Magnesium Resources of the United States— A Geologic Summary and Annotated Bibliography to 1953

GEOLOGICAL SURVEY BULLETIN 1019-E

Magnesium Resources of the United States— A Geologic Summary and Annotated Bibliography to 1953

By ROBERT E. DAVIS

CONTRIBUTIONS TO BIBLIOGRAPHY OF MINERAL RESOURCES

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MAGNESIUM RESOURCES OF THE UNITED STATES A GEOLOGIC SUMMARY AND ANNOTATED BIBLIOGRAPHY TO 1953

By Robert E. Davis

ABSTRACT

Magnesium ranks eighth in order of abundance in the earth's crust and occurs sparsely in sea water and in larger quantities in a wide variety of igneous, sedimentary, and metamorphic rocks. The presently important commercial sources of magnesium metal and magnesium compounds are sea water and sea-water bitterns, dolomite, magnesite, brucite, and inland brines. Brines are only briefly mentioned in this report.

Magnesium and its compounds are used widely in the aircraft, automotive, metallurgical, building, pharmaceutical, agricultural, glass, rubber, paper, textile, and paint industries.

Magnesium is extracted from sea water or sea-water bitterns by the process used by the Dow Chemical Co. at their magnesium plant at Freeport, Tex., or by some variation of the Dow process. In this process lime is used to precipitate magnesium hydroxide from the water; the precipitate is dissolved in hydrochloric acid and magnesium chloride is produced; the magnesium chloride is decomposed in an electrolytic cell into magnesium and chlorine. It is now common practice to substitute dolomite for lime. The dolomite furnishes the necessary lime and additional magnesium to the reaction.

Magnesite, or magnesium carbonate, occurs in commercial quantities in the United States principally as a replacement in dolomite. Its chief use is as a refractory material in the metallurgical industries; it is used to a lesser extent in the fertilizer, rubber, textile, and paper industries; During World War II magnesite was used as a commercial source of magnesium metal.

In the past magnesite has been mined in California, Washington, Nevada, and Texas; at present the only commercial domestic production is from Nye County, Nev., and Stevens County, Wash. Magnesite occurs also in New Mexico, Idaho, Oregon, Utah, Pennsylvania, and Vermont. The occurrence of magnesite in each of these States is discussed briefly.

Brucite occurs in commercial quantities only at Gabbs, Nye County, Nev.

Dolomite, the double carbonate of magnesium and calcium, occurs chiefly as a sedimentary rock, commonly interbedded with limestone. The term "high-grade," as used in the present report, refers to dolomite rock containing more than 40 percent magnesium carbonate and less than about 3 percent noncarbonates. The largest single use of dolomite, where the chemical composition of the rock is important, is as a refractory material. It may be used in either its natural state or calcined. During World War II, and to some extent during the postwar years, dolomite has been used as an ore of magnesium metal.

Dolomite occurs in at least 40 States, but the largest sources of high-grade rock probably underlie parts of Ohio, Indiana, Illinois, Michigan, and Wisconsin. Large reserves also are present in the limestone valleys of the Appalachian Mountains, extending from Alabama to New Jersey. Except for Louisiana and the northern Great Plains States, dolomite occurs in nearly every State west of the Mississippi River. The more important dolomitic formations in each State are described briefly.

INTRODUCTION

PURPOSE AND SCOPE OF REPORT

The present report is a compilation of information on the dolomite, magnesite, and brucite deposits and occurrences in the United States, with a brief section on the use of sea water as a source of magnesium and magnesium compounds. It has been compiled from published literature and data in the files of the U. S. Geological Survey. Many of these data are the result of investigations made by the Geological Survey during World War II, and this information, particularly that collected by C. F. Deiss on the dolomite deposits of the Western United States, has been drawn on freely in the preparation of the present report.

It is the purpose of this report to present, by means of text and map (pl. 2), a summary of the United States resources of magnesium contained in dolomite, magnesite, and brucite as a general guide to their distribution, geologic environment, purity, and utilization. Owing to their limited use as sources of magnesium and magnesium compounds, olivine, serpentine, and the various saline minerals—kieserite, langbeinite, epsomite, kainite, carnallite, and polyhalite—are considered beyond the scope of the present compilation.

Well brines rich in magnesium are the raw materials for a substantial part of the annual domestic production of certain magnesium compounds. Such brines occur in several areas in the United States but are extracted commercially only in Michigan. Magnesium sulfate is produced from lake brine in the State of Washington. The geologic occurrence and chemical composition of these inland brines are broad subjects, about which relatively little detailed information has been published. The brine resources of the United States are not discussed in this paper.

It is hoped that the information presented will prove useful as a general background of knowledge for field appraisals of areas that might be considered commercial sources of magnesium raw materials. Most of the areas of present and potential commercial importance are considered, most of the pertinent geologic formations within these areas are described, and sample data are at least representative, if not complete. The selected, annotated bibliography is not a complete list of all the literature examined, but it contains the published reports used in preparing this work and the reports considered as most helpful in appraising areas containing magnesium raw materials.

ABUNDANCE, AVAILABILITY, AND USES

Magnesium ranks eighth in order of abundance of the elements in the earth's crust, comprising 2.09 percent by weight of the igneous rocks (Rankama and Sahama, 1950, p. 448) and about 0.13 percent by weight of sea water (Rankama and Sahama, 1950, p. 295). It occurs also in a wide variety of sedimentary rocks. Magnesium is a constitutent of at least 150 minerals (Ford, 1932, p. 805–806), but the element and its compounds have been extracted commercially from only a few substances. Magnesium-bearing materials are widespread, and reserves in the United States are virtually inexhaustible. The possible sources of magnesium in the United States and the approximate percentage of magnesium contained in each are listed in the table below.

Magnesium raw materials in the United States

Material	*Composition*	*Percent Mg*
Brucite	$Mg(OH)_2$	42
Magnesite	$MgCO_3$	29
Serpentine	$H_4Mg_3Si_2O_9$	26
Olivine (chrysolite)	$(Mg,Fe)_2SiO_4$	19
Kieserite	$MgSO_4.H_2O$	18
Dolomite	$CaCO_3.MgCO_3$	13
Langbeinite	$2MgSO_4.K_2SO_4$	12
Epsomite	$MgSO_4.7H_2O$	10
Kainite	$MgSO_4.KCl.3H_2O$	10
Carnallite	$MgCl_2.KCl.6H_2O$	9
Polyhalite	$2CaSO_4.MgSO_4.K_2SO_4.2H_2O$	4
Well brines	Mg, Ca, K, Na sulfates and chlorides [1]	1
Sea water	Mg, etc., chlorides	.13

[1] Inland well and lake brines vary widely in composition but generally contain less than 1 percent Mg.

Sea water, well brines, dolomite, magnesite, and brucite are the chief commercial sources of magnesium compounds in the United States. Although each of these is also an ore of magnesium metal by present-day technologies, all are not of economic value commercially under normal competitive conditions.

Enormous quantities of magnesium are in large deposits of olivine and serpentine in the United States. Both materials have been used commercially to a limited extent as fertilizer ingredients and for other purposes (Birch and Wicken, 1949, p. 538–540). Some olivine has been used also in the production of special-use refractories (Gwinn, 1943, p. 2). Adequate resources of other raw materials, technologic problems, and cost of processing have prevented olivine and serpentine from becoming important commercial sources of magnesium and its compounds (Barnes and others, 1950, p. 43–44; Gwinn, 1943, p. 5). They remain, however important potential raw-material sources.

Before World War II sea water was becoming an increasingly important source of magnesium and magnesium compounds. For strategic reasons during the war, however, when rapid expansion of metal-producing facilities became necessary, utilization of inland sources of magnesium raw materials was advisable in order that new plants would not have to be concentrated along sea coasts. New technologies in extractive metallurgy were developed (Ball, 1944; Case and others, 1944; Dungan, 1944; Humes, 1944; Lloyd and others, 1944; Mayer, 1944; Pidgeon and Alexander, 1944; Pierce and others, 1944; Ware, 1944), and, despite higher production costs, magnesium was produced commercially from magnesite and dolomite, materials that had long been commercial sources of certain magnesium compounds.

The most important products derived from magnesium-bearing materials are magnesium metal and magnesium oxide, or magnesia. Magnesium is the lightest of the structural metals in common use. It is about two-thirds the weight of aluminum, and it has become increasingly important in the aircraft and automotive industries for certain items where some strength can be sacrificed in favor of lighter weight. It is used also in the metallurgical industries as a scavenger and deoxidizer. Magnesia is an important refractory material and is used widely in the steel industry. Magnesia and other magnesium compounds, such as magnesium carbonate, magnesium sulfate, and magnesium chloride, are used widely in the building industry, in pharmaceutical preparations, as fertilizer ingredients, and in the glass, rubber, paper, textile, and paint industries.

SEA WATER AND SEA-WATER BITTERNS

Sea water contains approximately 0.13 percent magnesium by weight, or about 6 million tons of magnesium per cubic mile. Reserves of magnesium in sea water are virtually inexhaustible. At present 7 plants in the United States produce magnesium or magnesium compounds, using as raw materials sea water or sea-water bitterns, the saline residue or brine remaining after most of the water has been evaporated and the salt, sodium chloride, extracted. The concentration of magnesium in these bitterns is many times that in normal sea water. As shown in the table below at least 7 magnesium compounds are produced from these raw materials.

The processes by which magnesium and its compounds are derived from sea water and bitterns have been briefly described by Seaton (1942, p. 20–25). Basically, the processes used in the various plants are similar to that used in the plant of the Dow Chemical Co. at Freeport,Tex., for the production of magnesium. Briefly, the Dow process is as follows: the sea water is treated with calcined oyster shell (calcium oxide, or lime) and magnesium hydroxide is precipitated; after most of the excess water is filtered off, the magnesium hydroxide precipitate is dissolved in hydrochloric acid and magnesium chloride is produced; the remaining water is filtered off and the magnesium chloride dried; the dry magnesium chloride is fed into an electrolytic cell where it is decomposed into chlorine gas and magnesium metal. The procedure is described in somewhat more detail by Gross (1949, p. 29–34).

Manufacturing plants producing magnesium and magnesium compounds from sea water and bitterns

[Data from Irving and Uswald, 1954, p. 4–5]

Company	Location	Products	Raw materials
Kaiser Aluminum & Chemical Corp.	Moss Landing, Calif.	Refractory magnesia Caustic-calcined magnesia Magnesium hydroxide	Sea water and dead-burned dolomite.
Westvaco Chemical Division, Food Machinery & Chemical Corp.	Newark, Calif.	Refractory magnesia Caustic-calcined magnesia Magnesium hydroxide	Sea-water bitterns, dead-burned dolomite, and magnesite.
Westvaco Chemical Division.	Chula Vista, Calif.	Magnesium chloride	Sea-water bitterns.
Marine Magnesium Division, Merck & Co., Inc.	South San Francisco, Calif.	Magnesium oxides Magnesium hydroxide Magnesium carbonate	Sea water, sea-water bitterns, and dead-burned dolomite.
Northwest Magnesite Co.	Cape May, N. J.	Refractory magnesia	Sea water and calcined dolomite.
Dow Chemical Co.	Freeport, Tex.	Caustic-calcined magnesia Magnesium chloride [1] Magnesia Magnesium	Sea water.
Dow Chemical Co.[2]	Velasco, Tex.	Magnesium chloride [1] Magnesium	Sea water.

[1] Magnesium chloride cell feed for magnesium.
[2] Government-owned, Dow-operated magnesium plant; not listed in original reference.

At plants producing magnesium compounds, the process described is not carried to completion, and variations in processing depend on the raw materials used and the end product desired. The chief variation in the basic process is the substitution of calcined dolomite for calcined shell or limestone as a source of lime. Dolomite not only furnishes the necessary lime but also increases the yield of magnesium hydroxide by furnishing additional magnesium to the reaction. This substitution is made at most of the plants, as can be seen in the table above.

Theoretically, any place in the United States that borders on the ocean would be a potential plant site for the production of magnesium from sea water. Several factors that affect the number and location of such plants must, however, be considered.

The physical qualifications of a potential plant site are an important factor. The shape of the shoreline and action of the water currents should be such that the discharge of the large volumes of water from the plant will not be recirculated into the area of intake. The area of sea-water intake should be relatively free from sources of contamination, and an adequate source of fresh water should be available to meet plant requirements. There should also be adequate electric power for plant operations and a nearby source of lime in the form of shells, limestone, or dolomite for use as a precipitant.

An economically suitable plant site should be within a reasonable distance of a ready or potential market for either the main products or one or more of the coproducts that could be recovered from the sea water or bitterns. Coproducts from sea water might include bromine, calcium chloride, and sodium chloride. For the production of magnesium, electric power should be relatively inexpensive because of the large amount used in the electrolysis of magnesium chloride. Of strategic importance is the fact that plants along the coastal areas of the United States would be somewhat more vulnerable than inland plants to possible air or sea attack in case of war. Although sea-water reduction plants are not the least expensive either to build or to maintain, operating costs have been such that other methods of metal production do not compare favorably from an economic standpoint (Surplus Property Administration, 1945, p. 25).

MAGNESITE

DESCRIPTION

Magnesite is the naturally occurring carbonate of magnesium, and its theoretical composition is MgO, 47.8 percent and CO_2, 52.2 percent. Iron may substitute for magnesium to form a complete series from magnesite to siderite, $FeCO_3$ (Palache and others, 1951, p. 163). Manganese and calcium also may substitute for magnesium to a limited degree. Magnesite is commonly massive, coarse to fine grained or compact and porcelaneous; it may also be earthy or chalky (Palache and others, 1951, p. 162). The mineral varies in color but generally is white or grayish; it has a vitreous to dull luster. Although crystalline magnesite may closely resemble limestone or coarse dolomite, it is slightly harder (hardness $3\frac{3}{4}$–$4\frac{1}{4}$) and heavier (specific gravity 3) and reacts only slightly to cold dilute acids. The crystalline variety is yellowish or brownish white, but it may also be pure white.

MODE OF OCCURRENCE

The four principal modes of occurrence of magnesite, as described by Bain (1924), are (1) as a chemical precipitate in bedded playa-lake deposits, commonly interbedded with limestone, dolomite, clay, or other detrital materials; (2) as a cryptocrystalline replacement product of serpentinized rocks, deposited in veins, pockets, and shear zones by the action of carbonated waters of either magmatic or meteoric origin; (3) as crystalline replacement bodies in limestone and dolomite, formed by the action of magnesium-containing solutions on the preexisting carbonate rocks; and (4) as vein fillings. Other types of occurrence listed by Palache and others 1951, p. 164) include crystalline beds of metamorphic origin associated with schists, cavity minerals in igneous flow rocks, oceanic salt deposits, and as a primary mineral in igneous rocks.

Only the first three types mentioned are of economic interest, and all domestic production at present is from deposits of the third type. Of possible commercial interest is a unique occurrence in eastern Nevada in which magnesite occurs as veins, nodules, and lenses replacing volcanic tuff (Vitaliano, 1951).

USES

Magnesite is used chiefly for refractories, which find their major application in the steel industry in basic open-hearth furnaces and basic converters (Birch and Wicken, 1949, p. 538). The subject has been discussed in some detail by Comber (1937). For refractory use magnesite is dead burned, a process of intense heating which drives off essentially all the carbon dioxide leaving magnesia, which is partly fused or sintered. Granular dead-burned magnesite is used for the building up of furnace bottoms and to some extent for patching; in the form of brick it is used for the lining of furnace walls. Because magnesite contains no lime, it generally is more satisfactory than dolomite, particularly for the manufacture of refractory brick. The presence of lime in dolomite causes difficulties as outlined in the discussion of dolomite refractories (p. 397). However, owing to its relatively low cost and its proximity to markets, dolomite has found much wider use as a patching or repairing material for furnaces than has magnesite (Schallis, 1942, p. 1). Refractory magnesia derived from sea water also is increasing in use as a substitute for dead-burned magnesite.

