Lucketts and Leesburg. Montgomery County, Blacksburg and Christiansburg.

Rockbridge County, Glasgow and Lexington. Rockingham County, Linville. Shenandoah County, Oranda and Strasburg. Warren County, Limeton and Riverton.

Limonite. See Mountain brown ore, Oriskany brown ore, and Valley brown ore.

Magnetite. Principal deposits in Giles County, near Big Stony Junction.

Small deposits in Giles County, near Ripplemead; Louisa County, Mineral; Wythe County, Wytheville; in many of the Piedmont counties, and has been mined in Franklin County, at Rocky Mount; and Pittsylvania, at Pittsville.

Malachite. Buckingham County, with cupriferous pyrite in copper mine near Anaconda. Charlotte County, has been mined with chalcocite and bornite near Keysville. Halifax County, as alteration of original sulphides in Virginina copper mines. Madison County, small quantity in Milans Gap prospects. Page County, has been mined southeast of Luray, near Ida. Rappahannock County, has been mined near Front Royal. Warren County, near Linden. Occurs in small quantity in many other places.

Manganese. See Manganite, Psilomelane, Pyrolusite, and Wad.

Manganite. Occurs in small quantity, from a trace to 10 per cent of the ore, in most manganese deposits in the State.

Marble. Little or no marble has been produced in several years. Quarried formerly to small extent in Rockingham County. Good quality of marble is reported, undeveloped in Albemarle County, west of Scottsville on Buck Island, and on Limestone and Meechum creeks. Botetourt County, about three-fourths mile southeast of Buchanan. Campbell County, a few miles from Lynchburg. Culpeper County, on Rapidan River, near mouth of Summerduck Run and on Mountain Run. Fauquier County, on Rappahannock River, near Marsh Run. Giles County, near base of Angels Red Mountain and near Chapmans Ferry. Loudoun County, Taylortown and in vicinity of Goose Creek. Montgomery County, considerable quantity of black marble near Blacksburg. Nelson County, near mouth of Tye River. Orange County, between Gordonsville and Orange. Page County, on east side of Massanutten Mountain. Rockbridge County, 5 miles from Lexington. Scott County, near Gate City and in valley portion of county. Shenandoah County, near New Market and Woodstock. See also Onyx marble.

Marl (calcareous). Widely distributed in nearly all counties of tidewater region; also in many valley counties on west side of Blue Ridge; formerly of limited use as flux. Marl of the Coastal Plain has been used in manufacture of Portland cement.

Marl (greensand). Limited largely to inner margin of Coastal Plain region. Exposed along Potomac, Rappahannock, Pamunkey, and James rivers, and on interstream areas; used as fertilizer; has been worked at several places, especially on James and Pamunkey rivers; carries a small variable per cent of phosphoric acid; of little value as source of phosphate.

Massicot (lead ore). Wythe County, Austin mines, in small quantities with galena and other lead ores.

Melaconite (black oxide of copper). Carroll County, in upper portions of copper lodes; also in Floyd and Grayson counties. Warren County, has been mined at Linden.

Mica (muscovite). Has been prospected or mined: Amelia County, at Amelia and Jetersville. Bedford County, near New London. Goochland County, near Goochland. Hanover County, near Hewlett. Henry County, at Ridgeway. Pittsylvania County, south of Chatham. Has been observed in several other counties. Principal production from Amelia County.

- Microlite.** Amelia County, occurs sparingly, Amelia mica mines, fine brilliant yellow to red gem stone.
- Millstone (burrstone).** Montgomery County, Prices Fork, 5 miles southwest of Blacksburg, siliceous conglomerate quarried on Brush Mountain.
- Monazite.** Amelia County, occurs sparingly, fine specimens with microlite, in mica mines near Amelia. Also found as sand in stream gravels.
- Moonstone.** Amelia County, occurs in mines at Amelia, some fine gems have been cut. Hanover County, found near Hewlett.
- Mountain brown ore.** Occurs in two belts, one extending along west slope of Blue Ridge from Front Royal, Warren County, to 10 miles south of Roanoke, Roanoke County. The other belt extends along the east side of the New River-Cripple Creek district, Pulaski County, and along and near to the Wythe-Carroll county boundary. Associated with Cambrian quartzite. Principal groups of mines: Page County, at Shenandoah. Rockingham County, Grottoes. Rockbridge County, Vesuvius and Buena Vista. Roanoke County, Roanoke. Brown ore also mined near Pitts-ville, Pittsylvania County. Gossan ore of the sulphide deposits of crystalline area formed the basis of the first iron industry in the South.
- Nelsonite.** Prospected: Nelson County, near Roseland and Bryant, and Roanoke County, near Vinton.
- Nickel.** Reported in pyrrhotite from several localities in Piedmont region, especially in Floyd-Carroll-Grayson plateau in southwest Virginia and in Amherst County, near Lynchburg. Principal work done on Lick Fork, in Floyd County, 7 miles southeast of Shawsville.
- Niter.** In numerous caves in Shenandoah limestone in the valley on west side of Blue Ridge. Has been procured for local use.
- Ocher.** Has been mined: Bedford County, near Bedford City. Chesterfield County, near Bermuda Hundred, on Appomattox River. Loudoun County, in Little Catoclin Mountain, near Leesburg. Page County, Stanleyton, near Marksville. Rockingham County, near Keezletown and near west base of Massanutten Mountain, also along Naked Creek, 5 miles southeast of Shenandoah station. Warren County, excellent grade umber half mile east of Shenandoah Railway, mined and shipped.
- Onyx marble.** Stalactitic and stalagmitic deposits on walls and floors of caves in Valley region. Luray, Page County, largest deposit.
- Oriskany brown ore.** Deposits occur locally in western portion of Appalachian belt from Maryland to southwestern Virginia. Principal mines in Alleghany County, near Longdale, Covington, Lowmoor, and Potts Creek. Other mines are: Augusta County, Buffalo Gap and Ferrol mines. Botetourt County, near Glen Wilton, Dagger Springs, and Oriskany. Pulaski County, Pulaski. Wythe County, Max Meadows.
- Peat.** Extensive deposits in the great Dismal Swamp, where it was formerly made into fuel near the canal.
- Phosphate.** Alleghany County, phosphate nodules occur at base of Devonian black shale, near Clifton Forge, extent unknown. Small quantities at base of Devonian in Smyth County near Marion and in Washington County near Saltville. *See also* Marl and Nelsonite.
- Potash.** *See* Niter.
- Psilomelane (manganese ore).** Augusta County, Crimora, Lyndhurst, and Vesuvius mines. Botetourt County, Houston mines near Troutville. Campbell County, near Mount Athos and Evington. Nelson County, has been mined with pyrolusite near Warminster. Page County, Dry Run
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mine near Compton, also Eureka mine near Stanleyton, shipped. Rockingham County, several mines near Elkton. Smyth County, Umbarger mine near Sugar Grove and Currin Valley mine near Attoaway.

Pyrite. Botetourt County, prospects near Bonsack station. Buckingham County, near Arvonias, Dillwyn, and elsewhere, has been mined for gold. Carroll County, mined at Monarat for sulphuric acid. Culpeper County, 18 miles west of Fredericksburg on Rapidan River, has been mined for gold. Dinwiddie County, near Pools Siding. Fauquier County, has been mined for gold near Morrisville. Goochland County, mined for gold 2 miles west of Caledonia and elsewhere. Louisa County, mined extensively for sulphuric acid at Mineral. Montgomery and Floyd counties, on west side of Blue Ridge along Brush and Laurel creeks, gold bearing. Orange County, near Rapidan River and along and north of narrow-gage railroad between Fredericksburg and Orange, gold bearing. Prince William County, large deposit near Dumfries. Rockbridge County, with cassiterite in quartz veins in Irish Creek area. Spotsylvania County, in northwest corner and elsewhere, near Rappahannock River, was mined for gold. Stafford County, in western part near Rappahannock River, was mined at Garrisonville for gold. About one-half the production of the United States comes from Carroll, Louisa, and Prince William counties.

Pyrolusite (black oxide of manganese). Amherst County, scattered through clay and as replacements in granite at Stapleton, has been mined. Augusta County, in Lower Cambrian quartzite at Crimora mine near Crimora station and near Lyndhurst. Botetourt County, in manganeseiferous clay at Houston mines near Troutville. Campbell County, high grade in nodular masses and as replacements in granite at Mount Athos, Evington, Otter River, and Clarion (Lynch), mined near Evington, Mount Athos, and Otter River. Frederick County, in limestone at Paddy Mills mine in southwest corner of county. Nelson County, has been mined at Warminster and Midway Mills. Page County, Eureka mine near Stanleyton. Rockbridge County, Midvale. Shenandoah County, in sandstone at Powells Fort, has been mined at Baltimore and Philadelphia mines. Smyth County, in psilomelane at Umbarger mine near Sugar Grove and filling cavities in limonite at Currin Valley mine. Warren County, in limonite deposits associated with quartzite at Happy Creek mine near Front Royal. Wythe County, has been mined near Wytheville.

Pyrrhotite (magnetic pyrites). Largest occurrence is a lode that has a maximum width of 100 feet and extends 20 miles from Floyd County through Carroll Mountains, Grayson County. Carroll County, mined for sulphuric acid between Chestnut Creek and New River near Sylvatus. Fauquier County, occurs near Broad Run. Floyd County, in mica schist 8 miles southeast of Floyd; also has been mined on Lick Fork in northern part of county; nickeliferous. Franklin County, in mica schist at Howell mine near Rocky Mount. Grayson County, in Carroll Mountains. Louisa County, with pyrite in mines near Mineral. Prince William County, small quantity with pyrite in Cabin Branch mine near Dumfries.

Quartz (amethyst). *See* Amethyst.

Quartz (gem). Fairfax County, milky-white chalcedony, greenish-colored, colorless, and smoky quartz, near Fairfax; gems cut.

- Quartzite.** Found in places along James River between Scottsville and Lynchburg, in Albemarle, Appomattox, Bedford, Buckingham, Campbell, Fluvanna, and Nelson counties. Quarries at several places formerly worked for building stone.
- Radium.** *See* Fergusonite.
- Road metal.** *See* Gabbro, Gneiss, Granite, Limestone, Syenite, and Trap rock.
- Rutile.** Goochland County, prospected near Peers. Hanover County, prospected at Gouldin, in pegmatite dikes, in residual soil, and in gravels. Nelson County, large deposits in pegmatite and nelsonite dikes, Roseland and 5 miles northwest of Arrington. *See also* Ilmenite and Nelsonite.
- Salt (brine).** Smyth County, pumped at Saltville, for manufacture of alkali and caustic soda. Formerly used for manufacture of salt; no salt made for some years.
- Salt (rock).** Occurs in large quantity with gypsum from Plasterco, Washington County, to within 3 miles of Chatham Hill, Smyth County; not mined.
- Sand (building).** Widely distributed, considerable quantity along streams. Dug in Pulaski County, at Delton; Rockingham County, North River; Shenandoah County, Edinburg; Spotsylvania County, Fredericksburg, Massaponax, and other places.
- Sand (glass).** Fine white sand of suitable quality is found along eastern edge of Middle Valley region. Amherst County, Stapleton Mills. Augusta County, near Greenville. Rockbridge County, Balcony Falls, along west base of Blue Ridge. Roanoke County, Catawba Mountain, 9 miles northwest of Salem. Worked only at Salem locality.
- Sand (molding).** Has been found chiefly in vicinity of Fredericksburg, Petersburg, and Richmond. Is dug on Cowardin place at Richmond.
- Sandstone.** Lower Cambrian sandstone quarried along Chesapeake & Ohio Railway, Augusta County, for crushed stone. Silurian sandstone extends along Great Valley, fine to coarse, suitable for constructional work. Mississippian sandstone found in Augusta, Bland, Botetourt, Craig, Frederick, Montgomery, Pulaski, Roanoke, Rockingham, Shenandoah, Smyth, and Wythe counties; quarried at Pulaski, Pulaski County, for building material. Pennsylvanian sandstone found in Buchanan, Dickenson, Lee, Russell, Scott, Tazewell, and Wise counties; quarried for local building stone. Sandstone of the Newark group distributed in seven areas east of Blue Ridge, few quarries, good stone; quarried near Warrenton, Fauquier County, and in vicinity of Manassas, Prince William County. Cretaceous sandstone found near Fredericksburg on Rappahannock River, Spotsylvania County, and at several points in Brunswick, Chesterfield, and Greensville counties; has been quarried in vicinity of Aquia Creek and on Rappahannock near Fredericksburg, Spotsylvania County.
- Schist (mica).** Common in Piedmont region. Quarried: Campbell County, at Altavista, for ballast; Franklin County, near Rocky Mount, for flagging.
- Siderite.** Washington County, with magnetite in limestone, near Abingdon.
- Silver.** Halifax County, in copper ores of the Virgilina district. Louisa County, in pyrite mines near Mineral.
- Sipyrite (columbate of erbium).** Amherst County, adherent to magnetite, occurs sparingly on northwest slope of Little Friar Mountain.
- Slate.** Quarried: Albemarle County, at Esmont. Amherst County, Snowden. Buckingham County, Arvonlo. Fauquier County, has been quarried near White Sulphur Springs, 6 miles south of Warrenton. Undeveloped beds in Craig, Prince William, and Stafford counties.

Smithsonite (zinc carbonate). Albemarle County, in lead-zinc mine near Faber. Pulaski County, oxidized ore of Delton mines near Delton, has been mined. Russell County, with calamine in prospects 10 miles north of Castlewood. Wythe County, secondary mineral of lead and zinc mines at Austinville.

Soapstone. Production much larger than that of any other State. Widely distributed in older crystalline rocks of Piedmont region east of Blue Ridge. Albemarle and Nelson counties, extensively quarried near Green, Hawkins, Findley, Ball, and Appleberry mountains. Has been quarried: Amelia County, at head of Walnut Creek. Campbell County, on Otter River. Charlotte County, near Cullen. Fairfax County, Annandale, near Clifton station, Falls Church, and Tenley. Franklin County, Rocky Mount. Good stone undeveloped at many other localities.

Spessartite (garnet). Amelia County, fine gems cut from mines at Amelia.

Sphalerite (zinc blende). Albemarle County, common in fluorspar-quartz lenses near Faber. Bedford County, occasionally found in barite near Thaxton. Botetourt County, has been mined near Bonsack station. Buckingham County, has been mined for gold near Arvonnia, Dillwyn, and elsewhere. Culpeper County, has been mined for gold 18 miles west of Fredericksburg on Rapidan River. Fauquier County, has been mined for gold near Morrisville. Goochland County, mined for gold 2 miles west of Caledonia and elsewhere. Halifax County, in Virgilina copper district. Louisa County, frequent in small quantities of pyrite in mines near Mineral. Orange County, near Rapidan River and along and north of narrow-gage railroad between Fredericksburg and Orange. Prince William County, locally with pyrite in Cabin Branch mine near Dumfries. Pulaski County, prospected in unaltered limestone in bed of New River. Russell County, has been mined in Copper Creek 7 miles south of Castlewood. Smyth County, has been mined with galena along South Fork of Holston River in Rye Valley. Spotsylvania County, has been mined for gold near Rappahannock River in northwest corner of county. Stafford County, has been mined for gold in western part of county, near Rappahannock River. Wythe County, with galena and pyrite at Austinville, Bertha, and Cedar Springs.

Staurolite. Good crossed crystals (fairy stones), have some value as curios; found in Patrick County.

Sunstone. Amelia County, Amelia.

Syenite. Suitable for building stone, undeveloped, occurs in Carroll County, northeastward from Sylvatus and on Big Reed Island Creek. Charlotte County, from Drakes Branch to near Charlotte Courthouse. Floyd County, in northwest corner. Greene County, near Elkton. Madison County, at Milams Gap. Warren County, along west side of Blue Ridge, near Front Royal.

Talc. Found in commercial quantity and mined in Fairfax County, at several places near Clifton station and Wiehle. Orange County, near Rhoadesville, mined and saved for crayons and burners.

Tantalite. Amelia County, fine splendent crystals near Amelia.

Tantalum. See Columbite, Fergusonite, and Tantalite.

Tetradymite. Goochland and Fluvanna counties, Tellurium mine. Spotsylvania County, Whitehall gold mines. Stafford County, Monroe mine.

Thorium. See Monazite.

Tin. See Cassiterite.

Titanium. See Ilmenite, Nelsonite, and Rutile.

Tourmaline. Amelia County, in pegmatite dikes in Amelia district, and in some of the quartz veins in the gold belt.

Trap rock. Occurs in many counties in Piedmont region. Used for road metal.

Travertine. See Onyx marble.

Tripolite. See Diatomaceous earth.

Tungsten. See Wolframite.

Umbur. Grayson County, about 2½ miles south of Troutdale. Page County, Milams Gap near Luray; in Blue Ridge of north Virginia and in Blue Ridge of southwest Virginia.

Unakite. Grayson County, about 2½ miles south of Troutdale, along the Marion-Jefferson public road. Madison and Page counties, in Blue Ridge, near Luray, at Milams Gap.

Valley brown ore. Occurs in same general area as mountain brown ore. Associated with limestone. Mines: In Augusta County, Lofton; Page County, Luray; Pulaski County, Reed Island; Rockbridge County, Midvale; Wythe County, Foster Falls and Ivanhoe.

Verde antique. Loudoun County, occurs on Goose Creek, not used.

Wad. Augusta County, with other manganese ores at Crimora and in siliceous rock near Waynesboro. Rockingham County, interbedded with clay at Kendall and Flick mine near Elkton.

Wolframite. Rockbridge County, with cassiterite and a little scheelite in Irish Creek area.

Yttrium. See Allanite.

Zinc minerals. See Calamine, Smithsonite, and Sphalerite.

Zircon. Amelia County, in pegmatite dikes in Amelia district. Hanover County, as highly zirconiferous sandstone of Calvert age, 3 miles west of Ashland.

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Antimony. *See* Stibnite.

Argentite. Okanogan County, Moses (Nespelem) district, in Apache and Little Chief mines. Stevens County, Deer Trail (Cedar Canyon) district, at Silver Queen and Orchid mines.

Arsenic (native). Snohomish County, Monte Cristo. *See also* Arsenopyrite, Realgar, and Scorodite.

Arsenopyrite (arsenical pyrite). King County, Mono claims near Berlin and Apex mine. Okanogan County, Twisp and Squaw Creek districts, mined for gold. Snohomish County, principal ore in Monte Cristo district; with chalcopyrite in Stilaguamish district, mined for gold and silver; mined also near Everett for gold, silver, and arsenic.

Asbestos. Chelan County, developed property near Leavenworth. Occurs in Mount Stuart and Wenatchee Mountains but not mined; also through Cascade Mountains.

Basalt. Most abundant surface rock in State. In southeastern part, chiefly Columbia River lavas. Quarried at following places: Asotin County, 2 miles north of Asotin. Clarke County, at Camas and Fishers Landing, 10 miles above Vancouver. Cowlitz County, Kelso, Olequa, and Stella. King County, Franklin and Riverton. Kitsap County, Charleston. Klickitat County, Goldendale and Klickitat. Lewis County, Meskill. Skagit County, Deception Pass and Fidalgo. Spokane County, Marshall and Spokane. Thurston County, Gate. Walla Walla County, Dixie. Whitman County, Colfax, Palouse, and Pullman. Yakima County, 6 miles southwest of North Yakima, and at Selah. Quarried in other places also.

Bismuth. *See* Cosalite.

Bornite (purple copper ore). King County, Climax claims southwest of Baring, carries silver. Pierce County, Surprise claims, Carbon River district. Snohomish County, important ore at Index prospects.

Brown iron ore (limonite). Snohomish County, Monte Cristo district, mined for gold and silver. Stevens County, prospects near Deep Creek Lake southeast of Northport.

Cassiterite (tin ore). Spokane County, in pegmatite cutting Archean gneiss, quartzites, and schists at Silver Hill, 12 miles southeast of Spokane; has been prospected.

Celestite. Skagit County, near La Conner.

Cement material. Chelan County, Wenatchee Valley. Okanogan County, Havillah, Riverside, and Wauconda. Pend Oreille County, Metaline and Metaline Falls. San Juan County, Orcas and Lopez islands. Skagit County, Jackson Creek, Rockport; and Sauk. Snohomish County, Index. Whatcom County, Kendall. *See also* Limestone.

Cerargyrite (horn silver). Stevens County, occurs with lead ores in Cedar Canyon district. Mined and shipped from Orchid.

Cerium. *See* Monazite.

Cerussite (lead carbonate). Stevens County, argentiferous, occurs in Cleveland, Colville, and Summit mining districts; has been mined.

Chalcocite (copper glance). Lewis and Skamania counties, St. Helena district, not mined. Snohomish County, Index district, mined at Ethel and Independent mines.

Chalcopyrite (copper pyrite). Chelan County, claims in Horseshoe Basin and Railroad Creek districts, carries gold and silver. King County, chief mineral of Climax claims near Baring and Dutch Miller, carries gold and silver. Lewis and Skamania counties, St. Helena district, auriferous. Okanogan County, Myers Creek, Palmer Mountain, Upper Methow, Twisp Creek, and Squaw Creek districts, carries gold and silver. Pierce County, a number of claims in Carbon River district. Snohomish County, one of chief ores of Monte Cristo district, mined for gold and silver; principal gold ore of Stilaguamish district; mined for gold and silver at Index district. Stevens County, Copper King mine, Chewelah.

Cinnabar. Kittitas County, 12 miles north of Roslyn, at the head of the Middle Fork of Teanaway River.

Clay (brick). Bricks are made from local clay deposits at the principal towns in more than half of the counties. Pits at the following places: Chelan County, Chelan and Wenatchee, and immense quantities occur along Queniult River. Clarke County, Vancouver. Columbia County, Dayton. Cowlitz County, near Olequa. Ferry County, near Republic. Grays Harbor County, at Aberdeen. Jefferson County, immense quantities occur along Queniult and Queets rivers. King County, near Seattle, Taylor, Renton, Kummer, Vanasselt, Woodinville, and elsewhere. Kitsap County, Harper. Kittitas County, Cle Elum. Lewis County, Centralia, Chehalis, and Little Falls. Lincoln County, Irby. Okanogan County, Okanogan. Pierce County, Fox Island, Gig Harbor. Skagit County, Alger. Snohomish County, Everett. Spokane County, Deer Park, Freeman, Spokane, and elsewhere. Stevens County, Bossburg. Chewelah, Clayton, Kettle Falls, Northrup, and Springdale. Walla Walla County, Walla Walla. Whatcom County, Bellingham. Whitman County, Colfax, Oakesdale, Palouse, and elsewhere. Yakima County, mined in valley of Yakima River near North Yakima and at Granger. Small pits are worked in other places not mentioned.

Clay (fire). Cowlitz County, occurs 2 miles east of Sopenah. King County, Kummer and Taylor. Pierce County, Clay City. Spokane County, Mica. Stevens County, occurs at Clayton and Northport. Whatcom County, near South Bellingham. Whitman County, Palouse.

Clay (kaolin). Pierce County, occurs at Eatonville (white, plastic). Lewis County, Napavine. Stevens County, Clayton.

Clay (pottery). Cowlitz County, occurs along Cowlitz River, a few miles above Olequa and 2 miles east of Sopenah; dug at Sopenah. King County, small quantity dug at Auburn. Stevens County, Clayton. Whitman County, occurs along Palouse River near Palouse.

Clay (sewer pipe). King County, Bayne and Kummer. Spokane County, Mica and Spear.

Clay (shale). King County, Renton. Stevens County, Bossburg, Kettle Falls, and Northport.

Clay (slip). Stevens County, Bossburg.

Coal (bituminous and subbituminous). King County, Green River district, highly bituminous; mined at Pocahontas mine. Kittitas County, Roslyn-Cle Elum district, excellent quality; mined at Roslyn and Cle Elum mines, 4 to 5½ feet thick; shipped. Pierce County, Wilkeson-Carbonado district, lying midway between Tacoma and Mount Rainier; six beds worked at Wilkeson mine; four beds worked at Carbonado mine, 4 to 7 feet; coking and steam. Whatcom County, Blue Canyon mine on southeast shore of Lake Whatcom, 7 feet.

Coal (subbituminous and lignite). Cowlitz County, Kelso-Castle Rock district, mined on Coal Creek, 8 miles west of Kelso; shipped. King County, Newcastle-Issaquah district, seven beds worked at Issaquah mine; four beds at Coal Creek mine, 3 to 14 feet; Renton-Cedar district, mined at Cedar Mountain mine near Renton, 8 feet; Green River district, mined at Gem mine near Franklin, and Lawson mine near Black Diamond. Lewis County, Chehalis-Centralia district, mined near Centralia, bed 5½ feet; small mine near Chehalis, bed 4 feet. Thurston County, mined 4 miles from Tenino.

Coal (semianthracite). Whatcom County, number of coal beds in coal measures on Glacier Creek; prospects.

Cobalt. Ferry County, occurs in small quantity, as erythrite, with nickel minerals near Keller.

Copper (native). Pierce County, rare. Found at Eatonville.

Copper minerals. Copper is the predominant metal produced in the following districts: Ferry County, Belcher, Lone Star, Sanpoil. Okanogan County, Osoyoos Lake (Oroville). Pierce County, Carbon River (Fairfax station). Skagit County, Bald Mountains, 10 miles south of Lymon. Snohomish County, Index, Silver Creek, Stilaguamish. Stevens County, Chewelah; of minor importance in many other districts. *See also* Bornite, Chalcocite, Chalcopyrite, Malachite, Melanconite, and Tetrahedrite.

Cosalite (argentiferous). Stevens County, with wolframite at Cedar Canyon and hübnerite at Loon Lake; not saved.

Diabase. Kittitas County, as dikes in upper valley of Teanaway River. Also underlies part of the great lava area along Columbia River.

Diatomaceous earth (infusorial earth, tripolite). Yakima County, is mined near North Yakima. Kittitas County, is mined near Ellensburg. Franklin County, abundant near Pasco.

Epsomite. Okanogan County, 2½ miles northwest of Oroville, in Epsom Lake, in sec. 14, T. 40 N., R. 27 E., a deposit several inches thick coats edges and bottom of shoals in the lake; mined.

Fluorspar. Ferry County, on claim of Fogarty group, 4 miles north of Kellar.

Galena. Chelan County, claims in Horseshoe Basin district, gold and silver. Ferry County, containing silver; mined in Covada district. Lewis and Skamania counties, claims in St. Helens district. Lincoln County, has been mined for silver at Crystal mine, 1½ miles east of mouth of Spokane River. Okanogan County, mined for gold and silver at Monterey and Yakima mines. Myers Creek district, and Golden Zone and Gold Hill mines, Palmer Mountain district, and mined in Park City and Nespelem districts, where it contains silver. Snohomish County, principal gold and silver ore in Monte Cristo and Stilaguamish districts. Stevens County, chief silver-bearing mineral at Colville; mined for gold and silver at Deer Trail mines, and Silver Queen, Cedar Canyon district. Spokane County, in siliceous veins at Silver Hill; carries silver.

Gold (lode). Gold is the predominant metal produced in the following districts: Chelan County, Bridge Creek, Entiat, Horseshoe Basin, Lakeside, Leavenworth, Peshastin, Railroad Creek, and Wenatchee. Ferry County, Danville and Republic. King County, Money Creek, 6 miles from Berlin. Kittitas County, Fish Lake, Swauk. Okanogan County, Myers Creek, Nighthawk, Palmer Mountains, Squaw Creek, Twisp, Wauconda. Snohomish County, Darrington, Granite Falls, Monte Cristo. Stevens County,

Meyers Falls, Orient. Whatcom County, Mount Baker, Slate Creek. Gold occurs in other mining districts but is of less importance than some other metal. *See also* Sylvanite.

Gold (placer). Asotin County, occurs in black sands of Snake River and at Clarkston, small production. Chehalis County, at Oyhut. Clallam County, at Shishi Beach, Ozette River, and Yellow Bank. Clarke County, at Camas and Brush Prairie. Douglas County, in sands of Columbia River. Ferry County, has been mined in sands and gravels of Columbia River at many points between mouths of Kettle and Nespelem rivers, and along Granite Creek near Republic; is mined in small way on Strawberry Creek, a tributary of west fork of Sanpoil River. Kittitas County, Swauk district, 12 placers. Lincoln County, at Davenport and at Hell Gate Bar, a few miles above Sanpoil, and at Peach Bar. Okanogan County, has been mined along Mary Ann Creek, tributary of Myers Creek. Snohomish County, occurs near Silverton. Stevens County, at Wilmot Bar and Marcus. Thurston County, on Wahkiakum and Sand islands and along Columbia River. Whatcom County, in Slate Creek and Mount Baker districts. Whitman County, along Snake River and in vicinity of Horse Creek. Yakima County, at Mabton.

Granite. King County, Baring, Franklin, Snoqualmie, and Veazie. Mason County, Hoodspout (or Lilliwaup). Pierce County, Electron. Snohomish County, Granite Falls, Halford, and Index. Spokane County, quarried at Medical Lake and 9 to 12 miles north of Spokane. Stevens County, China Bend and Bossburg. Whitman County, quarried at Granite Point and on Snake River, 20 miles below Lewiston, and at mouth of Grande Ronde River.

Hematite (red iron ore). Kittitas County, occurs 20 miles north and little west of Cle Elum. Skagit County, along south bank of Skagit River near Hamilton. Snohomish County, mined for gold and silver in Monte Cristo district. Stevens County, in prospects near Deep Creek Lake, southeast of Northport.

Hübnerite. Stevens County, mined near Loon Lake and Deer Park; occurs with argentiferous cosalite in quartz veins and pegmatite cutting granite and schists.

Infusorial earth. *See* Diatomaceous earth.

Iridium. *See* Iridosmine.

Iridosmine. Clallam County, small quantity with gold at Shishi Beach, 2 miles northwest from Point of Arches.

Iron minerals. Iron is the principal metal produced in Kings County, at Snoqualmie Pass. Skagit County, Hamilton. Stevens County, Deep Creek Lake. *See also* Brown iron ore, Hematite, Magnetite, Ocher, Pyrite, and Pyrrhotite.

Lead. *See* Cerusite, Cosalite, Galena, and Mineral paint.

Limestone (building). Chelan County, Chelan. Ferry County, Keller. Pend Oreille County, Metaline. Snohomish County, quarried 3 miles east of Granite Falls; shipped to Seattle and elsewhere. Stevens County, Northport.

Limestone (cement material). Ferry, King, Okanogan, San Juan, Skagit, Snohomish, Stevens, and Whatcom counties; limestone suitable for cement making, associated with shale.

Limestone (flux). San Juan County, worked on East Sound, Orcas Island; San Juan Island, deposit extending from Roche Harbor to Westcott Bay, extensively worked. Stevens County, Evans and Northport.

Limestone (lime). Chelan County, burned at Lake Chelan. Ferry County, burned between Republic and Wauconda. King County, near Olga and at Seattle. San Juan County, Orcas Island, Deer Harbor, and Roche Harbor; San Juan Island, deposit extending from Roche Harbor to Westcott Bay, extensively worked. Snohomish County, 3 miles east of Granite Falls. Stevens County, Springdale.

Limonite. *See* Brown iron ore.

Magnetite (magnetic iron ore). In sands of Columbia River placers, northeast Washington, not recovered. King County, in Cascade Mountains, 2½ miles north and west of Snoqualmie Pass. Kittitas County, 20 miles north and a little west of Cle Elum, on Cle Elum River. Skagit County, deposits along south bank of Skagit River, from Hamilton to Marble Mountain.

Malachite. Snohomish County, Monte Cristo district, mined for gold and silver.

Manganese ore (psilomelane). Grays Harbor County, near Humptulips. Okanogan County, near Omak (mined). Mason County, near Lake Cushman.

Marble. Chelan County, Chelan and Leavenworth. Lincoln County, Miles. Spokane County, 8 miles northwest of Milan. Stevens County, 8 miles northwest of Addy; Bluecreek; Bossburg, 3 to 5 miles east of Chewelah; 2 to 5 miles southwest of Chewelah; 4 miles east-southeast of Colville; 15 miles east-southeast of Mill Creek; 7 miles northeast of Echo; Greenway Mountain; 1 mile northeast of Marble; Ryan; 2 miles east of Valley; 5 miles northwest of Valley. Whatcom County, Maple Falls. Also counties of Cowlitz, Okanogan, and Skagit; several kinds of good marble reported.

Melaconite. Snohomish County, Monte Cristo district, mined for gold and silver.

Mercury. *See* Cinnabar.

Mica. Chelan County, Chelan.

Mineral paint. Lead paint is made at Spokane and Tacoma from Idaho and Washington ores. Pierce County, metallic paint mined at Eatonville. *See also* Ocher.

Molybdenite (sulphide of molybdenum). Chelan County, in quartz at Crown Point, Railroad Creek district; small quantity has been mined. Ferry County, Sanpoil district, occurs in many prospects. Okanogan County, Golden Zone mine, Palmer Mountain district, in pegmatite near Conconully. Pend Oreille County, Metaline district; has been prospected. Snohomish County, rare in Monte Cristo district.

Monazite. Grays Harbor County, in black sands at Moclips and Grays Harbor; not recovered. Douglas County, occurs in sands of Columbia River. Stevens County, occurs at Wilmot Bar, Columbia River.

Nickel. Unidentified minerals. Ferry County, Congress mine near Keller. Okanogan County, Stepstone prospect, 12 miles north of Nespelem.

Ocher. Stevens County, reported at Valley.

Oil. *See* Petroleum.

Opal. Walla Walla County, Whitman Creek, near Oregon line, 5 miles northwest of Moscow, has been mined.

Peat. Occurs in swampy valleys in several localities, as that of Wilsons Creek, in Douglas County.

Petroleum. Clallam County, wells were drilled near Forks and near Lapush, at mouth of Soleduck River. Grays Harbor County, wells drilled on coast near Taholah at mouth of Queniult River and near Copales Rock. Jeffer-

son County, wells drilled on coast, about 4 miles southeast of Lapush, at mouth of Quillayute River, and on coast just east of Hoh Head. Thurston County, between Tenino and Grand Mound. Whatcom County, wells drilled at Happy Valley, near Fairhaven. No production reported for the State.

Platinum. Clallam County, occurs with gold at Shishi Beach. Pacific County, occurs in black sands at Beards Hollow; not recovered.

Pyrargyrite (ruby silver). Okanogan County, Moses district, Little Chief mine. Snohomish County, in gold and silver ores of Forty-five mine, Stilaguamish district.

Pyrite. Common in many mining districts, as follows: Chelan County, in granite in Holden claims, Railroad Creek district, carries gold and silver. Ferry County, Chesaw mines, northwest of Republic. Lewis and Skamania counties, with copper ores in St. Helens district. Okanogan County, mined for gold and silver at Yakima and Review mines, Myers Creek district, and at Golden Zone and Gold Hill mines, Palmer Mountain district. Snohomish County, gold bearing in Monte Cristo district, and with galena in Stilaguamish district. Stevens County, scattered through quartz 5 miles northeast of Loon Lake. Whatcom County, large masses of ore exposed in Mount Baker district; carries gold and silver.