Caustic-calcined, or light-burned, magnesite is produced at a lower temperature than is required for dead-burned magnesite. Light-burned magnesite is essentially magnesium oxide, but it contains a small quantity, from 0.5 to about 7 percent, of residual carbon dioxide and remains unsintered (Birch and Wicken, 1949, p. 522). This more reactive material is used in the manufacture of magnesium oxychloride cement, for fertilizer, and in the rubber, textile, and paper industries (Ladoo and Meyers, 1951, p. 308–309).

A new use for magnesite in the United States is in the manufacture of magnesium metal. In Nevada, during World War II, magnesite ore from the Gabbs area was used in the large magnesium plant at Henderson. Briefly, the process (Ball, 1944) involved calcining the magnesite and mixing the resulting magnesia with pulverized coal to form briquettes, which then were charged into an electric furnace in the presence of chlorine gas, producing carbon dioxide and molten magnesium chloride. The magnesium chloride was then reduced in an electrolytic cell to chlorine gas and magnesium metal. The Henderson plant produced more than 81,000 tons of metal from 920,000 tons of magnesite ore quarried from the Gabbs deposits (Callaghan and Vitaliano, 1948, p. 1).

Chemical specifications for magnesite are as varied as its uses and usually are made on the basis of the calcined material, either light burned or dead burned (Birch and Wicken, 1949, p. 535–537). In general, crude magnesite to be marketable should contain a minimum of about 43 percent magnesia (Harness and Jensen, 1943, p. 7). Impurities commonly present in magnesite consist principally of lime, silica, iron, and alumina. The lime content should be at a minimum, being particularly detrimental in light-burned material. Some iron is desirable in magnesite that is to be used for refractories, particularly if the iron is in the form of carbonate. The iron aids the dead-burning process by allowing the magnesia to sinter at lower temperatures (Harness and Jensen, 1943, p. 7).

MINING AND BENEFICIATION

The mining of magnesite is controlled by the geology of the deposit, and it may be by either underground or open-pit methods. Deposits of the California type, which consist of veins and irregular stockworks in the serpentinized country rock, generally must be worked by underground methods. One such operation, that of the Bald Eagle mine near Gustine, Calif., has been described by Perry and Kirwan (1938). The Washington and Nevada deposits, which occur as massive crystalline replacements in dolomite, are worked by open-pit methods. The major departure from standard quarry practice is the maintenance of relatively narrow benches and narrow working faces to permit selectivity in quarrying (Parker, 1945). The quarrying methods used in the Nevada deposits are similar to those used in Washington; they have been described briefly by Birch and Wicken (1949, p. 524–527) and in more detail by Parker (1945) and Holmes (1949).

Contaminating materials, the most common of which in the Washington and Nevada deposits are dolomite and magnesium silicates, must be removed before the magnesite is calcined. Before World War II, magnesite ore was brought up to required grade by careful hand sorting or by mechanical classification through screening. Such upgrading was costly and not always as satisfactory as desired, and, about 1941, froth flotation was introduced at the Chewelah, Wash., operation (Seaton, 1942, p. 7). Flotation was used also during World War II at the plant at Gabbs, Nev. Still more recently heavy-media separation has been utilized to beneficiate ore at Gabbs and Chewelah (Birch and Wicken, 1949, p. 525; Utley, 1952, p. 98).

GENERAL DISTRIBUTION

Commercial deposits of magnesite are not widely distributed in the United States. The only producing mines at present (1954) are those in Stevens County, Wash., and Nye County, Nev. Other States that have produced magnesite during recent years include California and Texas. Relatively small occurrences of doubtful commercial importance occur in New Mexico, Idaho, Oregon, Utah, Pennsylvania, and Vermont.

DISTRIBUTION BY STATES

On the following pages the magnesite deposits of the United States are described briefly by States, which are listed in alphabetical order. Accompanying each State summary is a list of deposits and occurrences, the locations of which are shown on plate 2.

CALIFORNIA

Occurrences of magnesite are numerous throughout the Coast Range and the western Sierra Nevada areas of central and southern California. Many of the deposits and mines have been discussed briefly by Bradley (1925, p. 41–140) and some in more detail by Hess (1908) and Gale (1914). Little is known regarding the magnesite reserves in the State, but according to Vernon (1950, p. 177), reserves of readily accessible, high-grade magnesite are nearly depleted.

Magnesite mined in California in 1886 (Bradley, 1925, p. 37) was the first to be commercially produced in the United States. The State continued as the only domestic producer until operations in the extensive deposits in eastern Washington were initiated in 1916 (Stone, 1918, p. 665). Magnesite was mined in California continuously until 1945 when the Western mine, in the Red Mountain district of Santa Clara and Stanislaus Counties, finally ceased operations (Bodenlos, 1950, p. 227). Since that time the Western mine has been worked intermittantly on a small scale. The large-scale production of magnesia from sea water and the high cost of mining, as well as the depletion of reserves, have caused the near-cessation of magnesite mining in California.

Most of the deposits, except for those in San Bernardino County, are associated with serpentinized parts of the pre-Cretaceous ultramafic intrusives in the Coast Range and in the western Sierra Nevada (Gale, 1914, p. 486). The magnesite occurs principally as replacements in serpentine and as fissure fillings in zones of fracturing. Most of the deposits were small, and reserves in many totaled only a few thousand tons. A few were considerably larger, the most extensive being those in the Red Mountain district. These deposits have been described in detail by

Bodenlos (1950). The original reserves of the deposit at the Western mine were about 1 million tons, but most of this has been mined out; a recent estimate of reserves of the Western and several other mines in the district totals less than 180,000 tons of measured, indicated, and inferred ore (Bodenlos, 1950, p. 259).

The magnesite is typically cryptocrystalline, massive, brittle, and white, although the color may vary to gray, light green, pink, or even brick red. Its fracture is conchoidal, and freshly broken surfaces resemble unglazed porcelain (Bodenlos, 1950, p. 238). This type of magnesite generally is purer than the more coarsely crystalline varieties that occur as replacements in carbonate rocks; one analysis of material from the Western mine shows a magnesium carbonate content in excess of 99 percent (Bodenlos, 1950, p. 239).

Bodenlos (1950, p. 259–266) believes that the magnesite in the Red Mountain district was formed by the action of ascending hydrothermal solutions, heavily charged with carbon dioxide and carrying magnesium and silica derived from sources at depth. Magnesite, silica, and hydrous magnesium silicate minerals were deposited in fractured zones in the serpentinized country rock. The magnesite occurs both as replacement of serpentine and as fissure-filling material. Earlier theories of origin (Hess, 1908, p. 17–18; Bain, 1924, p. 417–419; Perry and Kirwan, 1938, p. 9–10) suggested the simple alteration of serpentine or of preexisting ultramafic rocks through the action of carbon dioxide-bearing waters. These solutions were regarded by some geologists to be hypogene and by others as supergene.

Crystalline magnesite replacing dolomite occurs near Cima and Lucerne Valley, San Bernardino County. The deposit near Cima has been discussed briefly by Rubey and Callaghan (1936, p. 118–119). The magnesite in these deposits generally is less pure than that in the serpentine replacement deposits; the chief impurities are silica and lime. Mineralization probably is associated with Jurassic igneous activity, which resulted in the replacement of favorable zones in the limestone and dolomite of Paleozoic age.

Sedimentary magnesite, deposited as beds in inland lakes of Tertiary age, occurs near Needles and Kramer, San Bernardino County, and near Bissell, Kern County. The deposits near Needles have been described in detail by Vitaliano (1950) and the one near Bissell by Gale (1914, p. 512–516), Bain (1924, p. 415–416), Bradley (1925, p. 47–50), and Rubey and Callaghan (1936, p. 114–117). The amount of impurities in these deposits is higher than in those of other types, but the magnesite in the Needles deposit is pure enough to have been considered as a possible source of magnesium ore early in World War II (Vitaliano, 1950, p. 365).

Magnesite in California

[M.D.M. indicates Mount Diablo base line and meridian (Calif.–Nev.); S.B.M. indicates San Bernardino base line and meridian (Calif.)]

No. on pl. 2	County	Deposit and locality	Reference
6	Mendocino	Southard ranch deposit; 2 miles from Willets.	Bradley, 1925, p. 52.
7	do	Hixon ranch; sec. 11, T. 12 N., R. 11 W., M.D.M., 6 miles by road north of Preston.	Bradley, 1925, p. 52; Hess, 1908, p. 21.
8	Sonoma	Cloverdale area:	
		a. Albertez ranch deposits; 2 miles southwest of Cloverdale.	Bradley, 1925, p. 89.
		b. Battenburg deposit; sec. 32, T. 12 N., R. 10 W., M.D.M.	Bradley, 1925, p. 89; Hess, 1908, p. 22.
		c. Burgans ranch deposit; 1 mile north of Battenburg mine.	Bradley, 1925, p. 91.
		d. Melville ranch deposit; 2 miles southeast of Cloverdale.	Bradley, 1925, p. 92; Hess, 1908, p. 23.
		e. George Hall ranch deposit; 3 miles southeast of Cloverdale.	Hess, 1908, p. 24.
		f. Pat Cummings claim; 2.5 or 3 miles S. 35° W. of Cloverdale.	Do.
9	do	Northwest of Guerneville:	
		a. Madeira deposit (Healdsburg Marble Co.); SW corner sec. 31, T. 9, N., R. 10 W., M.D.M.	Bradley, 1925, p. 91; Hess, 1908, p. 25–26.
		b. Meeker ranch deposit; secs. 2 and 3, T. 8 N., R. 11 W., M.D.M.	Bradley, 1925, p. 91–92.
		c. Snyder ranch; about 12 miles southwest of Healdsburg.	Bradley, 1925, p. 92.
		d. Sonoma Magnesite Co. (Red Slide deposit); secs. 6, 7, 8, 17, and 20, T. 9 N., R. 11 W., M.D.M.	Bradley, 1925, p. 92–96; Hess, 1908, p. 26–27.
		e. Western Carbonic Acid Gas Co. (Gillam Creek deposit); sec. 6, T. 8 N., R. 10 W., M.D.M.	Bradley, 1925, p. 96–97; Hess, 1908, p. 24–25.
10	Napa	Pope and Chiles Valleys:	
		a. White Rock deposit (Pope Valley or Walters mine); sec. 2, T. 9 N., R. 5 W., M.D.M.	Bradley, 1925, p. 56–58; Hess, 1908, p. 28–29.
		b. Maltby No. 2 mine (Blanco and Snowflake mines); sec. 28, T. 8 N., R. 4 W., M.D.M.	Bradley, 1925, p. 54–55; Hess, 1908, p. 29–31.
		c. Priest mine; sec. 23, T. 8 N., R. 4 W., M.D.M.	Bradley, 1925, p. 55.
		d. Russell deposit; sec. 24, T. 8 N., R. 4 W., M.D.M.	Hess, 1908, p. 31.
		e. Elder or Detert mine (Matthai or Cleveland mine); sec. 36, T. 8 N., R. 4 W., M.D.M.	Bradley, 1925, p. 53–54; Hess, 1908, p. 31.
11	Nevada	Deposits at Nevada City and in sec. 22, T. 16 N., R. 8 E., M.D.M.	Bradley, 1925, p. 58.
12	Placer	a. Little Bear mine; sec. 35, T. 16 N., R. 10 E., M.D.M.	Bradley, 1925, p. 59; Gale, 1914, p. 501–503.
		b. Placer County Properties Co.; sec. 13, T. 15 N., R. 10 E., and secs. 7 and 18, T. 15 N., R. 11 E., M.D.M.	Bradley, 1925, p. 59.
		c. Sullivan, et al; sec. 19, T. 16 N., R. 11 E., M.D.M.	Bradley, 1925, p. 59–60.
		d. Towle deposits; sec. 6, T. 15 N., R. 11 E., and secs. 24 and 36, T. 16 N., R. 10 E., M.D.M.	Bradley, 1925, p. 60.
13	Alameda	a. Cedar Mountain Magnesite mine; sec. 27, T. 4 S., R. 3 E., M.D.M.	Bradley, 1925, p. 41.
		b. Hayes ranch deposit; sec. 24, T. 4 S., R. 2 E., M.D.M.	Bradley, 1925, p. 42.

Magnesite in California—Continued

No. on pl. 2	*County*	*Deposit and locality*	*Reference*
13	Alameda—Con	c. Winship properties; sec. 25, T. 4 S., R. 3 E., M.D.M.	Bradley, 1925, p. 43.
		d. King claim; 2 miles from Arroyo Mocho and 22 miles southeast of Livermore.	Hess, 1908, p. 37.
		e. Banta's Camp deposit; sec. 16, T. 5 S., R. 4 E., M.D.M.	Do.
14	Santa Clara	a. Bradford ranch deposit; small veins 4 miles southeast of Edenvale.	Bradley, 1925, p. 78.
		b. Burnett ranch deposit; 3 miles northeast of Coyote Station.	Bradley, 1925, p. 78–79; Hess, 1908, p. 31–32.
		c. Cochrane ranch deposit; 4.5 miles east of Madrone Station and 1.5 miles south of the junction of Coyote and San Felipe Creeks.	Bradley, 1925, p. 79.
		d. O'Connell Bros. ranch (Weber ranch); two groups of deposits: north group is 3 air miles northeast of Madrone, south group is 3.5 road miles east of Madrone.	Bradley, 1925, p. 79–80; Hess, 1908, p. 32–33.
15	do	Red Mountain area:	
		a. Western mine; secs. 18 and 19, T. 6 S., R. 5 E., M.D.M.	Bodenlos, 1950; Bradley, 1925, p. 79–87; Gale, 1914, p. 498–501; Hess, 1908, p. 33–37.
		b. Security deposit; sec. 13, T. 6 S., R. 4 E., M.D.M.	
		c. Standard Magnesite Co.; sec. 18, T. 6 S., R. 5 E., M.D.M.	
		d. Winship properties; secs. 1 and 11, T. 6 S., R. 4 E., and sec. 7, T. 6 S., R. 5 E., M.D.M.	
		e. Fidelity deposit (never operated); sec. 12, T. 6 S., R. 4 E., M.D.M.	
16	Stanislaus	Red Mountain area:	
		a. Red Mountain mine (California Magnesite Co. or Patterson mine); sec. 17, T. 6 S., R. 5 E., M.D.M.	Bodenlos, 1950, p. 271–273; Bradley, 1925, p. 98–99.
		b. G. L. Fenster, et al; group of claims in sec. 22, T. 6 S., R. 5 E., M.D.M.	Bradley, 1925, p. 99.
17	do	a. Bald Eagle mine (Gustine Magnesite Co.); sec. 32, T. 8 S., R. 7 E., M.D.M.	Bradley, 1925, p. 99–101; Perry and Kirwan, 1938, p. 3–15.
		b. Howard Cattle Co.; sec. 5, T. 9 S., R. 7 E., M.D.M.	Bradley, 1925, p. 101–102.
18	Tuolumne	a. Gray Eagle Magnesite claim; sec. 16, T. 1 S., R. 14 E., M.D.M.	Bradley, 1925, p. 138–139.
		b. Monarch Mine Co.; small body 1.5 miles from Chinese Camp.	Bradley, 1925, p. 139.
		c. Peter Maki claims; sec. 6, T. 1 S., R. 14 E., M.D.M.	Do.
		d. White Rock Magnesite mine; sec. 6, T. 1 S., R. 14 E., M.D.M.	Bradley, 1925, p. 139–140.
19	San Benito	a. Bonanza Quicksilver mine; sec. 29, T. 18 S., R. 12 E., M.D.M.	Bradley, 1925, p. 66.
		b. Sampson Magnesite mine (Maltby No. 3); secs. 34, 35, and 36, T. 17 S., R. 11 E., M.D.M.	Bradley, 1925, p. 66–71; Gale, 1914, p. 503–509.
		c. Standard group (Superior Magnesite Co.); secs. 35 and 36, T. 17 S., R. 11 E., M.D.M.	Bradley, 1925, p. 71.
20	Fresno	a. Snow Cap and Governor claims; 9 miles east of Sanger.	Hess, 1908, p. 50–51; Gale, 1914, p. 509.
		b. Piedra area; includes several properties.	Bradley, 1925, p. 44–46.