Pyrrhotite. Snohomish County, one of chief ores of Monte Cristo district; carries gold and silver; occurs with chalcopyrite at Silverton, Stilaguamish district, mined for gold.

Quicksilver. See Cinnabar.

Realgar. Lewis County, has been mined for arsenic at Mineral. Skagit County, Clear Lake. Snohomish County, has been mined in Monte Cristo district.

Road metal. Grays Harbor and Thurston counties, basalt between Gate City and Aberdeen. Kitsap County, basalt quarried at Orchard. King County, volcanic rock quarried between South Seattle and Black River Junction. See also Basalt.

Sand (building). Common along entire course of Columbia and other large rivers, in Puget Sound region, and near many large towns; has been dug at following places; Grays Harbor County, Chehalis River at Aberdeen. King County, Richmond Beach and Vashon Island. Pierce County, Steilacoom and Tacoma.

Sand (molding). King County, dug at Cedar Mountain and Richmond Beach.

Sandstone. Has been quarried at following places: Ferry County, Republic. King County, Cumberland. Kitsap County, Bremerton and Waterman. Pierce County, Fairfax and Wilkeson. San Juan County, East Sound, Provost post office, 5 miles from Roche Harbor, Steward Island, and Waldron Island. Skagit County, Sedro Woolley. Thurston County, Tenino. Whatcom County, Bellingham district and Chuckanut.

Scheelite. Ferry County, Silver Leaf mine, Covada. Spokane County, associated with quartz at Silver Hill, not mined. Stevens County, in Silver Reef mine, with silver ore in Troy district, $1\frac{1}{2}$ miles west of Columbia River and 5 miles west of Gifford.

Scorodite. Snohomish County, oxidized ore of Monte Cristo district, mined for gold and silver.

Serpentine. Chelan and Kittitas counties, common south of Mount Stuart. Stevens County, quarried on Green Mountain near Valley.

Silver. Chelan County, with gold ore in Pole Pick mine and in Ivanhoe mine, Peshastin district, and in minor quantity in several other districts. Ferry County, in gold quartz veins at Tom Thumb, Quilp, Lone Pine, Surprise,

and other mines near Republic, predominant metal in Meteor and Sanpoil districts. Lincoln County, principal metal at Crystal district, 15 miles north of Davenport. Okanogan County, in gold quartz veins in Palmer district, mined at Gold Hill, Black Bear, and War Eagle mines, in Moses (Nespelem) district and in Upper Meteor district. Stevens County, in Chewelah, Deer Trail, Colville, Silver Queen, and other districts. Skagit County, number of claims in Thunder Creek district. *See also* Argentite, Cerargyrite, Pyrargyrite, and Sylvanite.

Silver (native). Okanogan County, in Apache mine, Moses (Nespelem) district.

Sphalerite (zinc blende). Okanogan County, mined at Yakima mine, Myers creek district, for gold and silver. Snohomish County, one of chief ores of Monte Cristo district; mined for gold and silver with galena in Stilaguamish district; mined at Forty-Five mine for gold and silver. Stevens County, with galena in Deer Trail (Cedar Canyon) district.

Stibnite. Ferry County, occurs in Enterprise (Covada) district, considerable quantity in Longstreet and other mines and prospects of district. King County, Great Republic mine. Kittitas County, about 20 miles north of Ronald on east fork of Cle Elum River in Camp Creek district. Okanogan County, mined near Methow.

Strontianite. Skagit County, near La Conner.

Strontium. *See* Celestite and Strontianite.

Sylvanite. Okanogan County, Squaw Creek district.

Talc. Skagit County, 7 miles above Marblemount, was mined.

Tetrahedrite. Okanogan County, many claims in Squaw Creek district. Snohomish County, Stilaguamish district, mined at Forty-Five mine for gold and silver.

Thorium. *See* Monazite.

Tin. *See* Cassiterite.

Trap. *See* Basalt.

Travertine. *See* Tufa.

Tripolite. *See* Diatomaceous earth.

Tufa. Mason County, outcrops along beach $2\frac{1}{2}$ miles on west side of Hoods Canal, has been quarried 2 miles northeast of Hoodspoint. Stevens County, extensive deposits on China Bend on Columbia River near Northport; has been quarried.

Tungsten. *See* Hübnerite, Scheelite, and Wolframite.

Volcanic ash. Occurs at many places in eastern part of State. Beds from 100 to 150 feet thick have been found between basalt flows.

Wolframite. Okanogan County, occurs 35 miles northwest of Loomis, near Cathedral Peak, development in progress; 35 miles north of North Yakima, on shore of Bumping Lake. Spokane County, associated with quartz at Silver Hill. Stevens County, mined at Germania mine, Deer Trail (Cedar Canyon) district; on Silver Leaf mining claim, 5 miles west of Gifford and $1\frac{1}{2}$ miles south of Covada; also at Daisy.

Zinc. *See* Sphalerite.

Zircon. In black sands on the coast and in many streams.

WEST VIRGINIA.

- Barite** (heavy spar). Mercer County, on north slope of East River Mountain, not mined.
- Bromine.** Manufactured from brine in Kanawha County, at Malden. Mason County, Hartford and Mason. *See also* Salt.
- Brown iron ore** (brown hematite, limonite). Berkeley County, south of Martinsburg, pits were opened and ore shipped. Grant County, Greenland Gap, has been mined. Greenbrier County, prospects near Anthony Creek Gap. Hampshire County, near Capon Springs, on ridges north of Capon Springs. Hardy County, has been mined at a number of places near Wardensville. Jefferson County, ore bank 4 miles above Harpers Ferry, has been mined. Mineral County, has been mined near Keyser. Monroe County, considerable quantity in Zenith area, in flint and lime at Crimson Spring; prospects on Peters Mountain and elsewhere, has been mined at Crinson Spring. Morgan County, Sandy Ridge. Pendleton County, at many places along North Fork Mountain; prospects on sides of Little Mountain, 2 miles east of Franklin. Pocahontas County, prospects on Beaver Lick Mountain. Raleigh County, has been mined near Beckley.
- Cement material.** Jefferson County, Cambrian limestone used for natural cement near Shepherdstown. Mineral County, Lewistown limestone quarried at Cedar Cliff. Preston County, Greenbrier limestone used at Manheim on Cheat River, for Portland cement. Occurs but not used for cement in Berkeley County, near Martinsburg. Jefferson County, Charlestown, and Millville. Mineral County, near Keyser. Monongalia County, along Cheat River, 6 miles east of Morgantown, and on Deckers Creek. Tucker County, in vicinity of Hendricks.
- Cement material** (calcareous tufa, travertine, calcareous marl). Grant County, Patterson Creek. In Hardy, Hampshire, Jefferson, and other counties in large deposits; not mined.
- Clay** (brick). Dug and used at following places: Barbour County, Philippi. Berkeley County, near Martinsburg. Cabell County, Barboursville, Central City, Culloden, Huntington, and Milton. Greenbrier County, Caldwell. Hancock County, Kenilworth, New Cumberland, and Zalia. Harrison County, Clarksburg and Glen View. Jackson County, Ripley and Ravenswood. Jefferson County, Shepherdstown. Kanawha County, Charleston and South Ruffner. Lewis County, Janelew and Weston. Marion County, Colfax, Fairmont, and Hammond. Marshall County, Moundsville. Mason County, Huntington, Point Pleasant, and Spilman. Mineral County, Ridgeley. Mingo County, Williamson. Monongalia County, Morgantown and Randall. Preston County, Kingwood. Putnam County, Bancroft. Randolph County, Elkins. Ritchie County, Pennsboro. Roane County, Spencer. Taylor County, Colfax and Thornton. Tyler County, Middlebourne. Upshur County, Buckhannon. Wetzel County, Brooklin and New Martinsville. Wood County, Parkersburg. Also in other counties.
- Clay** (fire). Barbour County, flint clay 1 mile east of Junior. Braxton County, near Savageville, has been mined. Hancock County, Kenilworth, occurs in vicinity of New Cumberland. Harrison County, occurs 1 mile east of Clarksburg. Kanawha County, near Charleston, has been mined. Marion County, flint and plastic clay worked at Hammond. Mineral County, occurs 1 mile east of Piedmont. Monongalia County, occurs near Morgantown. Preston County, occurs along Cheat River. Taylor County, occurs near Lost Run, Thornton. Tucker County, North Fork of Blackwater River. Wayne County, occurs near Cassville.

- Clay** (stoneware). Has been dug and used at following places: Harrison County, Bridgeport. Jackson County, Ravenswood. Monongalia County, Morgantown. Wood County, Parkersburg. Occurs in Randolph County at Elkins. Preston County, is dug at Victoria.
- Coal** (bituminous and semibituminous). Over 20 workable coal beds in State; hundreds of mines; coal all of Carboniferous age; mined in Barbour, Boone, Braxton, Brooke, Cabell, Clay, Doddridge, Fayette, Gilmer, Grant, Greenbrier, Hancock, Harrison, Kanawha, Lewis, Lincoln, McDowell, Marion, Marshall, Mason, Mineral, Mingo, Monongalia, Nicholas, Ohio, Pleasant, Preston, Putnam, Raleigh, Randolph, Ritchie, Roane, Taylor, Tucker, Upshur, Wayne, Webster, Wetzel, and Wyoming counties. Bituminous coal in all these counties except Fayette, McDowell, Mercer, Raleigh, and Wyoming, where the coal is mostly the semibituminous and high-grade bituminous, smokeless coal of the New River and Pocahontas fields.
- Fluorspar.** Jefferson County, Shepherdstown, in white limestone, not mined.
- Gas.** See Natural gas.
- Grahamite** (asphalt). Ritchie County, was once extensively mined 25 miles southeast of Parkersburg, and is still mined there in a small way.
- Grindstone.** Has been quarried: Jackson County, at Lone Cedar, 21 miles south of Parkersburg. Kanawha County, on north side of Kanawha River, at Sattes. Upshur County, Buckhannon. Wood County, north of Parkersburg.
- Halite.** See Salt.
- Hematite** (red iron ore). Grant County, prospects in southeastern part, South Fork Mountain. Hardy County, has been mined near Wardensville and Perry. Mineral County, has been mined 1 mile southeast of Keyser. Monongalia County, location of several early furnaces which used local ore.
- Hematite** (fossil ore). Grant County, vicinity of Greenland Gap, parallel seams 5 feet thick, has been mined. Greenbrier County, Anthonys Creek and Howard Creek, prospected, both fossil and black ore. Hardy County, middle and also on north mountain ranges, large bodies developed. Mercer County, north slope of East River Mountain, Bluestone River, on Black Oak and Flat Top mountains, prospected. Monroe County, Little Mountain, prospected. Pendleton County, South Fork Mountains, prospected.
- Iron ore.** See Brown iron ore, Hematite, Ocher, Oriskany brown ore, Pyrite, and Siderite.
- Limestone** (building). Quarried: Greenbrier County, at Falling Spring and Lewisburg. Jefferson County, near Charlestown, at Millville, and at Shepherdstown. Marion County, Fairmont. Mercer County, Bluefield. Mineral County, Patterson Creek. Monongalia County, Rock Forge (mail Dells-low). Monroe County, Hunters Springs. Ohio County, Wheeling. Preston County, Buckhorn, small quantity quarried at Orr; also 1 mile west of Corinth.
- Limestone** (crushed stone). Quarried: Greenbrier County, at Fort Spring. Jefferson County, Keller and three-quarters of a mile west of Engles siding. Mineral County, Keyser. Monongalia County, Sturgis. Monroe County, near Frazier. Ohio County, near Wheeling. Preston County, Afton.
- Limestone** (flux). Berkeley County, has been extensively quarried for flux at Bunker Hill and Martinsburg.

Limestone (lime). Burned for lime: Berkeley County, at Bunker Hill. Greenbrier County, Fort Spring. Jefferson County, Millville. Monroe County, Snowflake. Preston County, Afton, Cranesville, and elsewhere.

Limonite. *See* Brown iron ore.

Manganese ore. Greenbrier County, in Oriskany iron ores at Glenmore; not mined.

Marble. Hampshire County, Hanging Rock. Mercer County, Willowton.

Mica (muscovite). Berkeley County, muscovite occurs in the Slate district, 13 miles west of Blue Ridge; not mined.

Natural gas. West Virginia has led all other States in gas production since 1909. The most prolific gas fields are located in Lewis, Harrison, and Ritchie counties, with notable production from Boone, Braxton, Brooke, Cabell, Calhoun, Clay, Doddridge, Gilmer, Hancock, Kanawha, Lincoln, Logan, Marion, Marshall, Monongalia, Mingo, Nicholas, Ohio, Pleasants, Putnam, Roane, Taylor, Tyler, Upshur, Wayne, Wetzel, Wirt, and Wood counties. The total number of productive gas wells in the State at the close of 1914 was 7,194. Wells range in depth from a few hundred to 4,000 feet.

Niter (saltpeter). Found in caves in Greenbrier, Monroe, and Pocahontas counties; has been used.

Ocher. Cabell County, on Guyandotte River. Hardy County, South Branch Valley. Jefferson County, Lost River, near Harpers Ferry and near Shepherdstown. Lewis County, yellow ocher near Weston. Pendleton County, Clines Crossroads. Wayne County, near Ceredo; not mined.

Oil. *See* Petroleum.

Oil shale. *See* Shale.

Oriskany brown ore. Northeastern part of State.

Petroleum. Immense quantities produced in Braxton, Brooke, Cabell, Calhoun, Clay, Doddridge, Gilmer, Hancock, Harrison, Jackson, Kanawha, Lewis, Lincoln, Marion, Marshall, Mason, Monongalia, Ohio, Pleasants, Putnam, Ritchie, Roane, Tyler, Wayne, Wetzel, Wirt, and Wood counties. Harrison and Lincoln counties produced over 1,000,000 barrels each in 1909. At the end of 1914 there were 14,932 productive oil wells in the State, ranging in depth from a few hundred to 3,580 feet. The production of oil in 1913 was 11,567,299 barrels, valued at \$28,823,814. In 1914 it was 9,680,033 barrels, valued at \$18,468,540.

Potash. *See* Niter.

Pyrite. Berkeley County, in Slate district, 13 miles west of Blue Ridge; not mined.

Quartz (sand). Hampshire County, Blue Gap, Short Mountain, cliffs of white sandrock. Monongalia County, near Morgantown, very soft sandstone. Morgan County, Sir Johns Run; not used.

Road metal. *See* Limestone (crushed stone), Sandstone, and Slate.

Salt (brine). Obtained: Kanawha County, near Malden. Mason County, at Hartford and Mason. Wood County, Kanawha. Production over 145,000 barrels of salt in 1914. Salt has been made from brine wells at following places: Braxton County, Bulltown, on Little Kanawha. Clay County, at mouth of Otter Creek, on Elk River. Mercer County, New River. Monongalia County, along Cheat River, Deckers Creek, and Scotts Run, in borings for oil. And at other localities.

Sand (building). Dug and used at following places: Cabell County, at Huntington. Kanawha County, Charleston and on Elk River. Marshall County, Moundsville. Mason County, Hogsett. Monongalia County, Star City. Morgan County, Berkeley Springs. Ohio County, Wheeling.

Preston County, Holmes station. Taylor County, Grafton. Upshur County, Buckhannon and Ivanhoe. Wood County, near Parkersburg.

Sand (glass). Monongalia County, Homewood sandstone member of the Pottsville formation, quarried on Deckers Creek at Sturgis, 9 miles southeast of Morgantown. Morgan County, large quarries in Oriskany sandstone, near Berkeley Springs, obtain large quantities of high-grade white glass sand. Preston County, Holmes station, near Independence, Homewood sandstone member of Pottsville formation. Randolph County, has been quarried at Silica. Taylor County, has been quarried near Grafton. Upshur County, early Pennsylvanian sandstone was quarried at Craddock.

Sand (molding). Dug in Cabell County, at Huntington; Monongalia County, at Star City and other places.

Sandstone. Barbour County, quarried at Junior, Philippi, and vicinity, and near Laurel. Braxton County, small quarry at Frametown, Gassaway, and West Gassaway. Brooke County, near Wellsburg, local use. Cabell County, small quarry 2 miles southwest of Huntington. Fayette County, Kanawha Falls. Hancock County, Kings Creek (mail Holidays Cove) and below New Cumberland. Harrison County, Clarksburg, Farnum, and Viropa. Jackson County, Ravenswood, Sherman, and Murrayville. Kanawha County, Charleston and Sattles. Lewis County, Weston. McDowell County, Gary. Marion County, Downs, Fairmont, Farmington, Mannington, and Rivesville. Mercer County, Bluefield. Mineral County, Bloomington. Monongalia County, Morgantown, Sturgis, and West Morgantown. Monroe County, has been quarried near Alderson. Ohio County, Wheeling. Preston County, Bowlesburg, Albright, Kingwood, Rowlesburg, and Zevely. Randolph County, Kingsville. Ritchie County, Cornwallis, Harrisville, and Pullman. Summers County, has been quarried near Hinton. Taylor County, quarried at Grafton, West Grafton, Yates, and Fetterman. Tyler County, Middlebourne and Sistersville. Upshur County, Buckhannon. Wetzel County, Littleton, New Martinsville. Wirt County, Burning Springs. Wood County, Parkersburg.

Schist. Micaceous quartz schist (sericitic). Jefferson County, near Harpers Ferry, suitable for cupola blocks, furnace brick, silica brick, fire mortar, etc.

Shale (oil). Devonian. Underlies almost the entire State, excepting a small area in the northeastern part, but is generally at considerable depth.

Siderite (carbonate of iron). Has been prospected or mined in small way at the following places: Barbour County, near Philippi. Braxton County, mouth of Strange Creek. Clay County, has been worked by Elk River Iron Co., Standing Rock Run. Grant County, thin seam at several localities. Kanawha County, near Charleston. Marion County, Fairmont. Mineral County, thin seams at several localities. Monongalia County, Deckers Creek, Scott Run, Booth Creek, and Cheat River, eastern part. Preston County, Three Forks Creek, Reedsville, Tunnelton, and Muddy Creek. Taylor County, near mouth of Lost Run. Wayne County, eight seams 1 to 3 feet thick on Big Sandy River at Cassville.

Siderite (black band ore). Has been mined: Clay County, on Little Sycamore Creek of Elk River. Fayette County, Bell Creek. Kanawha County, Davis and Briar creeks. Nicholas County, Little Elk Run. Wayne County, near Big Sandy River.

Slate. Berkeley County, rather inferior quality quarried 3 miles northeast of Martinsburg.

WISCONSIN.

- Arsenopyrite.** Oconto County, in vein in granite quarry south of Mountain.
- Asbestos** (actinolite). Portage County, has been mined near Stevens Point.
- Azurite** (blue carbonate of copper). Grant, Iowa, and Lafayette counties, found at several points in lead and zinc district.
- Barite** (heavy spar). Grant, Iowa, and Lafayette counties, deleterious gangue mineral, abundant in certain of the lead and zinc mines.
- Brown iron ore** (bog iron ore). Juneau County, near Necedah. Wood County, Grand Rapids. In many other localities in marshes of central and northern Wisconsin. Not mined.
- Brown iron ore** (brown hematite, limonite). Florence County, accompanies hard hematite ore at Commonwealth and Florence mines. Grant, Iowa, and Lafayette counties, in minor quantities in ore-bearing crevices and in pockets of rock of the lead and zinc region. Pierce County, mined and smelted at Spring Valley. Sauk County, Ironton, Westfield, and elsewhere.
- Cement** (natural). Milwaukee County, Devonian limestone, formerly used for natural cement north of Milwaukee on Lake Michigan, and at Berthelet.
- Cement material** (Portland). Low magnesian limestones and marls not common.
- Cerussite** (lead carbonate). Grant, Iowa, and Lafayette counties, secondary mineral of lead and zinc mines, mined with galena, which it coats.
- Chalcocite** (copper glance). Iowa County, Mineral Point copper mines, with chalcopyrite and carbonate.
- Chalcopyrite** (copper pyrites). Florence County, found in quantities sufficient to encourage exploration in green schists south of Homestead settlement, in southeastern part of county. Grant, Iowa, and Lafayette counties, has been mined at several points in lead and zinc region. Oconto County, in vein in granite near Mountain. Richland and Vernon counties, occurs sparingly in Cambrian ("Potsdam") sandstone.
- Clay** (brick). Dug and worked near almost every large town in the State. Production of common brick in 1914 valued at \$799,109.
- Clay** (drain tile). Calumet County, Chilton. Jefferson County, Jefferson. Ozaukee County, Port Washington. Walworth County, Elkhorn. Also in other counties.
- Clay** (kaolin). Barron County, occurs at Rice Lake, sec. 19, T. 35 N., R. 9 W. Jackson and Wood counties, along junction of Laurentian and Cambrian rocks. St. Croix County, Hersey, washed and sold to paper manufacturers; excellent kaolin in vicinity of Glenwood; not used. Wood County, well exposed at Grand Rapids and worked for fire brick.
- Clay** (pottery). Rock County, terra-cotta art ware formerly made at Edgerton, from mixture of Edgerton white-burning and Springfield red-burning clay.
- Clay** (shale). Cincinnati shales worked for brick and tile at Oakfield, Fond du Lac County; at Brickport, Calumet County. Decomposed granite and schists of shaly nature worked for brick at Ringle, Marathon County; Stevens Point, Portage County; Grand Rapids, Wood County. Large deposits not worked in Clark and Jackson counties. Eau Claire County, large supply of pre-Cambrian shales suitable for brick, near Eau Claire; not used.
- Copper** (native). Ashland County, occurs in veins, amygdulæ, and scattered through epidotized trap, and in sandstone, on Montreal and Bad rivers. Bayfield County, in southwestern part of county. Douglas County, in

Annicon, Brule, and Black rivers. Iowa County, has been mined at Mineral Point. Float boulders common in eastern Wisconsin. Found at many points in upper Mississippi lead region.

Copper ores. See Azurite, Chalcocite, Chalcopyrite, and Malachite.

Feldspar. Marathon County, in pegmatite at Stettin, about 5 miles northwest of Wausau; not mined.

Flint. Abundant in the southwestern part of the State, in certain parts of Galena dolomite in Grant, Iowa, and Lafayette counties, and in Niagara dolomite in eastern part of State; not used.

Galena. Original lead ore of upper Mississippi Valley. Grant County, mined at Platteville, Cuba City, and Hazel Green. Iowa County, occurs at Mifflin, Highland, Montfort, Livingston, Linden, Mineral Point district, and Dodgeville. Lafayette County, Benton and Shullsburg. Green County, has been mined near Monroe.

Ganister. Quarried from quartzite in Sauk County, at Ablemans and Devils Lake.

Granite. Quarried for monuments: Douglas County, Superior. Green Lake County, Berlin and Uteley. Jackson County, Black River Falls. Marathon County, Granite Heights and Wausau. Marinette County, Amberg, Athelstane, Middle Inlet. Marquette County, Montello and Neshkora. Sauk County, North Freedom. Waupaca County, Granite City and Waupaca. Waushara County, Lohrville, Neshkoro, Red Granite, Spring Lake, and Warren. Occurs: Lincoln County, Irma. Wood County, abundant at Jenny Bull Falls, Marshfield, and at many other places. Quarried for paving blocks at Montello, Berlin, Red Granite, Waupaca, and Lohrville; for crushed stone at Mountain, in Oconto County.

Granite porphyry. Wood County, has been quarried near Dexterville, on Yellow River.

Graphite. Portage County, amorphous graphite mined at Junction City.

Hematite (red hematite). *Iron Ridge.*—"Clinton" or "fossil" ore, near Mayville, Dodge County, in beds of irregular outline and lenticular cross section.

Menominee Range.—Western extension is worked extensively at Commonwealth and Florence mines, in T. 40 N., R. 18 E., in Florence County. Beds of great thickness in Huronian rocks. Hard red ore accompanied by some limonite.

Penokee-Gogebic Range.—Large deposits, upon which a number of mines are working in eastern side of Iron County. The deposits occur in pitching troughs formed by the intersection of "greenstone" dikes and the foot-wall quartzite. Ore is mostly a soft red or brownish-red hematite with a little hard, steely, specular hematite.

Baraboo Range.—Deposits of red hematite ore in Huronian iron-bearing rocks in Sauk County; several mines being developed.

Iron minerals. See Brown iron ore, Hematite, Magnetite, Marcasite, Mineral paint, Ocher, Pyrite, Pyrrhotite, and Sienna.

Kaolin. See Clay (kaolin).

Lead minerals. See Cerussite and Galena.

Limestone (building). Brown County, at Askeaton, Bay Settlement, Depere, Duck Creek, and Greenleaf. Buffalo County, Alma, Bluff Siding, Fountain City, Marshland, and Nelson. Calumet County, Chilton. Columbia County, Pardeeville. Crawford County, Bridgeport and Prairie du Chien. Dane County, Madison and Middleton. Dodge County, Beaver Dam, near Foxlake, Knowles, Richwood, and near Watertown. Door County, Sevass-

topol (mail, Sturgeon Bay). Fond du Lac County, Peebles, small quantity quarried at Waupun and in vicinity of Marblehead. Grant County, Boscobel, Cassville, Lancaster, and Rockville. Green Lake County, Markesan. Iowa County, Cobb, Highland, Mineral Point, Spring Green, and Wyoming. Jefferson County, Fort Atkinson and Watertown. Kewaunee County, Algoma, small quantity quarried at Kewaunee. La Crosse County, Holmen, La Crosse, Mindora, Onalaska, and West Salem. Lafayette County, Darlington. Manitowoc County, Cooperstown. Milwaukee County, Milwaukee and Wauwatosa. Monroe County, Leon and Sparta. Outagamie County, Appleton, Dale, Hortonville, Kaukauna, Mackville, Seymour, and elsewhere. Ozaukee County, Cedarburg. Pepin County, Pepin. Pierce County, Elmwood and Maiden Rock. Polk County, in vicinity of Osceola. Racine County, small quantity quarried at Burlington, Ives, and Racine. Rock County, Beloit, Edgerton, Fulton, and Janesville. St. Croix County, small quantity quarried at River Falls. Sauk County, Spring Green. Sheboygan County, Sheboygan Falls. Trempealeau County, very small quantity quarried at Trempealeau. Vernon County, La Farge, Stoddard, and Viroqua. Walworth County, Springfield, small quantity quarried at Whitewater. Waukesha County, Genesee, Lannon, Menominee Falls, and Waukesha. Winnebago County, Menasha, Neenah, Oshkosh, Omro, Poygan, and Winneconne. Wood County, small quantity quarried at Grand Rapids.

Limestone (crushed stone). Quarried at following places: Brown County, at Green Bay, De Pere, Duckcreek, and Greenleaf. Buffalo County, Alma and Fountain City. Calumet County, Brillion and Chilton. Dane County, Madison. Dodge County, near Foxlake, Knowles, and Richwood. Door County, Sebastopol, Sturgeon Bay, and Sawyer. Fond du Lac County, Hamilton, Marblehead, Oakfield, and Waupun. Grant County, Boscobel, Cassville, and Lancaster. Iowa County, Mineral Point. Jefferson County, Watertown. Kewaunee County, Kewaunee. La Crosse County, La Crosse and Onalaska. Lafayette County, Burlington. Manitowoc County, Quarry and Valders. Milwaukee County, Wauwatosa and Milwaukee. Monroe County, Sparta. Outagamie County, Appleton, Black Creek, Hortonville, Kaukauna, and elsewhere. Ozaukee County, Cedarburg, Druucker, and Grafton. Racine County, Burlington and Racine. Rock County, Janesville. Sheboygan County, Sheboygan and Sheboygan Falls. Trempealeau County, Galesville. Vernon County, Stoddard and Viroqua. Waukesha County, Lannon and Waukesha. Winnebago County, Neenah, Omro, and Oshkosh.

Limestone (flux). Quarried: Dodge County, at Knowles and Mayville. Fond du Lac County, Hamilton.

Limestone (hydraulic, water lime, cement rock). Fond du Lac County, quarried at Ripon. Milwaukee County, has been quarried at Milwaukee. Winnebago County, has been quarried at Poygan.

Limestone (lime). Quarried in following places: Buffalo County, at Alma. Calumet County, Brillion, Clifton, and elsewhere. Dodge County, Knowles and Mayville. Door County, Baileys Harbor, Fish Creek, and elsewhere. Fond du Lac County, Hamilton and Marblehead. Green County, Martintown. Iron County, Penoque Gap, along Bad River, mixed magnetite and hematite ores. Jackson County, Black River Falls. Kewaunee County, Kewaunee. Lafayette County, Darlington. Manitowoc County, Grimms, Manitowoc, and Quarry. Oconto County, Chase and Gillette. Outagamie County, Black Creek. Ozaukee County, Cedarburg,

Druecker, and Grafton. Pierce County, Elmwood. Racine County, in vicinity of Racine. Trempealeau County, Arcadia. Vernon County, Stoddard. Washington County, Rockfield and South Germantown. Waukesha County, Templeton.

Limonite. See Brown iron ore.

Magnetite. Ashland and Bayfield counties, in quartzites and slates of the Huronian in Penokee range. Chippewa County, Penokee Gap, along Chippewa River, mixed magnetite and hematite ores, ferruginous schists. Florence County, found in small quantities in Commonwealth iron ores, and in slates and schists, associated with ores and lean iron-bearing rocks; not mined. Jackson County, Black River Falls.

Malachite (green carbonate of copper). Iowa and Lafayette counties, found at several points in lead and zinc region, not mined.

Manganese. See Wad.

Marcasite (white iron pyrites). Iowa County, accompanies sphalerite near Dodgeville. Lafayette County, common with lead and zinc ores in mines near Hazel Green, Meekers Grove, Strawbridge, and Sullsburg; mined.

Mineral paints. Dodge County, at Iron Ridge. See also Sienna.

Ocher. Juneau County, brown ocher has been mined. Waupaca County, red and yellow ocher at Clintonville.

Peat. Underlying many bogs and swamps. Attempted use not yet successful.

Pyrite (iron pyrites). Grant County, mined at Platteville. Abundant in some lead and zinc mines associated with galena and sphalerite, as in Iowa and Lafayette counties.

Pyrrhotite. Oconto County, 2½ miles southeast of Mountain.

Quartzite. Quarried for ganister and paving materials: Dodge County, near Portland. Jefferson County, at Waterloo. Juneau County, occurs in large quantities near Necedah. Marathon County, quarried at Wausau for sandpaper, grit, and quartz. Sauk County, at Ableman, Baraboo, and Devils Lake, for silica brick and ganister.

Rhyolite. Green Lake County, quarried at Berlin and Utley.

Road metal. See Flint, Granite, Granite (porphyry), Limestone (crushed stone), Quartzite, Rhyolite, Sand and gravel, Sandstone, and Trap rock.

Sand and gravel. Occur all over eastern and northern portions of State. Used locally as road material and for concrete work. Principal deposits, Kenosha County, along Fox River, near Camp Lake and Wilmot. Rock County, near Janesville and Beloit. Walworth County, Fontana.

Sand (building). Dug at following places: Ashland County, on Oak Island. Fond du Lac County, at Ripon. Kenosha County, Kenosha and Wilmot. Marathon County, Wausau and Rib River. Marinette County, Marinette. Milwaukee County, Milwaukee. Monroe County, Tomah. Racine County, Burlington. Rock County, Janesville and Beloit. Walworth County, Fontana. Waukesha County, Waukesha. Used also in manufacture of sand-lime brick at Portage, Columbia County. Dane County, Madison. Milwaukee County, Milwaukee. Washington County, Barton.

Sand (glass). Dug in Columbia County at Portage; Monroe County, Tomah; Rock County, Beloit; St. Peter sandstone in many localities, as at Waukau, Winnebago County, not used.

Sand (molding). Dug in following places: Columbia County, Portage. Fond du Lac County, Fairwater. Green Lake County, Berlin. Racine County, Burlington and Racine. Rock County, Beloit.

Sandstone. Keweenawan sandstone outcrops on shore of Lake Superior from Ashland to Superior. Bayfield County, quarried at Bayfield, Houghton, Port Wing, and Siskiwit Point. Cambrian ("Potsdam") sandstone is

quarried in Buffalo County, at Nelson and Mondovi. Chippewa County, Chippewa Falls. Clark County, abundant in vicinity of Neillsville. Small quantity quarried in Crawford County, at Prairie du Chien. Dane County, Madison. Dodge County, near Portland and Waterloo. Douglas County, Wentworth. Dunn County, Colfax, Downs ville, and Dunnville. Fond du Lac County, Fond du Lac. Grant County, Boscobel. Iowa County, Linden. Jackson County, Alma Center and near Black River Falls. Juneau County, Mauston and Orange (mail Camp Douglas). La Crosse County, Holmen, small quantity, and Onalaska. Lafayette County, Argyle and Darlington. Monroe County, Leon, small quantity quarried at Sparta, Lafayette, and Tomah. Oconto County, Gillett. Outagamie County, Appleton and Black Creek. Pepin County, Durand. Portage County, Stevens Point, harder beds used for paving blocks. St. Croix County, small quantity quarried, Glenwood. Sauk County, Ableman, Baraboo, Devils Lake, Laval le, and North Freedom. Trempealeau County, Arcadia, Galesville, and Independence. Waupaca County, near New London. Waushara County, Plainfield. Wood County, small quantity quarried at Grand Rapids and near Centralia.

Sienna and umber. Iowa County, at Mineral Point, not worked.

Silica (for silica brick). Sauk County, quarried from quartzite at Ableman and Devils Lake.

Smithsonite (carbonate of zinc). Important ore of lead and zinc mines. Mined in Grant County at several mines. Iowa County, Dodgeville and Highland. Lafayette County, at several zinc mines.

Specularite. Found with hematite. *See also* Hematite.

Sphalerite (zinc blende). Most important ore of lead and zinc region. Grant County, mined at Platteville, Cuba, and Hazel Green. Iowa County, near Dodgeville, Highland, Linden, Mineral Point, Mifflin, Rewey, Montfort, and Livingston. Lafayette County, near Benton, Buncombe, Shullsburg, and Meekers Grove.

Trap rock. Quarried: Douglas County, at South Range. Marinette County, at Niagara. Polk County, at Dresser Junction. Also at many other places.

Umb er and sienna. Iowa County, at Mineral Point, not worked.

Wad. In iron mines in Iowa, Grant, and Lafayette counties, widely distributed in small quantities in lead and zinc mines. St. Croix County, occurs near Wilson and in other localities in northern Wisconsin.

Zinc ore. *See* Smithsonite and Sphalerite.

WYOMING.