Magnesite in California—Continued

No. on pl. 2	*County*	*Deposit and locality*	*Reference*
20	Fresno—Con	c. Piedra Magnesite Co. (Fresno Magnesite Co.); sec. 5, T. 13 S., R. 24 E., M.D.M.	Bradley, 1925, p. 44.
		d. Piedra mine (Ward); sec. 9, T. 13 S., R. 24 E., M.D.M.	Bradley, 1925, p. 44–45.
21	Monterey	a. Undeveloped deposits in sec. 28, T. 23 S., R. 15 E., M.D.M.	Bradley, 1925, p. 53.
		b. Kings Magnesite Co.; sec. 26, T. 23 S., R. 15 E., M.D.M.	Do.
22	Kings	Kings Magnesite Co.; sec. 20, T. 23 S., R. 16 E., M.D.M.	Bradley, 1925, p. 51.
23	Tulare	Hamilton ranch deposit; sec. 22, T. 18 S., R. 27 E., M.D.M.	Bradley, 1925, p. 110; Gale, 1914, p. 509–511; Hess, 1908, p. 39–49.
24	do	a. Cross ranch deposit (Burr Bros. lease); sec. 19, T. 19 S., R. 27 E., M.D.M.	Bradley, 1925, p. 107.
		b. Merryman Magnesite mine; sec. 7, T. 19 S., R. 27 E., M.D.M.	Bradley, 1925, p. 119.
		c. Mitchell deposit; sec. 12, T. 19 S., R. 26 E., M.D.M.	Bradley, 1925, p. 121.
		d. Wood Magnesite mine; sec. 6, T. 19 S., R. 27 E., M.D.M.	Bradley, 1925, p. 137.
		e. Dumont Magnesite; sec. 10, T. 19 S., R. 27 E., M.D.M.	Bradley, 1925, p. 108.
25	do	a. Adeline Magnesite mine (later El Mirador Magnesite Co.); sec. 24, T. 20 S., R. 27 E., M.D.M.	Bradley, 1925, p. 106.
		b. Blue Crystal Magnesite group; sec. 24, T. 20 S., R. 27 E., M.D.M.	Bradley, 1925, p. 106–107.
		c. Fairview Magnesite mines; sec. 30, T. 20 S., R. 28 E., M.D.M.	Bradley, 1925, p. 109.
		d. Headburg Magnesite; sec. 11, T. 20 S., R. 27 E., M.D.M.	Bradley, 1925, p. 118.
26	do	a. DeMoulin mine (Magnesite Refractories Co. or Stewart mine); sec. 12, T. 21 S., R. 27 E., M.D.M.	Bradley, 1925, p. 107–108.
		b. Gill ranch (Sierra Magnesite Co.); secs. 7 and 8, T. 21 S., R. 28 E., M.D.M.	Bradley, 1925, p. 109–110.
		c. Oakland Magnesite Co.; secs. 7 and 8, T. 21 S., R. 28 E., M.D.M.	Bradley, 1925, p. 123.
		d. Harker mine; sec. 17, T. 21 S., R. 28 E., M.D.M.	Bradley, 1925, p. 110–117.
27	do	a. Duncan Magnesite mine; sec. 25, T. 21 S., R. 28 E., and sec. 30, T. 21 S., R. 29 E., M.D.M.	Bradley, 1925, p. 108–109.
		b. Hawley Pulp and Paper Co. (Duncan property); sec. 30, T. 21 S., R. 29 E., M.D.M.	Bradley, 1925, p. 117–118.
		c. Lindsay Magnesite mine; secs. 30 and 31, T. 21 S., R. 29 E., M.D.M.	Bradley, 1925, p. 124–125.
		d. McKiernan mine (west of Lindsay mine).	Bradley, 1925, p. 119.
		e. Rex Plaster mine (Sierra Magnesite Co.); sec. 31, T. 21 S., R. 29 E., M.D.M.	Bradley, 1925, p. 124.
		f. Tulare Mining Co.; secs. 30 and 31, T. 21 S., R. 29 E., M.D.M.	Bradley, 1925, p. 125–129.
28	do	a. Deer Creek mine (Langley-Cook lease); sec. 21, T. 22 S., R. 28 E., M.D.M.	Bradley, 1925, p. 107.
		b. Mentz property (Ravalli lease); sec. 28, T. 22 S., R. 28 E., M.D.M.	Bradley, 1925, p. 119.
		c. Oakland Magnesite Co.; sec. 21, T. 22 S., R. 28 E., M.D.M.	Bradley, 1925, p. 123.

Magnesite in California—Continued

No. on pl. 2	*County*	*Deposit and locality*	*Reference*
28	Tulare—Con.	d. Simmons ranch deposit (Bartlett lease); 8 miles southeast of Porterville.	Bradley, 1925, p. 135.
		e. Tulare Mining Co.; sec. 28, T. 22 S., R. 28 E., M.D.M.	Bradley, 1925, p. 135–137.
29	do.	Chamberlain ranch deposits; secs. 3 and 10, T. 23 S., R. 28 E., M.D.M.	Bradley, 1925, p. 107.
30	San Luis Obispo	Small veins on the Kisar place, 8 or 9 miles northwest of Cambria.	Bradley, 1925, p. 76.
31	Santa Barbara	Happy Canon claims; sec. 15, T. 7 N., R. 29 W., S.B.M.	Bradley, 1925, p. 77.
32	Los Angeles	Magnesite outcrops on properties of California Graphite Co., 18 miles from Saugus.	Bradley, 1925, p. 52.
33	Kern	Reported occurrence in Walker's Pass in the Sierra Madre Mountains, east of Bakersfield.	Bradley, 1925, p. 50.
34	do.	Near Bissell; sedimentary deposit in the northeastern part of sec. 11, T. 10 N., R. 11 W., S.B.M.	Bradley, 1925, p. 47–50; Gale, 1914, p. 512–516; Rubey and Callaghan, 1936, p. 114–117.
35	San Bernardino	Kramer Hills; sedimentary deposit in secs. 10, 11, 14, and 15, T. 9 N., R. 6 W., S.B.M.	
36	do.	North Lucerne Valley; sec. 15, T. 6 N., R. 1 W., S.B.M., dolomite with veins of magnesite.	
37	do.	Afton; 1.5 miles east of Afton Station; low grade.	Bradley, 1925, p. 72–75; Rubey and Callaghan, 1936, p. 117–118.
38	do.	a. Cima; small deposit about 12 miles northeast of Cima.	Rubey and Callaghan, 1936, p. 118–119.
		b. Cima; reported but unconfirmed occurrence in Providence Mountains, about 12 miles southeast of Cima.	Bradley, 1925, p. 75; Rubey and Callaghan, 1936, p. 119.
39	do.	Needles; 14 miles by road southwest of Needles; two sedimentary deposits: one in secs. 15 and 22, T. 8 N., R. 21 E., S.B.M., the other in the southwestern part of T. 8 N., R. 21 E.	Vitaliano, 1950.
40	Riverside	Hemet Magnesite mine; sec. 31, T. 5 S., R. 1 W., S.B.M., about 4 miles by road from Winchester.	Bradley, 1925, p. 61–65.

IDAHO

Surface deposits of hydromagnesite, 2 to 4 feet thick and covering areas of from 2 to 13 acres, occur about 4 miles from Soda Springs, Bannock County (Yale and Stone, 1921b, p. 12–13). The material, although appearing somewhat earthy and impure, consists of about 90 percent hydromagnesite and 10 percent impurities. Reserves of usable material are not known, and the deposits have not been developed (Hodge, 1938, p. 74).

Magnesite in Idaho

No. on pl. 2	*County*	*Deposit and locality*	*Reference*
47	Bannock	Soda Springs; small deposits of hydromagnesite occur about 4 miles from Soda Springs.	Hodge, 1938, p. 74; Yale and Stone, 1921b, p. 12–13.

NEW MEXICO

Magnesite occurs in the Organ Mountains and San Andres Mountains of Dona Ana County and in the Burro Mountains near Redrock, Grant

County, about 30 miles north of Lordsburg. The deposits in the Organ Mountains are in the southern part of the range, east of Las Cruces, along the southern boundry of T. 23 S., R. 4 E., New Mexico principal meridian. These deposits have been described by Dunham (1935, p. 236). The magnesite replaced certain beds in dolomite inclusions in a quartz monzonite intrusive. Analyses (Dunham, 1935, p. 237) show the magnesite to be of good quality. The deposits have been developed, but resources are not known. A smaller occurrence is reported on the southwest side of the San Andres Mountains north of Organ Pass (Taft, 1936).

A small deposit of magnesite, hydromagnesite, and brucite crops out west of Ash Creek about 2 miles above its junction with the Gila River, near Redrock, Grant County. It has been described briefly by Yale and Stone (1921a, p. 234). The magnesite occurs in lenses in partly serpentinized limestone or dolomite associated mainly with Precambrian intrusives.

Magnesite in New Mexico

No. on pl. 2	*County*	*Deposit and locality*	*Reference*
49	Grant	Ricolite Canyon (near Redrock); small deposit of magnesite, hydromagnesite, and brucite occurs on the west side of Ash Creek, about 2 miles above its junction with the Gila River.	Yale and Stone, 1921a, p. 234.
50	Dona Ana	Organ Mountains; magnesite and dolomite occur in South and Target Range Canyons in the southeastern part of T. 23 S., R. 4 E.	Dunham, 1935, p. 236; Talmage and Wootton, 1937, p. 111.
51	do	San Andres Mountains; occurrence on southwest side of mountains; north of Organ Pass.	Taft, 1936; Talmage and Wootton, 1937, p. 112.

NEVADA

Magnesite, in deposits representing both the carbonate rock replacement and the sedimentary types, occurs in several localities in Nevada. However, only the group of deposits at Gabbs, Nye County, is of commercial importance. The Gabbs area is also the only area in the United States known to contain commercial deposits of brucite. Other magnesite deposits in Nevada are either too small or of too low grade to be of commercial value under present conditions.

GABBS

Although the brucite deposits at Gabbs were discovered in 1927 (Callaghan, 1933, p. 7), very little ore was mined, and that only intermittently, during the next several years. Commercial production began in 1934 (Partridge and Davis, 1935, p. 1168) and, except during 1935, has been continuous up to the present (1954). Nearly the entire production has been shipped to Ohio where it is processed for use in special refractories (Ladoo and Myers, 1951), p. 120). Magnesite has been produced since about 1940 and, from September 1942 to November 1944, it supplied the ore for the world's largest magnesium plant at Henderson, near Las Vegas, Nev. (Callaghan and Vitaliano, 1948, p. 1). At present two companies are producing refractory magnesia from Gabbs magnesite (Irving and Uswald, 1954, p. 4).

The deposits are on the western slope of the Paradise Range, in the extreme western part of Nye County, approximately 29 miles by road northeast of Luning. The geology of the Gabbs area has been described by Callaghan (1933) and by Callaghan and Vitaliano (1948). The material that follows has been summarized from the latter report, except where noted. Magnesite and brucite occur as replacement deposits in dolomite, the uppermost beds of the Luning formation (Upper Triassic), present here as an overriding plate above a thrust fault. In the mineralized areas the dolomite, which generally is dense, dark gray to black, and fine grained, has been replaced by recrystallized dolomite, magnesite, brucite, and silicate minerals.

The magnesite is coarse to very fine grained, massive, white to gray with a brown-weathering surface, and often is so similar in appearance to the recrystallized dolomite which it replaced that the two cannot readily be distinguished. The brucite, which is massive, has a soapy appearance, and varies from white to yellow or brown, is found in bodies that are distributed along the contact between the magnesitized areas and a granodiorite stock. The mineralization is thought to be associated with the granodiorite.

Impurities contained in various minerals associated with the magnesite include iron, alumina, silica, and lime. Particularly troublesome in mining are the many apophyses from the stock into the mineralized areas, necessitating some selectivity in mining. Beneficiation is accomplished by flotation or heavy-media separation (Utley, 1952, p. 98).

The origin of the magnesite and associated minerals is complex, as several stages probably were involved in the genesis of the present mineral assemblage. Essentially, the process of mineralization involved replacement of the dolomite by magnesite and recrystallized dolomite through the action of hypogene solutions. Igneous intrusive rocks were then emplaced and were accompanied by the introduction of pyrite and silicate minerals. Brucite probably was formed at this time. Later solutions caused magnesite and brucite to be replaced by dolomite.

Callaghan and Vitaliano (1948, p. 17) estimate 27 million tons of magnesite containing less than 5 percent lime and total reserves of magnesitic material at about 52 million tons in the principal ore bodies exposed at the surface.

OVERTON

A large sedimentary deposit of magnesite occurs about 5 miles south-southwest of Overton, Clark County. The geology of the area has been described by Longwell (1928), and Rubey and Callaghan (1936, p. 119–139) have presented detailed descriptions of the deposit, its origin, and mineralogy. This brief summary is taken from the latter report. The deposit of magnesite occurs in thin beds of varied composition associated with a thick unit of white clayey dolomite belonging to the Horse Spring formation of Tertiary(?) age. The deposit is lenticular and is covered with gravel overburden ranging from 30 to 50 feet in thickness. Resources are estimated to be more than 5 million tons of impure magnesite containing more than 30 percent magnesia and occurring in beds at least 6 inches thick.

CURRANT CREEK

A unique occurrence of magnesite represented in a group of deposits in the Currant Creek district, about 29 miles by road southwest of Ely, has been described by Vitaliano (1951). The district lies on the boundary between White Pine and Nye Counties. Magnesite occurs as nodules, veins, lenses, and disseminated grains in masses of altered tuff of Tertiary age. Locally the tuffaceous matrix contains a magnesium silicate mineral of the serpentine group. The complex mineralogy of the deposits has been described in detail by Faust and Callaghan (1948). Although much of the magnesitic material is quite high in silica and lime, it is amenable to partial beneficiation (Holmes and Matson, 1950, p. 8). Vitaliano (1951, p. 23) estimates that reserves in the district include about 10,000 tons of commercial-grade magnesite and about 350,000 tons of the magnesium silicate-bearing material.

Magnesite in Nevada

No. on pl. 2	*County*	*Deposit and locality*	*Reference*
41	Nye	Gabbs; large commercial deposits of brucite and magnesite in secs. 26, 35, and 36, T. 12 N., R. 36 E., M.D.M.[1]	Callaghan and Vitaliano, 1948.
42	Nye and White Pine	Currant Creek district; two groups of small deposits in the northwestern part of T. 12 N., R. 61 E., and adjoining part of T. 12 N., R. 60 E.; and in T. 12 N., R. 59 E., (unsurveyed) M.D.M.	Vitaliano, 1951.
43	Esmeralda	Lone Mountain; reported but unconfirmed occurrence southwest of Tonapah, near Mount Diablo base line, Rs. 39 to 41 E.	Gale, 1912, p. 520; Rubey and Callaghan, 1936, p. 143–144.
44	Nye	Payne deposit; small deposit 28.4 miles northwest of Indian Springs, on the Oak Springs Road.	
45	Clark	Overton; sec. 2, T. 17 S., R. 67 E., and secs. 34 and 35, T. 16 S., R. 67 E., M.D.M., about 5 miles south-southwest of Overton; large sedimentary deposit.	Rubey and Callaghan, 1936, p. 119–139.
46	do	Bauer deposit; 17 miles by road southeast of St. Thomas and 9 miles due north of the former Gold Butte Post Office; somewhat impure sedimentary deposit.	Rubey and Callaghan, 1936, p. 140–141.

[1] Mount Diablo base line and meridian (Calif.-Nev.).

OREGON

Deposits of magnesite, probably similar to those associated with serpentine in California, are reported along the lower Illinois River, on the

Smith River, and on Diamond Creek, Curry County; and near Holland, Josephine County (Hodge, 1938, p. 73–74). Details concerning these deposits are lacking, but it is doubtful that commercial deposits occur in this area (F. G. Wells, 1952, oral communication).

Magnesite in Oregon

No. on pl. 2	*County*	*Deposit and locality*	*Reference*
4	Curry	Deposits along the lower Illinois River, the Smith River, and on Diamond Creek.	Hodge, 1938, p. 73–74.
5	Josephine	Near Holland	Hodge, 1938, p. 74.

PENNSYLVANIA

Magnesite occurs in narrow veins and stockworks in the State Line serpentine along the Pennsylvania-Maryland boundary. Deposits along the Chester-Lancaster County line, near where Octoraro Creek crosses the State line, were mined during the last century (Stone, 1922, p. 1). Smaller deposits have been noted also in Fulton and Peach Bottom Townships, Lancaster County (Stone, 1922, p. 2).

Magnesite in Pennsylvania

No. on pl. 2	*County*	*Deposit and locality*	*Reference*
54	Chester and Lancaster.	Small deposits near the oxbow of Octoraro Creek on the Pennsylvania-Maryland boundary.	Stone, 1922, p. 1.
54	Lancaster	Occurrences in Fulton and Peach Bottom Townships.	Stone, 1922, p. 2.

TEXAS

Magnesite was produced during and immediately following World War II from deposits in the Sharp Mountain area, south of Llano, Llano County, for use principally as fertilizer. The most important deposits are 3 and 6 miles southeast of Llano where they occur as lenses in dolomite marble, part of a Precambrian sequence of metamorphic rocks which has been intruded by granites (Chelf, 1941). Some analyses of the material have been published (Schoch, 1938), but estimates of reserves in the area are not available.

A small deposit of low-grade magnesite occurs with dolomite as a lens in chlorite schist about 3 miles northwest of Mason, Mason County (McCammon, 1941, p. 4). Reserves are estimated to be less than 15,000 tons of mixed magnesite and dolomite (McCammon, 1941, p. 5).

Magnesite in Texas

No. on pl. 2	*County*	*Deposit and locality*	*Reference*
52	Mason	Mason, 3 miles northwest; low-grade deposit.	McCammon, 1941, p. 4–5.
53	Llano	a. Gray Fowler tract (Meramec Minerals Co.); 3 miles by road southeast of Llano.	Chelf, 1941.
		b. Stribling ranch deposit (Texas Mines); 6 miles southeast of Llano.	Chelf, 1941.

UTAH

Small lenses and veins of magnesite occur in the Fish Springs district, about 15 miles east of Callao, Juab County. The deposits have been discussed briefly by Crawford (1941). The magnesite replaces parts of a buff-colored hydrothermally altered dolomite of Cambrian age. The deposits probably are too small to mine for the magnesite alone, but might be recovered in conjunction with quarrying of the enclosing dolomite. Nothing is known, however, of the purity of the dolomite.

Magnesite in Utah

No. on pl. 2	County	Deposit and locality	Reference
48	Juab	Fish Springs deposit; small veins in the Fish Springs district in T. 11 S., R. 14 W.	Crawford, 1941.

VERMONT

Magnesite is associated with talc locally in the belt of ultramafic rocks that extends in a north-south direction through the central part of Vermont. Experiments on flotation of talc-magnesite ores have produced magnesite-rich tailings (Clemmer and Cooke, 1936).

WASHINGTON

Commercial deposits of magnesite are restricted to the so-called "magnesite belt," a narrow, well-defined zone some 30-odd miles long, which is entirely in Stevens County, northeastern Washington. The magnesite is of the carbonate rock replacement variety. Deposits range in size from those of small tonnage to large irregular lenses containing reserves in excess of a million tons, which are adequate to support production for some years.

Production of magnesite on a commercial scale began at the end of 1916, and in 1917, the first full year of production, the new industry supplied more than 100,000 tons of crude magnesite (Tyler, 1931b, p. 24), an amount equal to half that produced the same year by the well-established industry in California. Production has been nearly continuous since that time, and systematic development and exploration, aided by a better understanding of the possible mode of origin of the magnesite, have resulted in the establishment of large reserves during recent years (Bennett, 1943). New methods of beneficiation have been an important factor in increasing the tonnage of usable material.

Much has been written about the Stevens County deposits, and the more important work has been summarized briefly by Bennett (1941, p. 4–6). According to Bennett, the magnesite deposits are confined almost entirely to areas within his Stensgar dolomite, a formation in his Deer Trail group (Precambrian(?)) of argillites, slates, phyllites, quartzites, and dolomites. The Stensgar, generally 300 to 350 feet thick but more than 700 feet thick in its northern area of outcrop, is typically a fine-grained dense light-bluish or pinkish-gray dolomite. Locally it has been recrystallized into a medium- to coarse-grained dolomite marble. The formation is exposed in a series of outcrops that extends in a south-southwesterly direction from a few miles northwest of Chewelah, along the eastern foothills of the Huckleberry Mountains, to a point within 2 miles of the Spokane River, a total distance of about 31 miles.

According to Campbell and Loofbourow (1942, written communication) and Callaghan (1942, written communication), the so-called Stensgar dolomite changes locally, either gradually or rather abruptly, into magnesite. The magnesite varies from finely to coarsely crystalline and from white through gray to brown and black in color. Where magnesitization of the dolomite has been extensive, the rock tends to stand topographically higher than the surrounding dolomite, because of its greater resistance to weathering. The impurities are chiefly lime, in included dolomite; silica, as quartz or in silicate minerals; and, to some extent, iron carbonate. Flotation and heavy-media separation are used to remove the impurities.

Magnesite in Washington

No. on pl. 2	*County*	*Deposit and locality*	*Reference*
1	Skagit	Rockport; reported occurrence 0.5 mile from the Great Northern Railway.	Hodge, 1938, p. 73.
2	Okanogan	Riverside area; reported occurrence	Do.
3	Stevens	Magnesite belt; extends from 4 miles northwest of Chewelah to within 2 miles of the Spokane River.	Bennett, 1941; Bennett, 1943; Campbell and Loofbourow, 1942, written communication.
		a. Finch quarry; sec. 30, T. 32 N., R. 40 E.	
		b. Moss-Allen quarry; secs. 25 and 36, T. 32 N., R. 39 E., and secs. 30 and 31, T. 32 N., R. 40 E.	
		c. Woodbury quarry; sec. 1, T. 31 N., R. 39 E.	
		d. Mountain View deposit; sec. 3, T. 31 N., R. 39 E.	
		e. Nogue deposit; sec. 4, T. 31 N., R. 39 E.	
		f. Phoenix deposit; sec. 3, T. 31 N., R. 39 E.	
		g. Midnight deposit; sec. 7, T. 31 N., R. 39 E.	
		h. Keystone quarry; sec. 9, T. 31 N., R. 39 E.	
		i. Davis deposit; sec. 18, T. 31 N., R. 39 E.	
		j. Double Eagle quarry; sec. 18, T. 31 N., R. 39 E.	
		k. Crosby quarry; sec. 18, T. 31 N., R. 39 E.	
		l. Red Marble quarry; sec. 25, T. 31 N., R. 38 E.	
		m. U. S. Magnesite quarry; sec. 10, T. 30 N., R. 38 E.	
		n. Turk quarry; sec. 1, T. 29 N., R. 37 E., and sec. 36, T. 30 N., R. 37 E.	

Magnesite mineralization apparently has been most intense in the north-central part of the belt, and mining operations are centered mainly in the areas southwest of Chewelah and west of Valley. At least two large deposits occur, however, in the southern part of the belt southeast of Fruitland, in the vicinity of Turk (Bennett, 1943).

The most probable theory of origin, according to Callaghan (1942, written communication), is that the preexisting dolomite was recrystallized or replaced by magnesite through the action of ascending hydrothermal solutions, probably associated with nearby granitic intrusives, which spread through fractures and along bedding planes removing lime and depositing magnesia. Field evidence indicates that deformation of the dolomite preceded the formation of the magnesite and that major shearing and faulting were the controlling factors in the distribution of the magnesite (Bennett, 1941, p. 14).

OTHER STATES

Magnesite, probably of little more than mineralogical interest, occurs in Massachusetts, Maryland, New Jersey, and New York (Harness and Jensen, 1943, p. 2).

RESERVES

Reserves of magnesite are difficult to calculate, because of the irregularities in size and shape of many of the deposits, lack of uniformity in composition of the material, different chemical and physical specifications for various uses, and possibilities for beneficiation. Reserves of usable magnesite readily available for removal by open-pit methods in Washington and Nevada were estimated in 1944 (U. S. Bur. Mines and U. S. Geol. Survey, 1948, p. 128) at about 8 million tons, with an additional 85 million[1] tons of impure material that could be considered inferred ore. At the 1941 rate of consumption, these reserves were considered sufficient for about 250 years, according to the reference cited. Crude magnesite mines in 1941 amounted to about 375,000 tons (Schallis and Warner, 1942, p. 1499). In 1952 approximately 511,000 tons were mined (Irving and Uswald, 1954, p. 1).

DOLOMITE

DESCRIPTION AND DEFINITIONS

The mineral dolomite is the double carbonate of calcium and magnesium, expressed as $CaMg(CO_3)_2$ or $CaCO_3.MgCO_3$, and contains approximately 30.4 percent CaO, 21.9 percent MgO, and 47.7 percent CO_2 (Palache and others, 1951, p. 212). Expressed as carbonates the composition is 54.35 percent $CaCO_3$ and 45.65 percent $MgCO_3$ (Ford, 1932, p. 516). Bivalent iron or manganese can substitute within limits for magnesium to form other varieties (Palache and others, 1951, p. 211–

[1] This figure, as given in the reference, is 85,000 tons. From other data given, it clearly is a typographical error and should be 85 million tons.

213). Dolomite is similar in appearance to calcite ($CaCO_3$) but is slightly harder (calcite, hardness 3; dolomite, hardness 3½–4), heavier (calcite, specific gravity 2.71; dolomite, specific gravity 2.85), and reacts very slowly, if at all, with cold dilute acid. Pure dolomite is colorless or white but may vary through shades of red, green, brown, and gray to black. It commonly is massive, finely to coarsely granular, but sometimes is porcelaneous and breaks with a conchoidal fracture.

Dolomite, used as a rock name, generally is applied to carbonate rocks composed of mixtures of dolomite and calcite, and, although massive bodies of pure crystallized dolomite are not common in nature, dolomitic rocks occur extensively. Unfortunately, there is little uniformity in the use of the name, and rocks containing relatively small percentages of magnesium carbonate have been referred to in much of the literature as dolomites. Conversely, in a great deal of the older literature the term "limestone" was applied to rocks that are now called dolomites and magnesium limestones.

It is somewhat difficult to reconcile scientific and industrial definitions of dolomite. Pettijohn (1949, p. 312) defines dolomites as "those varieties of limestones containing more than 50 percent carbonate, of which more than half is dolomite." Following Pettijohn's classification, a rock containing 90 percent or more dolomite in the carbonate fraction would be classed as dolomite; one containing 50 to 90 percent dolomite in the carbonate fraction would be a calcitic dolomite. If the "dolomite" were a pure carbonate rock, in which the carbonate fraction would comprise 100 percent of the total weight, 19.67 to 21.86 percent by weight of the rock would be magnesia. If, on the contrary, only the minimum requirements of the definition are met, that is, if the carbonate fraction constitutes about 50 percent of the total weight, a rock containing as little as 9.84 percent by weight of magnesia also would be classed as dolomite. A dolomite of this composition would not satisfy industrial requirements for a high-magnesia rock.

More useful to industry are those definitions that show relationship between the magnesia content of the total rock and its lithologic designation. Different schemes of classification have been used in the literature, and there seems to be some agreement that to be called a dolomite a rock should contain a minimum of 40 percent magnesium carbonate (about 19.5 percent MgO) (Hatmaker, 1931, p. 2; Hopkins, 1942, p. 3; Weitz, 1942, p. 3). The classification of the carbonate rocks as "natural building stones" on page 392, Part 3 of 1952 Book of American Society for Testing Materials Standards includes the following definitions:

Dolomite—A limestone containing in excess of 40 percent of magnesium carbonate as the dolomite molecule.

Magnesian (Dolomitic) Limestone—A limestone containing not less than 5 nor more than 40 percent of magnesium carbonate.

In the present paper, the terms dolomite and dolomitic or magnesian limestone will be used, insofar as possible, in conformance with the definitions above. In general, the rocks whose localities are shown on the tables accompanying the State summaries contain less than 10 percent noncarbonates. The terms "high-purity" and "high-grade" are used interchangably to designate rocks containing only a few percent of impurities. If the impurities are in excess of about 3 percent, the rock is designated as "moderately high" in impurities. Rock containing more than about 5 percent impurities is called "high" in impurities.

The writer has found that in the literature little reliability can be placed on the lithologic designation of a rock as a dolomite, unless the report bears specifically on the economic possibilities of a deposit or the description is accompanied by chemical analyses. This is true particularly in older reports. In the descriptions of individual formations in the following pages, the lithologic designations have sometimes been modified by this writer to conform to the definitions above, usually on the basis of the chemical analyses included in the reports studied.

ORIGIN AND MODE OF OCCURRENCE

The origin of dolomite has been the subject of much study. Van Tuyl (1916) presented an excellent review of the various theories of origin and the evidence supporting and opposing each. Pettijohn (1949, p. 316) classifies all the theories of origin under three major catagories. These are "(1) primary precipitation of the dolomite, (2) selective leaching of calcite from an original mixture of calcite (or aragonite) and dolomite, and (3) replacement of an original calcitic limestone." Evidence indicates that most dolomites probably are the result of replacement of preexisting sediments, although Stout (1941, p. 9–11) believes that the extensive dolomites of Silurian age of western Ohio are primary precipitates. The time of replacement of the original sediments is problematical. Steidtmann (1911, p. 325–342; 1917, p. 435–445) and Van Tuyl (1916, p. 398–399) have presented evidence indicating that the more extensive dolomites have been formed by the alteration of limestones beneath the sea, probably by the diagenetic replacement of calcium carbonate by dolomite. Miller (1934, p. 51–53) also believes that the dolomites of Pennsylvania have been formed in large part by the same processes. Hewett (1931, p. 57–67), through comprehensive field and laboratory study, has shown that alteration due to the action of magnesia-rich solutions on limestone has formed dolomite in southern Nevada. Pettijohn (1949, p. 317) suggests that dolomitization may take place at several stages in the formation of the final rock.