- Agate (moss).** Carbon County, has been mined near Sweetwater River; common in other localities. Fremont County, head of Long Creek and on Sage Hen Creek, north of Granite Mountains. Natrona County, on Sage Hen Creek, northeast of Granite Mountains. Platte County, Wilde and Deercorn mine, 2 miles northwest of Guernsey, moss agate, also red and banded; mined intermittently.
- Allanite.** Albany County, near Albany station. Occurs near line between secs. 3 and 10, T. 14 N., R. 78 W., in pegmatite.
- Anglesite (lead sulphate).** Carbon County, at Ferris, with galena, cerusite, and quartz.
- Argentite (silver sulphide).** Laramie County, with other ores, Laramie Peak.
- Asbestos (chiefly chrysotile).** Albany County, Laramie Range. Carbon County, in Seminole Mountains. Converse County, occurs 10 miles south of Glenrock. Crook County, Black Hills. Natrona County, mined on Casper Mountain, 8 miles south of Casper, and on Smith Creek, 20 miles southeast of Casper; fair quality; associated with serpentine; 2 mills erected in 1910; small production.
- Asphalt.** Fremont County, occurs 4 miles northeast of Fort Washakie at a depth of 1,500 feet in wells drilled for oil, and in nearly all of the oil districts as maltha or breas. Big Horn County, west slope of Bighorn Mountains in secs. 28, 29, 32, 33, T. 52 N., R. 89 W.
- Azurite (blue carbonate of copper).** Albany County, Rambler, and Blanche mines at Holmes, Grand Encampment district. Carbon County, occurs but not mined in Seminole district. Crook County, Warrens Peak. Johnson County, Bighorn Mountains. Platte and Goshen counties, in Hartville Uplift in many prospects; mined in Copper Belt mines.
- Barite (heavy spar).** Albany County, Medicine Bow Mountains; not mined. Crook County, Black Hills. Park County, at Kirwin.
- Bentonite (medicinal or paper clay).** Occurs in Albany, Big Horn, Carbon, Converse, Crook, Fremont, Hot Springs, Johnson, Natrona, Park, Sheridan and Weston counties; used for weighting paper, as an adulterant, for hoof packing, and in the manufacture of antiphlogistine. Albany County, extensive deposits well developed on Rock Creek in eastern part of county; deposits also occur respectively at 8 and 20 miles southwest of Laramie; has been shipped from Rock Creek and Laramie Basin. Big Horn County, thick deposits in northern part of Bighorn Basin, near Hartman and the Montana boundary. Weston County, near Newcastle; has been shipped from Clay Spur and Newcastle. In Hot Springs County it occurs in beds 3 feet thick.
- Bismuth.** See Bismuthinite and Bismutite.
- Bismuthinite.** Albany County, occurs near Cummings City; not mined.
- Bismutite.** Albany County, has been mined on Jelm Mountain.
- Bornite (purple copper ore).** Carbon County, mined at Encampment district. Platte County, formerly mined about Hartville.
- Brown iron ore (limonite).** Albany County, occurs at Jelm mines. Converse County, near Douglas. Fremont County, on Little Popo Agie Creek; not mined.
- Cassiterite.** Crook County. Stream tin has been found sparingly at various times in the gulches around Nigger Hill, S. Dak., on State line.

Cement material (Portland). Albany County, 15 feet of pure marl in Niobrara formation, 8 miles southwest of Laramie. Laramie County, Niobrara and Minnekahta limestones and Graneros shale member of the Benton, near Cheyenne. Weston County, near Newcastle. Not used.

Cerargyrite (horn silver). Crook County, Black Butte mines, Warrens Peak. Fremont County, associated with other ores in Wind River Mountain mines.

Cerium metals. See Allanite and Monazite.

Cerussite (carbonate of lead). Albany County, in schists and diorite at Esterbrook; has been mined and shipped. Carbon County, with galena and quartz at Ferris. Crook County, Black Butte mines, hard and soft carbonates; argentiferous; has been mined.

Chalcocite (copper glance). Albany County, in gneiss and schist at Jelm; gold and silver values; Doane-Rambler and other mines. Carbon County, important ore of Encampment district. Platte and Goshen counties, important ore in Hartville Uplift; carries gold and silver at some mines.

Chalcopyrite (copper pyrites). Albany County, in granite and schist at Jelm mines; gold values. Carbon County, important ore of Encampment district; Seminole Mountains. Fremont County, South Pass City, with other ores. Laramie County, with iron ores in quartz at Ulcahoma mine, near Hecla; carries gold and silver. Park County, at Kirwin. Platte and Goshen counties, important ore of Hartville Uplift.

Chromite (chromic iron ore). Large deposits in the southern part of the State. Converse County, mined at Deer Creek canyon, 15 miles southwest of Glenrock. Natrona County, similar deposit occurs on Casper Mountain.

Chromium. See Chromite.

Chrysocolla (copper silicate). Platte and Goshen counties, Hartville iron range. Mined at Green Hope, Silver Cliff, and Copper Belt mines.

Chrysotile. See Asbestos.

Clay (brick). Abundant throughout the State. Brick made in the following localities: Albany County, Laramie. Big Horn County, Basin, Cody, Park, and Worland. Carbon County, Encampment. Converse County, Douglas. Crook County, Gillette. Fremont County, Lander and Thermopolis. Natrona County, Casper. Platte County, Wheatland. Sheridan County, Sheridan. Sweetwater County, Green River. Also in other counties.

Clay (medicinal or paper). See Bentonite.

Coal. Estimated tonnage of coal in the ground second largest in the United States; about 50 per cent of the area of the State is underlain by coal-bearing formations.

Coal (bituminous). *Laramie Basin.*—Albany County, mined for local use at Rock, Dutton, and Mill creeks.

Coal (bituminous and subbituminous). *Green River field.*—Carbon, Fremont, Sweetwater, and Uinta counties; contains 4,800 square miles of available coal and 20,000 square miles of coal deeply buried. Carbon County, bituminous coal mined at Hanna and Rawlins. Sweetwater County, Rock Springs. Uinta County, Cumberland, Diamondville, Kemmerer, and Spring Valley.

Henry's Fork field.—Uinta County, coal widely distributed; little developed.

Coal (bituminous coking). *Cambria field.*—Weston County, large mine at Cambria; about 12 square miles of workable coal; has been coked.

Coal (subbituminous). *Bighorn Basin*.—Big Horn and Park counties, mines near Basin, Cody, Crosby, Gebo, Meeteetse, and Thermopolis.

Powder River field.—Largest in the State; lies between Black Hills and Bighorn Mountains; extends from Montana line south to North Platte River; Upper Cretaceous and Eocene; beds have a maximum thickness of 45 feet; 11,000 square miles underlain by workable beds. Mined in Converse County at Glenrock, Big Muddy, Inez station, and Lost Spring; Johnson County, Buffalo; Sheridan County, Carney, Dietz, Monarch, and Sheridan. Small quantity for local use taken at many places.

Wind River Basin.—Fremont and Natrona counties. Mined in Popo Agie Valley, 8 miles northeast of Lander and near Hudson; 8 feet.

Cobalt. Albany County, with gold-copper ores in Medicine Bow mines at Holmes. Laramie County, with copper ores in Silver Crown district.

Copper (native). Albany County, in granite at Rambler mine, Grand Encampment district. Fremont County, Copper Mountain district. Platte and Goshen counties, Hartville Uplift; mined in Iron Belt mines.

Copper minerals. Copper is the predominant metal produced in the following districts: Albany County, Douglas Creek, Horse Creek, Jelm Mountains, and Laramie Peak. Carbon County, Encampment, French Creek, Rankin, and Seminole. Converse County, Warbonnet. Fremont County, Copper Mountain, De Pass, and Owl Creek. Goshen County, Rawhide Buttes. Johnson County, Bull Camp. Laramie County, Hecla. Natrona County, Casper Mountain. Park County, Kirwin, Sunlight. Uinta County, Cockscomb. *See also* Azurite, Bornite, Chalcocite, Chalcopyrite, Chrysocolla, Covellite, Cuprite, Malachite, Melanconite, Tennantite, and Tenorite.

Corundum (emery). Fremont County, Wind River Range; not mined.

Covellite. Albany County, mined at Rambler mine at Holmes, Grand Encampment district. Platte and Goshen counties, Hartville Uplift.

Cuprite (red copper oxide). Albany County, Rambler mine at Holmes, Grand Encampment district. Big Horn County, prospects in Bull Creek, Walker Prairie, in Bighorn Mountains. Crook County, associated with hard carbonate ores at Black Buttes and Inyankara Peak; has been mined. Platte and Goshen counties, mined in Hartville Uplift; prospects in Whalen Canyon, Muskrat Canyon, and Rawhide Buttes.

Epsomite (Epsom salt, magnesium sulphate). Long, needle-shaped crystals in soda lakes in Albany, Carbon, and Natrona counties. Brooklyn Lake, area 90 acres, covered with nearly pure deposit, near Wilcox station, Albany County.

Flagstone. Common in same localities as marble, limestone, and sandstones. Has been quarried for local use.

Galena (argentiferous). Albany County, mined for gold and silver in gneiss and schist at Jelm. Carbon County, at Ferris in fissure veins with quartz, cerussite, anglesite. Crook County, has been mined at Black Buttes. Park County, Kirwin.

Gas. *See* Natural gas.

Gold (lode). Produced in following districts, in most cases as predominant metal: Albany County, Centennial, Holmes, and Jelm Mountains. Crook County, Bear Lodge and Black Buttes. Fremont County, Atlantic, Owl Creek, and South Pass. Goshen County, Rawhide Buttes. Laramie County, Hecla. Lincoln County, Horse Creek, 85 miles north of Kemmerer, near Merna. *See also* Sylvanite.

Gold (placer). Albany County, Douglas Creek and Keystone. Big Horn County, Shoshone River and Bald Mountain. Carbon County, on the South French Creek. Crook County, Sand Creek and Nigger Hill. Fremont

County, Atlantic and Lewiston; South Pass City, hydraulicking. In 1912-13 was dredged on Wind River, 7 miles west of Riverton and 8 miles northeast of Riverton, near Noble. Johnson County, in Kelley Creek near Buffalo, and in Bighorn Mountains. Park County, Shoshone River and Clark Fork at Crandall. Sweetwater County, Green River. Uinta County, in sands of Snake River, mined intermittently, and on Snake Creek.

Granite. Abundant in Bighorn Mountains, Hartville Uplift, Laramie Range, and Medicine Bow Range; production small.

Graphite (plumbago). Fremont County, near Miners Delight. Goshen County, Haystack Hills. Platte County, near Ironton; has been mined.

Grindstone. Carbon County, quarried near Rawlins; small production.

Gypsum. Albany County, rock gypsum is mined at Red Butte, and used by one mill for making plaster; gypsite, or earthy gypsum, is dug near Laramie and used by two mills for making plaster. Has been mined west of Sheridan; occurs abundantly in Big Horn, Carbon, Converse, Crook, Fremont, Johnson, Laramie, Natrona, Sweetwater, Uinta, and Weston counties.

Halite (common salt). In soda lakes in Albany, Carbon, and Natrona counties. Salt springs numerous in several counties. Crook County, at Cambria, salt was made by evaporating water of Salt Creek.

Hematite (red iron ore). Carbon County, extensive deposit north of Rawlins was mined for flux; also on south side of the Seminole Mountains, 35 miles north of Rawlins, and at Jelm mines. Platte and Goshen counties, chief ore of Hartville iron range; mined at Sunrise, Lone Jack, and Good Fortune mines.

Ilmenite (titanic iron ore). Laramie County, Iron Mountain; immense dike, not mined.

Iron. Iron is the chief metal produced in Laramie County, at Iron Mountain, and in Platte County, at Hartville. Chromic iron ore is produced in Converse County, in Deer Creek district. *See also* Brown iron ore, Chromite, Hematite, Ilmenite, Magnetite, Mineral paint, Pyrite, and Pyrrhotite.

Kaolin. Carbon County, occurs near the soda lake, pure and in quantity.

Lead. *See* Anglesite, Cerusite, and Galena.

Limestone. Albany County, 3 miles northeast of Laramie, used for lime in beet-sugar refining. Limestones of Carboniferous and Jurassic age in many counties afford an abundance of good lime suitable for plaster; some of these limestones are hydraulic.

Limestone (building). Quarried: Albany County, at Laramie. Carbon County, Rawlins. Fremont County, Thermopolis. Laramie County, Horse Creek. Platte County, Hartville and near Guernsey. Sheridan County, Sheridan. Sweetwater County, Green River.

Limestone (flux). Quarried: Carbon County, at Rawlins. Platte County, Guernsey.

Limonite (brown hematite). *See* Brown iron ore.

Magnetite (magnetic iron ore). Albany County, in diorite near Foxpark. Carbon County, with hematite, near Rawlins.

Malachite (green carbonate of copper). Albany County, abundant in Rambler mine, and found in Blanche mine at Holmes, Grand Encampment district. Carbon and Cook counties, prospects at Bull Camp and Walker Prairie, in Bighorn Mountains, with other ores. Park County, Kirwin, as vein mineral. Platte and Goshen counties, important ore of Hartville Uplift; mined at Green Hope, Silver Cliff, and Copper Belt mines.

Manganese ore. Albany County, west side of Laramie Peak.

Marble. Albany County, west flank Laramie Range; east flank Medicine Bow Range; 100-foot ledge of good quality, Cooper Lake station. Converse County, Douglas, red, good quality. Crook County, west flank Black Hills. Fremont County, Rattlesnake Mountains. Johnson County, Big-horn Mountains. Platte County, Hartville, east flank Laramie Range, abundant in the Carboniferous; pure white marble occurs 20 miles west of Wheatland.

Marl. Albany County, 15 feet pure marl, 8 miles southwest of Laramie.

Melaconite (black oxide of copper). Albany County, quantity in Rambler mine, Holmes. Platte County, Michigan cine.

Mica (muscovite). Albany County, in Medicine Bow Range. Converse County, occurs in sizable plates at Glenrock. Fremont County, 60 miles west of Lander. Goshen County, in Haystack Mountains near Hartville. Platte County, near Ironton.

Mineral paint. Carbon County, made from soft iron ore at Rawlins. Suitable material at Hartville and other iron localities.

Mirabilite (sodium sulphate, glauber salt). In soda lakes in Albany, Carbon, and Natrona counties; has been mined in Albany County near Laramie and in Natrona County, Sweetwater Valley.

Molybdenite. Park County, in Bryan mine, at Kirwin.

Monazite. Carbon County, in black sands in Bald Mountain district. Sheridan County, reported from Bighorn Mountains.

Natron (carbonate of soda). Sweetwater County, Green River; borings in the Wasatch sandstone (Eocene?) at depths of 125 and 700 feet yield an almost concentrated solution of sodium carbonate utilized for the manufacture of caustic soda. Common in soda lakes of Albany, Carbon, Natrona, and Sweetwater counties; not marketed.

Natural gas. Big Horn County, Bighorn Basin gas field; gas from anticlines at western base of Bighorn Mountains; used commercially at Basin, Byron, and Greybull. Converse County, small field near Douglas. Hot Springs County, considerable quantities, as yet not utilized, in Grass Creek oil field. Occurs in central Park County, near Cody, and in southern Park County, in Buffalo Basin.

Nickel ore. Converse County, in pyrrhotite, Esterbrook district. Laramie County, in ores of Ulcahoma mine, and associated with copper ores, Little London mine, near Hecla.

Niter. Sweetwater County, soda niter in Leucite Hills.

Oil. *See* Petroleum.

Oil shale. *See* Shale.

Ozokerite (mineral wax). Fremont County, occurs 20 miles southeast of Lander. Sweetwater and Uinta counties, near Colorado line, in Tertiary and Cretaceous; shipped east for use in manufacture of ointments and insulating material.

Palladium. Albany County, in copper ores with platinum in Rambler mine at Holmes.

Petrified wood. Common in badlands in many parts of the State.

Petroleum. Productive areas of considerable importance in Big Horn County, near Basin, Byron, and Greybull. About 15 wells drilled on Torchlight dome, 3 miles east of Basin; 10 wells on a small anticline directly north of this dome; and about 35 wells on the Greybull dome, at the mouth of Greybull River. Petroleum, paraffin base, in Fremont County, north and east of Lander, near Riverton, Saddlerock; in Hot Springs County, along Grass Creek, 5 miles northwest of Ilq; and in Natrona County, at Salt

Creek, north of Casper. Hot Springs County, in Grass Creek anticline, 20 or more wells drilled; nearly all found oil. Petroleum occurs in small quantities in Big Horn County, near Bonanza; in Converse County, near Douglas; in Crook County, near Moorcroft; in Johnson County, along Powder River; in Lincoln County, near Labarge; in Weston County, near Newcastle; and in Uinta County, near Spring Valley. The total production of the State in 1913 was 2,406,522 barrels, valued at \$1,187,232; in 1914 it was 3,560,375 barrels, valued at \$1,679,192.

Phosphate rock. Fremont County, extends 50 miles northwest and southeast from Lander and occurs along northern boundary. Hot Springs County, underlies area near Thermopolis and along southern boundary. Lincoln County, mined and shipped at Cokeville; large area 140 miles long; beds 10 feet thick.

Platinum. Albany County, in copper ores of the Rambler mine, at Holmes. Lincoln County, in concentrates from Snake River placers. *See also* Sperrylite.

Potash. Sweetwater County, large quantity in wyomingite and other rocks of Leucite Hills. No method known for making it commercially available. *See also* Niter.

Pumice. Albany County, beds 4 to 6 feet thick near Sportsmans Lake.

Pyrite (iron pyrites). Albany County, with copper ores, Encampment district, in Jelm and Ulaehoma mines; mined for gold and silver content. Sweetwater and other counties, with gold and quartz veins; little worked.

Pyrrhotite. Albany and Converse counties, underlying iron oxides at Cooney Hill and with copper ores in prospects in North Laramie district.

Road metal. *See* Asphalt, Granite, Limestone, Marble, and Sandstone.

Salt. Uinta County, mined at Auburn. Salt produced from brine south of Star Valley on Salt Creek. *See also* Halite.

Sand (building). Dug in small quantity for local use at many places.

Sand (glass). Albany County, from soft sandstone of Casper formation. Has been quarried 3 miles east of Laramie.

Sandstone. Albany County, quarried at Laramie, small quantity. Big Horn County, Cody. Carbon County, Rawlins. Crook County, Aladdin. Fremont County, Lander and Thermopolis. Laramie County, Iron Mountain and Underwood. Sheridan County, Arno, Dietz, and Absawkee Park. Uinta County, Cumberland, Evanston, Oakley, Frontier, and Glencoe, and at many other towns and villages.

Shale. Albany County, used for making brick at Laramie.

Shale (oil). Green River formation (Eocene), in southwestern part of the State, on Green River and its tributaries; some shale rich in oil.

Silver (native). Platte County, Silver Cliff mine in Hartville Uplift and in other copper mines. *See also* Argentite, Cerargyrite, and Sylvanite.

Sperrylite. Albany County, has been found at Rambler mine, Holmes.

Sphalerite. Platte County, mined with hematic in Hartville mines.

Sulphur. Hot Springs County, massive and in small crystals in travertine near Thermopolis; mined and shipped. Park County, in local deposits on south side of Shoshone River; at lower end of Shoshone Canyon, and on west side of Sulphur Creek; occurs in the Sunlight Basin, 52 miles northwest of Cody; has been mined near Cody.

Sylvanite. Crook County, occurs in Bear Lodge Mountains.

Tennantite. Platte County, has been mined north of Guernsey in Copper Bottom prospect, SE. $\frac{1}{4}$ sec. 23, T. 29 N., R. 65 W.

Tenorite. Albany County, quantity at Rambler mine, Holmes.

Thorium. *See* Monazite.

Tin. *See* Cassiterite.

Titanium. *See* Ilmenite.

Travertine. Hot Springs County, near Thermopolis, on Bighorn River (abundant), and in Yellowstone National Park in the northwestern part of the State.

Trona (sodium carbonate). Sweetwater County, number of wells at Greenwater; produce good soda; shipped.

Tufa. *See* Travertine.

Tungsten. *See* Wolframite.

Wolframite. Albany County, small stringer in copper mine near Holmes.

Wood, silicified. Abundant in Yellowstone National Park.

Wyomingite. Sweetwater County, in Leucite Hills, abundant. Future source of potash when method for making it commercially available is discovered.

Yttrium. *See* Allanite.

Zinc. *See* Sphalerite.

GLOSSARY AND INDEX.

The definitions in this glossary are not intended to be sufficiently full and detailed for the identification of unknown minerals. They are expected only to show definitely what is meant by the terms used in the first part of the paper. The aim has been to make the definitions as clear as possible for the reader not used to technical terms. However, the intricacies of the subject do not permit all definitions to be made perfectly clear to those who are wholly unfamiliar with minerals or with chemical terms and symbols.

In the hope of adding to the usefulness of the definitions the percentages of those constituents which ordinarily give the mineral its value and items that may make the relations of the minerals clearer have generally been stated.

The list of uses of the mineral given in the definition is not complete. The aim, however, has been to give all the principal uses in the order of their importance, and where practicable some of the minor but more interesting uses. It may also be noted that the uses of some minerals have changed from time to time. With improved methods of treatment and the discovery of new or more valuable applications the useless of yesterday becomes the useful of to-day. For example, low-grade gold ores that were considered worthless 20 years ago have become rich assets with the introduction of the cyanide process. Zinc minerals of the Western States that were valueless or caused loss in marketing the ores 15 years ago can now be sold at a profit. The ores of the Alice, Emma, and other mines at Butte, Mont., formerly worked for silver, are now worked for zinc, and the ores of the mines at Ducktown, Tenn., formerly worked for copper, are now valuable chiefly for sulphuric acid. From tungsten ores of Colorado that were thrown on the dump 15 years ago concentrates having a value of more than \$2,000 a ton are obtained. Many iron ores that are rich in phosphorus were neglected until the Thomas process provided means for their profitable reduction. Monazite containing thorium acquired importance with the invention of the incandescent mantle for gas burners. On the other hand, decreasing prices or the discovery of better substances for a given use may make a particular mineral or deposit unprofitable. During the great decline in the price of silver, which began in 1880, many silver mines became dormant. Aluminum is being extensively used on an increasing scale as a substitute for tin and iron. Alloys of tungsten and molybdenum with other metals are being used as substitutes for platinum.

Free use has been made of Dana's monumental "System of Mineralogy," Kemp's "Handbook of Rocks," and publications of the United States Geological Survey and the Bureau of Mines. Much

technical information has been derived also from the current journals on mining, metallurgy, mineralogy, and industrial and engineering chemistry. The Standard and Century dictionaries, the United States and National Standard dispensaries, and other recognized works have also been consulted.

It is thought that a table of atomic weights will be of use in connection with formulas of the minerals, and therefore the list given by the International Committee on Atomic Weights, 1915, is printed below. The list also gives the chemical symbols of the elements.

International atomic weights, 1915.¹

	Symbol.	Atomic weight.		Symbol.	Atomic weight.
Aluminum.....	Al	27.1	Iron.....	Fe	55.84
Antimony.....	Sb	120.2	Krypton.....	Kr	82.92
Argon.....	A	39.88	Lanthanum.....	La	139.0
Arsenic.....	As	74.96	Lead.....	Pb	207.20
Barium.....	Ba	137.37	Lithium.....	Li	6.94
Bismuth.....	Bi	208.0	Lutecium.....	Lu	174.0
Boron.....	B	11.0	Magnesium.....	Mg	24.32
Bromine.....	Br	79.92	Manganese.....	Mn	54.93
Cadmium.....	Cd	112.40	Mercury.....	Hg	200.6
Cæsium.....	Cs	132.81	Molybdenum.....	Mo	96.0
Calcium.....	Ca	40.07	Neodymium.....	Nd	144.3
Carbon.....	C	12.0	Neon.....	Ne	20.2
Cerium.....	Ce	140.25	Nickel.....	Ni	58.68
Chlorine.....	Cl	35.46	Niton (radium emanation)....	Nt	222.4
Chromium.....	Cr	52.0	Nitrogen.....	N	14.01
Cobalt.....	Co	58.97	Osmium.....	Os	190.9
Columbium.....	Cb	93.5	Oxygen.....	O	16.0
Copper.....	Cu	63.57	Palladium.....	Pd	106.7
Dysprosium.....	Dy	162.5	Phosphorus.....	P	31.04
Erbium.....	Er	167.7	Platinum.....	Pt	195.2
Europium.....	Eu	152.0	Potassium.....	K	39.10
Fluorine.....	F	19.0	Praseodymium.....	Pr	140.6
Gadolinium.....	Gd	157.3	Radium.....	Ra	226.4
Gallium.....	Ga	69.9	Rhodium.....	Rh	102.9
Germanium.....	Ge	72.5	Rubidium.....	Rb	85.45
Glucinum.....	Gl	9.1	Ruthenium.....	Ru	101.7
Gold.....	Au	197.2	Samarium.....	Sa	150.4
Helium.....	He	3.99	Scandium.....	Sc	44.1
Holmium.....	Ho	163.5	Selenium.....	Se	79.2
Hydrogen.....	H	1.008	Silicon.....	Si	28.3
Indium.....	In	114.8	Silver.....	Ag	107.88
Iodine.....	I	126.92	Sodium.....	Na	23.00
Iridium.....	Ir	193.1	Strontium.....	Sr	87.63

¹ Clarke, F. W., Thorpe, T. E., Ostwald, W., and Urbain, G., Annual report of the International Committee on Atomic Weights, 1916: Am. Chem. Soc. Jour., vol. 37, p. 2451, November, 1915.

	Symbol.	Atomic weight.		Symbol.	Atomic weight.
Sulphur.....	S	32.06	Tungsten.....	W	184.0
Tantalum.....	Ta	181.5	Uranium.....	U	238.2
Tellurium.....	Te	127.5	Vanadium.....	V	51.0
Terbium.....	Tb	159.2	Xenon.....	Xe	130.2
Thallium.....	Tl	204.0	Ytterbium (Neoytterbium)...	Yb	172.0
Thorium.....	Th	232.4	Yttrium.....	Yt	89.0
Thulium.....	Tm	168.5	Zinc.....	Zn	65.37
Tin.....	Sn	119.0	Zirconium.....	Zr	90.6
Titanium.....	Ti	48.1			

Abrasives. Mineral or rock substances used in grinding, abrading, and polishing. *See also* Burrstone, Corundum, Diatomaceous earth, Emery, Garnet, Grindstone, Millstone, Novaculite, Oilstone, Pumice, Scythestone, Tripoli, Volcanic ash, and Whetstone.

Acanthite. A silver sulphide, Ag_2S . It contains 87 per cent silver.
Colorado.

Actinolite. A light-green calcium-magnesium-iron amphibole, $3\text{Mg}(\text{Fe})\text{O} \cdot \text{CaO} \cdot 4\text{SiO}_2$ used as an ornamental stone. *See also* Asbestos.

Ægerite. *See* Wurtzillite.

Ægirite. A monoclinic pyroxene having the general composition, $\text{Na}_2\text{O} \cdot \text{Fe}_2\text{O}_3 \cdot 4\text{SiO}_2$. Vanadiferous ægirite near Libby, Mont., contains 4 per cent of V_2O_5 , which replaces a part of the Fe_2O_3 .
Montana.

Æonite. *See* Wurtzillite.

Agalmatolite. *See* Pyrophyllite.
California, North Carolina.

Agate. A variegated chalcedony, SiO_2 . Used as a gem, and in mechanical lines, for meter and scale bearings, phonograph needles, dental tools, mortars and pestles, and for ornaments.

Arizona, Arkansas, California, Colorado, Connecticut, Georgia, Michigan, Montana, Nebraska, New Jersey, North Carolina, Oregon, Rhode Island, Texas, Utah, Wyoming.

Agatized wood. *See* Wood.

Aikinite, needle ore. Sulphobismuthite of lead and copper, $3(\text{PbCu}_2)\text{S} \cdot \text{Bi}_2\text{S}_3$.
Arizona, Colorado.

Alabandite. Manganese sulphide, MnS .
Arizona, Colorado.

Alabaster. Compact fine-grained gypsum, white or delicately shaded. *See also* Gypsum.

Arizona, California, Texas.

Albite, Soda feldspar. A silicate of aluminum and sodium, $\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$.
See also Feldspar.

Allanite, Orthite. A complex variable silicate of aluminum, iron, the cerium metals (cerium, didymium, lanthanum), and in smaller quantity those of the yttrium group. Important source of rare metals, especially salts of cerium.

Colorado, New York, North Carolina, Pennsylvania, Texas, Virginia, Wyoming.

Almandite, common garnet. An iron-aluminum garnet, $3\text{FeO} \cdot \text{Al}_2\text{O}_3 \cdot 3\text{SiO}_2$. Used very abundantly as an abrasive material, and as a gem (precious garnet).

Colorado, Connecticut, New Hampshire, New York, North Carolina, Oregon, Pennsylvania.

Altaite. A lead telluride, PbTe .

California, Colorado.

Aluminum. A metallic element, Al . Not found native. Aluminum, by reason of its light weight and freedom from oxidation, is used on an increasing scale in making kitchen utensils, surgical appliances, jewelry, and fancy articles, and bearings for machinery. It is beginning to be used in the interior decoration of business offices. Powdered metal is used in painting, as a constituent of explosives, especially explosive shells, and as a patented source of heat. Metallic aluminum is also used on an increasing scale in constructing automobiles, dirigible balloons, and aeroplanes, and in kettles and vats for making preserves, oils, varnishes, beer, and acids. *See also* Bauxite, Cryolite, and Halloysite.

Alum minerals and alum salts. Natural salts from which alum can be made. *See also* Halloysite and Kalinite.

Alabama, California, Massachusetts, Nevada, New Mexico, Tennessee, Texas, Utah, Virginia.

Alunite. A hydrous sulphate of aluminum and potassium, $\text{K}_2\text{O} \cdot 3\text{Al}_2\text{O}_3 \cdot 4\text{SO}_3 \cdot 6\text{H}_2\text{O}$. It contains, when pure, 11.4 per cent potash, K_2O . Impure or sodic varieties may contain chiefly sodium instead of potassium. Used abroad in manufacture of potash alum. Use for extraction of potassium sulphate (potash) recently begun in Utah. Also available as a source of alumina and aluminum salts and for use, either raw or calcined, as a fertilizer.

Arizona, California, Colorado, Nevada, Utah.

Alunogen. A hydrous aluminum sulphate, $\text{Al}_2\text{O}_3 \cdot 3\text{SO}_3 \cdot 18\text{H}_2\text{O}$. A prospective source of alumina.

California, New Mexico.

Amalgam. A native compound of silver and mercury, in which the percentage of silver ranges from 27.5 to 95.8. Native gold amalgam carrying 39 to 42.6 per cent gold has also been found.

California, Colorado.

Amatrice. *See* Variscite.

Amazon stone. A green microcline, a variety of potash feldspar. Used as a semiprecious and ornamental stone.

Colorado, Virginia.

Amber, Fossil resin, Succinite. Used in pharmacy, the arts, and as a gem. Colorado.

Amblygonite. A fluophosphate of aluminum and lithium, $\text{Li}(\text{AlF})\text{PO}_4$. An important source of lithium, used in medicine and in making storage batteries.

California, Colorado, South Dakota.

Amethyst. A purple or bluish-violet quartz, SiO_2 . Used as a gem.

Arizona, California, Colorado, Connecticut, Georgia, Maine, Michigan, New Jersey, New Mexico, North Carolina, Pennsylvania, South Carolina, Texas, Virginia.

Amianthus. *See* Asbestos.

Amphibole. A group name for a series of minerals which, although crystallizing in different systems, are closely related in form, as shown by the common prismatic cleavage of 54° to 56° , also in optical characters and chemical composition. They consist essentially of silicates of lime, iron, magnesia, alumina, and in some varieties of soda. Hornblende is the commonest variety. *See also* Asbestos and Tremolite.

Amphibolite. A metamorphic rock consisting chiefly of hornblende or of some member of the hornblende group. Used for ornamental work. South Dakota.

Andalusite. An aluminum silicate, $\text{Al}_2\text{O}_3\cdot\text{SiO}_2$. Sometimes used as a semi-precious stone. *See* Chiastolite.

Andradite. The common calcium-iron garnet, $3\text{CaO}\cdot\text{Fe}_2\text{O}_3\cdot 3\text{SiO}_2$. Used as an abrasive, and fine, clear specimens as gems.

Arizona, Utah.

Anglesite. Lead sulphate, PbSO_4 . Contains 68 per cent lead.

Arizona, California, Colorado, Idaho, Missouri, Nevada, New Mexico, South Dakota, Utah, Wyoming.

Anhydrite. Calcium sulphate, CaSO_4 or $\text{CaO}\cdot\text{SO}_3$. Contains 41.2 per cent lime and 58.8 per cent sulphur trioxide. Usually associated with gypsum, to which it alters. Differs from it in being harder and in lacking water of crystallization. Not of economic importance.

California, Michigan.

Annabergite. A hydrous nickel arsenate, $\text{Ni}_3\text{As}_2\text{O}_8\cdot 8\text{H}_2\text{O}$.

Colorado, Nevada.

Anthracite, Hard coal. A hard black lustrous coal containing 85 to 95 per cent carbon as against 70 to 85 per cent in bituminous or "soft" coal. *See also* Coal.

Colorado, Massachusetts, New Mexico, Pennsylvania, Rhode Island, Virginia.

Antimony. An element, Sb. Sometimes found native. Used in Babbitt and other bearing metals; type metal; "white metal" alloys used as a foundation for silver plate; coffin trimmings, toys, clock frames, etc.; shrapnel and other bullets and shot. Some of its salts are used in manufactured rubber, enamels for household utensils and wares, in glass making, and in dyeing. Used in the manufacture of safety matches and percussion caps. Used sparingly in pyrotechnics and medicine. Owing to the demand for the metal in making shrapnel bullets the price of antimony rose after the outbreak of the European war from 6 cents to 50 cents a pound, with the result that many deposits previously dormant became active producers. *See also* Bindheimite, Bournonite, Cervantite, Dyscrasite, Jamesonite, Nagyagite, Polybasite, Stibiconite, and Stibnite.

Arizona, Arkansas, California, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Washington.

Antimony glance. *See* Stibnite.

Antimony ocher. *See* Stibiconite.

Apatite. A calcium phosphate containing a little fluorine or chlorine, $\text{Ca}_4(\text{CaF})(\text{PO}_4)_3$ or $\text{Ca}_4(\text{CaCl})(\text{PO}_4)_3$. The fluorapatite contains 42.3 per cent P_2O_5 and the chlorapatite 41 per cent P_2O_5 . Used as a gem.

California, Colorado, Maine, New Jersey, New York, Pennsylvania, South Dakota, Virginia.

Apophyllite. A calcium-hydrogen silicate, some specimens of which contain potassium and fluorine, $\text{K}_2\text{O}\cdot 0.8\text{CaO}\cdot 16\text{SiO}_2\cdot 16\text{H}_2\text{O}$. Occasionally used as a gem.

California.

Aquamarine. A transparent light bluish green beryl. Used as a gem.

California, Colorado, Connecticut, Maine, Massachusetts, New Hampshire, North Carolina, South Carolina.

Aragonite. Calcium carbonate, CaCO_3 , used in the manufacture of cement and lime and as an ornamental stone.

Oregon, South Dakota.