Dolomites and dolomitic limestones occur chiefly as sedimentary strata associated with limestones and other sedimentary rocks of chemical or detrital origin. They may form thick extensive beds, thin beds, or lenses and irregular masses. Many formations, some designated "limestone," others "dolomite," are in fact composed of limestone layers, dolomite layers, and layers of dolomitic limestone. In addition to such stratigraphic variations in composition, formations commonly contain beds that vary in composition from limestone to dolomite along their strike. Thus, a certain bed that is limestone in one locality may be represented elsewhere by a bed of dolomitic limestone or dolomite. Less commonly, marbleized dolomite occurs as lenses or layers associated with gneisses, schists, or other metamorphic rocks, as typified by occurrences in Massachusetts, North Carolina, and Texas.

Although dolomitic limestones are of widespread occurrence, large deposits of pure dolomite are much more restricted, and many potentially commercial deposits are confined to definitely limited zones within formations of impure carbonate rocks that are unsuitable for chemical or other industrial purposes.

USES

The following reports summarize most of the uses of limestone and dolomite (Miller, 1934, p. 77–111; Lamar and Willman, 1938; Stout, 1941, p. 426–447). Although these summaries are somewhat general, they afford a good background on the uses of the carbonate rocks. More detailed information regarding specifications for specific uses will be found in the literature. Chemical and physical specifications vary widely, not only with the use but also with the user, as technologies have been modified in order to make use of local sources of raw materials. Any given deposit, after it has been thoroughly studied for its size, uniformity, ease of quarrying, and marketability, should be adequately tested to determine whether or not the rock will fulfill requirements of the potential consumer.

The uses of the carbonate rocks can be divided into two broad categories: those in which the physical properties are more important and those in which the chemical composition is more important. The second category can be further subdivided into (a) uses in which limestone is required, (b) uses in which dolomite is required, and (c) uses in which one type can be substituted for the other.

The construction industries annually consume great quantities of limestone and dolomite in the first category. Physical properties of the rock are important, and, in general, the chemical composition of the rock need be considered only insofar as it affects the physical properties. Limestone and dolomite are used interchangably in the form of dimension stone and as crushed and broken stone for concrete aggregate, railroad ballast, road metal, riprap, and a variety of other purposes.

The agricultural, chemical, and manufacturing industries consume the carbonate rocks for uses in which the chemical composition is more important. Uses that annually require large amounts of reasonably pure limestone include the manufacture of portland cement, high-calcium lime, alkalies, calcium carbide, mineral feeds, sugar refining, and others. Dolomite is required for refractories, magnesium production, manufacture of technical carbonate, and the milk-of-lime-process for the manufacture of paper. The uses that require dolomite as a raw material have been described by Colby (1941). Substitution of one rock type for the other is permitted when the rock is to be used for agricultural limestone, blast-furnace flux stone, fertilizer ingredient, coal-mine dusting, rock-wool production, whiting substitute, and various fillers.

It is difficult to determine the tonnage of dolomite consumed annually in the United States. Published statistics (Chandler and Jensen, 1954, p. 1205) show that in 1951 more than 5 million tons of dolomite was used as refractories, nearly 364,000 tons for basic magnesium carbonate (including refractory magnesia), and 92,000 tons in the paper industry. In addition to this known amount, an undetermined part of a total of more than 205 million tons of "limestone" was dolomite and dolomitic limestone used as dimension stone and as crushed and broken stone for many purposes.

Of the numerous uses of dolomite that do not permit substitution of limestone, the most important from the tonnage consumed are as refractories and for magnesium production. As noted above, several million tons of dolomite are used annually for refractories. Capacity production of metallic magnesium from plants in the United States that use only dolomite as a raw material would require a total of about 560,000 tons of dolomite per year. These two uses are described in more detail below.

REFRACTORIES

Dolomite and dolomitic limestone containing not less than 35 percent magnesium carbonate have found wide application in the steel industry and in the nonferrous metals industry as a substitute for grain magnesite. The subject of dolomite refractories has been discussed in general terms by Lamar and Willman (1938, p. 18–20) and Colby (1941, p. 3–4) and in more detail by Schallis (1942). The rock is used in the form of crushed raw stone, dead-burned clinker, and as a base for special refractories. It is used chiefly for patching or repairing furnaces and also for building up bottoms and banks of basic open-hearth furnaces and, to a lesser extent, electric furnaces.

Owing to the instability of the lime, dolomite has not proved to be a very satisfactory substitute for magnesite in the form of refractory brick (Schallis, 1942, p. 6). In order to form a stable brick, the dolomite must be processed in such a way as to control hydration and chemical reactivity of the lime. Hydration causes deterioration of the bricks, both in storage and in use, and difficulty in handling. Chemical reaction with materials in the furnace also decreases the utility of the brick. To impart the necessary refractory properties to dead-burned dolomite the lime must, then, be partly or completely inhibited (semistabilized or stabilized) or must be removed. Several methods for the extraction of magnesia from dolomite have been summarized by Schallis (1943).

Various chemical specifications for dolomite to be used as refractory material have been mentioned in the literature (Lamar and Willman, 1938, p. 19–20; Colby, 1941, p. 3–4). The minimum requirement for magnesium carbonate content is 35 percent. The silica content should be less than 1 percent and the combined alumina and iron oxide less than 1.5 percent. Naturally occurring impurities generally are undesirable because they act as diluents, decreasing the carbonate content, and they do not usually occur uniformly throughout the rock. Impurities, principally iron oxide, may be added to the rock when crushed, however, to facilitate the dead-burning process (Schallis, 1942, p. 4)

MAGNESIUM

Dolomite has been used successfully as a commercial ore of magnesium in several processes, including ferrosilicon reduction (Pidgeon), carbothermic (Hansgirg), and certain of those involving electrolysis of magnesium chloride. During World War II attention was turned to the development of these processes in order to utilize dolomite, the widespread occurrence of which eliminated the necessity for building magnesium plants along sea coasts.

Since World War II the ferrosilicon reduction process is the only one that has attained any importance in the United States, although it is uneconomic under normal competitive conditions. Of the 6 Government-owned plants, 4 are ferrosilicon reduction plants and 2 are electrolytic plants. These facilities are now used only intermittently to supplement production from the single, privately owned sea-water plant. The table below lists the magnesium plants in the United States and also shows the capacity tonnage dependent upon dolomite as a source of raw material.

Despite their higher costs of production, the ferrosilicon reduction plants, according to Comstock (1954, p. 797), have made satisfactory standby facilities because of their simplicity of design and operation, their easily and economically storable equipment, and the comparatively low consumption of electric power per unit of magnesium produced. Approximately 4.5 kwh are needed to produce 1 pound of magnesium (the power is used in the production of the ferrosilicon reducing agent), as contrasted with 10 kwh per pound of magnesium produced by the electrolytic process.

The ferrosilicon reduction process has been described by Pidgeon and Alexander (1944) and by Pidgeon and others (1946). Essentially, this process involves crushing and calcination of the dolomite; grinding, mix-

Magnesium metal plants in the United States

[Data from U. S. Bur. Mines. The plant at Freeport, Tex., is owned by Dow Chemical Corp. All others are Government owned]

Plant	Process	Annual capacity (in short tons)	Raw material and source
Freeport, Tex	Electrolytic	26,000	Sea water; Gulf of Mexico.
Velasco, Tex	do	36,000	Do.
Painesville, Ohio	do	18,000	$MgCl_2$ cell feed; Ludington, Mich., and Freeport, Tex.
Canaan, Conn	Ferrosilicon	5,000	Dolomite; Canaan, Conn.
Wingdale, N. Y	do	5,000	Do.
Spokane, Wash	do	20,000	Dolomite; Marble, Wash.
Manteca, Calif	do	10,000	Dolomite; Natividad, Calif.

ing, and briquetting the calcine with ground ferrosilicon; and heating in an evacuated nichrome steel retort. By this process the magnesium is vaporized, and the vapor is collected and condensed in the cooler end of the retort to form a cluster of crystalline magnesium. An easily removed residue of unfused dicalcium silicate and iron remains in the retort. The reaction proceeds according to the following equation:

$$2MgO + 2CaO + (xFe)Si \rightarrow (CaO)_2SiO_2 + 2Mg + (xFe)$$

The ferrosilicon reduction process is the only one in which magnesia is reduced directly from calcined dolomite. Other processes using dolomite involve removal of the magnesium from the dolomite, either as the hydroxide or the chloride, preliminary to thermal reduction or electrolysis (Pidgeon and others, 1946).

Purity of the dolomite is important. Pilot plant operations at the beginning of the war showed that dolomite for use in the ferrosilicon reduction process should contain at least 21 percent magnesia and less than 2 percent acid-insoluble material (Mayer, 1944, p. 363). According to Pidgeon and Alexander (1944, p. 338–339), acid insolubles up to about 3 percent were found to be merely diluents, but when present in excess of 3 percent they notably depressed the yield of magnesium. More than a trace of the alkali metals sodium and potassium was found to be particularly undesirable and, in some instances, dangerous (Pidgeon and Alexander, 1944, p. 339–340). As they vaporize and condense along with the magnesium, experience has shown that these metals are likely to ignite spontaneously when the vacuum is broken and the condensate exposed to air.

Although it is desirable to use dolomite containing impurities that are within the tolerances outlined, chemical analyses (Deiss, 1955, p. 133,

136) show that rock slightly below these standards has been used successfully as magnesium ore. Advances in technology eventually may permit the use of dolomite containing alkalies in presently prohibitive amounts or containing impurities in excess of 3 or 4 percent. Such relaxing of specifications would greatly increase the already enormous available tonnage of usable dolomite and considerably broaden the distribution of reserves.

MINING AND BENEFICIATION

As most dolomites and dolomitic limestones for chemical purposes are used in the form of fragments, the rock is obtained by standard crushed-stone quarrying methods. Bowles (1939, p. 452–470) and Goldbeck (1949, p. 269–286) have described the general features of exploiting carbonate rock deposits for crushed stone.

The choice of quarrying methods is determined by the geological and physical characteristics of the deposit. Usually, one of two main methods is employed. Pit quarrying is used when a deposit lies below the adjacent ground surface level; bank or open-cut quarrying is used when the deposit stands at or above the adjacent ground level (Goldbeck, 1949), p. 271). In either method the quarry face may be shot down in benches or as a single face. One or more of several drilling and blasting techniques may be used, depending chiefly upon the physical character of the rock. Various drilling and blasting methods have been described by Bowles (1939, p. 453–459) and by Goldbeck (1949, p. 272–278). Removal of the overburden, which may consist of soil or unmarketable rock or both, usually is necessary before quarrying by either the pit or bank methods.

Not uncommonly, where a deposit contains rock of a particularly desirable quality and the geology of the deposit precludes economical stripping of the overburden, underground quarrying may be employed. This is usually done by the room-and-pillar method or some variation thereof (Bowles, 1939, p. 467–468; Goldbeck, 1949, p. 285–286).

In the production of crushed stone for chemical purposes, it is sometimes necessary to improve the quality of the quarry-run rock. Such upgrading can be accomplished by one or more methods, including hand-sorting, washing, and screening. Recently heavy-media separation has been used commercially to improve the quality of dolomite by removing granite that is associated with the deposit. The process has been described by Utley (1952) and Lenhart (1953).

No one standard procedure for the operation of a crushed stone quarry would be applicable to all deposits. The practicability of the various techniques for stripping, drilling and blasting, loading, hauling, upgrading, and crushing must be determined by the quarry operator, whose major concerns are the cost and quality of his product.

GENERAL DISTRIBUTION

Dolomite and dolomitic limestone are of widespread occurrence in the United States. Enormous quantities of dolomitic limestone are in many geologic formations, ranging in age from Precambrian through Mesozoic. Large, readily accessible supplies of high-purity dolomite are, however, somewhat more limited in occurrence.

Immense tonnages of high-grade dolomite, most of it probably suitable for either refractory or metal production, are in the region around the Great Lakes. These dolomites are principally Ordovician and Silurian in age. In some areas they occur as extensive, near-surface, essentially flat-lying beds; in others they are local facies of extensive limestone or dolomitic limestone beds.

Dolomites occur locally in the great limestone valleys of the Appalachian Mountains, from central Alabama northeastward through southeastern Pennsylvania to New Jersey. Dolomite, some of which has been used as magnesium ore, also occurs in several small areas in southeastern New York and in the western parts of Connecticut, Massachusetts, and Vermont.

In the Western United States dolomite generally does not occur in extensive thick beds but rather as more localized deposits, some of which contain substantial tonnages of high-grade rock. Such deposits are found in nearly every State with the exception of the northern Great Plains States. Dolomite from deposits in Washington and California has been used in the production of magnesium in plants at Spokane, Wash., and Manteca, Calif.

DISTRIBUTION BY STATES

Information pertaining to the dolomite and dolomitic limestone resources of the United States, arranged alphabetically by States, is given in the following pages. Because dolomite is a high-tonnage low-cost commodity and cannot be economically transported great distances, the value of a given deposit is controlled largely by its proximity to transportation facilities and markets. It is thought, therefore, that a summary of the resources of each State might be more useful to a potential quarry operator or consumer than a summary of a larger region or one based on geologic formations alone. The geologic formations known to contain dolomite or dolomitic limestone are mentioned for each State, but only those considered more important as possible commercial sources of these rock types for use in the chemical and manufacturing industries are described in detail.

Accompanying each State summary is a list of known or reported occurrences of dolomite and of dolomitic limestone only slightly less magnesian than dolomite (these contain a minimum of about 39 percent magnesium carbonate). For each occurrence there are listed the location, the quarry or quarries (active and inactive quarries are not distinguished), and the geologic formation.

In general, the descriptions of geologic formations are composite descriptions based upon information obtained from more than one source. For convenience in reading, the references which were drawn upon for the material in each paragraph are listed at the end of the paragraph, and the reader is advised to consult each of the references listed for more detailed information on a given subject.

ALABAMA

Dolomite occurs in large quantities in northeastern Alabama. The more important deposits are in the area east and northeast of Birmingham, where the rock is used extensively as flux stone in the smelting of iron ore. The dolomites and dolomitic limestones of the series represented by the shaded area on the map (pl. 2) include, in ascending stratigraphic order, the Brierfield, Ketona, Bibb, and Copper Ridge dolomites, of Upper Cambrian age, and the Chepultepec dolomite, of Lower Ordovician (Beekmantown) age. The series has an aggregate thickness of more than 5,000 feet, and the rocks crop out principally in the anticlinal valleys of the northeastern part of the State. High-purity dolomite is, however, limited mainly to the Ketona, and large-scale quarrying is restricted to this formation. (Butts, 1926; Jones, 1926; Smith and others, 1926)

Ketona dolomite.—The Ketona dolomite is primarily a light-gray medium- to coarse-crystalline thick-bedded dolomite. It is nearly free of silica. The formation attains a thickness of from 500 to 600 feet. Its outcrops extend from Vance, Tuscaloosa County, along the Jones River to Bessemer, Jefferson County, thence northward into Opossum Valley, where the formation is typically developed and the rock extensively quarried. The Ketona crops out also from Chepultepec to Remlap in Murphrees Valley, Blount County, and in the Shoal Creek area of Shelby County, north of Montevallo. Chemical analyses indicate that the Ketona dolomite is the most promising source of high-purity dolomite in the State, and

Dolomite quarries and occurrences in Alabama

County	*Locality*	*Formation*	*Reference*
Lee	Chewacla; quarry	Chewacla marble	Jones, 1926.
Jefferson	Bessemer; quarries 2 miles west	Ketona dolomite	Ball and Beck, 1938.
	Birmingham area; quarries	do	
	a. Dolcito; quarries	do	
	b. Ketona; quarry	do	Burchard and Butts, 1910.
	c. Lardona; quarry	do	Do.
	d. North Birmingham; quarries	do	Do.
	e. Thomas; quarry	do	Do.
Shelby	Montevallo; quarries 5 miles north	do	Butts, 1911.
Talladega	Talladega	Copper Ridge dolomite	Weitz, 1942.
Tuscaloosa	Vance; quarry	Ketona dolomite	Burchard and Butts, 1910.

available supplies of rock seem to be large in the Birmingham district. (Burchard and Butts, 1910; Butts, 1926; Jones, 1926; Weitz, 1942)

Other formations.—Other known occurrences of high-grade dolomite in Alabama include a lens in the usually cherty Copper Ridge dolomite near Talladega, Talladega County, and portions of the Chewacla marble (Precambrian) near Chewacla, Lee County. The extent and therefore the potential importance of these occurrences is not known. (Weitz, 1942)

ARIZONA

Dolomite and dolomitic limestone occur principally in the central and northwestern parts of Arizona. Smaller occurrences are also in the southeastern part of the State. The dolomites occur predominantly as zones within the Redwall limestone, the Martin formation, and their equivalents. A 60-foot dolomite zone is in the upper part of the Muav limestone of the Grand Canyon area. Many of the deposits are readily accessible to transportation, and some probably would yield considerable tonnages of rock if mined by open-pit methods. Most of the deposits are, however, interbedded or otherwise closely associated with shale, limestone, and sandstone. These probably are not uniformly pure over wide areas and would require selective quarrying or, in a few places, underground quarrying. The most promising deposit of dolomite seems to be that in Tassai Ridge, near Pierce Ferry, Mohave County.