Argentite, Silver glance. A silver sulphide, Ag_2S . Contains 87 per cent silver.

Arizona, California, Colorado, Idaho, Maine, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming.

Arsenic. An element, As . Sometimes found native. In the elemental form arsenic is used to harden shot and make them take a rounder form. As arsenious oxide, the "white arsenic" or "arsenic" of commerce, it is used extensively in glass, as an insecticide, and weed and vermin killer. Many other arsenic compounds are also used as insecticides, and others are used to a small extent in dyeing. Used also in medicine and tanning. About all the commercial arsenic of the United States is produced as a by-product by copper smelters from arsenical copper ores. *See also* Arsenopyrite, Mimetite, Niccolite, Orpiment, Realger, Scorodite, Smaltite, and Sperrylite.

Arizona, California, Montana, Nevada, Virginia, Washington.

Arsenical nickel. *See* Niccolite.

Arsenical pyrite. *See* Arsenopyrite.

Arsenobismite. Bismuth arsenate, $2\text{Bi}_2\text{O}_3 \cdot \text{As}_2\text{O}_5 \cdot 2\text{H}_2\text{O}$, a yellow earthy cryptocrystalline new mineral. A source of bismuth.

Utah.

Arsenolite (white arsenic). Oxide of arsenic, As_2O_3 . A source of arsenic.

California.

Arsenopyrite, Arsenical pyrite, Mispickel. A sulpharsenide of iron, FeAsS . Contains 46 per cent arsenic, equivalent to 57.7 per cent white arsenic, As_2O_3 . The chief source of arsenic, commonly gold bearing.

Arizona, California, Colorado, Connecticut, Georgia, Idaho, Maine, Montana, Nevada, New Hampshire, New York, North Carolina, Oregon, South Dakota, Utah, Vermont, Virginia, Washington, Wisconsin.

Asbestos, Actinolite, Amianthus, Chrysotile. A fibrous variety of amphibole. In commerce it includes also fibrous serpentine (chrysotile). Amianthus is a fine silky amphibole asbestos. The properties of asbestos, such as its noncombustibility, nonconductivity of heat and electricity, and its fibrous structure, make it one of the most useful minerals for many structural uses. New uses are frequently found. Used largely for fireproofing and heat insulation. Chrysotile is spun into yarn and rope and woven into cloth for theater curtains, fireproof clothing, shoes, and gloves. Used commonly for stove holders, table mats, and for brake bands on motor cars. When practically free from iron, as is that from Arizona, it is an excellent nonconductor of electricity, and fine yarn is made of it to cover and thus insulate copper and other wire conductors. Amianthus is extensively used for pipe and boiler covering to preserve the heat and for filtering acids and other corrosive chemicals. Millboard is made of it for fire protection about stoves, and flooring, plaster, stucco, and shingles, as well as asbestos lumber, made of it are fireproof materials. It has also a wide application for military uses, such as closing the breeches of big guns, in connection with torpedoes, in the manufacture of time fuses, dynamite shells, and other munitions. The asbestos is used alone or mixed with Portland cement, magnesia, sawdust, or other substances. The greater

part of the asbestos produced is derived from Georgia, but the best quality comes from Arizona.

Alabama, Arizona, California, Colorado, Connecticut, Delaware, Georgia, Idaho, Maryland, Massachusetts, Michigan, New York, North Carolina, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Vermont, Virginia, Washington, Wisconsin, Wyoming.

Asphalt, Mineral pitch. A general name for a large group of viscous, pliable, elastic, and brittle substances which soften on application of heat and melt at 90° to 100° F. They are related in origin to petroleum, are made up of complex hydrocarbon derivatives, and contain more or less sulphur and generally oxygen. They range in color from brown to black and are impervious to water. They are mostly or wholly soluble in turpentine. Many varieties occur native; others are produced by the boiling down of asphaltic petroleum. The several varieties differ from one another in hardness, behavior when heated, and in the proportions soluble in carbon disulphide, turpentine, naphtha, and other organic solvents. Used chiefly as a bond for crushed rock, etc., for roads, pavements, foundations, roofing material, damp courses in houses, as a protective covering for wood or iron, as an ingredient of roofing felt, and in certain varnishes and japans. *See also* Albertite, Bitumen, Brea, Elaterite, Gilsonite, Grahamite, Impsonite, Maltha, Nigrite, Residuum, Tabbite, and Wurtzilite.

Alabama, Arkansas, California, Colorado, Indiana, Kansas, Kentucky, Michigan, Missouri, Nevada, Ohio, Oklahoma, Oregon, Tennessee, Texas, Utah, Wyoming.

Auerlite. A silicophosphate of thorium containing about 70 per cent of thorium. Like zircon in form. An important source of thorium.

North Carolina.

Aurichalcite. Basic carbonate of zinc and copper.

California, Colorado, New Mexico, Utah.

Autunite. A hydrous phosphate of uranium and calcium, $\text{CaO} \cdot 2\text{UO}_3 \cdot \text{P}_2\text{O}_5 \cdot 8\text{H}_2\text{O}$. Contains 62.7 per cent UO_3 , equivalent to 61.6 per cent U_3O_8 , and is radioactive. Important source of radium and uranium.

South Dakota, Utah.

Axinite. A borosilicate of aluminum and calcium with varying quantities of iron and manganese. Exact composition doubtful. Used as a gem.

California, Nevada.

Azurite. Blue copper carbonate, $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$. Contains 46 per cent copper. Sometimes used as a gem. Also used as a pigment (not very durable).

Arizona, Arkansas, California, Colorado, Connecticut, Idaho, Missouri, Montana, Nevada, New Jersey, New Mexico, North Carolina, Oklahoma, Oregon, Pennsylvania, South Dakota, Tennessee, Utah, Virginia, Wisconsin, Wyoming.

Azumalachite. A mixture of blue and green copper carbonates. Used as a gem. Arizona, Utah.

Barite, Barytes, Heavy spar. Barium sulphate, BaSO_4 . Used principally as a pigment in mixed paints, in the manufacture of lithopone—a chemically prepared white pigment consisting of zinc sulphide and barium sulphate—in the preparation of other barium salts, such as the nitrate, used in pyrotechnics for green fire, and as a base upon which the lake pigments are precipitated. It is also used in the manufacture of white rubber goods, asbestos cement, and artificial ivory, in giving weight to paper, and in the preparation of fertilizers, boiler compounds, insecticides, peroxide of hydrogen, and artificial driftwood salts. Some varieties take a high polish and are used in place of marble.

Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Georgia, Idaho, Kentucky, Maryland, Missouri, Nevada, New Mexico, New York, North Carolina, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin, Wyoming.

Basalt. A dense to glassy dark-colored basic volcanic rock, composed essentially of soda-lime feldspar and pyroxene, with or without olivine, and with accessory magnetite or ilmenite and apatite. The glassy varieties are composed of the uncrystallized constituents of these minerals and are called obsidian. Used extensively as crushed stone for ballast, road metal, and concrete, and locally for building and paving stone. Comprises with diabase the typical "trap rock." Vesicular basalt used for bed plates and beater rolls in paper-making machinery.

Arizona, California (*see* Road metal), Connecticut (*see* Trap rock), Idaho, Massachusetts (*see* Trap rock), Nevada, New Jersey (*see* Trap rock), Oregon, Utah, Washington.

Bauxite. Hydrated alumina, essentially $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$. The chief uses of bauxite are as a raw material in the production of metallic aluminum, in the manufacture of aluminum salts, in the manufacture of bauxite bricks, and in the manufacture of alundum (fused alumina) for use as an abrasive and also in making calcium aluminate to give a quick set to certain plaster compositions.

Alabama, Arkansas, California, Colorado, Georgia, Tennessee, Virginia.

Beaverite. A hydrous sulphate of copper, lead, and ferric iron, $\text{CuO} \cdot \text{PbO} \cdot \text{Fe}_2\text{O}_3 \cdot 2\text{SO}_3 \cdot 4\text{H}_2\text{O}$.

Utah.

Beegerite. Sulphobismuthite of lead. May yield bismuth as a by-product.

Colorado.

Benitoite. A blue barium-titanium silicate, $\text{BaTiSi}_3\text{O}_{10}$. Used as a gem.

California.

Bentonite (Denver mud, Denver clay, medicinal clay, paper clay). A bedded plastic clay which swells immensely upon wetting. Used as sizing for paper, absorbent in dynamite manufacture, retarder for hard (gypsum) plaster, adulterant in candies and drugs, hoof packing, and as a constituent of the remedial dressing known as antiphlogistine.

California, Montana, South Dakota, Utah, Wyoming.

Berthierite. Sulphantimonite of iron, FeSb_2S_4 .

California.

Beryl. A glucinum-aluminum silicate, $3\text{GlO} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$. Used as gem when clear and well colored. The grass-green variety is known as emerald; light-green, beryl; blue-green, aquamarine. Contains 14 per cent glucina (glucinum oxide).

Alabama, California, Colorado, Connecticut, Georgia, Maine, Massachusetts, New Hampshire, New Mexico, North Carolina, Pennsylvania, South Carolina, South Dakota, Utah, Virginia.

Bindheimite. A hydrous antimonate of lead; an oxidation product of jamesonite. A source of antimony and lead.

Arizona, Nevada, Utah.

Binnite. Arsenical copper sulphide, $\text{Cu}_5\text{As}_3\text{S}_8$.

Utah.

Biotite. A black or brown mica. *See also* Mica.

Bismite. Bismuth oxide, Bi_2O_3 . A source of bismuth.

Nevada, Utah.

Bismuth. An element, Bi. Found as a native metal. The metal is used as a component of cliché or low melting-point metals and in solders. Its salts,

such as the subnitrate, subgallate, salicylate, and others, are used in medicine. *See also* Beegerite, Bismuthinite, Bismutite, Cosalite, and Tetradymite.

Arizona, California, Colorado, Connecticut, Georgia, Nevada, New Mexico, Utah, Washington.

Bismuth arsenate. *See* Arsenobismite and Mixite.

Bismuthinite. Bismuth sulphide, Bi_2S_3 . Contains 81.2 per cent bismuth. The chief source of bismuth.

Arizona, California, Colorado, Connecticut, Nevada, Wyoming.

Bismutite. A basic bismuth carbonate of doubtful composition, perhaps $\text{Bi}_2\text{O}_3 \cdot \text{CO}_2 \cdot \text{H}_2\text{O}$. Contains about 80 per cent bismuth. An important source of bismuth.

Arizona, California, Colorado, Nevada, New Mexico, Utah, Wyoming.

Bitumen. A general name for various solid and semisolid hydrocarbons. In 1912 the term was used by the American Society for Testing Materials to include all those hydrocarbons which are soluble in carbon disulphide, whether gases, easily mobile liquids, viscous liquids, or solids. *See also* Asphalt.

California, Tennessee.

Bituminous rock. Asphalt-impregnated limestone, sandstone, or other rock. Used extensively in highway and pavement construction, the rock being crushed or pulverized and often rendered more suitable by the addition of an appropriate flux. *See also* Asphalt.

California, Colorado, Kentucky, Oklahoma, Texas, Utah.

Blackjack. *See* Sphalerite.

Black oxide of manganese. *See* Pyrolusite.

Blende. *See* Sphalerite.

Bloedite. Hydrous sulphate of magnesium and sodium, $\text{MgSO}_4 \cdot \text{Na}_2\text{SO}_4 \cdot 4\text{H}_2\text{O}$. Prospectively a source of Epsom salts.

California, New Mexico.

Bloodstone (heliotrope). A variety of chalcedony or jasper, dark green in color, interspersed with small red spots. Used as a gem.

California.

Bluestone. The commercial name for a dark bluish-gray feldspathic sandstone or arkose. The color is due to the presence of fine grains of black and dark-green minerals, chiefly hornblende and chlorite. The rock is extensively quarried in New York. Its toughness, due to slight metamorphism and the ease with which it may be split into thin slabs, especially adapt it for use as flagstone. The term has been locally applied to other rocks, among which are dark-blue slate and blue limestone. Used for curbing, flagging, building, crushed stone, and paving.

New York, Pennsylvania.

Blue vitriol. *See* Chalcantithite.

Bog iron ore. *See* Brown iron ore.

Bog manganese. *See* Wad.

Borax, Tincal. Sodium tetraborate, $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$, or $\text{Na}_2\text{O} \cdot 2\text{B}_2\text{O}_3 \cdot 10\text{H}_2\text{O}$. Used in many trades: For enameling ironware, such as bathtubs and sinks, and crockery, pottery, and tile. Extensively used in industrial chemistry, medicine, and the household. As an antiseptic; for preserving foods; in manufacture of baking powder, flavoring extracts, soap, starch, glue, insecticides, blacking, inks, dyes, glass, paints, varnish, paper, playing cards, stove polish, silk, tobacco, threads, water clarifiers, welding compounds, in softening water, tanning leather, and in metallurgy.

California, Nevada, Oregon, Texas.

Bornite, Erubescite, Peacock, Purple, or Horseflesh copper ore. A sulphide of copper and iron, Cu_3FeS_4 . Contains 62 per cent copper. An important copper-ore mineral; used also for ornaments.

Arizona, California, Colorado, Connecticut, Idaho, Maine, Maryland, Montana, Nevada, New Hampshire, New Mexico, North Carolina, Oregon, Pennsylvania, South Dakota, Utah, Virginia, Washington, Wyoming.

Bournonite. Sulphantimonite of lead and copper, $3(\text{Pb,Cu}_2)\text{.Sb}_2\text{S}_6$. A source of antimony.

Arizona, California, Colorado.

Braunite. A somewhat variable manganese silicate, approximately $3\text{Mn}_2\text{O}_3\text{.MnO.SiO}_2$. A minor source of manganese. Used sparingly in the manufacture of chlorine.

Arkansas, California, Georgia, New Jersey, Vermont.

Brea. Semisolid natural asphalt. Used as a flux, as roofing material, and in pavement construction.

California.

Brine. See Bromine and Salt.

Brittle silver ore. See Stephanite.

Brochantite. A basic sulphate of copper, $\text{CuSO}_4\text{.3Cu(OH)}_2$.

Arizona, California, Colorado, New Mexico, Utah.

Bromargyrite. See Bromyrite.

Bromine. An element, Br. It does not occur native, but is derived in large quantities from brines. Its form of occurrence in the brines is unknown. Used as an oxidizer in many chemical reactions instead of chlorine and for dissolving gold and separating it from platinum and silver; also for disinfectants, preparing bromine salts, and in making aniline colors. Also extensively used in making the asphyxiating gases employed in the European war. See also Bromyrite, Embolite, and Salt.

Michigan, Ohio, Pennsylvania, West Virginia.

Bromyrite (bromargyrite). A silver bromide, AgBr . Contains 57 per cent of silver. It is also a source of bromine.

Arizona, Nevada, New Mexico.

Brongniardite. A lead-silver sulphantimonide, $\text{PbAg}_2\text{Sb}_2\text{S}_6$. Contains 26.2 per cent of silver.

Arizona.

Brookite. Titanium oxide, TiO_2 , a possible source of titanium.

Arkansas.

Brown hematite. See Brown iron ore.

Brown iron ore, Bog iron ore, Brown hematite, Limonite, Mountain brown ore, Oriskany brown ore, Valley brown ore. Its approximate formula is $2\text{Fe}_2\text{O}_3\text{.H}_2\text{O}$, equivalent to about 59.8 per cent iron. Probably a mixture of hydrous iron oxides. Many deposits of iron ore not yet specifically determined are provisionally placed under this heading. Important source of iron; used also in manufacture of some yellow and brown paints.

Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Idaho, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming.

Brownstone. *See* Sandstone.

Brucite. Magnesium hydroxide, $Mg(OH)_2$. Magnesia, 69 per cent; water, 31 per cent. Not plentiful. Where it occurs in sufficient quantities it could probably be used in making plaster and fire brick. By calcining it may be converted like magnesite into magnesia and used in the pulp-paper industry, in medicine, and in the arts.

New Jersey, New York, Pennsylvania.

Burrstone. A tough siliceous rock used for millstones. *See also* Millstone. Georgia, Mississippi.

Cacholong. Opaque, bluish-white, porcelain-white, pale yellowish or reddish opal. Used as a gem.

Arizona.

Cadmium. A bluish-white metallic element, Cd, not found native but occurs in certain secondary minerals in various zinc deposits of the western United States. Used in the metallic form in amalgams and alloys to lower the melting point and make them more ductile and malleable, and its various salts are used in the arts, in medicine; and in electroplating. *See* Greenockite.

Calamine. A hydrous zinc silicate, $H_2O \cdot 2ZnO \cdot SiO_2$. Contains 54 per cent zinc. A source of zinc; also used as a gem.

Arkansas, California, Colorado, Connecticut, Kansas, Maryland, Missouri, Nevada, Oklahoma, Pennsylvania, Tennessee, Utah, Virginia.

Calaverite. A telluride of gold and silver, $(Au, Ag)Te_2$. Variable in composition but contains about 39.5 per cent gold and 3.1 per cent silver.

California, Colorado.

Calciovolborthite. A vanadate of copper and calcium. Contains about 38 per cent V_2O_5 . A source of vanadium.

California, Colorado, Utah.

Calcite. Hexagonal (rhombohedral) calcium carbonate, the more common form of $CaO \cdot CO_2$, the principal constituent of high calcium limestones. Contains 56 per cent lime, CaO . The characteristic mineral of limestone, marble, chalk, onyx marble, and Iceland spar (used in optical instruments).

Arizona, California, Kentucky, Maine, Minnesota, Missouri, Oregon, South Dakota, Tennessee.

Caledonite. A green basic sulphate of lead and copper of uncertain composition.

California.

Caliche, Subterranean travertine, Tepetate, Tierra blanca, Vadose limestone. A calcareous deposit which occurs in extensive sheets or beds from 1 foot to 15 feet in thickness underlying the surface soil of the gravelly plains and mesas, especially in the vicinity of limestone formations, in the hot arid regions of the Southwest of which the Great Valley plain of Tucson, Ariz., is a good example. It resembles earthy limestone. It is essentially a lime carbonate, and contains 70 to 80 per cent of $CaCO_3$. It is formed by precipitation and concentration of calcareous material through the evaporation of subsurface lime-bearing waters. It is valuable for flux and the manufacture of caustic lime and cement, and is locally used for road metal.

Arizona, California, Nevada, New Mexico, Texas, Utah.

Californite. A compact, massive vesuvianite, used as an ornamental stone and as a gem.

California.

Carnotite. A canary-yellow hydrous potassium-uranium vanadate, $K_2O \cdot 2UO_3 \cdot V_2O_5 \cdot 8H_2O$. The name is ordinarily used for a mixture of carnotite and tyuyamunite ($CaO \cdot 2UO_3 \cdot V_2O_5 \cdot 8H_2O$). It is rarely sufficiently crystallized for the proportions of the two minerals to be detected but generally occurs in a powdery form, though it is here and there talcose. Is radioactive and is the principal source of radium. *See also* Tyuyamunite.

Arizona, Colorado, Nevada, Pennsylvania, Utah.

Cassiterite. Tin oxide, SnO_2 . Contains 79 per cent tin. The mineral from which practically all tin is obtained.

California, Colorado, Connecticut, Georgia, Idaho, Maine, Montana, New Hampshire, North Carolina, South Carolina, South Dakota, Texas, Virginia, Washington, Wyoming.

Catlinite, Indian pipestone. A red clay found chiefly in southwestern Minnesota, used for ornamental purposes; and formerly used by the Indians for making pipes.

Arizona, Minnesota.

Cat's-eye. *See* Chrysoberyl.

Celestite. Strontium sulphate, $SrO \cdot SO_3$. It is the principal source of strontium salts, whose chief use (in this country) is in the manufacture of fireworks and night signals used by railway and steamship companies. Strontium salts are used also in medicine. The hydroxide is used in sugar refining.

Arizona, Arkansas, California, Michigan, New York, Ohio, Texas, Washington.

Cement material. Limestone, shale, clay, chalk, marl, volcanic ash, volcanic tuff, river mud, and other material suitable for the manufacture of cement. Cement rock is an argillaceous limestone used in the manufacture of natural hydraulic cement and Portland cement. Contains lime, silica, and alumina in varying proportions, and usually more or less magnesia.

Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming.

Cerargyrite, Horn silver. Silver chloride, $AgCl$. Contains 75 per cent silver.

Arizona, California, Colorado, Idaho, Maine, Montana, Nevada, New Mexico, South Dakota, Utah, Washington, Wyoming.

Cerium. *See* Allanite, Cyrtolite, Gadolinite, Monazite, Polycrase, Samarskite, and Sipylite.

Cerussite. Lead carbonate, $PbO \cdot CO_2$. Contains 77.5 per cent lead.

Arizona, Arkansas, Colorado, Connecticut, Idaho, Illinois, Iowa, Kansas, Missouri, Montana, Nevada, New Mexico, New York, North Carolina, Oklahoma, Oregon, Pennsylvania, South Dakota, Tennessee, Utah, Virginia, Washington, Wisconsin, Wyoming.

Cervantite. An orthorhombic antimony oxide, Sb_2O_3 . A source of antimony.

California, Idaho, New Mexico, Utah.

Chalcanthite, Blue vitriol, Copper sulphate. A hydrous copper sulphate, $CuO \cdot SO_3 \cdot 5H_2O$, used in veterinary medicine as an antiseptic.

Arizona, California, Colorado, Idaho, Montana, Nevada, North Carolina, Tennessee.

Chalcedony. A transparent or more generally translucent cryptocrystalline quartz. Lines or fills cavities in rocks. Used as ornamental stone.

Arizona, California, Colorado, Idaho, Iowa, Nebraska, Nevada, Oregon, Utah.

Chalcocite, Copper glance. A copper sulphide, Cu_2S . Contains 79.8 per cent copper.

Arizona, California, Colorado, Connecticut, Georgia, Idaho, Maine, Maryland, Minnesota, Missouri, Montana, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, Wisconsin, Wyoming.

Chalcophanite and Hydrofranklinite. A hydrous manganese-zinc oxide $(\text{Mn,Zn})\text{O} \cdot 2\text{MnO}_2 \cdot 2\text{H}_2\text{O}$. Useful only for mineralogic specimens.

Colorado, New Mexico.

Chalcopyrite, Copper pyrites, Yellow copper ore. A sulphide of copper and iron, CuFeS_2 . Contains 34.5 per cent copper. In places carries gold and silver.

Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Georgia, Idaho, Maine, Massachusetts, Minnesota, Missouri, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, Wyoming.

Chalcotrichite. Hairlike crystals of cuprite (copper oxide).

Utah.

Chalk. A soft, compact, fine-grained, light-colored limestone composed of the delicate skeletons of rhizopods and other marine organisms. It can easily be sawed into blocks when fresh from the quarry; on drying it hardens. Used for building stone and for crayons.

Alabama, Arkansas, Colorado, Iowa, Kansas, Nebraska, New Mexico, South Dakota.

Chert, Hornstone. An impure flint or chalcedony with splintery fracture. More brittle than flint. Used mainly for road metal.

Alabama, Arizona, Arkansas, Iowa, South Dakota, Tennessee.

Chiastolite, Macle. A variety of andalusite, aluminum silicate, $\text{Al}_2\text{O}_3 \cdot \text{SiO}_2$, in which carbonaceous impurities are arranged in a regular manner along the longer axis of the crystal, in some varieties resembling the Greek letter "chi," X, whence the name. Used as a gem.

California, Massachusetts. (Found in other States but not utilized.)

China clay. See Kaolin.

Chlorastrolite. Not a definite mineral but probably a mixture of zeolites. Found as small, light bluish-green pebbles, with finely radiated structure, on Isle Royal, Lake Superior. Used as a gem.

Michigan.

Chlorutahlite. See Variscite.

Chrome mica. See Fuchsite.

Chromic iron. See Chromite.

Chromite, Chromic iron, Chromic iron ore. A chromite of iron, $\text{FeO} \cdot \text{Cr}_2\text{O}_3$. Contains 68 per cent chromic oxide. Used extensively in the manufacture of high-speed or chrome steel, to which it gives a hardness and resistance to temperature that fit the steel for armor plate and projectiles as well as for high-speed tools. Owing to the bright color of its compounds it is also

largely used in making pigments, dyes, and paints. Its power to withstand high temperatures fits it for furnace lining, and it is made into chrome brick for this use. In tanning it gives to leather a softness and durability that fits it for hunting shoes, etc. It is the source of chromium salts.

California, Georgia, Maryland, Massachusetts, New York, North Carolina, Oregon, Pennsylvania, Virginia, Wyoming.

Chromium. *See* Chromite and Crocoite.

Chrysoberyl. A glucinum-aluminum oxide, $\text{GlO}.\text{Al}_2\text{O}_3$, known as cat's-eye when it has a chatoyant effect. A semiprecious stone used as a gem.

Colorado, Connecticut, New York.

Chrysocolla. A hydrous copper silicate. Contains theoretically about 36 per cent of copper. Sometimes used as a gem, as a poor substitute for turquoise.

Arizona, California, Colorado, Maryland, Michigan, Montana, Nevada, New Jersey, New Mexico, North Carolina, Oregon, Utah, Virginia, Wyoming.

Chrysolite. *See* Olivine.

Arizona.

Chrysoprase. An apple-green chalcedony, the color of which is due to nickel. Used as a gem.

Arizona, California.

Chrysotile. Fibrous serpentine. *See also* Asbestos.

Arizona, California, Maryland, Vermont, Wyoming.

Cinnabar. A vermilion mercury sulphide, HgS , 86 per cent mercury. It is the common ore of mercury or quicksilver and forms hexagonal crystals. *See also* Metacinnabarite.

Arizona, California, Colorado, Idaho, Nevada, Oregon, South Dakota, Texas, Utah, Washington.

Clay. A residual or sedimentary rock which, when finely ground and mixed with water, is plastic (flint clay and kaolin excepted) and retains its molded shape when air dried. When moderately heated (to a dull red heat in many varieties, but the range is considerable) the particles soften enough to partly coalesce and form a stony mass upon cooling. The chemical and mineralogic compositions have a considerable range. The physical properties are correspondingly variable and are equally important. The clay base corresponds closely to kaolinite and similar hydrous aluminum silicates, and material in excess of that required to form these substances is regarded as impurity. The most common impurities are silica, iron, alkaline earths, lime, magnesium, alkalis, carbonaceous matter, titanium, and sulphur.

The uses of clay are many and varied, and new ones are being found constantly. Among the common uses are the following:

In the manufacture of structural and building materials, notably brick and cement, comprising adobe (sundried) brick; common, front, fancy, or ornamental, enameled, and hollow brick; chimney pipe and tops; drain-tile; fireproofing, including hollow building tile or blocks; flue lining; foundation block; hip rolls and cresting; radial chimney brick and block; silo block; stovepipe thimbles; terra cotta; terra-cotta lumber; tile (art, book, ceramic, floor, roofing, and wall); tunnel block; and wall coping.

Domestic products, which enter largely into household use in the form of porcelain, white earthenware, stoneware, and yellow and Rockingham ware for table, cooking, and ornamental use; also sanitary ware, including bathtubs.

Refractory materials, such as fire brick, tile, and blocks, charcoal furnaces, crucibles, muffles, scorifiers, and other assay supplies, furnaces, glasshouse pots, stove lining, retorts and condensers, saggars, and tuyères.

Unburned clay is used in making artificial teeth, crayons, and emery wheels; as a filler for paint, rubber, and other materials; as fire mortar; as a food adulterant; in fulling cloth; in lead pencils; medicines; for modeling and molding; packing for horses' feet; in the manufacture of paper (wall, writing, and other varieties); in plaster; in scouring soap; in taxidermy; and in the manufacture of ultramarine.

Other uses include acid brick; aquarium ornaments; art and chemical pottery; battery cups; ceramic sculpture; condensing worms; curbing; doorknobs; femish ware; garden and lawn pieces; grate tile; lead pots; porcelain electric and hardware supplies; porous cups; pumps; razor hones; shuttle eyes and thread guides; pipes; toy marbles; umbrella stands; and sanitary ware.

The total value of the clay products marketed in the United States in 1914 was \$164,986,983.

Clay occurs in every State.

As there are many kinds of clays, the following classification is useful:

High-grade clays:

White-ware clays (nonplastic and plastic):

Kaolin, porcelain, or china clay.

Ball clay.

Paper clay.

Refractory or fire clays:

Glass-pot clay.

Flint clay.

Plastic fire clay and shales.

Graphitic fire clay.

Pottery or stoneware clays.

Medicinal clay, bentonite, Denver mud.

Low-grade clays:

Vitrifying clays and shales:

Terra cotta clays and shales.

Sewer-pipe clay and shale.

Roofing-tile clay and shale.

Brick clays and shales:

Loess clay.

Glacial clay.

Pressed-brick clay and shale.

Paving-brick clay and shale.

Adobe clay.

Gumbo.

Slip clays.

Fuller's earth.

HIGH-GRADE CLAYS.

WHITE-WARE CLAYS.

Kaolin or china clay (nonplastic).—Kaolins are residual white-burning clays, consisting chiefly of the hydrous aluminum silicates and generally possessing little or no plasticity. White-ware clays are used for porcelain, china, white ware, pottery, high-grade tile, and paper manufacture.

Kaolin or china clay (plastic).—A sedimentary, generally white clay containing a high percentage of kaolinite and little or no iron oxide. Its principal uses are in the manufacture of paper, sanitary ware, and tile. The plastic kaolins are sometimes referred to as china and ball clays and contain more fluxing impurities than the nonplastic kaolins. They are also often called paper clays.

Ball clays.—White-burning plastic clays of high tensile strength and bonding power and little or no iron oxide. They are extensively used as an ingredient of high-grade tile and white-ware mixtures to give the body sufficient plasticity and bonding power.

Paper clay.—A highly plastic white clay, free from sand.

REFRACTORY CLAYS.

Fire clays.—Refractory or fire clays are clays which endure high temperature without change other than dehydration, but the term is frequently misapplied. Many of the best fire clays are nonplastic, this property being supplied by the addition of a small quantity of less refractory but plastic material. Comparative freedom from fluxes, such as iron, alkaline earths, alkalis, and excessive silica, is essential. The composition, both chemical and mineralogic, is similar to that of ball clay. The principal uses of refractory clays are for materials required in the industries (especially in iron and steel manufacture and in coke making) where high temperatures must be withstood.

Glass-pot clay.—A variety of refractory clay which, besides possessing refractory qualities, burns dense at a low temperature without warping and has good bonding power.

Flint clay.—A nonplastic hard, dense, refractory clay, having an appearance much like flint, a shell-like fracture, and a composition like plastic fire clay.

Plastic fire clays and shales.—Refractory clays and shales which are plastic when wet.

Graphitic fire clay.—A black clay resembling soft coal. It contains about 60 per cent silica and 30 per cent iron and alumina, and burns buff or white. It is used for the manufacture of pressed brick and converter lining and binding. It seems to be a product of the disintegration of graphitic schist or slate.

POTTERY CLAYS.

The general term pottery clays includes some refractory and vitrifying clays. These clays are as a rule semirefractory and burn to a dense mass. High plasticity, tensile strength, and complete retention of form while burning are essential properties. A buff color may be produced, owing to the content of iron or manganese. In ordinary practice a mixture of clays is used. Some of the products are earthen and common stone ware (both plain and decorated), crockery, and glazed ware.

MEDICINAL CLAY.

Bentonite, Denver mud.—A bedded or sedimentary plastic clay which swells immensely on wetting. Mixed with glycerine it forms a proprietary medication known as antiphlogistine. It is used in medicine and as packing for horses' hoofs; also for paper filling and sizing.

LOW-GRADE CLAYS.

VITRIFYING CLAYS.

Vitrifying clays are similar to pottery clays but are composed of lower grade material. They may be semirefractory, should burn dense, and should contain considerable iron, both for color and flux. Fair tensile strength is desirable,

as is also low fire shrinkage and low vitrification temperature, with a good range in temperature between incipient and complete fusion.

Terra-cotta clays and shales.—For terra-cotta ware a semirefractory clay of good grade is preferred. When burnt, low shrinkage and freedom from soluble salts and warping are essential.

Pipe clays.—Almost any fine-grained clay that has a well-developed plasticity and a high percentage of iron, which apparently favors the formation of the necessary glaze, is suitable for pipe clay.

Roofing tile and fireproofing requires semirefractory clay or shale, with fair plasticity and tensile strength, which burns hard at a low temperature. Other uses are for enameled brick, hollow tile, and conduits.

Paving brick.—Material for paving brick includes many impure shales as well as semirefractory clays. It should possess fair plasticity and good tensile strength.

BRICK CLAYS.

Almost any kind of clay which possesses plasticity can be used for common brick. Red-burning clays are preferable, as they harden at a low temperature. Loess, glacial, and marine clays are also used for this purpose. Brick and draintile are the principal products.

Loess (clays).—The term loess is applied to extensive, uniformly fine-grained deposits which are high in silica, low in alumina, and high in alkalies. Their use is confined to common brick and other cheap products. They are of Pleistocene age and are commonly thought to consist of wind-deposited dust. In the Mississippi Valley they are commonly known as bluff deposit.

Glacial clays are local deposits of generally tough, dense, gritty clays formed directly by the continental glacier or waters issuing from it into flood plains and lakes in the glaciated area of the northern United States. Those formed directly by the ice, as a rule, contain many stones. Some of the glacial clays, as in the State of Michigan, are used extensively in the manufacture of cement and pottery, as well as brick.

Pressed brick.—A fairly good quality of clay or shale is required for pressed brick. The shrinkage in air and fire must be low and the temperature of vitrification moderately low. For light-colored brick a semirefractory clay is used.

Adobe clays.—Adobe clays are surface clays which are high in lime, and hence can be used for but few products, the chief of which is adobe or sundried brick.

GUMBO CLAYS.

The term gumbo clays is applied to fine-grained, plastic, tenacious surface clays of recent formations. Their occurrence along stream channels in the western Central States suggests a relation to loess. The burned product is used largely for railroad ballast, but in some places also for brick.

SLIP CLAYS.

Slip clays are used for glazing. They possess the properties of fineness of grain, high percentage of fluxing impurities, and low shrinkage in air, low temperature of fusion, and early maturity in burning. Their use on different clays calls for a wide range in physical properties. Color is of secondary importance, as it is more or less under control.

FULLER'S EARTH.

The clay, known as fuller's earth, seems to consist principally of amorphous hydrous aluminum silicates with a considerable amount of alkaline earths, iron, and excess of silica. Its property of adsorption renders it useful as a decolorizer and filtering agent. The better grades are porous and impart no permanent taste nor odor to the treated liquids. It may or may not be plastic.

Coal. A carbonaceous substance formed from the remains of vegetation by partial decomposition. The principal varieties are anthracite or hard coal, bituminous or soft coal, and lignite.

Coal is used chiefly as a fuel for generating steam for power and heating and for making coke, gas, tar, ammonia, and other products.

From the volatile constituents driven off by distillation in the process of coking coal is derived the great group of by-products known as coal-tar products, coal-tar and aniline dyes, etc. These products, about 1,200 in number now on the world's market, comprise 900 distinct and different chemical substances. They are widely used in nearly all lines of manufacture, art, industry, and domestic life. Only a few of them, those from which many other by-products are derived, can be mentioned here.

The quantity and uses of products from the by-product coking of a short ton (2,000 pounds) of normal bituminous coal are said to be as follows:

Coke, 1,500 pounds, used as fuel in foundry and blast furnaces and for heating.

Gas, 5,000 cubic feet, generating heat measuring about 500 British thermal units, used as fuel in heating furnaces and open-hearth furnaces and for general heating.

Tar, 5 to 7 gallons, used principally as roofing material, binder for road making, in paints, as fuel, and as a source of pyridene, which is used in high explosives, and, with its by-products, for making solutions and denaturing alcohol. Coal tar is also the source of phenol and creosotes, from which are derived dyestuffs, disinfectants, and salicylic acid. Phenol is used also in explosives. Anthracene, from which are made dyestuff and other by-products, is another derivative of coal tar. Other coal-tar by-products are the pitches used in making roof felt, insulating material, and as a binder for briquets and other materials. From the naphthalenes are made fuel, dyestuffs, and preserving materials, and from the tar oils are derived wood-preserving preparations and fuel.

Ammonia gas, 4½ pounds, employed in making liquid ammonia for use in refrigeration, fertilizers, and for making ammonium salts, such as ammonium nitrate, ammonium sulphate, and ammonium chloride.

Crude benzol, 2½ gallons, used for manufacturing pure washed benzol, pure washed toluol, pure xylol, intermediate products, and solvent naphtha. The washed or pure benzol, C_6H_6 , 1½ gallons, is used as a liquid fuel; as a solvent of rubber, fats, and oils; in cleaning clothes; and in preparing chemicals, dyestuffs, and explosives. The washed toluol, C_7H_8 , two-fifths gallon, is used for making dyestuffs, scents, explosives, medical preparations, saccharine, and many other by-products. The washed xylol, C_8H_{10} , one-sixth gallon, is used in making dyes and scents, and for other purposes. The solvent naphtha, one-fifth gallon, is used in making enamels, enamel resin, varnishes, waterproofing material, as a solvent for rubber, in laundry work, and in purifying crude anthracene.

Popular interest in coal tar is centered mainly in the dyestuffs and the other refined drugs and chemicals derived from it. The United States has

developed little manufacture of these products and has depended on European nations, particularly Germany, for the bulk of its supply. The coal-tar industry is very complex. There is a continual change in demand, and only a small part of the tar, about 10 per cent, can be made into drugs and dyes. The other 90 per cent, which is suited only for making pitches and heavy oils, forms the basis of an industry that is already well developed in the United States.

Recent developments in methods of refining have shown that benzol and toluol, substances that are widely used in making dyestuffs and explosives, can be commercially recovered from petroleum, which, therefore, seems likely to become an important domestic source of dyes.

Alabama, Arizona, Arkansas, California, Colorado, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Michigan, Missouri, Montana, Nebraska, Nevada, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, Wyoming.

Cobalt. A metallic element, Co, not found native. Used in coloring glass and ceramic wares blue; in high-speed tool steels; in stellite (an alloy of cobalt, chromium, and other metals, depending on the use for which it is intended); and in insect poisons. *See also* Cobaltite, Erythrite, Linnæite, and Smaltite.

California, Colorado, Idaho, Missouri, Nevada, South Carolina, Tennessee, Washington, Wyoming.

Cobalt bloom. *See* Erythrite.

Cobalt glance. *See* Cobaltite.

Cobalt pyrites. *See* Linnæite.

Cobaltite, Cobalt glance. A sulpharsenide of cobalt, CoAsS . Contains 35.5 per cent of cobalt. Ore of cobalt and used in porcelain painting.

Arizona, California, Oregon.

Coke. Coal from which the volatile constituents have been driven off by heat, so that the fixed carbon and the ash are fused together. Commonly artificial, but natural coke is also known. Used chiefly for blast-furnace fuel. New Mexico, Utah, Virginia.

Colemanite. A hydrous borate of calcium, $2\text{CaO} \cdot 3\text{B}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$. The commonest source of borax and boracic acid in the United States.

California.

Coloradoite. Mercuric telluride, HgTe . Occurs in too small quantities to be of commercial value.

Colorado.

Columbite. A variable columbate and tantalate of iron and manganese containing preponderant columbium and grading into tantalite, in which tantalum preponderates. Has been used as a source of tantalum. *See also* Samarskite, Sipylite, and Tantalite.

California, Colorado, Connecticut, Maine, North Carolina, South Dakota, Virginia.

Conglomerate. Consolidated gravel. Used, when of satisfactory character, for building and for crushed stone, as at Roxbury, Mass. The "puddingstone" conglomerate beds in the Triassic sandstones of certain Eastern States and the "Potomac marble" or limestone conglomerate of Maryland are used for building stone. Columns of Potomac marble conglomerate may be seen in the Capitol at Washington, D. C.

Conichalcite. Hydrous arsenate of copper and calcium $(\text{Cu,Ca})_3\text{As}_2\text{O}_8 \cdot \text{Ca}(\text{OH})_2 \cdot \frac{1}{2}\text{H}_2\text{O} (?)$. A minor source of copper.

Utah.

Copper. An element, Cu. Sometimes found as native metal. Widely used in the different industries, chiefly for electric transmitters, in brass manufacture, in copper castings, such as those for machinery and for household utensils. Has been used for coins since the earliest times. Nearly a million pounds was used for coins in the United States in 1914. Five million pounds is used annually in the United States in making ordinary pins, which are composed mainly of brass that contains 65 per cent copper. *See also* Azurite, Azurmalachite, Beaverite, Bornite, Brochantite, Chalcanthite, Chalcocite, Chalcopyrite, Chrysocolla, Covellite, Cuprite, Enargite, Famatinite, Freibergite, Goldfieldite, Linarite, Malachite, Melanconite, Stromeyerite, Tennantite, Tenorite, Tetrahedrite.

Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Georgia, Idaho, Maine, Maryland, Michigan, Minnesota, Missouri, Montana, Nevada, New Jersey, New Mexico, New York, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, Wyoming.

Copper (native). Not commonly found in commercial quantity. Was used by aborigines for cutting implements and for ornaments.

Arizona, California, Colorado, Connecticut, Idaho, Maryland, Michigan, Minnesota, Montana, Nevada, New Mexico, Oklahoma, Oregon, Pennsylvania, Utah, Virginia, Washington, Wisconsin, Wyoming.

Copper glance. *See* Chalcocite.

Copper pyrites. *See* Chalcopyrite.

Copper sulphate. *See* Chalcanthite.

Coquina. A porous limestone composed of fragments of marine shells. Used for building stone and road metal.

Florida.

Cordierite, Iolite, Water sapphire. A magnesium-iron-aluminum silicate. Sometimes used as a gem.

Colorado, Connecticut.

Corkite. A phosphate or arsenate with sulphate of ferric iron and lead. A minor source of lead.

Utah.

Coronadite. A manganate of lead and manganese, $(\text{Mn,Pb})\text{Mn}_2\text{O}_7$. Resembles psilomelane in general aspect. A mineralogic curiosity, useful for specimens only.

Arizona.

Corundum. Aluminum oxide, Al_2O_3 . The clear-colored varieties form the gems sapphire, ruby, oriental emerald, and oriental topaz; the granular impure variety is known as emery and is used as an abrasive.

Alabama, California, Colorado, Connecticut, Delaware, Georgia, Idaho, Massachusetts, Montana, Nevada, New York, North Carolina, Oregon, Pennsylvania, South Carolina, Virginia, Wyoming.

Cosalite. A sulphide of lead and bismuth, $\text{Pb}_2\text{Bi}_2\text{S}_8$. Contains 42 per cent bismuth.

Colorado, Utah, Washington.

Cotton ball. *See* Ulexite.

Covellite. An indigo-blue copper sulphide, CuS. Contains 66.4 per cent copper.

Alabama, Arizona, Colorado, Georgia, Idaho, Montana, Nevada, South Carolina, Utah, Wyoming.

Crocidolite. Silicate of sodium and iron, a rock-forming mineral belonging to the amphibole group, used as ornamental stone and for gems.

California.

Crocoite. Lead chromate, $\text{PbO} \cdot \text{CrO}_3$. Contains 68.9 per cent PbO and 31.1 per cent CrO_3 . Used for cabinet specimens.

Arizona.

Cryolite. A fluoride of sodium and aluminum, $3\text{NaF} \cdot \text{AlF}_3$. Used as an ore of aluminum and in making soda and glass.

Colorado.

Cubanite. Sulphide of copper and iron.

California.

Cuprite. Native red copper oxide, Cu_2O . Contains 88.8 per cent copper.

Arizona, California, Colorado, Connecticut, Idaho, Missouri, Montana, Nevada, New Jersey, New Mexico, North Carolina, Oregon, Pennsylvania, South Dakota, Tennessee, Utah, Virginia, Wyoming.

Cuprodescloizite. Descloizite that contains considerable copper and a little water, $2\text{PbO} \cdot 2\text{CuO} \cdot \text{V}_2\text{O}_5 \cdot \text{H}_2\text{O}$. *See also* Descloizite.

Arizona, California.

Cuproscheelite. A scheelite containing about 6 per cent of copper oxide.

Arizona.

Cuprotungstite. Tungstate of copper, CuWO_4 ; also tungstate of copper and calcium $(\text{Ca,Cu})\text{WO}_4$. Of no economic value.

Arizona.

Cyanite, Disthene. Identical in chemical composition with andalusite and sillimanite, $\text{Al}_2\text{O}_3 \cdot \text{SiO}_2$, but differing in crystal form. Generally in flat-bladed pieces. Sometimes used as a gem.

Arizona, Massachusetts, North Carolina, Pennsylvania.

Cyanotrichite. *See* Lettsomite.

Cyrtolite. A yellowish to brownish mineral containing zirconia, yttria, ceria, and other rare earths. Found in pegmatites.

New York, North Carolina, Texas.

Dark ruby silver. *See* Pyrargyrite.

Datolite. A hydrous silicate of boron and calcium, $\text{H}_2\text{O} \cdot 2\text{CaO} \cdot \text{B}_2\text{O}_3 \cdot 2\text{SiO}_2$. Used as a gem.

California, Michigan.

Descloizite. A vanadate of lead and zinc, $2\text{PbO} \cdot 2\text{ZnO} \cdot \text{V}_2\text{O}_5 \cdot \text{H}_2\text{O}$, found only in the oxidized parts of veins. Occurs in too small quantities to be of economic value. *See also* Cuprodescloizite.

Arizona, New Mexico.

Diabase. A basic igneous rock usually occurring in dikes or intrusive sheets and composed essentially of plagioclase feldspar and augite with small quantities of magnetite and apatite. The plagioclase forms lath-shaped crystals lying in all directions among the dark irregular augite grains, giving rise to the peculiar diabasic or ophitic texture, which is a distinctive feature in the coarser-grained occurrences. Olivine diabase contains olivine in addition to the above-named minerals. Used chiefly as crushed stone for road metal; also for building stone, monumental work, and for paving blocks ("Belgian blocks"), often under the trade name of granite. Comprises, with basalt, the typical trap rock.

California, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Virginia, Washington.

Diamond. A very hard, native, crystallized form of carbon, C. When pure and clear it is used as a gem.

Arkansas, California, Georgia, Indiana, Michigan, North Carolina, Virginia.

Diatomaceous earth, Infusorial earth, Tripolite. An earthy substance or soft rock composed of the siliceous skeletons of small aquatic plants called diatoms. Used chiefly in the manufacture of filters, abrasives, and polishing powders. A polishing material for precious metal ware; an absorbent of liquid materials, and an insulating material. Used also for fireproofing. In Germany it is used for artificial fertilizers and in the manufacture of water glass, various cements, glazing for tile, artificial stone, sealing wax, fireworks, gutta percha objects, Swedish matches, solidified bromine, and papier-mâché. It is placed on the market as a loose powder and also as cut or molded bricks.

Alabama, Arizona, California, Colorado, Delaware, Florida, Idaho, Maryland, Maine, Massachusetts, Nebraska, Nevada, New Hampshire, New Jersey, New York, Oregon, South Carolina, South Dakota, Utah, Vermont, Virginia, Washington.

Didymium. See Monazite.

Diopside. A calcium-magnesium silicate, $\text{CaMg}(\text{SiO}_3)_2$. Used in making pottery and as a gem.

Alabama, California, Georgia, New York.

Dioptase, Emerald copper. Hydrrous copper silicate, H_2CuSiO_4 . Sometimes used as a gem.

Arizona.

Diorite. A granitoid rock composed essentially of hornblende and feldspar which is mostly or wholly plagioclase, with accessory biotite and augite or augite alone. Minute grains of magnetite and titanite may be visible. Quartz may be present in considerable amount, in which case the rock is called quartz diorite. Quarried in a number of States under the name of granite. See also Quartz diorite.

District of Columbia, Virginia.

Disthene. See Cyanite.

Dolomite. A carbonate of calcium and magnesium $(\text{Ca,Mg})\text{CO}_3$, or a rock composed mainly of that mineral. With a natural or artificial admixture of clay it is burned to form Rosendale hydraulic cement, for which purpose it should be low in iron and sulphur. It is used for many of the same purposes as ordinary limestone, burned and unburned. As a flux the silica present should not exceed 5 per cent. Magnesium lime made of it is especially adapted for making magnesium salts and for use in manufacture of paper by the sulphite process. Dolomite is also used as a source of carbonic acid, for which purpose it is, if anything, more valuable than ordinary limestone. Large quantities are used as building stone. It is sometimes used as a source of magnesia.

Alabama, Arkansas, California, Colorado, Connecticut, Indiana, Iowa, Kentucky, Maryland, Oregon, Pennsylvania, Rhode Island, Tennessee.

Dufrenite. A hydrrous iron phosphate. Contains approximately 27.5 per cent P_2O_5 , 62 per cent Fe_2O_3 , and 10.5 per cent H_2O . Exact composition doubtful. Does not occur in sufficient quantity to be of economic use.

Virginia.

Dufrenoyite. A sulpharsenide of lead, $\text{Pb}_2\text{As}_2\text{S}_5$. A minor source of lead.

Arizona, Idaho, Utah.

Dyscrasite. A variable silver antimonide including Ag_3Sb .

Arizona.

Eglestonite. A mercury oxychloride, $\text{Hg}_2\text{Cl}_2\text{O}$. A source of mercury.

Texas.

Elaterite. A massive amorphous dark-brown hydrocarbon or asphalt, ranging from soft and elastic to tough, hard, and brittle. It melts in a candle flame without fusing or decrepitation, has a conchoidal fracture, and gives a brown streak. Used for about the same purposes as gilsonite in the manufacture of paints, varnishes, etc. *See also* Wurtzilite.

Utah.

Electrum. A natural alloy of gold and silver containing approximately 40 per cent of silver.

California, Nevada.

Embolite. A chlorobromide of silver, $\text{Ag}(\text{Cl}, \text{Br})$.

Arizona, California, Colorado, Nevada, New Mexico.

Emerald. A rich-green variety of beryl. Used as a gem. *See also* Beryl.

Massachusetts, North Carolina.

Emerald copper. *See* Diophtase.

Emery. An impure form of corundum (Al_2O_3). Used as an abrasive. Commercial emery is made by mixing corundum and magnetite or hematite and sometimes spinel. *See also* Corundum.

Massachusetts, New York, Virginia.

Empressite. A silver telluride, AgTe . A source of silver.

Colorado.

Enargite. A copper sulpharsenide, Cu_3AsS_4 . Contains 48.4 per cent copper.

California, Colorado, Montana, Nevada, South Carolina, South Dakota, Utah.

Endlichite. *See* Vanadinite.

New Mexico.

Enstatite. Silicate of magnesium, MgSiO_3 . Occasionally used as a gem.

California.

Epidote. A basic orthosilicate of calcium, aluminum, and iron, $\text{H}_2\text{O} \cdot 4\text{CaO} \cdot 3(\text{Al}, \text{Fe})_2\text{O}_3 \cdot 6\text{SiO}_2$. More or less conspicuous in several granites and related rocks, for example, in Massachusetts, Rhode Island, Connecticut, Minnesota, and in Virginia, where it is a principal constituent of unakite. Used as a gem.

California, Colorado, Maine, Oregon.

Epsomite, Native Epsom salts. A hydrous magnesium sulphate, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$.

After purification it is sold as Epsom salts; used in medicine and dyeing.

California, Colorado, New Mexico, Tennessee, Utah, Washington, Wyoming.

Erbium. *See* Polycrase and Sipylite.

Erubescite. *See* Bornite.

Erythrite, Cobalt bloom. A hydrous cobalt arsenate, $\text{Co}_3\text{As}_2\text{O}_8 \cdot 8\text{H}_2\text{O}$. Found in the oxidized parts of cobalt and arsenic bearing veins. A source of cobalt.

California, Colorado, Idaho, Nevada.

Essonite. A cinnamon-colored variety of garnet. Called hyacinth when used as a gem, though the term more properly belongs to zircon.

Maine, New Hampshire.

Famatinitite. A copper-antimony sulphide, $3\text{Cu}_2\text{S} \cdot \text{Sb}_2\text{S}_3$. Contains 43.3 per cent copper.

Nevada.

Feather ore. *See Jamesonite.*

Feldspar. A general name for a group of abundant rock-forming minerals, the names and compositions of which are as follows:

Orthoclase, a monoclinic potassium-aluminum silicate, $K_2O \cdot Al_2O_3 \cdot 6SiO_2$; varieties are known as adularia and sanidine.

Microcline, a triclinic variety of the same composition as orthoclase.

Anorthoclase, a triclinic feldspar containing both sodium and potassium.

Plagioclase feldspars are a subgroup of triclinic minerals at one end of which is albite, a sodium-aluminum silicate, $Na_2O \cdot Al_2O_3 \cdot 6SiO_2$; and at the other end anorthite, a calcium-aluminum silicate, $CaO \cdot Al_2O_3 \cdot 2SiO_2$. Mixtures of these two molecules, which may be represented by Ab and An, respectively, form oligoclase, Ab_3An_1 to Ab_2An_1 ; andesine, Ab_2An_1 to Ab_1An_1 ; labradorite, Ab_1An_1 to Ab_1An_2 ; bytownite, Ab_1An_2 to Ab_1An_3 .

Celsian is similar to anorthite, but contains barium in place of calcium, $BaO \cdot Al_2O_3 \cdot 2SiO_2$.

Hyalophane is a monoclinic form containing barium and calcium.

Feldspar is found in practically all igneous rocks. It forms large crystals in pegmatites (giant granites), from which all the feldspar of commerce is mined. Used chiefly in the manufacture of pottery and as a bond in emery and corundum wheels. The potassium feldspars, orthoclase and microcline, and also the potassium-sodium feldspars are used in the manufacture of porcelain, chinaware, tiles, glaze, and enamels. Some pure sodium spar is used for the same purpose and also in the manufacture of opalescent glass. The potassium feldspars are also prospective sources of potash. Labradorite (peacock-color iridescence), microcline (Amazon stone, bluish green), oligoclase (sunstone, reddish from iron and other impurities), and orthoclase (moonstone having chatoyancy) are used as gems.

Alabama, California, Colorado, Connecticut, Delaware, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New York, North Carolina, Pennsylvania, South Carolina, South Dakota, Texas, Vermont, Virginia, Wisconsin.

Ferberite. An iron tungstate, $FeWO_4$. Applied to the wolframites which carry little or no manganese. Ferberite contains 76.3 per cent tungsten trioxide, WO_3 . An important tungsten ore mineral.

Arizona, Colorado, Idaho, Nevada, New Mexico, South Dakota.

Fergusonite. A metacolumbate and tantalate of yttrium, with erbium, cerium, uranium, etc. Found in pegmatites. Was formerly a source of rare-earth metals.

Texas, Virginia.

Figure stone. *See Pyrophyllite.*

Fire clay. *See Clay.*

Flagstone. A rock which may be cleft into large slabs suitable for sidewalks. *See also Bluestone, Sandstone, and Limestone.*

Alabama, Connecticut, Illinois, Indiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Tennessee, Vermont, Virginia, Wyoming.

Flexible sandstone. *See Itacolumite.*

Flint. A rather loose term, used in the United States for a dense fine-grained form of silica which is very tough and breaks with a conchoidal fracture and cutting edges. Used as an abrasive. Often crushed and sold as silica under different names. In the ceramic industry the name flint is used not only for ground flint but also has come to be applied to ground quartz and

other purely siliceous rock, such as sandstone and quartzite. Of different colors, white, yellow, gray, and black. *See also* Chert.

Arizona, Maryland, Nebraska, Wisconsin.

Flint rock. *See* Ganister.

Fluorspar, Fluorite. A calcium fluoride, CaF_2 . Color commonly purple, green, or white. About 80 per cent of the domestic fluorspar output, mainly in the form of gravel spar, and practically all of the imported fluorspar, is consumed as a flux in basic open-hearth steel furnaces. It is used also as a flux in blast furnaces, iron foundries, and silver, copper, and lead smelters; in the manufacture of fluorides of iron and manganese for steel fluxing; in the manufacture of glass, enameled and sanitary ware, and of hydrofluoric acid; in the production of aluminum; in the electrolytic refining of antimony and lead; in making high-power objectives in optical instruments; in measurement of infra-red radiations by astrophysicists; and for many other purposes. Fluorspar for making iron and steel should carry at least 80 per cent of calcium fluoride (CaF_2), and preferably it should be purer. For most other chemical uses it should contain 95 per cent or more of calcium fluoride.

Arizona, Arkansas, California, Colorado, Connecticut, Illinois, Kentucky, Maryland, Massachusetts, Missouri, New Hampshire, New Jersey, New Mexico, New York, Pennsylvania, South Dakota, Tennessee, Texas, Virginia, Washington, West Virginia.

Fool's gold. *See* Pyrite.

Fossil resin. *See* Amber.

Fossil wax. *See* Ozocerite.

Fossil wood. *See* Wood.

Franklinite. An iron-manganese-zinc oxide $(\text{Fe}, \text{Zn}, \text{Mn})\text{O} \cdot (\text{Fe}, \text{Mn})_2\text{O}_3$. Important source of zinc and ferro-manganese.
New Jersey.

Freestone. *See* Sandstone.

Freibergite. A silver-rich tetrahedrite. A silver-copper ore mineral. *See also* Tetrahedrite.

Arkansas, Idaho, Nevada, Oregon.

Freieslebenite. A lead-silver sulphantimonide, approximately $5(\text{Pb}, \text{Ag}_2)\text{S}_2\text{Sb}_2\text{S}_3$. Contains 24.5 per cent silver.

Arizona, Colorado.

French chalk. *See* Talc.

Fuchsite, Chrome mica. Green muscovite containing chromium. Used for ornamental work.

Vermont.

Fuller's earth. Clay whose composition is not thoroughly determined but which seems to consist principally of amorphous hydrous aluminum silicates with much magnesia, iron, and alkaline earths and excess of silica. It possesses the property of decolorizing oils and fats by retaining the coloring matter. It may or may not be plastic. Used chiefly in bleaching oils and fats and in making wall-paper pigments. *See also* Clay.

Arizona, Arkansas, California, Colorado, Florida, Georgia, Massachusetts, South Carolina, South Dakota, Texas.

Gabbro. A finely to coarsely crystalline igneous rock composed mainly of lime-soda feldspar (labradorite or anorthite), pyroxene, and commonly olivine. Magnetite or ilmenite, or both, and apatite are accessory minerals. It is generally dark colored. A little is used for monumental stone; also for

rough building stone and crushed stone for road metal, which may be locally called "trap rock."

California, Maryland, Pennsylvania, South Dakota, Virginia.

Gadolinite. A complex silicate of glucinum, iron, and the yttrium and cerium rare-earth metals. Occurs in pegmatites. Important source of rare-earth metals, especially yttrium.

Arizona, Colorado, Texas.

Galena. Lead sulphide, PbS. Contains 86.6 per cent lead. Is the principal lead-ore mineral.

Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Georgia, Idaho, Illinois, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nevada, New Hampshire, New Mexico, New York, North Carolina, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, Wyoming.

Ganister, Flint rock, Silex. A highly refractory siliceous sedimentary rock used for furnace linings.

California, Pennsylvania, Wisconsin.

Garnet. A group of silicate minerals including several species with related chemical structure commonly crystallized in dodecahedrons or trapezohedrons of the isometric (cubic) system. Garnets are not always pure but may contain the molecules of two species giving rise to intermediate types, as the gem rhodolite. Common varieties are almandite, iron-aluminum garnet (abrasive and gem, precious garnet); andradite, lime-iron garnet; essonite, gem variety of grossularite; grossularite, lime-aluminum garnet; pyrope, magnesia-aluminum garnet (gems, such as "Arizona ruby" and "Cape ruby"); rhodolite, isomorphous mixture of 2 molecules of pyrope and 1 molecule of almandite (used chiefly as an abrasive and also as a gem); spessartite, manganese-aluminum garnet (used as a gem, sometimes called hyacinth); topazolite; uvarovite. In some schist whetstones and grindstones garnet forms the important cutting grains. *See also* Almandite and Essonite.

Arizona, California, Colorado, Connecticut, Georgia, Idaho, Kentucky, Maine, Massachusetts, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Oregon, Pennsylvania, South Dakota, Utah, Virginia.

Garnierite. A hydrous nickel-magnesium silicate allied to genthite. One of the chief sources of nickel and its compounds.

Oregon.

Gas, natural. *See* Natural gas.

Genthite. A hydrous nickel-magnesium silicate, theoretically $2\text{NiO} \cdot 2\text{MgO} \cdot 3\text{SiO}_2 \cdot 6\text{H}_2\text{O}$, but the nickel content is variable.

Georgia, Oregon.

Geode. A hollow nodule or concretion, the cavity of which is lined with crystals. Used for specimens and ornamental work.

Illinois, Iowa, Oregon.

Giant granite. *See* Pegmatite.

Gilsonite, Uintaite. A brilliant black, very brittle variety of asphalt having a marked conchoidal fracture and a light-brown streak. Upon exposure to air readily breaks down into a brown powder. Decrepitates but fuses easily in a candle flame, burns and acts like sealing wax, leaving a sharp impression. Freely soluble in carbon disulphide (CS_2), almost equally so

in naphtha and hot turpentine. Widely used in the manufacture of paints, varnishes, and rubber substitutes, and enters into the manufacture of paving cements.

California, Oklahoma, Utah.

Glauber salt. *See* Mirabilite.

Glauberite. Sodium-calcium sulphate, $\text{Na}_2\text{SO}_4 \cdot \text{CaSO}_4$. Not of known economic use.

Arizona, California, New Mexico.

Glaucinite, Greensand. Essentially a hydrous silicate of iron and potassium, but the material is usually a mixture and consequently varies much in composition. The potash ranges from 2.2 to 7.9 per cent. A source of potash. *See* Marl.

Delaware, Maryland, New Jersey, North Carolina, South Dakota, Tennessee, Virginia.

Gneiss. A banded metamorphic rock with a more or less well-developed cleavage, but without the fissility of schist. Used for the same purpose as granite.

Connecticut, Delaware, District of Columbia, Georgia, Maryland, Massachusetts, Minnesota, New Jersey, North Carolina, Virginia.

Gold. An element, Au. Generally found as native metal. *See also* Amalgam, Calaverite, Electrum, Krennerite, Nagyagite, Petzite, Sylvanite.

Used in coinage (standard of value), jewelry, the arts, drugs, and in chemical and physical researches. Pure gold is chiefly used as a surface covering or plating to ornaments and utensils of other metals. It is also used extensively in dental work. When beaten out into leaf it is used for ornamental painting and lettering. For other purposes gold is hardened by being alloyed with copper or silver or both, such alloys being used for coinage, jewelry, and plate. The most useful artificial compound of gold is the chloride, which is used in photography and in the manufacture of ruby glass. Purple of Cassius is a compound containing gold and tin, which is also used in making ruby glass.

Alabama, Arizona, California, Colorado, Georgia, Idaho, Indiana, Iowa, Maine, Maryland, Michigan, Minnesota, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Carolina, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wyoming.

Goldfieldite. A sulphantimonide of copper in which part of the antimony is replaced by arsenic and bismuth and part of the sulphur by tellurium. A minor source of copper.

Nevada.

Goslarite. Zinc vitriol, $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$. A minor source of zinc.

Colorado, Pennsylvania.

Grahamite. A hydrocarbon resembling albertite in its jet-black luster. Is soluble in carbon disulphide and chloroform but not in alcohol, and is fusible. Occurs in veinlike masses. Specific gravity, 1.145. Has conchoidal fracture and is brittle. Used principally in pavement and highway construction, roofing, and making black paint.

Colorado, Oklahoma, West Virginia.

Granite. A granular igneous rock composed essentially of quartz, feldspar, and mica. The feldspar commonly includes both orthoclase and plagioclase. The mica may be either biotite or muscovite or both. Hornblende is a common and augite an uncommon component. Apatite, zircon, and magnetite are always present, generally as very small individuals. Used for construc-

tion work of different kinds, including dressed stone for the better grades of buildings, and rubble and rip-rap for rough buildings and breakwaters; for monumental and ornamental work; for paving blocks, curbing, and flagging; also crushed for road metal, railroad ballast, and concrete aggregate. Commercially almost all compact igneous rocks are called granite as distinguished from slate, sandstone, and marble.

Alabama, Arizona, California, Colorado, Connecticut, Delaware, District of Columbia, Georgia, Idaho, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, Wyoming.

Granite gneiss. *See* Gneiss.

Granite porphyry. A rock intermediate between granite and rhyolite or quartz porphyry, having the same minerals as the granite but a porphyritic texture like quartz porphyry. Used for foundation and building stone.

Arizona, Georgia, Wisconsin.

Granite syenite. *See* Syenite.

Graphite (plumbago, black lead). A soft, steel-gray to black, more or less impure, native form of carbon. The principal use is in making crucibles and other refractory products for the steel, brass, bronze, and electrochemical industries. Subsidiary uses are in the manufacture of stove polish, foundry facings, lead pencils, paint for metallic surfaces, and lubricants (dry or in mixture with oil or grease); as a material to prevent adherence of boiler scale to the boiler; and as a glaze for powder used in large ordnance.

Alabama, Arizona, California, Colorado, Connecticut, Georgia, Maine, Massachusetts, Michigan, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, Wisconsin, Wyoming.

Gravel. Small stones and pebbles or a mixture of sand and small stones. More specifically, fragments of rock worn by the action of air and water, larger and coarser than sand. When the mixture is cemented together into coherent rock it forms conglomerate. Used largely for filling along roadbeds, for road metal, railroad ballast, concrete aggregate, and other structural work; grinding, filter beds, and roofing. Gravel occurs and is used in every State. *See* Gravel in Arkansas, Iowa, Kentucky, Louisiana, Maine, Michigan, Tennessee, and Sand and gravel in other States.

Gray antimony. *See* Stibnite.

Gray copper ore. *See* Tennantite, Tetrahedrite.

Gray iron ore. *See* Hematite.

Gray manganese ore. *See* Manganite.

Green lead ore. *See* Pyromorphite.

Greenockite. Cadmium sulphide, CdS. Contains 77.7 per cent cadmium.

Greenockite occurs as a secondary mineral in zinc deposits in various parts of the United States, but not as a commercial deposit at any place. The majority of sphalerite deposits are cadmiferous, and cadmium in commercial quantity is obtained as a by-product in smelting these ores at certain plants. A minor source of cadmium and its compounds.

Arkansas, Colorado, Missouri, Pennsylvania.

Greensand. *See* Glauconite.

Greensand marl. Sands or marl containing glauconite. *See also* Marl.

Grindstone. A tough sandstone of fine and even grain, composed almost entirely of quartz, mostly in angular grains. It must have sufficient cementing

material to hold the grains together but not enough to fill the pores and cause the surface to wear smooth.

Colorado, Connecticut, Indiana, Massachusetts, Michigan, Missouri, Montana, Ohio, South Dakota, West Virginia, Wyoming.

Guano. The earthy hardened excreta of birds and bats, in caves, shelving rocks, and other roosting places. Valuable as a fertilizer for its phosphoric acid, ammonia, and potash.

New Mexico.

Gummite. An alteration product of uraninite of doubtful composition.

North Carolina.

Gypsite. See Gypsum.

Gypsum. Hydrous calcium sulphate, $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. Contains 32.5 per cent lime, 46.6 per cent sulphur trioxide, and 20.9 per cent water. Alabaster is a fine-grained compact variety, white, shaded, or tinted. Gypsite is an incoherent mass of very small gypsum crystals or particles, and has a soft, earthy appearance; contains various impurities, generally silica and clay. Satin spar is a fine fibrous variety which has a pearly, opalescent appearance. Selenite is a variety which occurs in distinct crystals or in broad folia. Some crystals are 3 or 4 feet long and clear throughout. Rock gypsum, the most common form and the principal source of gypsum, is a finely crystalline, white or pink to black deposit, occurring interbedded with other strata. Used crude as an ingredient in Portland cement manufacture and as land plaster. Used calcined for plaster of Paris, wall plaster, for molding and casting, Keene's cement, dental plaster, and in bedding glass for polishing. It is used in making plaster board, building blocks, and tiles, and also in the "staff" used in the construction of large temporary buildings like those of the international and other expositions. It is also used as an adulterant. White massive gypsum or alabaster is used by sculptors for interior ornamentation, and it is carved into vases and other objects of art.

Alabama, Arizona, Arkansas, California, Colorado, Florida, Idaho, Iowa, Kansas, Louisiana, Michigan, Mississippi, Montana, Nevada, New Mexico, New York, Ohio, Oklahoma, Oregon, South Dakota, Tennessee, Texas, Utah, Virginia, Wyoming.

Halite, Rock salt. Sodium chloride, NaCl . See also Salt.

Halloysite. A claylike aluminum silicate resembling kaolinite but amorphous, containing a larger but uncertain quantity of water, $2\text{H}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot \text{SiO}_2 + \text{aq}$. A source of alumina used for making aluminum. Used also in the manufacture of pottery.

Alabama, California, Georgia.

Halotrichite. Hydrous sulphate of iron and aluminum, $\text{FeSO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$. Not known to be of economic value.

California, New Mexico.

Hanksite. Carbonate sulphate of sodium. Not known to be of economic use. California.

Hard coal. See Anthracite.

Heavy spar. See Barite.

Heliotrope. See Bloodstone.

Hematite, Gray iron ore, Red iron ore, Specular iron, Specularite. Oxide of iron, Fe_2O_3 . Contains 70 per cent iron. Is an important source of iron; is used also in the manufacture of cheap paint, as polishing powder, and in a crushed form for ornamental work.

Alabama, Arizona, California, Colorado, Georgia, Idaho, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minne-

sota, Missouri, Montana, Nevada, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming.

Hessite. Silver telluride, Ag_2Te . Contains 63.3 per cent silver. Rare but valuable ore of gold and silver.

California, Colorado, Oregon.