Muav limestone.—The Muav limestone, of Middle Cambrian age, in the Grand Canyon area, is prevailingly a gray and buff mottled limestone overlain by calcareous sandstone and massive magnesian limestone. The magnesian limestone upper member is a hard buff crystalline rock, which forms cliffs upon weathering. Where exposed in the Grand Canyon, its thickness ranges from a thin wedge to about 70 feet. A chemical analysis of a "typical specimen" from Bass Canyon shows the rock to be dolomite, and it is reportedly uniform lithologically over considerable distances in the canyon, despite its markedly varied thickness. (Noble, 1922)

Martin formation.—The Martin formation (Devonian) of the central and southeastern mountain ranges and its Grand Canyon area equivalent, the Temple Butte limestone, contain zones of dolomite or magnesian limestone. The Martin formation, where typically developed, is a series of limestones, sandstones, and shales that grade into one another vertically and laterally and have an aggregate thickness of 300 to 400 feet. The lower part of the formation is the most prevailingly dolomitic. This zone contains dark-brown or black to light-gray, generally fine-grained, irregularly bedded dolomitic limestone beds, from 20 to more than 50 feet thick. The beds commonly contain dark chert nodules and masses and are interbedded with thin layers of green shale. The rock weathers to a characteristic buff color. Chemical analyses of samples of the Temple Butte and descriptions of the Martin indicate that the formations generally are moderately high in impurities and contain less than 40 percent magnesium carbonate. The poor grade and usually interbedded shales, limestones, and quartzites preclude the use of the rock, in most places, as a source of high-purity dolomite. (Huddle and Dobrovolny, 1952; Wilson, 1942)

Redwall limestone.—The Redwall limestone, of Mississippian age, is predominantly a light-gray to white thin- to very thick-bedded limestone. It ranges in thickness from a few feet in central Arizona to about 800 feet in the Grand Canyon area—perhaps more in the Lake Mead area. Its southern equivalent, the Escabrosa limestone, attains a comparable thickness in the southeastern part of the State. Brief studies of the Redwall in northwestern Arizona around Peach Springs, in Tassai Ridge, and between Chino Valley and Seligman have shown high-purity dolomite to be present. Chemical analyses show some zones of the dolomite to be moderately siliceous, however, and careful detailed sampling would be required to determine the exact areas of high-purity dolomite. (Huddle and Dobrovolny, 1952; Wilson 1942)

Other formations.—Massive light-gray dolomite occurs in lake beds of Tertiary age above the junction of Humbug Creek and the Agua Fria River, near Pleasant Lake, Yavapai County. The dolomite is about 25 feet thick and is present over an area of more than a square mile. An incomplete chemical analysis shows more than 40 percent magnesium carbonate, but no information is available as to the impurity content. (Wilson, 1942)

Dolomite occurrences in Arizona

County	*Locality*	*Formation*	*Reference*
Cochise	Bisbee; west and southwest	Martin formation	
Coconino	Grand Canyon Station; 15 miles northwest, at Bass Canyon.	Muav limestone, Temple Butte limestone, and Redwall limestone.	Noble, 1922; Wilson, 1942.
Gila	Globe; 3 miles northwest	Martin formation	
Maricopa	Roosevelt Dam; southeast wall of canyon.	do	
Mohave	Peach Springs; 2 miles east	Temple Butte limestone(?).	
	Tassai Ridge; southwest of Pierce Ferry.	Rocks of Devonian(?) and Mississippian age.	
Pinal	Superior; 0.5 mile east	Martin formation	
Yavapai	Chino Valley; 12–15 miles north	Redwall limestone	
	Pleasant Lake	Rocks of Tertiary age	Wilson, 1942.
	Seligman; 6 miles south	Redwall limestone(?)	

ARKANSAS

Dolomite and dolomitic limestone occur in northern Arkansas in several Middle and Lower Ordovician formations. They include the Jefferson City, Cotter, and Powell dolomites, the Smithville and Black Rock formations, and the Everton formation, listed in ascending stratigraphic order. Chemical analyses indicate that only the Cotter dolomite contains sufficient magnesium carbonate to be considered a potential source of high-grade rock. The other formations listed are dolomitic limestones; they probably contain only minor quantities of dolomite. The extent of outcrop of the Cotter dolomite is shown on the map (pl. 2). (Branner, 1941; Branner, 1942)

Cotter dolomite.—The Cotter dolomite is predominantly a gray cherty dolomite containing a few beds of sandstone and shale. The formation crops out extensively over the northern part of the State and attains a thickness of 500 feet in some places. Available chemical analyses, although showing more than 40 percent magnesium carbonate, show several percent of silica, and it is not known if these analyses are representative of the formation as a whole. Detailed sampling would be necessary to determine what areas might be suitable as sources of high-grade rock. Dolomite has been quarried from the Cotter at 2 localities in Benton County. (Branner and others, 1940; Branner, 1941)

Dolomite quarries and occurrences in Arkansas

County	Locality	Formation	Reference
Benton	Sulphur Springs; quarry	Cotter dolomite	Branner and others, 1940.
	Rogers; quarry	do	Do.
Carroll	Leatherwood Switch	do	Branner, 1941.
	Waldon's Switch	do	Do.
Marion	Woods mine	do	Do.

CALIFORNIA

Deposits of dolomite in California occur for the most part as more or less isolated or discontinuous masses, blocks, or lenses within rocks of other types and range in age from Precambrian to Mississippian. They are found principally in the southern half of the State, and commercial production has been from Tuolumne, Inyo, Monterey, San Benito, and San Bernardino Counties. Other occurrences have been reported from Los Angeles, San Luis Obispo, Santa Clara, Calaveras, Nevada, Alameda, El Dorado, Orange, Plumas, and Riverside Counties. Because of the nature of the occurrences, no attempt has been made to delineate on the map (pl. 2) the areal extent of the dolomite and dolomitic limestone units. The locations plotted are only those for which adequate information concerning the extent and type of deposit is available, or those for which chemical analyses of samples have been found in the literature. (Logan and Wright, 1950; Pabst, 1938; Weitz, 1942)

Reed dolomite.—The Reed dolomite, of Precambrian age, is exposed in several places in northern Inyo County. In this area the dolomite generally is tan gray or pale gray, finely crystalline, thick bedded, and is interbedded with 2- to 6-foot beds of bluish-gray dolomite. Much of the rock, particularly that in the upper portions of the exposed sections, contains veins and stringers of calcite and quartz. Probably only the lower 400 to 500 feet of the formation is sufficiently low in silica to be considered a potential source of high-purity dolomite. Outcrops have been studied in Black and Marble Canyons, 12.5 and 14 miles, respectively, southeast of Bishop. Chemical analyses show some of the rock in the lower, less siliceous zone to be of excellent quality. (Jenkins, 1938)

Rocks of Cambrian age.—Dolomite beds tentatively assigned to the Cambrian are in and near the Providence Mountains in the eastern part of San Bernardino County and near Barstow, to the west. Most of the deposits occur as fault blocks or as roof pendents in the Jurassic granitic intrusive rocks. In general, the dolomites are some shade of tan or light gray, although some are white. They are medium to coarse crystalline, thick bedded, and not uncommonly show some degree of metamorphism. Many of the deposits contain masses or stringers of hematite, calcite veins, and might be intruded by plugs and dikes of diorite or granite. Chemical analyses indicate the presence of high-purity dolomite, and some of the rock has been quarried for use as refractory dolomite. (Logan and Wright, 1950)

Rocks of Devonian age.—The dolomites of Devonian(?) age exposed north of Owens Lake near Keeler and Lone Pine, west-central Inyo County, occur in fault blocks of Ordovician, Devonian, and Carboniferous metasediments. The dolomites are usually medium to fine crystalline, thick bedded, predominantly white, and weather buff or pale tan. In some places greenstone dikes and plugs are in the rock, but analyses from certain localities indicate that, in general, the dolomite is of high purity. Dolomite is quarried near Keeler, and it appears likely that sizable reserves of quarriable dolomite are in the area. (Jenkins, 1938)

Sur series.—The Gabilan limestone of the Sur series, a group of metasediments the age of which is uncertain, contains dolomite in Monterey and San Benito Counties. At Pico Blanco, Monterey County, the dolomite occurs as lenses or pods in the sedimentary series; at Natividad, northeast of Salinas, Monterey County, and near Hollister, San Benito County, important deposits occur as roof pendents in the Santa Lucia granite. In the latter two localities the dolomite has been quarried and used for the production of magnesium metal and magnesia. The rock is usually white to bluish gray, medium to coarse crystalline, and is associated with and cut by veins and stringers of granite, chalcedony, and contact-metamorphic minerals. Even though highly selective quarrying and beneficiation have been necessary, a few of the deposits have proved economic, and large reserves of high-purity dolomite are available.

Calaveras formation.—Lenses of dolomite and dolomitic limestone occur in the Calaveras formation, of Mississippian age, in Tuolumne County. Lenses of dolomite occur in a large body of metamorphosed limestone that extends several miles northward from Sonora. The limestone contains some beds of quartzite, conglomerate, and slate; it is intruded by granite and lamprophyre dikes. The dolomite is commonly white, pale gray or dull gray, and is locally streaked with thin dark-gray bands. It is medium crystalline and soft and is cut by and interfingered with irregular masses of limestone. In a few localities the rock has been quarried for building stone; some of the rock may be suitable for refractories, although chemical analyses indicate that its quality is variable. Southeast of Victorville, San Bernardino County, similar good-quality dolomite, thought to be Mississippian in age, is found as roof pendents in the granitic country rock.

Dolomite quarries and occurrences in California

County	*Locality*	*Formation*	*Reference*
Inyo	Ballarat; 8 miles southeast	(?)	Logan, 1947.
	Bishop area:		
	a. Black Canyon	Reed dolomite	
	b. Marble Canyon	do	
	Keeler:		
	a. quarry 2.5 miles northwest	Rocks of Devonian(?) age.	
	b. quarries 4.5 miles northwest at Dolomite Siding.	do	Do.
	c. quarry 8 miles northwest at Alico Siding.	Rocks of Devonian age.	Do.
Monterey	Natividad; quarries	Sur series	Do.
	Pico Blanco; 20 miles south of Monterey.	do	
San Benito	Hollister:		
	a. quarry 11 miles south	do	Do.
	b. quarries 1.3 miles southeast of locality above.	do	Do.
San Bernardino	Amboy; 6 miles east	Rocks of Cambrian(?) age.	Do.
	Balch; 5 miles south	(?)	Do.
	Barstow; 5 miles west	(?)	
	Big Bear City; 7 miles south	(?)	Do.
	Cadiz; quarry 5.5 miles north	Rocks of Cambrian(?) age.	Do.
	Chubbuck Station; 2 miles southwest.	(?)	Do.
	Cima; 26 miles northwest	(?)	Do.
	Hinkley; quarry 5 miles southwest	Rocks of Paleozoic(?) age.	Do.
	Ivanpah; 3 miles southeast	(?)	Do.
	Kelso; 9 miles southeast	Rocks of Cambrian age	
	Lucerne Valley; quarry 10 miles north.	Rocks of Paleozoic age	Do.
	Newberry; 18 miles southeast	(?)	
	Siam; 1.5 miles south	Rocks of Cambrian age	Do.
	Victorville; 15 miles southeast	Rocks of Mississippian(?) age.	Do.
San Diego	Live Oak Springs; 12 miles northeast.	(?)	Do.
San Luis Obispo	Arroyo Grande; 15 miles northeast	(?)	Franke, 1935.
Santa Clara	San Jose	Sur series	
Tuolumne	Columbia:		
	a. quarry 0.25 mile east	Calaveras formation	
	b. quarries 2.8 miles north	do	Logan, 1947.
	c. quarries just north of those above.	do	
	Sonora; 7.6 miles southeast	do	

COLORADO

Considerable thicknesses of interbedded limestone, dolomitic limestone, and dolomite occur in central and western Colorado. Exposures of dolomitic formations are along the east side of the Front Ranges in parts of Douglas, Teller, El Paso, Fremont, and Pueblo Counties. West of the mountain front, the dolomitic formations crop out in two roughly parallel belts; exposures in the first belt are found principally in parts of Eagle, Lake, Park, Chaffee, and Fremont Counties, those of the second in Eagle, Pitkin, Gunnison, and Saguache Counties. Probably the three most important of the dolomitic formations are the Manitou limestone, the Chaffee formation, and the Leadville dolomite. Several analyses indicate the presence of high-purity dolomite, but little information is available regarding the extent and uniformity of the deposits. The shaded areas on the map (pl. 2) represent the generalization of undivided groups of dolomite and dolomitic limestone of Paleozoic age as shown on U. S. Geological Survey Missouri Basin Studies Map 10 and include rocks ranging in age from Cambrian to Mississippian. (Larrabee and others, 1947; Vanderwilt and others, 1947; U. S. Geol. Survey, 1935)

Manitou limestone.—The Manitou limestone (Ordovician) has been described from several areas in central Colorado and referred to variously as the Yule limestone, White limestone, and Manitou limestone. In general, it is a white, light- to dark-gray, or blue-gray dolomitic limestone, commonly fine grained, thin bedded, and somewhat siliceous. In the Leadville area it contains an abundance of white chert nodules. The formation ranges in thickness from 50 to nearly 400 feet. Chemical analyses show the rock to be a very siliceous dolomitic limestone, and, if these analyses are typical of the formation as a whole, it could not be considered a source of high-grade dolomite. (Emmons and others, 1927; Larrabee and others, 1947)

Chaffee formation.—The Chaffee formation, of Devonian age, comprises two distinct members; the parting quartzite member and the overlying, much thicker Dyer dolomite member. Dolomitic rocks equivalent to the Dyer include the Ouray limestone in the San Juan region of southwestern Colorado. The Dyer member is commonly about 80 feet thick, and the rock is principally a thin-bedded fine-grained dolomite which is locally cherty. It weathers generally to light buff or yellowish gray and not uncommonly contains thin shale partings. Chemical analyses of samples from near Garfield, Chaffee County, show some of the dolomite to be of excellent quality. Earlier writers did not recognize the Dyer member as a distinct unit but, rather, as constituting the lower portion of the Leadville limestone or Blue limestone of local usage. Some of the analyses of the Leadville limestone from Eagle and Lake Counties, therefore, might actually be of the Dyer member. No analyses of the Ouray limestone are available, but it reportedly contains no units of high-grade dolomite. (W. S. Burbank, 1952, oral communication; Emmons and others, 1927; Tweto, 1949)

Leadville limestone.—The Leadville limestone (Mississippian), overlying the Dyer member, consists of massive gray to blue-black crystalline dolomite or dolomitic limestone. Locally, near mineralized areas, the rock shows coarse recrystallization and at places a striped appearance because of the formation of alternating light and dark bands, which gave rise to the miners' term "zebra rock." Chemical analyses of the Leadville from near Red Cliff and Leadville show the presence of high-purity dolomite. The formation ranges in thickness from about 50 to 375 feet. (Emmons and others, 1927; Tweto, 1949)

Dolomite quarries and occurrences in Colorado

County	*Locality*	*Formation*	*Reference*
Chaffee	Garfield area; quarries	Chaffee formation	Crawford, 1913.
Eagle	Red Cliff area	Leadville limestone (and Chaffee formation?).	Crawford and Gibson, 1925.
Fremont	Canon City; quarry 1 mile west	Manitou limestone(?)	Colo. Bur. Mines, 1945.
El Paso	Colorado Springs; quarries	Manitou limestone	Larrabee and others, 1947.
Jefferson	Golden; quarry 3 miles south	(?)	Colo. Bur. Mines, 1945.
Lake	Leadville; quarries	Chaffee formation and Leadville limestone.	Emmons and others, 1927.
Park	Mount Silverheels	(?)	Argall, 1949.
Pitkin	Aspen	(?)	Do.
Summit	Tenmile district	(?)	Do.