Hetærolite, Wolfonite. A hydrous zinc-manganese oxide. Contains 20 per cent or more of zinc and is a subordinate source of zinc.

Colorado, New Jersey.

Hiddenite. An emerald-green spodumene. Used as a gem. *See also* Spodumene.

North Carolina.

Hinsdalite. A mineral related to alunite, but with replacements as indicated in the following formula: $2\text{PbO} \cdot 3\text{Al}_2\text{O}_3 \cdot 2\text{SO}_3 \cdot \text{P}_2\text{O}_5 \cdot 6\text{H}_2\text{O}$. Of no economic use. Colorado.

Horn silver. *See* Cerargyrite.

Hornstone. *See* Chert.

Hübnerite. Nearly pure manganese tungstate, MnWO_4 . When pure it contains 76.6 per cent tungsten trioxide, WO_3 . A source of tungsten, ferrotungsten, and sodium tungstate.

Arizona, California, Colorado, Idaho, Missouri, Montana, Nevada, New Mexico, South Dakota, Utah, Washington.

Hyalite. A variety of opal (hydrous silica) which occurs in clear globular or botryoidal forms, resembling drops of melted glass. Used as a gem.

Arizona, Georgia, Utah.

Hydrofranklinite. *See* Chalcophanite.

Hydrozincite, Zinc bloom. A basic zinc carbonate, exact composition uncertain, perhaps $3\text{ZnO} \cdot \text{CO}_2 \cdot 2\text{H}_2\text{O}$. A common source of zinc and its compounds. Arkansas, California, Colorado, Kansas, New Mexico, Utah.

Ilmenite, Menaccanite. Iron-titanium oxide, FeTiO_3 . Contains 36.8 per cent iron and 31.6 per cent titanium (52.7 per cent TiO_2). *See* Titanium for uses.

California, New Jersey, New York, North Carolina, Oregon, South Carolina, Texas, Virginia, Wyoming.

Impsonite. An asphalt much like albertite but almost insoluble in turpentine. Brittle, semivulcanized, burns without fusing. Uses prospectively about the same as those of grahamite. *See also* Grahamite.

Nevada, Oklahoma.

Indian pipestone. *See* Catlinite.

Infusorial earth. *See* Diatomaceous earth.

Iodyrite. Silver iodide, AgI . Contains 46 per cent silver.

Nevada, New Mexico.

Iolite. *See* Cordierite.

Iridium. A silver-white, hard, brittle metallic element, Ir, belonging to the platinum group. Found native in most crude platinum and with osmium as iridosmine in gold placers. Also recovered in small quantities in refining copper matte and gold bullion from different sources. Used to harden platinum, also for making contact points, standard weights, and pivots for scientific apparatus. Also used in porcelain painting and tipping pens.

California, Oregon, Washington.

Iridosmine. A natural alloy of iridium and osmium, IrOs . Analyses show 43 to 77 per cent iridium, 17 to 49 per cent osmium, and a little rhodium,

ruthenium, platinum, iron, and copper. Important source of the rare platinum metals iridium, osmium, and rhodium.

California, Oregon, Washington.

Iron. An element, Fe. * Rarely found native. By far the most common and most useful of all the metals. It occurs in abundance in nature in many forms (very rarely as the metal), being an important constituent of almost all rocks. The only native compounds, however, that can be profitably employed as a source of the metal are the oxides hematite, magnetite, and limonite and the carbonate siderite. Pure iron is not used in the arts. Wrought iron is used for a multitude of purposes, chiefly for forged parts of machinery, boiler plate, pipes for water and gas, and for girders and other structural members, but steel has largely replaced wrought iron for many uses. The chief uses of steel are for rails, ships, bridges, parts of machinery, and structures of various kinds. Cast iron is made mainly as an intermediate product in the manufacture of steel and wrought iron. It is also largely used for casting parts of machinery and for industrial and domestic utensils. The chief alloys of iron are those varieties of steel that contain different proportions of manganese and rare metals. These steels are for the most part harder and stronger than ordinary steel. Various cast alloys of iron with manganese and other metals are produced solely for the production of the special steels above mentioned. Chief of these are spiegel and ferromanganese, alloys of manganese and iron with considerable carbon, used in the manufacture of Bessemer steel and Hadfield's manganese steel. Artificial ferric oxide is employed as a pigment in rough polishing powder. The hydrate, carbonate, and other salts are used in medicine. An artificial mixture of the oxides (iron scale) is used in the conversion of iron into wrought iron and steel. Ferrous sulphate (copperas) is used to precipitate gold, and in the manufacture of Nordhausen sulphuric acid, iron mordants, inks, and other materials. Prussian blue, a cyanide, is a valuable iron pigment. Potassium ferrocyanide is used as a source of potassium cyanide and as a chemical reagent. *See also* Brown iron ore, Hematite, Ilmenite, Limonite, Magnetite, Marcasite, Mountain brown ore, Oriskany brown ore, Pisanite, Pyrite, Pyrrhotite, Siderite, Specularite, and Valley brown ore.

Iron pyrites. *See* Pyrite.

Itacolumite, Flexible sandstone. A variety of metamorphosed sandstone, slabs of which will bend noticeably without breaking.

Georgia.

Jack. *See* Sphalerite.

Jade, Jadeite, Nephrite. A hard and extremely tough mineral of varying composition, greenish white to deep green in color, used in making carved ornaments and as a gem. Part of the so-called jade is jadeite, a variety of pyroxene, essentially a metasilicate of sodium and aluminum; part is nephrite, a variety of amphibole, and essentially a metasilicate of iron, lime, and magnesium; and part is a variety of saussurite, which is commonly a complex alteration product of plagioclase feldspar. Williamsite, a variety of serpentine, is sometimes mistaken for jade.

Massachusetts.

Jamesonite, Feather ore. A sulphide of lead and antimony, $Pb_2Sb_2S_5$. A minor source of lead.

Arizona, California, Nevada, South Dakota, Utah.

Jarosite. A ferric sulphate, $K_2O.3Fe_2O_3.4SO_3.6H_2O$. Not of economic use. Utah.

- Jasper.** Red, brown, yellow, green, impure, slightly translucent cryptocrystalline quartz with a dull fracture. Used as a gem and ornamental stone.
Arizona, California, Massachusetts, New Mexico, Oregon, South Dakota, Texas, Utah.
- Jasperized wood.** *See* Wood.
- Jaspilite.** A term used around Lake Superior for the jasper associated with the iron ores. It is made up of bands of bright-red jasper alternating with bands of black, commonly specular hematite.
Michigan.
- Jefferisite.** *See* Vermiculite.
- Jet.** A dense black lignite, taking a good polish. Sometimes used for jewelry.
Colorado.
- Josephinite.** A natural iron-nickel alloy, Fe_2Ni_3 .
Oregon.
- Kalinite, Potash alum.** Hydrous aluminum-potassium sulphate, $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$. A prospective source of potash.
California, Nevada.
- Kaolin, Kaolinite, China clay, Porcelain clay.** A clay, mainly hydrous aluminum silicate, from which porcelain, china, stoneware, fire brick, fancy tile, and other products may be made.
Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Georgia, Indiana, Maryland, Massachusetts, Minnesota, Missouri, Nevada, North Carolina, Oregon, Pennsylvania, South Dakota, Texas, Utah, Vermont, Virginia, Wisconsin, Wyoming.
- Kleinite.** Mercury ammonium chloride. Formula uncertain. A source of mercury.
Texas.
- Krennerite.** Orthorhombic telluride of gold and silver. Composition variable, $(\text{Au}, \text{Ag})\text{Te}_2$. An analysis of krennerite from Cripple Creek gives gold 43.86 per cent, silver 0.46 per cent, tellurium 55.68 per cent. A source of gold and silver and their compounds.
Colorado.
- Kunzite.** A lilac-colored or pink spodumene. Used as a gem.
California, Maine.
- Labradorite.** A lime-soda feldspar used as an ornamental stone and as a gem.
See also Feldspar and Moonstone.
California, New York.
- Lapis lazuli.** A translucent, rich berlin-blue, azure-blue, violet-blue, or greenish-blue stone used for ornament. It is a mixture of lazurite, hauynite, amphibole, mica, pyrite, and other minerals. Used as a gem.
California.
- Lava.** A volcanic rock that has reached the surface of the earth while molten. Useful for railroad ballast, road metal, concrete, and building. The Columbia lava field, which occupies an area of about 200,000 square miles, chiefly in eastern Oregon and Washington, is one of the largest lava fields in the world. *See also* Basalt, Rhyolite, Trap.
California, Colorado, and other States.
- Lazulite.** A hydrous aluminum phosphate with varying proportions of iron and magnesium, $(\text{Fe}, \text{Mg})\text{O} \cdot \text{Al}_2\text{O}_3 \cdot \text{P}_2\text{O}_5 \cdot \text{H}_2\text{O}$. Azure blue in color, usually in pyramidal crystals; also massive. Used as an ornamental stone and as a gem.
California, Georgia.
- Lazurite.** Silicate of sodium and aluminum, with sodium sulphide, $\text{Na}(\text{NaS}_2\text{Al})\text{Al}_2(\text{SiO}_4)_3$. *See* Lapis lazuli.

Lead. A heavy metallic element, Pb. Rarely found native. Commercial lead is extremely pure and is largely used in sheets for roofing and making pipes. It is also used for bullets and for making white lead, red lead, litharge, and other materials. Lead hardened with a little antimony is used for coffins and for lining acid chambers. Of lead alloys the most important are that with tin, known as solder, and that with tin and antimony, known as type metal. Fusible alloys and antifricition alloys contain a large proportion of lead. Of the artificial compounds of lead by far the most important is white lead, a basic carbonate, which is the most useful pigment known. Red lead, an oxide, is also a valuable pigment and is used in the manufacture of flint glass. Litharge, another oxide, is used as pigment, as a constituent of many varieties of glass, and of glazes for clayware, and in manufacturing white lead. Lead chromate is used as a pigment, as is also lead sulphate. *See also* Altaite, Anglesite, Brongniardite, Cerusite, Crocoite, Dufrenoy'site, Galena, Jamesonite, Leadhillite, Linarite, Massicot, Mimetite, Minium, Plumbojarosite, Pyromorphite.

Alabama, Arizona, California, Colorado, Connecticut, Georgia, Idaho, Illinois, Iowa, Kansas, Maine, Massachusetts, Missouri, Montana, Nevada, New Mexico, New York, Oklahoma, Pennsylvania, South Dakota, Tennessee, Utah, Virginia, Wisconsin, Wyoming.

Leadhillite. Sulphate carbonate of lead, perhaps $4\text{PbO} \cdot \text{SO}_3 \cdot 2\text{CO}_2 \cdot \text{H}_2\text{O}$. A source of lead.

Arizona, Utah.

Lenzite ("wireless crystals"). A proprietary name adopted by the producing company for a mixture of galena, sphalerite, tetrahedrite, and possibly other minerals. It is used as a detector in wireless telegraphy.

Arizona.

Lepidolite. A light-colored (pearly, rose-red, violet-gray, lilac, yellowish) lithium-bearing mica. Contains from 3.9 to 5.9 per cent lithia, Li_2O . The chief source from which lithia salts are prepared.

California, Connecticut, Maine, South Dakota.

Lettsomite, Cyanotrichite. A hydrous copper-aluminum sulphate, $4\text{CuO} \cdot \text{Al}_2\text{O}_3 \cdot \text{SO}_3 \cdot 8\text{H}_2\text{O}$. A minor source of copper.

Utah.

Light ruby silver. *See* Proustite.

Lignite. A brownish-black coal in which the alteration of vegetable material has proceeded farther than in peat but not so far as in subbituminous coal.

Arkansas, Florida, Idaho, Kansas, Kentucky, Louisiana, Massachusetts, Minnesota, Mississippi, Montana, North Carolina, North Dakota, South Carolina, South Dakota, Tennessee, Texas.

Limestone. A rock composed mainly of calcium carbonate. Used for building stone and for crushed stone, paving, flagging, curbing, and in some places for ornamental and monumental stone. Unburned limestone is also used as the principal ingredient in Portland cement manufacture and for furnace flux. Limestone and dolomite are burned into lime for use in mortar, chemical industries, tanneries, alkali works, smelters, cyanide plants, for precipitating sediment in water, and for use in manufacture of paper, sugar, fertilizers, sand-lime brick, slag cement, steel, glass, disinfectants, soap, glue, and other articles. It is the cheapest of the alkalies. Dolomite is used for many but not all of the same purposes as limestone, burned and unburned. Magnesian lime made of it is especially adapted to the manufacture of magnesia and magnesium salts and to the manufacture of paper by the sulphite methods.

All parts of the United States except the District of Columbia and North Dakota.

Limonite. *See* Brown iron ore.

Linarite. A basic sulphate of lead and copper, $\text{PbO} \cdot \text{CuO} \cdot \text{SO}_3 \cdot \text{H}_2\text{O}$.

California, Utah.

Linnæite, Cobalt pyrites. A sulphide of cobalt, Co_3S_4 . A part of the cobalt is almost invariably replaced by nickel and to a less extent by iron and copper. Principally a source of cobalt.

Maryland, Missouri.

Lithiophilite, Triphylite. A salmon-colored to honey-yellow phosphate, chiefly of lithium, manganese, and iron, commonly associated with other minerals. $\text{Li}(\text{Fe}, \text{Mn})\text{PO}_4$. A possible source of lithium.

California, South Dakota.

Lithographic stone. A fine-grained homogeneous limestone, suitable for etching. Used for engraving in lithography. Practically all used in this country is imported, but domestic material of fair to good quality has been prospected and worked on a small scale.

Alabama, Iowa, Kentucky, Nebraska, New Mexico, South Dakota, Tennessee.

Lithium. A soft white metallic element, Li, which has no known use as an element. Its salts are used in medicine and in making storage batteries.

See Amblygonite, Lepidolite, Lithiophilite, and Spodumene.

Mackintoshite. A hydrous uranium-thorium silicate. A source of thorium.

Texas.

Macle. *See* Chialstolite.

Magnesite. Magnesium carbonate, $\text{MgO} \cdot \text{CO}_2$. Used chiefly in the manufacture of wood-pulp paper by the sulphite process, in the manufacture of oxy-chloride or Sorel cement; magnesite cement or plaster, which is used for sanitary flooring, artificial marble, tiles, and as plastic or stucco for exterior finish. Used also in making carbon dioxide, refractory bricks, and fireproof and damp-proof paints, and in the rubber industry.

California, Nevada, New Jersey, New York.

Magnesium. A silver-white metallic element, Mg. Used in the manufacture of shrapnel shells to produce light and smoke and in making copper castings to prevent blowholes by decomposing the gases formed in the melting of the copper. Until recently it was produced mainly by electrolysis from fused carnallite (hydrous potassium-magnesium chloride); now derived as a by-product from magnesium chloride. *See also* Brucite and Dolomite.

Magnetic pyrites. *See* Pyrrhotite.

Magnetite, Magnetic iron ore. The magnetic iron oxide, $\text{FeO} \cdot \text{Fe}_2\text{O}_3$, contains 72.4 per cent iron. The richest and purest ore of iron, used largely for the production of the commercial metal and to some extent as a flux in lead and copper smelting. Used also as a gem.

Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Georgia, Idaho, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, Wyoming.

Malachite. Green basic copper carbonate, $2\text{CuO} \cdot \text{CO}_2 \cdot \text{H}_2\text{O}$. Contains 40.3 per cent copper. A source of copper and used also for inlay in ornamental work and sometimes as a gem. Used as a pigment in imitation bronze.

Arizona, Arkansas, California, Colorado, Connecticut, Florida, Georgia, Idaho, Maryland, Missouri, Montana, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, Oklahoma, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, Wyoming.

Maltha, Natural liquid asphalt, Mineral tar. A black, viscous, freely soluble hydrocarbon derivative, a transition product between petroleum and asphalt, called residuum when produced by the boiling down of petroleum. Used as a surface dressing for roads, as a flux for softening hard bitumens, and as a protective coating for iron and steel work.

California.

Manganese. A metallic element, Mn. Occurs abundantly in nature, chiefly as oxides. The chief uses of manganese may be classed as metallurgic, in the manufacture of alloys, and as fluxes in the reduction of copper, lead, and silver ores, and chemical, as an oxidizer and as a coloring material. High-grade oxide ores free from iron are used chiefly to decolorize flint glass, for dry batteries, and in making drier of varnishes and paints. Minor uses are sundry chemical, such as for disinfectants, in preparing oxygen, and for making manganese bronze and similar alloys. Manganese bronze, the most important of the nonferrous alloys, is used for steamboat propellers, and other alloys are used for curios, statuary, and ornamental work. High-grade oxide ores that contain iron are utilized chiefly in making alloys, such as ferromanganese and spiegeleisen, for use in steel. They are also used less extensively as pigments for coloring glass and pottery, and in paints. Low-grade oxide ores are used in making alloys, such as spiegeleisen and manganiferous cast iron, for flux in lead smelting. *See also* Alabandite, Braunite, Chalcophanite, Coronadite, Manganite, Psilomelane, Pyrolusite, Rhodochrosite, Rhodonite, Tephroite, and Wad.

Alabama, Arizona, Arkansas, California, Colorado, Georgia, Maine, Maryland, Michigan, Minnesota, Missouri, Montana, Nevada, New Jersey, New Mexico, North Carolina, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming.

Manganese hydrate. *See* Psilomelane.

Manganite, Gray manganese ore. A hydrated manganese oxide, $Mn_2O_3 \cdot H_2O$. Used for the same purposes as pyrolusite, and next to that mineral it is the most important manganese ore. *See also* Pyrolusite.

Alabama, California, Georgia, Maryland, New Mexico, Virginia.

Marble. Crystalline granular limestone or dolomite, generally susceptible of a high polish. A commercial term for a relatively soft crystalline or semi-crystalline rock, susceptible of a good polish and of sufficiently attractive appearance for use as ornamental stone. The verde antique marbles consist mostly of serpentine. Used as monumental, statuary, ornamental, and building stone in exterior and interior work, and as mosaic cubes. The waste stone is used for rough building and crushed stone (including terrazzo) and in some places is burned into lime or used for flux. *See also* Onyx marble.

Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Georgia, Idaho, Iowa, Kentucky, Maryland, Massachusetts, Michigan, Missouri, Montana, Nevada, New Jersey, New Mexico, New York, North Carolina, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wyoming.

Marcasite, White iron pyrites. Orthorhombic iron disulphide, FeS_2 . Contains 46.6 per cent iron. A source of sulphur and sulphuric acid.

California, Colorado, Idaho, Iowa, Kansas, Michigan, Missouri, Montana, Oklahoma, Oregon, Wisconsin.

Marl. A soft earthy deposit of calcium carbonate, containing more or less clay and sand. A source of lime.

Alabama, Arkansas, Delaware, Florida, Georgia, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, South Carolina, Tennessee, Utah, Vermont, Virginia, Wyoming.

Massicot. Lead monoxide, PbO . Contains 92.8 per cent lead.

Colorado, Idaho, Nevada, Virginia.

Meerschaum, Sepiolite. A tough, compact hydrous magnesium silicate. Used for tobacco pipes, cigar holders, and ornamental work.

California, New Mexico.

Melaconite. Black copper oxide, CuO . Contains 79.8 per cent copper. The name given to an earthy, black, massive variety of tenorite.

Alabama, Arizona, California, Colorado, Idaho, North Carolina, Pennsylvania, Tennessee, Virginia, Washington, Wyoming.

Menaccanite. *See* Ilmenite.

Mercury, Quicksilver. An element, Hg , sometimes found native, but mostly derived from cinnabar. Normally, by far the greater part of the world's production of mercury is used in extracting gold and silver from their ores. In 1914-1916, owing to the European war, it was used mainly in the manufacture of fulminate for explosive caps, the demand for which caused the price to rise from \$37.50 to \$300 a flask. Used also in the manufacture of drugs, of electric appliances, and of scientific apparatus, thermometers, barometers, and for making vermilion. *See also* Amalgam, Cinnabar, Egles-tonite, Kleinite, Metacinnabarite, Montroydite, Terlinguaite, Tiemannite.

California, Colorado.

Mesolite. *See* Thompsonite.

Metacinnabarite. Composition and use same as cinnabar, but black in color, and crystallizing in isometric forms (tetrahedral). *See also* Cinnabar.

California.

Metaheawettite. A dark-red hydrous calcium vanadate occurring in microscopic crystals, which as a soft powdery or easily friable mass in some places fills cracks 2 inches in thickness. Probably $CaO \cdot 3V_2O_5 \cdot 9H_2O$. A possible source of vanadium.

Utah.

Mexican onyx. *See* Onyx marble and Travertine.

Mica. A hydrous silicate of aluminum (in some varieties partly replaced by iron, chromium, and other metals) and an alkali as potassium, sodium, or lithium, having a very fine basal cleavage which renders it capable of being split into thin, tough, transparent plates. The most common varieties are muscovite and biotite. Phlogopite and lepidolite are prominent locally. Used in trade for stove windows, gas-lamp chimneys, lamp shades, and spectacles, and as an insulating material in the manufacture of almost all kinds of electric machinery and apparatus. For these uses it is cut into sheets of different sizes, punched into washers and disks, and built into larger sheets by thin splitting and cementing many layers of the thin sheets with shellac under pressure and heat. Large quantities of mica are ground for the manufacture of silvered and gilded wall papers, fancy paints, lubricants, rubber goods, molded mica, roofing papers, as a covering for steam pipes, and in decorative cement work. Used in calico printing, as an absorbent of nitroglycerine, and in the manufacture of smokeless powder.

Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Georgia, Idaho, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana,

Nevada, New Hampshire, New Mexico, New York, North Carolina, Oregon, Pennsylvania, South Carolina, South Dakota, Texas, Vermont, Virginia, Washington, West Virginia, Wyoming.

Mica (altered). *See* Vermiculite.

Microlite. Essentially a calcium pyrotantalate. Contains also small quantities of fluorine, as well as columbium, tungsten, and other bases. Used as a gem.

Virginia.

Millerite. Nickel sulphide, NiS . Contains 64.1 per cent nickel.

California, Pennsylvania.

Millstone. A hard tough stone used for grinding cereals, cement rocks, and other materials. Usually a coarse-grained sandstone or fine quartz conglomerate.

Alabama, Georgia, Mississippi, New York, North Carolina, Pennsylvania, Virginia.

Mimetite. Lead chlorarsenate, $3\text{Pb}_3\text{As}_2\text{O}_8 \cdot \text{PbCl}_2$. A source of lead.

California, Colorado, Nevada, Utah.

Mineral liver. *See* Wiedgerite.

Mineral oil. *See* Petroleum.

Mineral paint. Minerals used as pigment, including the ochers, iron oxides, barite, etc. *See also* Morrisite, Ocher, Reddle, Shale, Sienna, Umber, and Vermiculite.

Alabama, Arizona, California, Colorado, Connecticut, Florida, Georgia, Indiana, Iowa, Kentucky, Massachusetts, Minnesota, Missouri, New Mexico, New Jersey, New York, Oregon, Pennsylvania, South Dakota, Tennessee, Washington, Wisconsin, Wyoming.

Mineral pitch. *See* Asphalt.

Mineral tar. *See* Maltha.

Mineral wax. *See* Ozocerite.

Minium. Red oxide of lead, $2\text{PbO} \cdot \text{PbO}_2$. Contains 90.6 per cent lead.

California, Colorado, Utah.

Mirabilite, Glauber salt. Hydrous sodium sulphate, $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$. A source of soda ash.

Arizona, California, Oregon, Utah, Wyoming.

Mispickel. *See* Arsenopyrite.

Mixite. Basic hydrous copper-bismuth arsenate, $20\text{CuO} \cdot \text{Bi}_2\text{O}_3 \cdot 5\text{As}_2\text{O}_5 \cdot 22\text{H}_2\text{O}$. In very slender acicular radiating crystals and tufts of crystals. Rare.

Utah.

Mohawkite. Arsenic ore of copper with minor amounts of nickel and cobalt. A variety of domeykite, Cu_3As .

Michigan.

Molybdenite. Sulphide of molybdenum, MoS_2 . Contains 60 per cent molybdenum, of which it is the chief source.

Arizona, California, Colorado, Connecticut, Idaho, Maine, Montana, Nevada, New Jersey, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, South Carolina, Utah, Washington, Wyoming.

Molybdenum. A metallic element, Mo, of wide but not abundant distribution. Used extensively in the manufacture of very hard steels that are peculiarly adapted for armor plate and for high-speed tools; used in the form of ribbon or wire in electric resistance furnaces and as supports for tungsten filaments in incandescent electric lamps; also used in tungsten-molybdenum alloys, which are becoming extensively employed as substitutes for platinum. Ammonium molybdate is used in the determination

of phosphorus and in other chemical work; also used in fireproofing and as a germicide in disinfecting railway passenger coaches. It is used in some forms of stellite, in Roentgen ray tubes, for dyeing, and for other purposes in the mechanical arts. *See also* Molybdenite and Wulfenite.

Monazite. Phosphate of the cerium metals (cerium, didymium, lanthanum) and other rare-earth metals, including thorium, which alone gives it commercial value. Some varieties carry no thorium, but others carry as much as 18 per cent thorium oxide. The chief source of thorium used for gas-light mantles and other purposes. Also a source of helium gas.

Colorado, Connecticut, Idaho, Montana, Nevada, New Mexico, North Carolina, Oregon, South Carolina, Utah, Virginia, Washington, Wyoming.

Montroydite. Oxide of mercury, HgO . A source of mercury.

Texas.

Monzonite. An igneous rock of granitoid texture, intermediate in mineral composition between syenite and diorite; both alkali feldspar (or orthoclase) and lime-soda feldspar (or plagioclase) are present in approximately equal amounts. Is used under the name of "dark granite" for monumental work when sufficiently attractive; also for rough building. It is the country rock closely associated genetically with many ore deposits in the West. *See* Granite.

Moonstone. A variety of feldspar, commonly transparent or translucent orthoclase, albite, or labradorite, which exhibits a delicate pearly opalescent play of colors.

Pennsylvania, Virginia.

Morrisite. A pearly white volcanic product, probably fine-grained tuff or pumice, possessing properties which render it peculiarly fitted for use as a base for pigments of practically all kinds.

Colorado.

Mountain brown ore. A local name for limonite or brown iron ore. Applied in Virginia to the low-grade siliceous variety, which commonly occurs in hard lumps and which is found on the mountain slopes at or near the contact of the Cambrian shale and sandstone with the Cambrian and Ordovician limestone. *See also* Brown iron ore, Valley brown ore.

Virginia.

Muscovite. Potash-bearing white mica, $\text{H}_2\text{KAl}_2(\text{SiO}_4)_3$. *See also* Mica.

Nagyagite. A sulphotelluride of lead, gold, and antimony, possibly $\text{Au}_2\text{Pb}_{14}\text{Sb}_4\text{Te}_7\text{S}_{17}$. The gold content ranges from 5.8 to 12.8 per cent, the sulphur from 8.1 to 10.8 per cent. A rare source of gold.

North Carolina.

Native Epsom salts. *See* Epsomite.

Native paraffin. *See* Ozocerite.

Natron. Hydrous sodium carbonate, $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$. Not of economic use.

Oregon, Wyoming.

Natural gas. A mixture of gaseous hydrocarbons found in nature. In many places associated with deposits of petroleum, to which it is closely related. Used chiefly for fuel and illumination. As an illuminant, natural gas was first used in the United States at Fredonia, N. Y., about 1824. As a fuel it was first used commercially in the United States in the Pittsburgh district of Pennsylvania about 1882, and is a source of both heat and power for domestic and industrial uses. Its use as fuel has accelerated the development of many industries for which it is peculiarly adapted, especially the iron, steel, and zinc industries, where it is used in puddling, open-hearth,

and heating furnaces and smelting plants, and the glass industry, where it is used in melting the ingredients and annealing the product. It is also used extensively in the manufacture of brick, pottery, and tile, at cement plants, in generating steam for power, and in internal-combustion engines. Large quantities of gas are used in making carbon black, and the heavy or casing-head gas from oil wells is used for making gasoline. It is used extensively as an illuminant. Though natural gas does not contain the hydrocarbons necessary to give a good light like those contained in coal and water gas, where used as an illuminant its light is very much improved by the Welsbach mantle or the Argand burner and chimney. Liquefied natural gas is used for lighting but finds more extended employment in certain industries where a high degree of heat is required, as in the melting of steel and in the welding and brazing of metals. Production of natural gas in 1914 was 591,866,733,000 cubic feet, valued at \$94,115,524, in which West Virginia, Pennsylvania, Ohio, and Oklahoma led the other States in the order mentioned. Marsh gas occurs and is used in a few homes for fuel and light in nearly all the drift-covered States and in some other States.

Alabama, Arkansas, California, Colorado, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Missouri, Montana, New Mexico, New York, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Utah, West Virginia, Wyoming.

Natural liquid asphalt. *See* Maltha.

Needle ore. *See* Aikinite.

Nelsonite. A dike rock composed essentially of ilmenite or rutile and apatite. Virginia.

Nephrite. *See* Jade.

Niccolite, Arsenical nickel. Arsenide of nickel, NiAs. Contains 43.9 per cent nickel.

Colorado.

Nicholsonite. A variety of aragonite (the orthorhombic carbonate of lime, CaCO_3) containing from less than 1 per cent up to 10 per cent of zinc. May be a subordinate source of zinc.

Colorado.

Nickel. A metallic element, Ni. Chiefly used in making nickel steel. A nickel-copper alloy is used as a jacket for bullets; great quantities of nickel are used in plating various metallic objects, and smaller quantities are used in making coins. The United States coin known as the "nickel" contains only 25 per cent of nickel; the rest is copper. Various nickel alloys are proposed as substitutes for steel. Monel metal, an alloy of nickel and copper containing also a small quantity of iron, is made by smelting the Sudbury (Canada) ores without separation of the metallic contents. Monel metal is used for valves on high-pressure steam engines, as a roofing material, in sulphuric-acid pumps, and in other places where a metal highly resistant to ordinary chemicals is needed. *See also* Annabergite, Garnierite, Genthite, Josephinite, Millerite, Niccolite, Pentlandite, Pyrrhotite, and Zaratite.

California, Georgia, Idaho, Minnesota, Missouri, Nevada, Oregon, Pennsylvania, South Carolina, Virginia, Washington, Wyoming.

Nigrite. A name given to a variety of asphalt mined at Soldier Summit, Utah, whose composition is imperfectly understood. Brittle, imperfectly fusible, and imperfectly soluble. Prospectively useful for the same purposes as grahamite. *See also* Grahamite.

Utah.

Niter, Saltpeter. Potassium nitrate, KNO_3 . Used in manufacturing nitric acid, gunpowder, and other explosives, as a fertilizer, and in curing meats.

Alabama, Arizona, Arkansas, California, Indiana, Oregon, Tennessee, Texas, Utah, Virginia, West Virginia, Wyoming.

Nivenite. A variety of uraninite high in uranium and carrying 10 per cent or more of the yttrium earths and 6.7 to 7.6 per cent thorium. It is wholly soluble in dilute sulphuric acid. A possible source of radium, yttrium, and rare-earth metals. *See* Uraninite.

Texas.

Novaculite. An extremely fine grained quartzose sedimentary rock. Used for making fine whetstones, oilstones, and hones, and in the manufacture of engraving and carving tools, and as a gem. Formerly used by the Indians for stone implements. The novaculite of Arkansas makes excellent whetstones. According to their color and quality these whetstones are known as Washita stones or Arkansas stones. The Arkansas stones are snow-white and are better for some purposes than the Washita stones.

Arkansas, Georgia, Massachusetts, Michigan, North Carolina, Oklahoma, Tennessee.

Obsidian, Volcanic glass. Extrusive igneous rocks which have cooled either without crystallization or with only partial crystallization. Used as a gem. Abundant in Yellowstone National Park and vicinity.

Arizona, California, Nevada, Utah.

Ocher, Mineral paint. A metallic oxide occurring in an earthy or pulverulent form. Commercially the term ocher is used to mean the yellow, red, and brown earthy iron oxides.

Alabama, Arkansas, California, Delaware, Georgia, Indiana, Iowa, Kentucky, Maine, Maryland, Mississippi, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, Pennsylvania, South Dakota, Vermont, Virginia, Washington, West Virginia, Wisconsin.

Octahedrite. Titanic oxide, TiO_2 . A possible source of titanium.

Arkansas.

Oil. *See* Petroleum.

Oil shale. *See* Shale.

Oilstone. A fine-grained whetstone on which oil is used. *See also* Novaculite.

Arkansas, Georgia, Indiana, Ohio.

Olivenite. Hydrous copper arsenate, $\text{Cu}(\text{CuOH})\text{AsO}_4$. Not of economic use. Utah.

Olivine, Chrysolite, Peridot. An orthosilicate of iron and magnesium, $2(\text{Mg, Fe})\text{O} \cdot \text{SiO}_2$. Used as a gem. A constituent of many basalts, gabbros, and closely related basic rocks. Peridotite consists largely of dunite, composed almost wholly of olivine.

Arizona, California, New Mexico, Oregon.

Onofrite. Sulphoselenide of mercury, $\text{Hg}(\text{S,Se})$. Contains 81 to 82 per cent of mercury.

Utah.

Onyx. A cryptocrystalline variety of quartz, made up of different colored layers, chiefly white, yellow, black, or red. Not found in commercial quantity in United States. Used as a gem.

Onyx marble (including Mexican onyx). Calcite somewhat resembling true onyx in appearance. Is usually formed as stalactites, stalagmites, vein filling, or spring deposits. Used as an ornamental stone. Nearly all the onyx marble used in the United States is imported from Mexico and Europe, but good domestic material is available. *See also* Travertine.

Arizona, Arkansas, California, Kentucky, Missouri, New Mexico, South Dakota, Tennessee, Texas, Utah, Virginia.

Opal. Hydrous silica, $\text{SiO}_2 \cdot x\text{H}_2\text{O}$. When it shows a play of colors, or opalescence, it becomes the fire opal or precious opal of commerce.

Arizona, California, Colorado, Georgia, Idaho, Nevada, New Mexico, Oregon, Texas, Utah, Washington.

Opalized wood. *See* Wood.

Idaho.

Oriskany brown ore. Deposits of limonite, hydrated iron oxide, occurring in beds of Oriskany age. *See also* Brown iron ore.

Maryland, Tennessee, Virginia, West Virginia.

Orpiment. Arsenic trisulphide, As_2S_3 . Contains 61 per cent arsenic (the element). A source of arsenic.

Utah.

Orthite. *See* Allanite.

Orthoclase. The monoclinic potash feldspar, $\text{K}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$. Contains a maximum of 16.9 per cent potash, K_2O . Used as a gem. *See also* Feldspar.

Osmium. A blue-white metallic element, Os, found as a natural alloy with iridium as iridosmine. Used mostly to harden platinum in an alloy, for pointing gold pens, in the preparation of electric-lamp filaments, and in the manufacture of standard weights; osmium oxide is used as a black stain in optical apparatus. *See also* Iridosmine.