CONNECTICUT

Limited quantities of high-purity dolomite occur in Connecticut, principally in the northwestern portion, as irregular lenses and layers in the Stockbridge limestone, of Cambrian and Ordovician age. This formation constitutes the marble belt of the western part of the State. The belt is indicated by irregular and discontinuous outcrops through western Litchfield and Fairfield Counties and is a continuation of the marble belt that extends through Vermont and western Massachusetts. The overburden in the region consists of glacial deposits and valley fill, which makes prospecting and quarrying difficult. (Dale, 1923; Moore, 1935)

Stockbridge limestone.—The Stockbridge limestone is generally a white to grayish-white medium- to coarse-grained thin-bedded to massive marble, either calcitic or dolomitic in composition. Detailed studies of the marble area have shown that the calcite and dolomite varieties grade into one another, both vertically and laterally. In general, the northern area of exposure is more dolomitic than the southern area. Dolomite of high quality is, however, found as far south as Redding, central Fairfield County. Much of the dolomite in the belt contains an abundance of irregularly distributed mica and, locally, disseminated sulfides. Analyses of the rock, particularly in the vicinity of Canaan and East Canaan, Litchfield County, where quarrying has been extensive, show the presence of high-grade rock. Dolomite from this area supplies the raw material for the Government-owned magnesium (ferrosilicon reduction) plants at Canaan, Conn., and Wingdale, N. Y. (Moore, 1935)

Dolomite quarries and occurrences in Connecticut

[Data from Moore, 1935]

County	*Locality*	*Formation*
Fairfield	Brookfield; quarries	Stockbridge limestone.
	Danbury; quarries	Do.
	Redding; quarries	Do.
Litchfield	Canaan; quarries	Do.
	East Canaan; quarries	Do.
	Falls Village; quarry 2 miles north	Do.
	Gaylordsville	Do.
	Lakeville	Do.
	New Milford; quarries	Do.
	Rattlesnake Hill; quarries	Do.

FLORIDA

The occurrences of dolomite in Florida are so sparse as to make them unsuitable as a source of high-grade rock. Considerable quantities of dolomitic limestone are in a narrow belt of discontinuous outcrops and subsurface patches along the west coast of the peninsula from Jefferson County to southern Sarasota County. These rocks from Citrus County northward are restricted principally to the Eocene and Oligocene sediments; those in Manatee and Sarasota Counties occur in sediments of Miocene age. (Hopkins, 1942)

In general, the dolomitic limestones of Eocene and Oligocene age are buff or brown, porous, and they are composed of masses of small dolomite crystals. Because of their crystalline structure and weak cementation, the rocks are friable and can be pulverized easily. Some harder masses occur within the softer portions of the rocks. The dolomitic rocks belonging to the Miocene series are usually light colored, siliceous, and hard on surface exposures. At depth, however, they are gray, softer, clayey in appearance, and contain appreciably less dolomite. (Hopkins, 1942; Vernon, 1951)

Dolomitic limestone quarries and occurrences in Florida

County	*Locality*	*Formation*	*Reference*
Citrus	Red Level; quarries	Rocks of Eocene age	Vernon, 1951.
Levy	Lebanon; quarry	----do	Do.
	Yankeetown	----(?)	Hopkins, 1942.
Manatee	Samoset; quarries	Rocks of Miocene age	Do.
Sarasota	Sarasota; quarry 3.5 miles northeast.	----do	Do.

Deposits of dolomitic limestone have been worked at several localities for the production of agricultural lime in the form of soil conditioner and fertilizer filler. Although these pits are not to be considered as high-grade dolomite quarries, they have been included on the map (pl. 2) along with generalized representations of the areas underlain by dolomite and dolomitic limestone. (Hopkins, 1942; Vernon, 1951)

GEORGIA

Dolomite and dolomitic limestone occur principally in the Paleozoic rocks of northwestern Georgia and in the Precambrian marble belts to the east. Because of their areal extent and chemical composition, the Knox dolomite and the Murphy marble probably are the two most important dolomitic formations. Deposits of lesser importance may occur in the Gainesville and Dahlonega marble belts and in the Shady dolomite. Dolomitic facies are reported also in the Chickamauga limestone, of Ordovician age, and the Fort Payne chert, of Mississippian age, but they are unlikely sources of high-grade dolomite. (Butts and Gildersleeve, 1948; Furcron, 1942)

Talladega slate.—According to Furcron (1942) the marble in the Talladega slate (Precambrian) of the Gainesville belt is somewhat dolomitic, but analyses do not indicate that any of it is high-purity dolomite. The marble crops out in the vicinity of Flowery Branch, Hall County, and northeastward, near the Stephens-Habersham County line, into South Carolina. (Furcron, 1942)

Murphy marble.—The Murphy marble, of Lower Cambrian age, is exposed in several localities in an interrupted belt that enters the State in northeastern Fannin County and extends southwestward through Gilmer and Pickens Counties to a point several miles north of Canton, Cherokee County. This series of outcrops constitutes the Whitestone-Marble Hill belt. Chemically, the Murphy marble varies in composition from almost pure calcite to dolomite containing as much as 43 percent magnesium carbonate. Analyses from Fannin, Gilmer, and Pickens Counties indicate the presence of rather high-purity dolomite in some areas. (Furcron, 1942; Ga. Div. Mines, 1939; Weitz, 1942)

Shady dolomite.—The Shady dolomite, of Cambrian age, is predominantly a bluish-gray medium-crystalline dolomite about 1,000 feet thick. Outcrops of the Shady are rare, being restricted principally to eastern Bartow County in an area extending from southeast of Cartersville northward to a point just north of Pine Log Creek. It crops out also for a distance of about 4 miles along the Southern Railway in the vicinity of Etna, western Polk County. Chemical analyses of samples from the Cartersville area show that dolomite moderately high in silica occurs locally. (Butts and Gildersleeve, 1948; Furcron, 1942)

Knox dolomite.—The Knox dolomite, of Cambrian and Ordovician age, is the most widespread dolomitic formation in Georgia and includes rocks that elsewhere have been separated into the Copper Ridge, Chepultepec, and Nittany dolomites. The Knox, averaging about 3,500 feet in thickness, is prevailingly a thick-bedded gray dolomite, locally containing an abundance of chert. Fresh outcrops of Knox are rare, but its general distribution is indicated by the residual chert fragments in the overlying soils. It occurs extensively as the bedrock formation in Bartow, Polk, Floyd, and Gordon Counties. The largest area is between Cartersville and Rome, in Bartow and Floyd Counties, where the width of the occurrence is approximately 22 miles. Many quarries have been developed in this formation, and several analyses indicate the presence of high-quality dolomite. No information on the reserves of high-grade material is available. (Butts and Gildersleeve, 1948; Furcron, 1942)

Dolomite quarries and occurrences in Georgia

County	*Locality*	*Formation*	*Reference*
Bartow	Adairsville; quarry 3 miles southeast.	Knox dolomite	Furcron, 1942; Butts and Gildersleeve, 1948.
	Cartersville	Shady dolomite	Furcron, 1942.
	a. barite mine 1.5 miles southeast	do	Do.
	b. quarry 2 miles southwest	Knox dolomite	Furcron, 1942; Butts and Gildersleeve, 1948.
	Cassville; 3.7 miles northeast	Shady dolomite	Furcron, 1942.
Catoosa	Graysville:		
	a. quarry 0.5 mile east	Knox dolomite	Do.
	b. quarry 1.5 miles southeast	do	Do.
Chatooga	Trion; quarry 1.5 miles north	do	Do.
Fannin	Mineral Bluff; 1 mile east	Murphy marble	Weitz, 1942.
Floyd	Cave Spring	Knox dolomite	Do.
	Vans Valley	do	Furcron, 1942.
Gilmer	Northcutt	Murphy marble	Do.
Habersham	Turnerville area; quarry	Talladega slate	Do.
Pickens	Jasper; quarry 2 miles east	Murphy marble	Do.
Polk	Youngs Station	Knox dolomite	Weitz, 1942.
Whitfield	Dalton:		
	a. quarry 0.5 mile west	do	Furcron, 1942.
	b. quarry 4 miles east	do	Do.

IDAHO

Dolomite deposits of any potential commercial importance are restricted mainly to south-central and southeastern Idaho in Lemhi, Custer, Butte, Bannock, Caribou, and Bear Lake Counties. The dolomitic formations range in age from Precambrian to Carboniferous, but only about half are worthy of mention. Deposits of high-grade rock are very scarce, the largest and purest occurring in the Fish Haven and Laketown dolomites. Other formations known to contain small, local deposits of high-grade rock, probably of no economic importance, include the Blacksmith and Nounan limestones, of Cambrian age, the Garden City limestone, of Ordovician age, and the Jefferson limestone, of Devonian age.

Fish Haven dolomite.—The Fish Haven dolomite, of Late Ordovician age, is generally a fine-textured medium-bedded dark-gray to blue-black dolomite, locally containing chert. The formation is about 500 feet thick. It is well exposed along the Portneuf River from Topaz to the ridge west of Bancroft, Bannock County; along the southwest side of the Lost River Range east of Mackay and northeast of Arco, Butte County; and probably along the crest of the Lemhi Range south of Gilmore, Lemhi County. A promising dolomite deposit east of the mouth of Elbow Canyon in the Mackay district is in the Fish Haven. Chemical analyses show that the formation contains dolomite of excellent quality in several localities.

Laketown dolomite.—The Laketown dolomite, of Silurian age, overlies the Fish Haven and is exposed in the same general areas. The formation is more than 500 feet thick, and the rock is predominantly a massive light-gray to whitish dolomite, locally containing lenses of calcareous sandstone. It forms the upper part of the ridge west of Lava Hot Springs, the ridge south of Topaz, and probably is exposed east of Mackay and along the crest of the Lemhi Range. Chemical analyses indicate that some of the purest dolomite in the State occurs in the Laketown dolomite.

Because outcrops of the dolomitic formations are few and discontinuous, and because most of them are grouped on the Idaho State geologic map (Ross and Forrester, 1947) as undifferentiated Paleozoic sedimentary rocks, no attempt has been made to delineate their areal extent on the map (pl. 2).

Dolomite occurrences in Idaho

County	*Locality*	*Formation*
Bannock	Bancroft; 2 miles west	Laketown dolomite(?).
	Blaser; 1 to 4 miles north	Garden City formation.
	Lava Hot Springs:	
	a. 2 miles west	Fish Haven dolomite and Laketown dolomite.
	b. 0.5 to 1 mile northeast	Fish Haven dolomite.
	Pebble; 1.4 miles south	(?).
	Topaz; south	Laketown dolomite.
Bear Lake	Paris; 6.6 miles west	Blacksmith limestone.
	St. Charles; 4.5 miles west	Nounan limestone.
Butte	Arco; 4 miles east	Fish Haven dolomite.
	Mackay; 10 miles east	Do.
Caribou	Monroe Canyon	Laketown dolomite.
Custer	Challis; 13 miles southeast	Jefferson limestone.
Lemhi	Gilmore; 6 miles south	Fish Haven dolomite and Laketown dolomite.

ILLINOIS

Extensive deposits of dolomite occur in Illinois, principally in the northern third of the State. Chemical analyses indicate that high-purity rock in commercial quantities generally is restricted to the Platteville to Galena sequence, of Ordovician age, in the north-central region and the four formations constituting the Niagara group (Silurian) in the northwestern and northeastern areas. Smaller quantities of dolomite are in other formations; these are included in the shaded area on the map (pl. 2). Although much of northern Illinois is covered by glacial drift, in many areas this overburden is only a few feet thick, and exposures of the dolomite bedrock are not uncommon. Many of the deposits are very pure, readily accessible, and extensive enough to be of potential importance as sources of high-grade material. Many areas in northern Illinois have already been extensively developed. (Weitz, 1942; Willman, 1943)

Platteville and Decorah formations.—The Platteville and Decorah formations, of Middle Ordovician age, consist of a series of interbedded limestone, dolomite, and beds of intermixed limestone and dolomite, having an average total thickness of 100 to 150 feet. The proportions of limestone and dolomite vary widely both vertically and laterally, as does the character of the beds; some are sandy, some cherty, and others shaly. Dolomite deposits moderately high in impurities are near Ashton, Lee County, Rockton, Winnebago County, and Winslow, Stephenson County. Outcrops of these formations occur as far south as southern La Salle County. (Willman, 1943)

Galena dolomite.—The Galena dolomite, which overlies the Decorah formation, comprises three members having an aggregate thickness of 200 to 250 feet. The lowest member, the Prosser, is made up of 20 to 40 feet of high-purity chert-free dolomite, 80 to 100 feet of generally cherty but locally high-purity dolomite, and about 30 feet of high-purity dolomite. The overlying Stewartville member consists of 40 feet of chert-free dolomite lithologically similar to the upper 30 feet of the Prosser. The Dubuque member, overlying the Stewartville, consists of shaly dolomite. The Galena is in parts of Boone, Carroll, De Kalb, Jo Daviess, Lee, Ogle, Stephenson, Whiteside, and Winnebago Counties. Chemical analyses of samples from several of these counties show that the rock is dolomite, usually with a moderately high impurity content. (Weller, 1945; Willman, 1943)

Joliet limestone.—The Joliet limestone, of Niagaran age, is composed of five dolomitic members of varied degrees of purity. At Joliet, the formation attains a thickness of approximately 75 feet, the upper 25 feet of which commonly is high-purity dolomite. The formation is exposed mainly in Du Page County and western Will County in the northeastern part of the State, and in western Carroll County and southern Jo Daviess County in the western part of the State. Chemical analyses show that high-grade dolomite is present in the Joliet and Du Page and Will Counties. (Willman, 1943)