Ozocerite, Fossil wax, Mineral wax, Native paraffin. A waxlike hydrocarbon, $\text{C}_{25}\text{H}_{52}$, yellow-brown to green to black in color; translucent when pure; feels greasy; fuses below 70° . Dissolves in all of the usual solvents of bitumen, including carbon disulphide. Streak is light to brown, and specific gravity is slightly less than 1. Yields ceresin when refined, paraffin wax and oil when distilled. Distantly related to asphalt. Chiefly used as a source of mineral wax or ceresin, the applications of which are numerous, such as making candles, waxed paper, and adulterating beeswax. Used largely in the manufacture of phonographic needles. Also used as a source of illuminating gas, oils, and other substances, as an insulator of electricity, and as a covering to protect metal surfaces against moisture, acids, or alkalis.

Utah, Wyoming.

Palladium. An element, Pd, one of the platinum metals. Occurs in minute quantities in copper ores and is recovered in electrolytic refineries. Used in dental work in different alloys.

Nevada, Wyoming.

Peacock copper ore. *See* Bornite.

Pearceite. Silver sulpharsenite Ag_3AsS_3 (arsenical polybasite).

Colorado, Montana, Utah.

Pearls. Lustrous calcareous concretions, chiefly of calcium carbonate, produced by shellfish. Used as gems.

Arkansas.

Peat. Partly decayed vegetable matter which has accumulated in marshes and wet places. Used as a fertilizer, as a filler for artificial or chemical fertilizers, in stock foods, in mud baths, as fuel, paper stock, and for insulating material, and as a deodorizer and preservative in slaughterhouses and garbage plants to improve the conditions under which tankage is produced; also for stable litter.

In Europe peat is produced in largest quantities for fuel, of which the commercial varieties are air-dried cut peat, air-dried machine peat, briquetted peat, peat powder, and peat coke or charcoal. Large quantities of poorly decomposed fibrous and mossy peat are prepared and sold for stable litter. Peat meal or dust is extensively produced and used as an absorbent and disinfectant in cesspools, outhouses, manure pits, and the like. It is also used largely to mix with refuse molasses for stock food, for packing and preserving fruit, vegetables, and fragile materials, and as surgical dressing and absorbent.

Fibrous peat is used, either directly or as a source of fiber, for making hospital mattresses and cushions. The selected and cleansed fiber is used for weaving coarse fabrics and for paper stock. This type of peat is also pressed into sheets 2 inches or more thick and used in the walls of buildings as insulation against changes of temperature and sound and as a substitute for cork in a variety of uses. Mixed with some other mineral substances, such as plaster of Paris, peat is made into a substitute for wood that is used to some extent in cabinet and structural work. Peat is also used as a source of dyes and of tanning material.

When subjected to destructive distillation in closed retorts, peat yields burnable gas and a quantity of charcoal, free from sulphur and phosphorus, and therefore useful for metallurgic processes. If the gases of distillation are cooled and condensed chemical compounds of economic value may be recovered from the crude distillates. Among the most important of these compounds are ammonia, recoverable as the sulphate, methyl or wood alcohol, acetic acid, acetine, or calcium acetate, petroleum oils of several grades, creosote, paraffin, and a substance resembling asphalt.

Ethyl alcohol has been made from peat by chemical treatment, and it has also been proposed to obtain nitrates and nitric acid from peat bogs by the action of electric currents and nitrifying bacteria on properly prepared beds of peat.

Experiments for producing peat in this country for many of the purposes for which it is used in Europe are now in progress, with the result that the peat industry is gradually being placed on a firm basis.

California, Connecticut, Florida, Georgia, Illinois, Indiana, Iowa, Maine, Massachusetts, Michigan, Minnesota, Nebraska, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, Washington, Wisconsin.

Pegmatite, Giant granite. An igneous rock, generally coarse grained but usually irregular in texture and composition, composed mainly of silicate minerals of large size, including quartz, feldspar, muscovite, biotite, tourmaline, beryl, lithia minerals, zircon, etc. Some pegmatites carry minerals containing the rare-earth metals, tin, tungsten, tantalum, uranium, and others.

Occurs in most of the New England and Atlantic Coast States and is the rock in which quarries for feldspar, mica, tourmaline, and beryl are commonly located.

Pencil stone. *See* Pyrophyllite.

Pentlandite. A sulphide of iron and nickel (Fe,Ni)S. A source of nickel. Pennsylvania.

Peridot. *See* Olivine.

Peridotite. A granular rock composed chiefly of olivine and pyroxene with little or no feldspar. A source of olivine and pyroxene used as gems.

Perovskite. Calcium titanate (CaTiO_3).

Colorado.

Petrified wood. See Wood.

Petroleum, Mineral oil. An oily, inflammable, liquid mixture of numerous hydrocarbons, chiefly of the paraffin series, found in the earth. The petroleum found in different areas vary widely in composition and appearance. Used extensively in the crude state in the industries as a fuel and a lubricant, in chemistry as a solvent, in cabinetmaking for finishing wood, and in metallurgy in the flotation process for concentrating metallic ores.

The refined products of crude petroleum, which number several hundred, find wide employment in the arts and industries. The following comprise the more important by-products and their uses:

Liquid pentane is employed in welding and brazing.

Rhigolene is a valuable local anesthetic for surgical use.

Cymogene is utilized in the manufacture of ice.

Petroleum ether (Sherwood's oil) and ligroine are extensively used as solvents for fats and fatty oils and are employed in the manufacture of rubber and rubber substitutes.

Petroleum spirit, including gasoline, naphtha, and petrol, is produced in many grades adapted to a variety of uses. Gasoline is the principal fuel used in internal-combustion engines for automobiles, motor boats, airplanes, motor cycles, and for other purposes. It is a source of heat in stoves and of light in lamps. Naphtha is used for cleaning and in the manufacture of paints, varnishes, soap, oilcloth, and linoleum.

Kerosene, the most common illuminating or burning oil, is used as an illuminant, as a source of heat, as a disinfectant, as a solvent, and as a destroyer of fruit-tree pests. "Headlight oil" and "mineral sperm oil" are especially refined types of illuminating oil prepared for specific purposes.

Gas oils, as the name implies, are used in the manufacture of oil gas and are employed in the enrichment of other artificial gases.

Lubricating oils range from carefully refined mineral oils through a great number of mixtures of mineral with animal or vegetable oils compounded to meet a great variety of requirements as to viscosity, temperature conditions, and type of bearings.

Paraffin wax is widely employed in the manufacture of candles and as a preservative for fruit, meats, eggs, flowers, building stone, and other material. It is used in the manufacture of matches, electric insulation, textiles, chewing gum, and crayons.

The greases, which are closely allied with the lubricating oils, comprise about 75 varieties of semisolid lubricants utilized directly as such and less directly as leather finishes and in the manufacture of leather and metal polishes.

Petrolatum or vaseline, the principal member of the grease family, is widely used by the pharmacist in compounding innumerable pastes, ointments, and salves for internal and external application. In the liquid form petrolatum is used by the physician as a mild and effective cathartic, and by the nose and throat specialist as a vehicle for protective sprays.

Petroleum asphalt, the residuum obtained in the refining of asphaltic oils, is used under the name of road oil for laying dust on streets and

highways and as a flux for softening solid bitumens. The heavier grades are utilized in the manufacture of roofing materials, building paper, paint, and waterproof felts, and extensively in pavement construction.

Petroleum coke, obtained as a residuum in refining paraffin-base oils, is used in the manufacture of ink, leather polish, stove polish, and paint, but more widely for carbon points in arc lamps and electrodes in batteries and electric furnaces.

Recent developments in methods of refining have shown that benzol and toluol, substances that find wide application in the manufacture of dye-stuffs and explosives, can be commercially recovered from petroleum with appropriate treatment. This phase of the petroleum industry therefore seems likely to become an important domestic source of dyes.

The total production of petroleum in 1914 was 290,312,535 barrels, having a value of \$233,991,903.21. This total represents marketed production and does not include the petroleum placed in storage, which in Oklahoma and California was large, that of Oklahoma being more than 19,000,000 barrels in 1914.

Alabama, California, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Missouri, Montana, New Mexico, New York, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Washington, West Virginia, Wyoming.

Petroleum asphalt. *See* Petroleum.

Petzite. Telluride of silver and gold $(Ag,Au)_2Te$. The gold content ranges from 18.2 to 25.6 per cent and the silver from 40.7 to 46.8 per cent.

California, Colorado, New Mexico.

Phenacite. Glucinum orthosilicate, Gl_2SiO_4 . Used as a gem.
Colorado.

Phosphate rock. A sedimentary rock containing phosphate of lime. The form in which the phosphate of lime occurs is obscure. Used in the manufacture of artificial fertilizers and chemicals containing phosphoric acid.

Alabama, Arkansas, Florida, Idaho, Kentucky, Montana, South Carolina, Tennessee, Utah, Virginia, Wyoming.

Phosphorus. A nonmetallic, generally yellowish-white element, P, occurring in nature in the form of phosphates, or salts of phosphoric acid. It is obtained from organic matter, as from bones and urine, and from minerals, such as apatite and vivianite. It is used in medicine and in the manufacture of matches. *See* Apatite, Vivianite, Wavellite, and Xenotime.

Pisanite. An iron sulphate in which part of the iron is replaced by copper, $(Fe,Cu)SO_4 \cdot 7H_2O$. A minor source of copper.
Montana, Utah.

Pitchblende. *See* Uraninite.

Arizona, Colorado, Connecticut, North Carolina, Utah.

Platinum. An element, Pt, occurring as a native metal. Practically all platinum is found in the metallic state, though small quantities are obtained from sperrylite and in the electrolytic refining of copper ores. One of the most important uses of platinum is as a catalyzer in what is technically known as "contact mass" in the manufacture of fuming sulphuric acid and sulphur trioxide. The platinum acts as an exciter in the formation of sulphur trioxide, which, on combination with water, yields sulphuric acid. It is also used for platinum dishes and utensils of many kinds in chemical laboratories, in the chemical and electrical industries, and in the manufacture of incandescent lamps, but its use in these lines each year becomes less, as it is being replaced by nickel-chromium alloys or metallic tungsten or metallic molybdenum or tungsten-

molybdenum alloys. It is also used in jewelry as a setting for precious gems. In 1916 the demand for platinum for use in making munitions raised the price of the metal from \$35 to \$90 an ounce. *See also* Sperrylite.

Arizona, California, Colorado, Idaho, Maine, Montana, Nevada, New York, North Carolina, Oregon, South Carolina, Utah, Washington, Wyoming.

Plumbojarosite. A hydrous sulphate of lead and iron, $\text{PbFe}_3(\text{OH})_{12}(\text{SO}_4)_4$. An ore of lead.

Colorado, Nevada, New Mexico, Utah.

Pollucite. Hydrous caesium-sodium-aluminum silicate, $\text{H}_2\text{O} \cdot (\text{Cs}, \text{Na})_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 5\text{SiO}_2$. Found in pegmatite. Commercial source of caesium compounds.

Maine.

Polybasite. Sulphide of silver and antimony, Ag_3SbS_4 . If pure, it would contain 75.6 per cent silver, but copper replaces part of the silver; also arsenic replaces antimony.

Arizona, Colorado, Idaho, Montana, Nevada.

Polycrase. A columbate and titanate of yttrium, erbium, cerium, and uranium, with some iron and water. A source of rare earth metals.

North Carolina, South Carolina, Texas.

Porcelain clay. *See* Kaolin.

Porphyry. An igneous rock in which relatively large, conspicuous crystals (phenocrysts) are set in a finer-grained or glassy groundmass. Porphyries are generally named in accordance with their rock composition (for example, granite porphyry, trachyte porphyry) or with the character of the phenocrysts, as quartz porphyry. Colloquially the word "porphyry" is used to mean almost any igneous rock, particularly one that is spotted, soft, or light colored.

Occurs in many States but is little used. Several light-colored porphyries are used for building in the Rocky Mountain and Pacific Coast States. *See* Rhyolite.

Potash. The oxide of potassium, K_2O . Not an independent compound, but used as a basis of comparison for all potash minerals and artificial salts. The potash of commerce is derived from the minerals carnallite, kainite, sylvite (not found in the United States), and niter, and also from certain seaweeds, wood ashes, and marls. The principal potash-bearing silicate minerals are orthoclase, leucite, sanidine, nephelite, and muscovite. Potash salts are essential to numerous industries, chiefly the fertilizer industry. They are also used in the manufacture of glass, in certain kinds of soap, in some explosive powders, and in the chemical industries, including the manufacture of alum, cyanides, bleaching powders, dyestuffs, and other chemicals. *See also* Alunite, Alunogen, Kalinite, and Niter.

Alabama, California, Colorado, Tennessee, Utah, Virginia, West Virginia, Wyoming.

Potash alum. *See* Kalinite.

Priceite. A friable, chalky boron mineral, $3\text{CaO} \cdot 4\text{B}_2\text{O}_3 \cdot 6\text{H}_2\text{O}$. A source of boron or borax.

Oregon.

Proustite, Light ruby silver. Silver-arsenic sulphide, $3\text{Ag}_2\text{S} \cdot \text{As}_2\text{S}_3$. Contains 65.4 per cent silver, of which it is a valuable ore.

Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah.

Psilomelane, Manganese hydrate. A common ore of manganese. Perhaps H_2MnO_3 .

Alabama, Arizona, Arkansas, California, Colorado, Georgia, Massachusetts, Montana, Nevada, New Mexico, North Carolina, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia.

Pumice. Highly vesicular or cellular glassy lava or volcanic dust and ash, generally rhyolitic in composition. Used for abrasive work, chiefly for wood polishing and in the preparation of tooth powder and certain cleansing and scouring compounds. Used also to a small extent for building stone and in cement and concrete work.

California, Idaho, Kansas, Nebraska, New Mexico, Oregon, South Dakota, Utah, Wyoming.

Pyrrargyrite, Dark ruby silver. Silver-antimony sulphide, $3\text{Ag}_2\text{S}\cdot\text{Sb}_2\text{S}_3$. Contains 59.9 per cent silver when pure, but analyses show from 57 to 60.9 per cent.

Arizona, California, Colorado, Idaho, Maine, Montana, Nevada, New Mexico, Oregon, Utah, Washington.

Pyrite, Fool's gold, Iron pyrites. Isometrically crystallized iron disulphide, FeS_2 . Contains 46.6 per cent iron and 53.4 per cent sulphur. Used chiefly in making sulphuric acid; also as a gem, especially from the Wilkes-Barre region, Pennsylvania. It is very widely distributed as a gangue mineral in ore deposits.

Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming.

Pyrolusite, Black oxide of manganese. Manganese dioxide, MnO_2 . Contains 63.2 per cent manganese. This mineral is the most useful ore for the production of chlorine and the manufacture of permanganates, owing to the fact that it is richer in oxygen than any other manganese ore. Pyrolusite is also used as a flux, as a source of manganese alloys, and for all other purposes mentioned under Manganese.

Alabama, Arizona, Arkansas, California, Colorado, Georgia, Maryland, Massachusetts, Montana, Nevada, New Mexico, New York, North Carolina, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia.

Pyromorphite, Green lead ore. Chlorophosphate of lead, $3\text{Pb}_3\text{P}_2\text{O}_8\cdot\text{PbCl}_2$. A minor ore of lead.

Arizona, California, Colorado, Connecticut, Georgia, Idaho, Montana, Nevada, South Carolina, South Dakota, Utah.

Pyrope. Magnesium-aluminum garnet, $3\text{MgO}\cdot\text{Al}_2\text{O}_3\cdot 3\text{SiO}_2$. Color deep red to nearly black. Used as a gem when transparent.

Arizona, Utah.

Pyrophyllite, Agalmatolite, Figure stone, Pencil stone. A hydrous aluminum silicate, $\text{H}_2\text{O}\cdot\text{Al}_2\text{O}_3\cdot 4\text{SiO}_2$. Resembles talc in color, feel, luster, and structure. Used as an ornamental stone, as a gem, for slate pencils, and for the "talc" or "talcum powder" of commerce. Carved by the Chinese.

California, North Carolina.

Pyroxene. See Diopside.

Pyrrhotite, Magnetic pyrites. A variable iron sulphide, FeS_2 to $\text{Fe}_{11}\text{S}_{12}$. Many pyrrhotites contain nickel and are mined as nickel ores. Also an important source of sulphuric acid, nitric acid, picric acid, trinitrotoluol, and other by-products.

Alabama, Arizona, California, Colorado, Connecticut, Idaho, Maine, Maryland, Massachusetts, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Vermont, Virginia, Washington, Wisconsin, Wyoming.

Quartz, Silica. Crystallized silicon dioxide, SiO_2 . The following varieties are used as gems: Amethyst, a variety of the well-known amethystine color; aventurine, a quartz spangled with scales of mica, hematite, or other minerals; false topaz or citrine, a yellow quartz; rock crystal, a watery clear variety; rose quartz, a pink variety; rutilated quartz, containing needles of rutile; smoky quartz, a brownish variety sometimes called cairngorm; and tiger-eye, crocidolite (an asbestos-like mineral) replaced by quartz and iron oxide, and having a chatoyant effect. Besides its use for gems and ornamental stone, quartz, when ground or crushed, is used in paint, as a wood filler and wood polisher; in the manufacture of chinaware and porcelain; as an abrasive, scouring, and cleansing agent; and in the manufacture of fused quartz ware and pottery; in the packing of acid towers; as ganister and flux in smelting; and as a heat and sound insulator.

Alabama, Arizona, Arkansas, California; Colorado, Connecticut, Delaware, District of Columbia, Georgia, Iowa, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Mexico, New York, North Carolina, Pennsylvania, Rhode Island, South Dakota, Tennessee, Texas, Virginia, West Virginia.

Quartz diorite. An igneous rock of a granitoid texture, whose chief feldspar is plagioclase, contains free quartz, generally some orthoclase, and one or several of the dark silicates biotite, hornblende, and augite. It is the deep-seated equivalent of the dacites and is closely related to the granodiorites and the quartz monzonites. It is used under the name of "dark granite" for monumental work when sufficiently attractive. Used for crushed stone at several places, and may be locally termed "trap rock" or "granite."

California, Massachusetts, Vermont.

Quartzite. A sandstone in which the grains are so cemented by silica that they break across when the rock is fractured. Used in a few places for building stone and crushed stone, but its extreme hardness limits its use. When pure and white it is used for the same purposes as quartz. *See also* Quartz.

Arizona, Iowa, Maine, Massachusetts, Michigan, Minnesota, Nevada, New Mexico, South Dakota, Virginia, Wisconsin.

Quartz monzonite. An igneous rock of granitoid texture, of mineral composition intermediate between syenite and diorite and with less quartz than granodiorite. The granite of commerce includes considerable quartz monzonite. Used for crushed stone, building, and monumental work much the same as granite. Several of the well-known New England "granites," the gray granites of Minnesota, and also of California, mostly fall in the class of quartz monzonite or that of granodiorite. *See* Granite.

Quicksilver. *See* Mercury and Cinnabar.

Arizona, California, Colorado, Nevada, Oregon, Texas, Utah.

Radium. A metallic element, Ra, derived through a series of intermediate elements from uranium. It gives off helium (the α rays) and alters to the emanation, a gas. Successive alterations give other elements, solids, part of which radiate β and γ rays (radium B, radium C, and radium E), and it is to these derived elements that radium owes its apparent radioactivity. Radium is never found in sufficient quantity to be visible, but

occurs only with uranium minerals in extremely minute quantities, amounting at most to 3 or 4 grains to the ton of material. From these it is separated to obtain the radium salts of commerce. Radium is almost wholly used as a curative agent in such diseases as cancer, lupus, eczema, and arthritis. A little radium is used in making luminous clock and watch faces and house numbers. *See also* Uranium.

Arizona, California, Colorado, Connecticut, Georgia, Idaho, Montana, Nevada, North Carolina, Pennsylvania, South Carolina, South Dakota, Texas, Utah, Virginia.

Realgar. Arsenic monosulphide, AsS . Contains 70.1 per cent elemental arsenic. A source of arsenic.

Utah, Washington.

Rectorite. Hydrated aluminum silicate, similar to kaolinite. Arkansas.

Reddle. Ocherous red clay. Useful in paint manufacture. Arkansas.

Red iron ore. *See* Hematite.

Red oxide of zinc. *See* Zincite.

Residuum. A product of petroleum refining. *See also* Asphalt and Petroleum.

Rhodium. A whitish-gray metallic element of the platinum group, Rh, found as an alloy in iridosmine and alloyed with platinum. Used in thermostatics for determination of high temperatures. *See also* Iridosmine.

Rhodochrosite. Manganese carbonate, MnCO_3 . Used for ornamental work. Can be used as a flux and as a source of manganese.

Arizona, California, Colorado, Georgia, Montana, Oregon, Utah.

Rhodolite. A variety of garnet characterized by its roselike color and brilliant luster. Composition corresponds to two molecules of pyrope and one of almandite. Used as a gem.

North Carolina.

Rhodonite. Manganese silicate, MnSiO_3 . Used as a gem and ornamental stone.

California, Maine, Massachusetts, Montana, New York, Oregon, Rhode Island, Utah.

Rhyolite. A highly siliceous compact or porphyritic, variously colored volcanic rock. The extrusive equivalent of granite. *See also* Lava.

Arizona, Idaho, Maine, Nevada, Wisconsin. Found in many other States but little utilized.

Rickardite. Purple copper telluride, Cu_2Te . Colorado.

Ricolite. *See* Serpentine. New Mexico.

Road metal. Rock suitable for surfacing macadamized roads and for foundations for asphalt and concrete roadways. *See also*, Basalt, Diabase, Granite, Gravel, Limestone, Marble, Sand, Sandstone, Slate, and Trap rock. All the States.

Rock salt. *See* Halite.

Roscoelite. A vanadium-bearing muscovite mica in which Al_2O_3 is partly replaced by V_2O_5 . The content of V_2O_5 may reach an equivalent of 28.85 per cent V_2O_5 , though it is generally much less.

California, Colorado.

Rose quartz. Crystalline quartz with a rose-pink color. Used as a gem or as an ornamental stone. *See also* Quartz.

California, Colorado, Maine, South Dakota.

Rosinjack. *See* Sphalerite.

Rowlandite. Yttrium silicate, $2Yt_2O_3 \cdot 3SiO_2$. Not found in sufficient quantity to be of economic use.

Texas.

Rubellite. Dark-pink or red tourmaline. Used as a gem. *See also* Tourmaline.

California.

Ruby. A transparent deep-red variety of corundum, Al_2O_3 . A well-known gem. Georgia, North Carolina.

Ruby silver. *See* Proustite and Pyrargyrite.

Rutile. Tetragonally crystallized titanium oxide, TiO_2 . Octahedrite is another tetragonal form with different facial angles. When crystallized in orthorhombic form titanium oxide is known as brookite. The chief source of titanium. Also used as a gem and as coloring matter for porcelain.

Arkansas, Colorado, Connecticut, North Carolina, Pennsylvania, South Carolina, Virginia.

Salt, Common salt, Halite. Sodium chloride, $NaCl$ (brine). Chiefly used, both crude and refined, in food for men and animals, and as a source of soda and other sodium compounds. Also largely used as a source of chlorine and hydrochloric acid. Used to form a glaze on pottery, in enameling, in many chemical and metallurgic industries, in refrigerating, for curing and preserving hides, fish, meat, butter, vegetables, and skins, and for clearing oleomargarine.

Alabama, Arizona, California, Idaho, Indiana, Kansas, Kentucky, Louisiana, Michigan, Nebraska, Nevada, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Tennessee, Texas, Utah, Virginia, West Virginia, Wyoming.

Saltpeter. *See* Niter.

Samarskite. A columbate and tantalate of uranium, the cerium metals, the yttrium metals, and minor quantities of other metals. A prospective source of radium.

North Carolina.

Sand. Incoherent fragments of minerals or rocks of small size, usually less than one-fourth of an inch in diameter and coarser than dust. As used in this work the term indicates material comminuted by natural means. Quartz grains generally predominate in natural deposits, although such deposits commonly contain many other minerals. Used for glass manufacture, molding, brickmaking, mortar, concrete, paving; grinding, sawing, and polishing rock; lining furnaces and ladles used for handling molten metal; to prevent slipping of wheels on slippery rails, for railroad ballast, filter beds, and other purposes.

All the States.

Sand, building. Any siliceous, clean, sharp sand, suitable for use in mortar, plaster, concrete, and sand-lime brick.

All the States.

Sand, filter. Clean silica sand in sorted sizes, used for beds in water-filtering plants.

California, Minnesota, New Jersey, South Dakota.

Sand, fire. Highly refractory silica sand, especially suitable for manufacture of fire brick, for lining furnaces and ladles used to contain molten metals; for making molds, and for other refractory products.

California, Illinois, Iowa, Michigan, Missouri, New Jersey, Ohio, Pennsylvania.

Sand, glass. Sand of medium grain consisting of 98 to 100 per cent of silica (SiO_2), used in glass making. Iron oxides should form less than 1 per cent of the mass. Unconsolidated sand deposits, including sand dunes, are used, as at Lake Majella, Cal.; soft sandstone is disintegrated or crushed, as the St. Peter sandstone in Illinois and Missouri; and quartzite is crushed, as at Cheshire, Mass., to make glass sand.

Alabama, Arkansas, California, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Nevada, New Jersey, New York, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, West Virginia, Wisconsin, Wyoming.

Sand, molding. A sand used in making molds for casting metal. Different metals, different weights of castings, and different positions in the mold require different sands.

Alabama, Arkansas, California, Colorado, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kentucky, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, New York, Ohio, Pennsylvania, South Carolina, Tennessee, Texas, Vermont, Virginia, Washington, West Virginia, Wisconsin.

Sand and gravel. An incoherent mixture of sand and gravel. Very common, especially along streams and ocean and lake shores and in glaciated areas. Used for concrete, road metal, and railroad ballast.

Occurs in all the States.

Sandstone. Consolidated sand, generally in beds. Used for different grades of building stone, also paving, flagging, curbing, ornamental stone, where sufficiently hard and tough for ganister, for crushed stone, road metal, railroad ballast, concrete; when pure and white it is used for the same purposes as quartz. *See also* Quartz.

Almost every State.

Sandstone (asphaltic). A loose-textured sandstone containing asphalt. Useful for road metal, pavement material, etc.

Arkansas, Colorado, Oklahoma, Utah.

Sandstone (bituminous). *See* Sandstone, asphaltic.

Sandstone, Bluestone. A tough, bluish sandstone used for flagging.

New York, Pennsylvania.

Sandstone, Brownstone. A sandstone of brown or reddish-brown color. Used for building.

Connecticut, Pennsylvania.

Sandstone, Flagstone. A sandstone which cleaves into flags suitable for sidewalks and areaways. Includes most bluestones. *See* Flagstone.

Sandstone (flexible). *See* Itacolumite.

Sandstone, Freestone. A sandstone which cuts with equal ease in any direction. Used for building.

Sapphire. Clear blue corundum, Al_2O_3 . A well-known blue gem. There are also white, pink, and yellow sapphires.

California, Colorado, Connecticut, Georgia, Idaho, Indiana, Montana, New Mexico, North Carolina, Oregon.

Satelite. The gem trade name for a fibrous serpentine having a chatoyant effect.

California.

Satin spar. *See* Gypsum.

Sauconite. Zinc-bearing clay.

Pennsylvania.

Scheelite. Calcium tungstate, CaWO_4 . Contains 80.6 per cent tungsten trioxide, WO_3 .

Arizona, California, Colorado, Connecticut, Idaho, Montana, Nevada, New Mexico, Pennsylvania, South Dakota, Utah, Washington.

Schist. A thinly laminated or foliated metamorphic rock, generally containing a large amount of mica, which splits more or less easily along closely spaced, nearly parallel planes. Modifying names are given according to the conspicuous minerals, such as quartz schist, mica schist, sericitic schist, and garnetiferous schist. Used locally for building stone under the name of "granite" and for crushed stone under the name of "trap rock."

Connecticut, Maine, Massachusetts, Pennsylvania, Vermont, Virginia, West Virginia.

Schwartzite. Mercurial tetrahedrite, a mercury-copper ore mineral.

Oregon.

Scorodite. Hydrous ferric arsenate, $\text{Fe}_2\text{O}_3 \cdot \text{As}_2\text{O}_5 \cdot 4\text{H}_2\text{O}$. A source of arsenic.

Utah, Washington.

Scythestone. A whetstone suitable for sharpening scythes, mostly made from fine-grained mica schists and novaculite. *See* Whetstone.

Selenite. Gypsum in distinct crystals or broad folla, $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. Used for making plaster of Paris and for optical purposes. *See also* Gypsum.

Selenium. An element, Se. Not found native in visible quantity. Is obtained as a by-product in the electrolytic refining of copper. Used in making red glass, electric resistances, and cells for measuring light. *See also* Onofrite and Tiemannite.

Sepiolite. *See* Meerschaum.

Serpentine. Hydrous magnesium silicate, $3\text{MgO} \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$, or a rock composed mostly of that mineral. Ricolite is a variety containing layers of white limestone or marble. Used for building and ornamental work.

Arizona, California, Colorado, Connecticut, Delaware, Georgia, Maryland, Massachusetts, New Jersey, New Mexico, New York, North Carolina, Pennsylvania, Rhode Island, Texas, Vermont, Washington.

Shale. A fine-grained rock formed by the consolidation of silt or clay and fissile along bedding planes. Ground and used as an ingredient in making Portland cement or used instead of clay in making brick and tile. Some shales of strong red, yellow, or brown colors are ground for use in paint. Common in almost every State. Only a few localities where it is used are recorded. *See also* Shale (paint).

Alabama, Georgia, Illinois, Kansas, Michigan, Nevada, Tennessee, Utah, Wyoming.

Shale (oil). Shale which will yield crude oil, ammonia, and other valuable products when subjected to destructive distillation. It seems likely to form an important source of oil when the present petroleum fields become exhausted, and may be a valuable source of coal-tar products. Some of the shale of the Green River formation (Eocene) of Colorado and Utah yields as high as 90 gallons of oil to the ton. The Green River formation occupies about 27,000 square miles in southwestern Wyoming and adjoining parts of Utah and Colorado, and this area contains a large reserve of oil. Some shale that is rich in oil occurs also in northeast Nevada at Elko. The Devonian black shale, which underlies about 300,000 square miles of area in the eastern United States, contains shale which will yield a small amount of oil. It occurs in a large area in southwestern New York, western Pennsylvania, West Virginia, eastern Ohio, nearly all of Kentucky, the most of middle Tennessee, northern Alabama, southwest Indiana, the southern two-thirds of Illinois, northeast Missouri, and the southeast

corner of Iowa; another area underlies the large southern peninsula of Michigan and adjoining portions of northeastern Indiana and northwestern Ohio. The carbonaceous shales associated with coal throughout the area of its occurrence contain oil, and they are being investigated.

Alabama, Colorado, Illinois, Indiana, Iowa, Kentucky, Michigan, Missouri, Nevada, New York, Ohio, Pennsylvania, Tennessee, Utah, West Virginia, Wyoming.

Shale (paint). Shale of strong yellow, brown, or red colors ground and used for paint.

Iowa, Missouri, New Jersey, Pennsylvania.

Siderite, Spathic iron ore. Iron carbonate, FeCO_3 . Contains 48.2 per cent iron. An important ore of iron.

Arizona, California, Colorado, Connecticut, Illinois, Indiana, Kansas, Kentucky, Maryland, Massachusetts, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, West Virginia.

Sienna. A brownish orange-yellow clay colored by iron and manganese oxides. Used as a pigment.

Alabama, California, Massachusetts, Pennsylvania, Wisconsin.

Silex. See Ganister.

Silica. An oxide of silicon, SiO_2 . Occurs in nature as a mineral of economic importance in quartz, chalcedony, chert, flint, opal, diatomaceous earth, agate, sand, quartzite, and sandstone; also as a constituent of all the silicate minerals. The most abundant constituent of the earth's crust. Used for the same purposes as quartz. Tripoli, crushed quartz, quartzite, and sandstone are commonly called silica.

Illinois, Massachusetts, Tennessee, Wisconsin.

Silver. An element, Ag. Sometimes found native. Metallic silver is largely used in the arts for preparing alloys and silver salts and for plating articles of utility and ornament. It is also used in assaying. The chief alloy is that with copper, sterling silver, which possesses all the beauty of the original silver but is much harder. Silver is extensively used for coinage, tableware, jewelry, and innumerable articles of ornament; also in the manufacture of mechanical, physical, and medical apparatus. The chief use of silver salts, such as the nitrate, bromide, and chloride, is in photography. The nitrate is also used in analytical work, in medicine, and in the manufacture of indelible inks. See also Acanthite, Amalgam, Argentite, Brongniardite, Bromyrite, Calaverite, Cerargyrite, Dyscrasite, Electrum, Embolite, Freibergite, Freieslebenite, Hessite, Iodyrite, Krennerite, Nagyagite, Petzite, Polybasite, Proustite, Pyrargyrite, Stephanite, Stetefeldite, Stromeyerite, Sylvanite, Xanthoconite.

Alabama, Arizona, Arkansas, California, Colorado, Georgia, Idaho, Illinois, Iowa, Kentucky, Maine, Maryland, Michigan, Minnesota, Missouri, Montana, Nevada, New Hampshire, New Mexico, North Carolina, Oregon, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, Wyoming.

Silver glance. See Argentite.

Sipylite. A columbate of erbium chiefly, also of the cerium metals and other metals. Used only for specimens.

Virginia.

Slate. A dense, fine-textured metamorphic rock whose separate minerals are indistinguishable to the unaided eye and which has an excellent parallel cleavage, so that it breaks into thin plates or pencil-like shapes. Milling slate is used for flooring, electric switchboards, blackboards, hand or

school slates, slate pencils, billiard, laboratory, and other table tops, vats, laundry tubs, sinks, mantels, hearths, bread boards, wainscoting, chimney and well caps, refrigerator shelves, memorial tablets, grave linings and vaults, stair treads, sanitary ware, flour bins, dough troughs for bakeries, and other purposes. A small quantity is "marbleized," or coated with preparations to imitate marble. Roofing slate is used chiefly for slant roofs, but small slates bedded in asphaltic mixture are used for flat roofs. Ground slate is used in combination with asphaltum for roofing boards or sheets. Waste slate, as well as slate unsuitable for roofing and other uses, is crushed in some places in coarse sizes for road metal and concrete aggregate, and in fine sizes for artificial roofing materials. The total value of slate sold in the United States in 1915 was nearly \$5,000,000.

Alabama, Arizona, Arkansas, California, Connecticut, Georgia, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Tennessee, Utah, Vermont, Virginia, West Virginia.

Smaltite. Cobalt diarsenide, CoAs_2 . Contains, when pure, 28.2 per cent cobalt. Through replacement of the cobalt by nickel it grades into chloanthite, the nickel arsenide, NiAs_2 . A source of cobalt.

Colorado.

Smithsonite. Carbonate of zinc, ZnCO_3 . Contains 52 per cent zinc. Used as an ore and as a gem.

Arizona, Arkansas, California, Colorado, Illinois, Iowa, Kansas, Kentucky, Maryland, Missouri, Nevada, New Mexico, Oklahoma, Pennsylvania, Tennessee, Texas, Utah, Virginia, Wisconsin.

Soapstone (massive impure talc). Large slabs used for laundry tubs and for tables, hoods, and tanks in laboratories where acids are used. Because it is a nonconductor of electricity, is refractory, and radiates heat slowly, soapstone is used for electric switchboards and insulators, for hearthstones, foot warmers; and fireless cookers.

Alabama, Arkansas, California, District of Columbia, Georgia, Maryland, Massachusetts, New Hampshire, New Jersey, North Carolina, South Carolina, Vermont, Virginia.

Soda. A white alkaline compound, sodium carbonate, natron. *See also* Salt, Thenardite, Urao.

California, Nevada.

Soda feldspar. *See* Albite.

Sodium. An element, Na, the metallic constituent or basis of common salt, a soft, white, plastic metal, which is slightly lighter than water. It does not occur native but is widely distributed in rock-forming silicates and the chloride, common salt, which is the chief source of the metal and its salts. Metallic sodium is a powerful reducing agent and is therefore used in the reduction of aluminum and other metals from their ores, as well as in the preparation of many organic compounds. Sodium amalgam, formed by dissolving sodium in mercury, is a good solvent for gold and is largely used in gold amalgamation. A liquid alloy of sodium and potassium is used for high-temperature thermometers. The artificial compounds of sodium are manufactured on an enormous scale for many industrial and domestic purposes. The peroxide is a most useful bleaching and general oxidizing agent. *See also* Natron, Salt, Soda, Thenardite, Urao.

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Spathic iron ore. *See Siderite.*

Specularite, Gray hematite, Specular hematite, Specular iron. An iron oxide, Fe_2O_3 , occurring in tabular or disklike crystals of gray color and splendid metallic luster. Also called "micaceous hematite" if occurring in foliated or micaceous masses. Contains 70 per cent iron. Used as an ore and rarely as a gem. *See also Hematite.*

Arizona, Idaho, Michigan, Minnesota, Missouri, New Mexico, Utah, Wisconsin.

Sperrylite. Platinum arsenide, PtAs_2 . The theoretically pure mineral would contain 56.5 per cent platinum, but antimony and rhodium are also present in small quantities. Important source of platinum.

Wyoming.

Spessartite. A manganese garnet. Used as a gem. *See also Garnet.*

Virginia.

Sphalerite, Blackjack, Blende, Jack, Rosinjack, Zinc blende. A sulphide of zinc, ZnS , crystallizing in isometric forms. Contains 67 per cent zinc. *See also Wurtzite.*

Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Georgia, Idaho, Illinois, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Minnesota, Missouri, Montana, Nevada, New Hampshire, New Mexico, New York, North Carolina, Oklahoma, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, Wyoming.

Sphene. *See Titanite.*

Spinel. An isometric mineral, typically magnesium aluminate, $\text{MgO} \cdot \text{Al}_2\text{O}_3$. The magnesium may be in part replaced by ferrous iron, or manganese, and the aluminum by ferric iron and chromium. Spinel is red, yellow, green, black, and other colors, and is used as a gem.

California, Colorado, Massachusetts, Montana, New York, North Carolina.

Spodumene. Lithium-aluminum silicate, $\text{Li}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2$. Used as a source of lithia, of which it contains as a maximum 8.4 per cent. The clear green variety, known as hiddenite, and the clear pink or lilac, known as kunzite, are used as gems.

California, Connecticut, North Carolina, South Dakota.

Staurolite. Iron-aluminum silicate, $\text{Fe}(\text{AlO})_4(\text{AlOH})(\text{SiO}_4)_2$. Sometimes used as a gem.

Georgia, North Carolina, Virginia.

Stephanite, Brittle silver ore. Silver-antimony sulphide, $5\text{AgS} \cdot \text{Sb}_2\text{S}_3$. Contains 68.5 per cent silver.

Arizona, California, Colorado, Maine, Montana, Nevada, New Mexico.

Stetefeldite. A somewhat uncertain compound containing silver, copper, iron, antimony, sulphur, and water. A minor source of silver.

Nevada.

Stibiconite, Antimony ocher. Hydrous oxide of antimony, $\text{Sb}_2\text{O}_3 \cdot \text{H}_2\text{O}$. Contains 74.5 per cent antimony, of which it is an important source.

California, Nevada.

Stibnite, Antimony glance, Gray antimony, Sulphuret of antimony. Antimony sulphide, Sb_2S_3 . Contains 71.4 per cent antimony. The principal ore mineral and chief source of antimony.

Arizona, Arkansas, California, Colorado, Idaho, Maryland, Montana, Nevada, New Mexico, Oregon, Utah, Washington.

Stromeyerite. A somewhat variable sulphide of silver and copper, $(\text{Ag,Cu})_2\text{S}$. Contains 50.2 to 52.7 per cent silver and 30.5 to 33.7 per cent copper.
Arizona, California, Colorado, Nevada.

Strontianite. Strontium carbonate, SrCO_3 . A source of strontium salts.
California, New York, Texas, Washington.

Strontium. A yellowish metallic element, Sr, known chiefly through its salts.
See Celestite and Strontianite.

Arizona, Arkansas, California, Michigan, New York, Ohio, and Texas.

Subterranean travertine. *See* Caliche.

Succinite. *See* Amber.

Sulphur. An element, S. Frequently found native. Sulphur takes fire at a low temperature, and for this reason it is extensively used as a means of producing fire in friction matches, powder, and fireworks. It is used also in making sulphurous and sulphuric acids, ultramarine, and carbon disulphide. Wool, silk, sponges, and other materials are bleached with sulphur in the form of the dioxide (SO_2). Wine casks, preserves, and other materials are treated with it as a preservative. Rubber is vulcanized with it. Large quantities of it are used for spraying grapevines, shrubbery, and plants, to protect them from fungous diseases. Used also in medicine and in fumigation against infectious diseases.

Alabama, California, Colorado, Georgia, Idaho, Kentucky, Louisiana, Michigan, Nevada, New Mexico, Tennessee, Texas, Utah, Wyoming.

Sulphuret of antimony. *See* Stibnite.

Sunstone. A variety of oligoclase feldspar containing numerous small inclusions which cause a delicate play of colors. Used as a gem.

Arkansas, New York, North Carolina, Virginia.

Syenite. A granular igneous rock composed mostly of alkali feldspar, with a subordinate amount of the black ferromagnesian silicate minerals hornblende, biotite, and augite, one or more of which may be present. In quartz syenites a small amount of quartz is also present. In nepheline and sodalite syenites, considerable amounts of the minerals nepheline and sodalite are present. Used for building stone at a few places, where it is locally known as granite. May be used for the same purposes as granite but is not as a rule so well adapted for them.

Arkansas, Maine, Massachusetts, New Hampshire, Vermont, Virginia.

Sylvanite. A gold-silver telluride $(\text{Au,Ag})\text{Te}_2$, containing gold and silver in the atomic ratio of 1 to 1, or 24.5 per cent gold and 13.4 per cent silver.

California, Colorado, Oregon, Washington, Wyoming.

Tabbyite. A black asphaltic substance, semibrittle, semiwaxy. Contains a small percentage of ceresin (mineral wax). Fuses in candle flame with slight intumescence. Freely soluble in carbon disulphide; only partly soluble in naphtha; low in sulphur. Used in the manufacture of paints, varnishes, rubber substitutes, and paving cement. *See also* Wurtzilite.

Utah.

Talc. A hydrous magnesium silicate, $\text{H}_2\text{O} \cdot 3\text{MgO} \cdot 4\text{SiO}_2$. Has a greasy or soapy feel and is soft and easily cut. It offers great resistance to acids and high temperatures. Occurs in beds more or less impure and is then known as steatite or soapstone. Also called potstone because it has been used for pots, owing to the ease with which it is worked and to its resistance to ordinary heats. The best compact grade is used for gas tips (lava burners), acetylene burners, electric insulators, pencils, crayons, tailor's chalk, etc. French chalk is a variety used for crayons. The

foliated pure-white variety is used for toilet powder and cosmetics. Ground talc is extensively used as a filler in making paper and crayons and also in paints. Its slip makes it a useful lubricator as well as a shoe and glove powder. Also used for fireless cookers.

Arkansas, California, Georgia, Maine, Maryland, Massachusetts, Michigan, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, South Dakota, Texas, Vermont, Virginia, Washington.

Tantalite. The member of the tantalite-columbite group of minerals which is composed of nearly or quite pure tantalate of iron and manganese. Nearly all tantalite contains some columbium. The members of the group containing more columbium are known as columbite. Tantalite is very rare. Pure tantalite, $(\text{Fe}, \text{Mn})\text{Ta}_2\text{O}_6$, would contain about 86 per cent Ta_2O_5 , or 70.4 per cent tantalum, but the actual percentage is generally much lower. An important source of tantalum.

South Dakota, Virginia.

Tantalum. One of the rare metals, Ta. It has never been found native in the United States but is a constituent of tantalite, columbite, strüverite, and, in less proportion, of several other rare minerals. So far as is known, tantalum minerals, when in place, are found only in pegmatite. Exception may perhaps be made of the minute quantities found in some tungsten and tin minerals. Tantalum now is little used. For a time it was used in making filaments for incandescent electric lamps. It has also been used in surgical and dental instruments and for pens. See Columbite, Fergussonite, Samarskite, and Tantalite.

Tellurium. A rare nonmetallic element, Te, found native as tin-white rhombohedral crystals and masses. Very little use is known for tellurium. A little has been used in coloring glass, and a patent has been taken out for its use in aluminum alloys.

Colorado.

Tengerite. Of doubtful composition; said to be yttrium carbonate. Too scarce to be of economic use.

Texas.

Tennantite, Gray copper ore. Copper-arsenic sulphide, $3\text{Cu}_2\text{S} \cdot \text{As}_2\text{S}_3$. Contains 57.5 per cent copper. Composition varies as in tetrahedrite, into which it grades.

Arizona, Colorado, Montana, Wyoming.

Tenorite. Black oxide of copper in minute black scales, CuO . Contains 79.8 per cent copper.

Arizona, New Mexico, Oregon, South Dakota, Utah, Wyoming.

Tepetate. See Caliche.

Tephroite. Manganese orthosilicate, $2\text{MnO} \cdot \text{SiO}_2$. Contains 70 per cent MnO , and commonly also small quantities of magnesium, iron, and zinc.

New Jersey.

Terlinguaite. Oxychloride of mercury, Hg_2ClO . Contains 88.65 per cent mercury.

Texas.

Tetradymite. Bismuth telluride, $\text{Bi}_2(\text{Te}, \text{S})_3$. Contains theoretically 51.9 per cent bismuth, but the actual content ranges from 50.4 to 52.8 per cent. Sulphur generally replaces part of the tellurium, and the mineral sometimes contains a trace of selenium. The sulphurous variety contains from 57.7 to 62.2 per cent bismuth, and may be represented by the formula $2\text{Bi}_2\text{Te}_3 \cdot \text{Bi}_2\text{S}_3$. Gold, copper, and iron are present in some tetradymites.

Arizona, California, Colorado, Maryland, Montana, New Mexico, North Carolina, South Dakota, Utah, Virginia.

Tetrahedrite, Gray copper ore, Freibergite. Copper-antimony sulphide, essentially $3\text{Cu}_2\text{S}\cdot\text{Sb}_2\text{S}_3$. Contains 52.1 per cent copper. In many tetrahedrites the copper is partly replaced by iron, lead, zinc, mercury, and silver, and the antimony by arsenic. Through the last replacement tetrahedrite grades into tennantite.

Arizona, California, Colorado, Idaho, Massachusetts, Montana, Nevada, New Mexico, North Carolina, Oregon, Tennessee, Utah, Washington.

Thallium. A soft white crystalline metallic element, Tl, occurring in small quantities in some varieties of pyrite and zinc blende. Used in incandescent lighting, in alloys, and in glass making.

Thenardite, Verde salt. Sodium sulphate, $\text{Na}_2\text{O}\cdot\text{SO}_3$. Not of economic use.

Arizona, California.

Thomsonite, Mesplit. Hydrous sodium-calcium-aluminum silicate $(\text{Na},\text{Ca})\text{O}\cdot\text{Al}_2\text{O}_3\cdot 2\text{SiO}_2\cdot \frac{1}{2}\text{H}_2\text{O}$. One of the zeolites, sometimes used as a gem and for ornamental work.

Michigan, Oregon.

Thorianite. A mineral of complex and uncertain composition but consisting chiefly of thorium and uranium oxides with minor quantities of many other bases. Contains about 12.1 per cent U_3O_8 and 71 per cent ThO_2 .

Montana.

Thorium. An element, Th. One of the rare-earth metals. Not found native. Its most important compounds are the oxide and the nitrate. The oxide is the chief constituent of Welsbach gas mantles and of the glower of the Nernst electric light. The nitrate is the salt which is used as the source of the oxide for these lamps. *See also* Auerlite, Mackintoshite, Monazite, Nivenite, Thorianite, Thorogummite, and Yttrialite.

Colorado, Connecticut, Idaho, Montana, Nevada, New Mexico, North Carolina, Oregon, South Carolina, Texas, Utah, Virginia, Washington, Wyoming.

Thorogummite. A hydrous silicate of uranium and thorium, $\text{UO}_3\cdot 3\text{ThO}_2\cdot 3\text{SiO}_2\cdot 6\text{H}_2\text{O}$. Contains 22 per cent UO_3 and 41 per cent ThO_2 .

Texas.

Tiemannite. Mercuric selenide, HgSe . Contains 71.7 per cent mercury and 28.3 per cent selenium.

California, Utah.

Tierra blanca. *See* Caliche.

Tin. A white malleable metallic element, Sn. Found in nature probably only in combination, principally as tin oxide, cassiterite. Used largely as a coating for sheet iron or sheet steel, to make tin plate, ordinarily known as "tin," and of which it forms only 1 to 3 per cent; used extensively in alloys for bearing metals, "white metals," and the like; also in making pipes for organs and in many places where a nonoxidizing metal is required. *See also* Cassiterite.

Tinical. *See* Borax.

Titanite, Sphe. Titanosilicate of calcium, CaTiSiO_6 . Used as a gem.

California.

Titanium. A dark-gray metallic rare-earth element, Ti. Never occurs native. In small quantities it is widely distributed; found in all igneous and many sedimentary rocks in different minerals, notably in ilmenite, rutile, brookite, anatase, and octahedrite. Ilmenite and rutile furnish the titanium of commerce. Used in cast iron, steel (steel rails, rim and tread of car wheels), and bronzes, largely as a purifier, deoxidizer, denitrogenizer, and for increasing the strength and hardness. Titanium-potassium oxalate is

used as a mordant in dyeing leather and some textiles. As the carbide and the oxide ilmenite it is used in arc lamps, and in lining puddling furnaces. Other titanium compounds find small use. As oxide it is used in porcelain painting, and it enters into the composition of artificial teeth.

Topaz. An aluminum fluosilicate, simplest formula $Al_2SiO_4F_2$, but with part of the fluorine commonly replaced by water. Used as a gem, especially when yellow.

California, Colorado, Connecticut, Maine, New Hampshire, Texas, Utah.

Topazolite. *See* Garnet.

Torbernite. A hydrous phosphate of uranium and copper, $CuO \cdot 2UO_3 \cdot P_2O_5 \cdot 8H_2O$.

A source of uranium and its salts.

South Dakota, Utah.

Tourmaline. A complex aluminum silicate of hexagonal crystallization containing boron and in some varieties lithium and other elements. Of various colors; the clear pink, blue, and green varieties are used as gems.

Arizona, California, Colorado, Connecticut, Georgia, Maine, Maryland, Massachusetts, North Carolina, Virginia.

Trap, Trap rock. A general name for dark fine-grained igneous rocks, particularly lavas or dikes of basalt, diabase, and similar rocks. It is a loosely used commercial term and has been made by some to include, besides basalt and diabase, a number of unrelated rocks, such as granite, gabbro, rhyolite (felsite), conglomerate (puddingstone), sandstone, and slate. Used extensively as crushed stone for road metal and concrete and locally for building and paving stone. *See also* Basalt and Diabase.

California, Connecticut, Delaware, Maine, Massachusetts, Michigan, Minnesota, New Jersey, New York, Oregon, Pennsylvania, Vermont, Virginia, Washington, Wisconsin.

Travertine, Tufa. Carbonate of lime, $CaCO_3$, deposited from solution in ground and surface waters. The cellular deposits are known as tufa, calcareous sinter, spring deposit, or cave deposit. When solid, banded, and susceptible of a good polish, it is known as Mexican onyx or onyx marble. True onyx, however, is banded silica or agate. Travertine forms the stalactites and stalagmites of caves, and the filling of some veins and spring conduits. Used for interior ornamental work. *See also* Onyx marble.

Arizona, California, Nevada, New Mexico, South Dakota, Utah, Virginia, Washington, Wyoming.

Tremolite. A white amphibole, $3MgO \cdot CaO \cdot 4SiO_2$, occurring as bladed crystals and fibrous aggregates. Not of economic use.

Connecticut, Georgia.

Triphylite. *See* Lithiophilite.

Tripoli. A porous siliceous rock resulting from the decomposition of siliceous limestone. Used for polishing powder and filters, also as a wood and paint filler.

Alabama, Arkansas, Georgia, Illinois, Indiana, Iowa, Kentucky, Minnesota, Missouri, Oklahoma, Tennessee.

Tripolite. *See* Diatomaceous earth.

Trona. An impure form of urao. *See* Urao.

California, Colorado, Nevada, Wyoming.

Tufa. *See* Travertine.

California, Nevada, Utah, Washington, Wyoming.

Tuff. Fragmental rock ejected from a volcano. It ranges from very fine, powdery material to coarse, heavy fragments. Used considerably in the

West for building stone, where it is similar to soft sandstone in workability and general appearance. *See also* Rhyolite and Volcanic ash.

Arizona, California, Nevada, New Mexico, Oregon.

Tungsten. A metallic element, W, not found native. Its melting point is the highest of the metals; it is insoluble in ordinary acids, and when in the form of fine wire its tensile strength exceeds that of iron or nickel. The great use of tungsten is as a component of the highly complex alloy steels known as high-speed steels, used in machinery, tools, projectiles, and the like. In these steels 14 to 20 per cent of tungsten is used. It is also used in some forms of stellite. (*See* Cobalt.) Smaller quantities are used in incandescent light filaments. Also used in electric contacts, Roentgen ray tubes, phonograph needles, and as an alloy with iron in castings for automobile engine valves, spark plugs, and the like. Also a component of tungsten-molybdenum alloys, which are being used on an increasing scale as substitutes for platinum. Owing to the demand of the metal for making tool steels to be used in cutting war steels the price of tungsten ores rose from \$6 in 1914 to \$110 or more a unit (20 pounds of tungsten trioxide) early in 1916. *See also* Cuproscheelite, Cuprotungstite, Ferberite, Hübnerite, Scheelite, and Wolframite.

Turquoise. Hydrous phosphate of aluminum and copper, $\text{CuO} \cdot 3\text{Al}_2\text{O}_3 \cdot 2\text{P}_2\text{O}_5 \cdot 9\text{H}_2\text{O}$. A well-known gem.

Arizona, California, Colorado, Nebraska, Nevada, New Mexico, Texas.

Tyuyamunite (pronounced tyu-ya-moon-ite). A canary-yellow hydrous calcium-uranium vanadate, $\text{CaO} \cdot 2\text{UO}_3 \cdot \text{V}_2\text{O}_5 \cdot 8\text{H}_2\text{O}$. In distinction from carnotite, which it resembles and with which it is probably generally associated, it is commonly found in tiny radially crystalline masses. With carnotite, the most important of the radium minerals.

Utah.

Uintaite. *See* Gilsonite.

Utah.

Ulexite, Cotton ball. Hydrous borate of sodium and calcium, probably $\text{Na}_2\text{O} \cdot 2\text{CaO} \cdot 5\text{B}_2\text{O}_3 \cdot 16\text{H}_2\text{O}$. Contains theoretically 43 per cent B_2O_3 . Analyses of the natural mineral show from 42 to 45.3 per cent B_2O_3 . A source of boron and borax.

California, Nevada, Oregon.

Umber. A chestnut-brown to liver-colored hydrated ferric oxide containing manganese oxide and clay. As found in nature it is called raw umber, and when heated so as to produce a reddish brown it is called burnt umber. Used chiefly as a pigment in the manufacture of paints and linoleum.

Pennsylvania, Vermont, Virginia, Wisconsin.

Unakite. A peculiar granite consisting essentially of yellow-green epidote, pink feldspar, and quartz, from the Unaka range of mountains along the border of North Carolina and Tennessee. Used in ornamental work.

North Carolina, Tennessee, Virginia.

Uraninite. A complex uranium mineral containing also rare earths, radium, lead, helium, nitrogen, and other elements. Uraninite in the stricter sense is applied to crystallized forms found in pegmatites. It contains thorium, cerium, lanthanum, and yttrium. The mineral found in Connecticut and North Carolina is of this variety. Pitchblende is the massive form, probably amorphous, and contains no thorium, but a specimen from Gilpin County, Colo., contained 7.6 per cent zirconia. Pitchblende is found in metalliferous

veins with sulphides. Both varieties contain radium. Contains from 65 to 90.7 per cent of the combined oxides UO_3 and UO_2 . *See also* Nivenite.

Arizona, California, Colorado, Connecticut, North Carolina, Utah.

Uranium. A heavy metallic element, U. Not found native. All uranium minerals contain radium. Many experiments have been made with the object of using uranium as an alloy in steel, but they do not seem to have been very successful. Uranium alloys with copper and other metals have been placed on the market to be used in brass and other alloy work, principally as deoxidizers. Uranium salts are used in glass and pottery coloring. *See also* Autunite, Carnotite, Fergusonite, Mackintoshite, Nivenite, Polycrase, Samarskite, Thorianite, Thorogummite, Torbernite, Tyuyamunite, Uraninite (including Pitchblende), Uranocircite, Uranophane, Uranospinite, Yttrialite, and Zeunerite.

Uranocircite. A hydrous phosphate of uranium and barium, $\text{BaO} \cdot 2\text{UO}_3 \cdot \text{P}_2\text{O}_5 \cdot 8\text{H}_2\text{O}$. A possible source of radium.

South Dakota.

Uranophane. A hydrous silicate of uranium and calcium, $\text{CaO} \cdot 2\text{UO}_3 \cdot 2\text{SiO}_2 \cdot 6\text{H}_2\text{O}$. A possible source of radium.

Georgia, Idaho, North Carolina.

Uranospinite. Probably an arsenate of uranium and calcium corresponding to autunite, $\text{CaO} \cdot 2\text{UO}_3 \cdot \text{As}_2\text{O}_5 \cdot 8\text{H}_2\text{O}$. Contains about 47.6 per cent uranium, equivalent to 56.1 per cent calculated as U_3O_8 .

Utah.

Urao. Hydrous sodium carbonate, $3\text{Na}_2\text{O} \cdot 4\text{CO}_2 \cdot 5\text{H}_2\text{O}$. Trona is an impure form of urao. Source of sodium carbonate. *See* Trona.

Uthallite. *See* Variscite.

Uvanite. Crystallized form of pitchblende, $2\text{UO}_3 \cdot 3\text{V}_2\text{O}_5 \cdot 15\text{H}_2\text{O}$. *See also* Uraninite.

Utah.

Uvarovite. *See* Garnet.

Vadose limestone. *See* Caliche.

Valley brown ore. A local name for limonite or brown iron ore. Applied in Virginia to the comparatively pure high-grade ore found in the Cambrian and Ordovician limestone which forms the Valley of Virginia. *See also* Brown iron ore, Mountain brown ore.

Virginia.

Vanadinite. Lead chlorvanadate, $9\text{PbO} \cdot 3\text{V}_2\text{O}_5 \cdot \text{PbCl}_2$. Contains when pure 19.4 per cent V_2O_5 , but arsenic and phosphorus both replace vanadium, so that the mineral grades into mimetite, $3\text{Pb}_3\text{As}_2\text{O}_5 \cdot \text{PbCl}_2$, and into pyromorphite, $3\text{Pb}_3\text{P}_2\text{O}_5 \cdot \text{PbCl}_2$. Endlichite is a variety of vanadinite containing considerable arsenic. Used as a source of vanadium compounds and of metallic lead.

Arizona, Colorado, Montana, Nevada, New Mexico.

Vanadium. An element, V. It does not occur native, but is found in the United States in the minerals carnotite, metaheawettite, roscoelite, vanadinite, descloizite, volborthite, calciovolborthite, tyuyamunite, and ægirite. The great use of vanadium is as a component of the high-speed tool and other steels. Vanadium is also used as a deoxidizer in steel, bronzes, brasses, and bearing metals. Small quantities of vanadium salts are used in various chemical industries.

Arizona, Colorado, Montana, Nevada, New Mexico, Oklahoma, Utah.

Variscite, Amatrice, Chlorutahlite, Uthallite. Green hydrous phosphate of aluminum, $\text{Al}_2\text{O}_3 \cdot \text{P}_2\text{O}_5 \cdot 4\text{H}_2\text{O}$. Used as a gem.

Arkansas, Nevada, Utah.

Vashegyite. A white massive compact hydrous aluminum phosphate, $4\text{Al}_2\text{O}_3 \cdot 3\text{P}_2\text{O}_5 \cdot 30\text{H}_2\text{O}$.

Nevada.

Verde antique. A dark-green rock composed essentially of serpentine (hydrous magnesium silicate). Usually crisscrossed with white veinlets of magnesium and calcium. Used as an ornamental stone. In commerce usually classed as a marble.

California, Georgia, Maryland, Massachusetts, New Jersey, New York, Virginia.

Verde salt. *See* Thenardite.

Vermiculite, Altered micas, Jefferisite. A silicate of alumina, iron, and magnesia, with water. Used as pigment in manufacture of silver paint, and after heating in manufacture of gold paint.

Pennsylvania.

Vesuvianite. A complex calcium-aluminum silicate of uncertain formula. A massive light-green variety is known as californite. Used as a gem.

Arkansas, California, Colorado, Maine, New Jersey, New York, Pennsylvania.

Vivianite. Ferrous phosphate, $\text{Fe}_3(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$.

Colorado, Idaho.

Volborthite. A hydrous vanadate of copper, barium, and calcium. A probable source of vanadium.

Arizona, Colorado.

Volcanic ash, Pumice, Volcanic tuff. A material made up of either loose or solidified small fragments and dust of lava, commonly glassy in character, blown from a volcano and deposited either on land or under water. If numerous large fragments are embedded in the ash the deposit is called volcanic agglomerate or volcanic breccia. Used in cement and concrete work, as abrasive material, polishing powder, cleansing compound, tooth powder, and for heat insulators.

Arizona, California, Colorado, Kansas, Montana, Nebraska, Nevada, New Mexico, Oklahoma, Oregon, South Dakota, Utah, Washington.

Volcanic glass. *See* Obsidian.

Volcanic tuff. *See* Volcanic ash.

Wad, Bog manganese. An impure mixture of manganese and other oxides. It contains 10 to 20 per cent of water and is generally soft, soiling the hand. A variety known as asbolite carries as much as 32 per cent cobalt. Used in the isolation of chlorine, and as a pigment on a small scale in preparing ochers and in brick mottling.

Arizona, Arkansas, California, Georgia, Maine, Massachusetts, Missouri, Montana, Nevada, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, Wisconsin.

Water sapphire. *See* Cordierite.

Wavellite. Hydrous aluminum phosphate, $3\text{Al}_2\text{O}_3 \cdot 2\text{P}_2\text{O}_5 \cdot 12\text{H}_2\text{O}$. Fluorine is present in some specimens up to 2 per cent. A source of phosphorus.

Alabama, Arkansas, Pennsylvania.

Whetstone. A stone suitable for sharpening tools. *See also* Novaculite.

Arkansas, Connecticut, Indiana, Massachusetts, Michigan, New Hampshire, Pennsylvania, Rhode Island, Utah, Vermont.

White iron pyrites. *See* Marcasite.

Wiedgerite, Mineral liver. A variety of asphalt. Not known to be of economic use.

Utah.

Williamsite. An apple-green impure variety of serpentine. Used for ornamental and semiprecious stones. *See also* Jade.

Pennsylvania.

Willemite. Zinc silicate, $2\text{ZnO} \cdot \text{SiO}_2$. Contains 58.6 per cent zinc. The zinc is commonly replaced in part by manganese. An important zinc-ore mineral, used as a gem, also to detect radium rays and by physicists to study luminous phenomena.

Arizona, New Jersey, New Mexico, Utah.

Witherite. Barium carbonate, BaCO_3 , a valuable source of barium and its compounds, especially the peroxide.

California.

Wolframite. A series of minerals composed of tungstate of iron and manganese $(\text{Fe}, \text{Mn})\text{WO}_4$, containing, when the iron and manganese are in a ratio of 1 to 1, 76.4 per cent tungsten oxide (WO_3), of which wolframite is an important source. As the iron increases and the manganese decreases wolframite grades into ferberite, the pure iron tungstate, FeWO_4 , with 76.3 per cent WO_3 . At the other end of the series is hübnerite, the pure manganese tungstate, containing 76.6 per cent WO_3 .

Arizona, California, Connecticut, Idaho, Missouri, Nevada, New Hampshire, New Mexico, South Dakota, Texas, Utah, Virginia, Washington, Wyoming.

Wolfstonite. *See* Hetaerolite.

Wood, silicified, Agatized wood, Fossil wood, Jasperized wood, Opalized wood, Petrified wood. Silicified wood is composed mostly of opal or chalcedony, agate, jasper, and other forms of silica and is formed by the replacement of wood by silica. The replacement of the woody matter by the silica takes place in such a way that the original form and structure of the wood are preserved, which, together with variegations, may give rise to striking and beautiful specimens. Used as gems and ornamental stone.

Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, South Dakota, Utah, Wyoming.

Wulfenite. Lead molybdate, PbMoO_4 . Contains 39.3 per cent MoO_3 . Calcium, chromium, copper, and vanadium are constituents of some varieties. A source of lead and molybdenum.

Arizona, California, Massachusetts, Nevada, New Mexico, Pennsylvania, Utah.

Wurtzilite, Egerite, Eonite, Elaterite, Tabbite. A sectile elastic asphaltic mineral which resists the usual solvents of bitumen. Is jet black by reflected light and deep red in thin plates; nonfusible in boiling water but softens, toughens, and becomes more elastic. In a candle flame it burns with a bright flame without fusing completely. It is practically insoluble in gasoline of 76° Baumé, partly soluble in ether, carbon disulphide, and turpentine, and less so in carbon tetrachloride. Used in the manufacture of roofing material, waterproof felts, building paper, rubber substitutes, and paving materials.

Utah.

Wurtzite. A zinc sulphide of the same composition as sphalerite, ZnS , but hexagonal in its crystallization.

Missouri, Montana, Nevada, Utah.

Wyomingite. A variety of rock which consists almost entirely of leucite (potassium-aluminum silicate) and phlogopite.

Wyoming.

Xanthoconite. Silver-arsenic sulphide, $3\text{Ag}_2\text{S} \cdot \text{As}_2\text{S}_3$. Contains 61.4 per cent silver.

New Mexico.

Xenotime. Essentially yttrium phosphate, YtPO_4 . Contains phosphorus pentoxide 38.6, yttria 61.4.

North Carolina.

Yellow copper ore. See Chalcopyrite.

Yttrialite. Silicate of thorium and the yttrium metals chiefly, but it contains also uranium and other elements in small quantity. Too scarce to be of economic use.

Texas.

Yttrium. A rare element, Yt, belonging to the cerium group. The oxide, yttria, is used with zirconia in the manufacture of the Nernst electric lamp. The yttrium-bearing minerals are cyrtolite, gadolinite, polycrase, rowlandite, samarskite, tenerite, xenotime, and yttrialite.

Arizona, Colorado, New York, North Carolina, Pennsylvania, South Carolina, Texas, Virginia, Wyoming.

Zaratite. A massive, vitreous emerald-green hydrous nickel carbonate, $\text{H}_{12}\text{Ni}_3\text{CO}_{11}$. Occurs usually as an incrustation. A possible source of nickel.

California, Maryland.

Zeolites. A group of minerals occurring in cracks and cavities of igneous rocks, especially the more basic lavas. Zeolites are hydrous silicates of aluminum, with either sodium or calcium, or both, and rarely barium or strontium. Before the blowpipe most of the zeolites fuse readily and with strong intumescence, whence their name, derived from the Greek, of "boiling stone." They are reported to be used for water softening under the name of permutite.

California, Colorado, Michigan, New Jersey.

Zeunerite. A hydrous copper-uranium arsenate, $\text{Cu}(\text{UO}_2)_2\text{As}_2\text{O}_8 \cdot \text{H}_2\text{O}$. A possible source of radium.

Utah.

Zinc. An element, Zn. Not found native. In metallic form, cast in slabs, is known as spelter. In this form it is used principally for galvanizing iron and steel, forming a rust-preventive coating; used in alloys, especially brass, which contains about 30 per cent of zinc; in desilverizing lead; in making galvanic battery zinc; and is rolled into sheet zinc. Sheet zinc is used for roofing, sheathing, gutters, and spouts; for kitchen table tops and other articles of domestic use; for lining packing cases, especially for ammunition; for fruit-jar tops; for photo-engraving; and as plates in marine steam boilers to prevent corrosion. Zinc dust or "blue powder," produced in smelting zinc ores, is used as a reducing agent in manufacturing organic compounds, in dyeing, in fireworks, and in the production of hydrogen. Zinc dust is used to precipitate gold from cyanide solutions and shavings cut from sheet zinc are also used for this purpose. Oxide of zinc (zinc white), obtained from the metal or direct from the ore, is a very valuable pigment which has largely replaced white lead. It is also used in making certain kinds of rubber goods. Zinc chloride is used as a disinfectant, as a preservative of wood, in refining oils, and in making stearic acid, ether, and parchment paper. Zinc sulphate is used in dyeing, in making glue, in the pigment known as lithopone, and as a drier in oil paints and varnishes. Zinc chromate is used as a pigment. Several zinc salts

are used in medicine. *See also* Aurichalcite, Calamine, Chalcophanite, Franklinite, Hetærolite, Hydrozincite, Nicholsonite, Smithsonite, Sphalerite, Willemite, Wurtzite, and Zincite.

Zinc blende. *See* Sphalerite.

Zinc bloom. *See* Hydrozincite.

Zincite, Red oxide of zinc. Zinc oxide, ZnO . Contains 80.3 per cent zinc.

New Jersey.

Zircon. Zirconium silicate, $ZrSiO_4$. When clear and orange-colored it is used for the gem known as hyacinth. *See also* Cyrtolite.

Colorado, Idaho, New Jersey, New York, North Carolina, Oklahoma, Oregon, Virginia, Washington.

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