Waukesha limestone.—The Waukesha limestone, of Niagaran age, is present in the same general areas as the Joliet. In northeastern Illinois, the rock is a dense fine-grained dolomite, usually highly argillaceous and approximately 25 to 30 feet in thickness. In this region it is exposed along the Des Plaines Valley from Joliet to Sag Bridge, along the Kankakee River northwest of Kankakee, and in quarries at Hillside and Elmhurst. The Waukesha in the northwestern region is a highly porous high-purity dolomite, about 50 feet thick. It is well exposed in Whiteside County and western Carroll County in the vicinity of Savanna, Fulton, and Morrison. (Willman, 1943)

Racine dolomite.—The Racine dolomite, of Niagaran age, generally contains many coral reefs. The reef rock is usually a very high-purity dolomite, but the interreef strata commonly are quite impure. In the northeastern region the formation attains a maximum thickness of 250 to 300 feet; it is exposed in Cook, Du Page, Will, and Kankakee Counties. In the northwestern area it is exposed in parts of Whiteside, Rock Island, and Carroll Counties. Chemical analyses indicate that the high-purity rock occurs in several of these counties. (Willman, 1943)

Dolomite quarries in Illinois

[Data from Krey and Lamar, 1925, and Willman, 1943]

County	*Locality*	*Formation*
Boone	Belvidere	Galena dolomite.
Carroll	Lanark	Do.
	Mount Carroll	Waukesha limestone.
	Savanna	Do.
Cook	Chicago	Racine dolomite.
	Chicago Heights	Do.
	Gary	Rock of the Niagara group.
	Hawthorne	Do.
	Hillside	Racine dolomite.
	La Grange	Do.
	McCook	Do.
	Riverside	Do.
	Thornton	Do.
Du Page	Elmhurst	Do.
	Naperville	Joliet limestone.
Jersey	Grafton	Rock of Silurian age.
Jo Daviess	Elizabeth	Galena dolomite.
	Galena Junction	Do.
	Warren	Do.
Kankakee	Kankakee	Rock of the Niagara group.
	Manteno	Racine dolomite.
Kendall	Plano	Galena dolomite.
Lee	Ashton	Decorah formation.
	Dixon	Galena dolomite.
	Palmyra	Do.
Ogle	Mount Morris	Do.
	Polo	Do.
Rock Island	Cordova	Port Byron limestone of Savage (1926).
Stephenson	Freeport	Galena dolomite.
	Ridott	Do.
	Rock City	Do.
	Winslow; 1 mile north	Platteville formation.
Whiteside	Albany	Racine dolomite.
	Fulton	Racine dolomite and Waukesha limestone.
	Morrison	Racine dolomite.
Will	Joliet	Joliet limestone.
	New Lenox	Racine dolomite.
	Romeo	Joliet limestone.
	Symerton; 3 miles east	Platteville formation.
Winnebago	Rockford	Galena dolomite.
	Rockton	(?).
	Seward	Galena dolomite.

Port Byron limestone of Savage (1926).—The Port Byron limestone, of Niagaran age, is lithologically similar to the rocks of the Racine, containing reefs of high-purity dolomite and averaging 50 to 75 feet thick. It is exposed in northern Rock Island County, where analyses show that high-grade rock is present. (Willman, 1943)

The shaded area on the map (pl. 2) represents the areal distribution of the Ordovician and Silurian carbonate rocks and, in addition, the Wapsipinicon and Cedar Valley limestones, of Devonian age. The latter formations, dolomitic in Iowa, are along the Mississippi River in Rock Island and Mercer Counties. Because of the many occurrences of dolomite in Illinois, only quarries in dolomite that are listed by Willman (1943) and not occurrences and road cuts, have been plotted on the map. Additional locations are listed in the report by Krey and Lamar (1925).

INDIANA

Dolomite and dolomitic limestone occur in the strata of Silurian and Devonian age which form the bedrock principally in the northwestern, east-central, and southeastern parts of Indiana. In the northwestern and east-central parts, where these rocks underlie extensive areas, outcrops are scarce and potential quarry sites limited because of the heavy overburden of glacial drift. Exposures are confined chiefly to the major drainage channels. In southeastern Indiana, however, where the formations are in a relatively narrow southward-trending belt and are generally not so dolomitic, overburden is thin or absent and exposures are numerous. Several formations have been described in the literature as being dolomitic; these include the Laurel and Louisville limestones, the Geneva dolomite, and the Jeffersonville limestone in the southeastern area, and parts of the Mississinewa shale, the Liston Creek formation, the Huntington dolomite and the Jeffersonville limestone (?) in the area to the north. Of these, however, as indicated by chemical analyses, only the Huntington and Geneva and the Jeffersonville appear to contain any quantity of high-grade dolomite. (Cumings and Shrock, 1928; Dawson, 1941; Deiss, 1952b; Esarey and Bieberman, 1948; Patton, 1949)

Huntington dolomite.—The Huntington dolomite, of Silurian age, is generally a massive to slabby evenly bedded yellowish, gray, or pinkish granular dolomite. Most exposures originally identified as Huntington are reefs and associated beds, some of which are now considered parts of the underlying Liston Creek formation. It has been suggested that all exposures called Huntington actually are reefs in older strata and that the Huntington is not a separate formation. Exposures of this dolomite are found in two general areas: one includes parts of Randolph, Jay, Adams, Wells, and Huntington Counties, and the second includes parts of Cass, Carroll, White, Pulaski, and Jasper Counties. Chemical analyses indicate that the dolomite is generally of good quality. The rock has been quarried in many localities in northern Indiana. (Cumings and Shrock, 1928; Patton, 1949)

Geneva dolomite.—The Geneva dolomite, of Devonian age, is predominantly a buff and chocolate-colored, calcareous, generally massive but sometimes thin-bedded dolomite. The formation ranges from a thin wedge to about 40 feet in thickness. It occurs as bedrock in a narrow belt extending from southern Rush County and Shelby County southward to the vicinity of Charlestown, Clark County, beyond which it generally is absent. Chemical analyses show that at least locally the Geneva dolomite contains rock of good quality. (Dawson, 1941; Patton, 1949)

Jeffersonville limestone.—The Jeffersonville limestone (Devonian), in its lower portion, consists of brown dolomitic limestone. The formation overlies the Geneva, and it is in the same general area, extending from eastern Bartholomew County southward to southern Clark County. One analysis of a sample from Jasper County, thought to be from the Jeffersonville limestone or its equivalent, indicates a dolomite having a high silica content. Another analysis of a sample from near Logansport, Cass County, shows a dolomite of excellent quality thought to be of Devonian (Jeffersonville?) age. (Dawson, 1941; Patton, 1949)

Dolomite quarries in Indiana

[Data from Cumings and Shrock, 1928, and Patton, 1949. Quarries marked with an asterisk (*) are listed by Patton as active]

County	*Locality*	*Formation*
Adams	Decatur	Huntington dolomite.
	*Geneva; 4.5 miles southeast	Do.
	*Linngrove; 1.5 miles northwest	Do.
	*Pleasant Mills; 3 miles southeast	Do.
Blackford	*Montpelier	Do.
Carroll	*Delphi	Do.
Cass	*Logansport; 2.5 miles east	Jeffersonville limestone(?).
Delaware	*Eaton	Huntington dolomite.
Huntington	*Huntington	Huntington dolomite and Liston Creek formation.
Jasper	*Rensselaer	Jeffersonville limestone(?).
Jay	*Portland; 1.5 miles west	Huntington dolomite.
Jefferson	*Wirt; 3 miles northwest	Geneva dolomite.
Pulaski	Franceville; 2.5 miles south	Huntington dolomite.
Randolph	Deerfield	Do.
	*Fairview; 1.5 miles southeast	Do.
	Maxville	Do.
	*Ridgeville; 0.5 mile southeast	Do.
Rush	*Millroy; 4 miles west	Geneva dolomite.
	*Moscow	Do.
Shelby	*Geneva; 1 mile west	Do.
	*Norristown	Do.
Wells	*Bluffton; 1.5 miles north	Liston Creek formation
White	*Monon; 1 mile south	Huntington dolomite.

IOWA

Several formations of Paleozoic age in Iowa are dolomites or dolomitic limestones, but little information is available regarding deposits of high-grade dolomite. The dolomites are confined geographically to the east-central and northeastern parts of the State and occur principally in the Galena dolomite and in rocks of Early Silurian age. Chemical analyses indicate that dolomite occurs at least locally also in the Oneota and Shakopee dolomites and in the Wapsipinicon and Cedar Valley limestones. Although surficial material, both windblown and glacial in origin, covers much of the area underlain by dolomite, exposures are plentiful, particularly along drainage channels. Quarrying in this area has been extensive. Because of the many quarries, only those for which chemical analyses of the rock quarried are available have been plotted on the map (pl. 2). (Beyer and Wright, 1914; Hershey, 1947; Smith, 1926; Tester, 1937)

Galena dolomite.—The Galena dolomite, of Ordovician age, may contain sizable deposits of high-grade rock. Of a total thickness of approximately 240 feet, only the lower 40 feet and the upper 100 feet are generally free of chert and relatively pure. The color of the rock varies but in general is buff or bluish. The Galena dolomite crops out along the Mississippi River and its tributaries from Jackson County northward into Alamakee and Winneshiek Counties, where it is less magnesian than to the south. Available analyses show the presence of dolomite containing more than 3 percent of impurities near Beulah, Clayton County, and Dubuque, Dubuque County. (Beyer and Wright, 1914; Smith, 1926; Tester, 1937)

Hopkinton dolomite.—The Silurian consists of two formations—the Hopkinton and Gower dolomites—and appears to offer the best possibilities as a potential source of high-grade dolomite. The Hopkinton comprises a sequence of dolomites that vary considerably in character and composition. The rock generally is light buff to yellow, thick bedded but sometimes finely laminated, hard to soft and earthy, and contains cherty zones. The Hopkinton attains its maximum thickness of about 220 feet in Dubuque and adjacent counties. It is in a rather broad belt extending from Clinton County northwestward to Fayette and Bremer Counties. Analyses show that high-grade dolomite is present in parts of Clinton, Delaware, and Jackson Counties. (Beyer and Wright, 1914; Smith, 1926; Tester, 1937)

Gower dolomite of Norton (1899).—The overlying Gower dolomite includes the LeClaire and Anamosa dolomites of Calvin (1895), which are perhaps reef and interreef facies, respectively, of the Gower. Rock of the LeClaire generally is bluish gray, grayish yellow, yellow or buff, hard, vesicular dolomite. The Anamosa is typically a thin- to medium-bedded dolomite, soft, laminated, and light buff or yellow. The total thickness of the Gower dolomite is about 80 feet. The formation is present in an area southwest of that underlain by the Hopkinton, principally in Scott, Clinton, Cedar, Jones, and Linn Counties. Analyses show the presence of high-grade dolomite in the latter three counties mentioned. (Beyer and Wright, 1914; Smith, 1926; Tester, 1937)

Wapsipinicon and Cedar Valley limestones.—The Wapsipinicon and Cedar Valley limestones, of Devonian age, range from limestone to dolomite. The basal portion of the Wapsipinicon, the Coggan member of Stainbrook (1944), is predominantly dolomite, which locally is cherty. Analyses of this member in Linn County show some excellent-quality dolomite. One analysis of the Cedar Valley limestone in Bremer County indicates dolomite with a high percentage of impurities. These formations form a belt from 25 to 75 miles in width extending from Scott and Muscatine Counties northwestward to Mitchell and Howard Counties. (Beyer and Wright, 1914; Norton, 1920; Smith, 1926; Stainbrook, 1944; Tester, 1937)

Dolomite quarries and occurrences in Iowa

County	*Locality*	*Formation*	*Reference*
Bremer	Plainfield; 3 miles north	Cedar Valley limestone	Beyer and Wright, 1914.
	Tripoli; 3.5 miles west	Hopkinton dolomite	Do.
Cedar	Cedar Valley; quarry	Gower dolomite	Do.
	quarry 6 miles west	Wapsipinicon limestone(?).	Beyer and Wright, 1914; Smith, 1926.
	Lime City; quarries	Gower dolomite	Do.
	Rock Creek; quarries	do	Beyer and Wright, 1914.
Clayton	Beulah; quarry	Galena dolomite	Smith, 1926.
Clinton	Clinton; quarry	Hopkinton dolomite	Do.
	Elwood; 2 miles east	do	Do.
Delaware	Delaware; quarry 2.5 miles west	do	Do.
	Earlville; quarry	do	Do.
	quarry 6 miles east	do	Do.
	Greeley; quarry 1.75 miles northeast.	do	Do.
Dubuque	Dubuque; quarries	Galena dolomite	Beyer and Wright, 1914.
	Eagle Point; quarry	do	Do.
	Peosta; quarry 0.75 mile northeast	Hopkinton dolomite	Smith, 1926.
Fayette	Postville; quarry 6 miles southwest.	do	Beyer and Wright, 1914; Smith, 1926.
Jackson	Maquoketa; quarries	do	Smith, 1926.
Jones	Anamosa; quarries	Gower dolomite	Beyer and Wright, 1914.
	Stone City; quarries	do	Beyer and Wright, 1914; Smith, 1926.
Linn	Bertram	Wapsipinicon limestone	Norton, 1920.
	Big Creek	do	Do.
	Indian Creek	do	Do.
	Mount Vernon; quarry	Gower dolomite	
	Springville	Wapsipinicon limestone	Do.
Scott	LeClaire; quarry	Gower dolomite	Smith, 1926.
Winneshiek	Fort Atkinson; quarry 1.5 miles northwest.	(?)	Do.

KANSAS

Deposits of dolomitic limestone in Kansas are restricted to two formations, the Stone Corral dolomite and the Day Creek dolomite, both Permian in age. Outcrops of these formations are scant, and available analyses of the rocks do not indicate that any dolomite is in the areas examined. It is doubtful that these deposits constitute a potential source of dolomite. It has been suggested that these rocks might be used in conjunction with waste oilfield brines for the extraction of magnesium or magnesium compounds. (Jewett and Schoewe, 1942; Weitz, 1942)

Stone Corral dolomite.—The Stone Corral dolomite forms a massive ledge of hard cellular gray dolomitic limestone. Below the surface the rock is a mixture of dolomite and anhydrite, but where exposed the anhydrite has been removed by the action of surface water. In some places, the cells remaining have been filled with calcite, thereby raising the calcium carbonate content of the rock. At its maximum development, in eastern Rice County, the formation attains a thickness of about 6 feet. It crops out in parts of Rice, Reno, Kingman, and Harper Counties, in south-central Kansas. (Jewett and Schoewe, 1942; Norton, 1939)

Day Creek dolomite.—The Day Creek dolomite is a single bed of fine-grained dense dolomitic limestone, locally siliceous, attaining a thickness of 2.5 feet. It is exposed near Ashland, Clark County. It is higher in impurities and lower in magnesium carbonate than rock of the Stone Corral. (Jewett and Schoewe, 1942; Norton, 1939)

Dolomitic limestone occurrences in Kansas

[Data from Jewett and Schoewe, 1942]

County	*Locality*	*Formation*
Clark	Ashland	Day Creek dolomite.
Rice	T. 20 S., R. 6 W	Stone Corral dolomite.

KENTUCKY

No extensive deposits of dolomite are known in Kentucky. Dolomitic limestones occur in certain of the Ordovician, Silurian, and Devonian formations on both the east and west sides of the Cincinnati Arch in north-central Kentucky and, locally, in rocks of Mississippian age. Formations that have been described as containing more than 30 percent of magnesium carbonate include the Oregon limestone, of Ordovician age; the Bisher formation of Foerste (1923), Laurel dolomite, Lilley dolomite of Rogers (1936) and Peebles dolomites of Foerste (1929), of Silurian age; and the Silver Creek limestone member, of Devonian age. Many other formations have been described as magnesian limestones containing less than 30 percent of magnesium carbonate. Of the formations named, probably only the Laurel limestone need be considered as a potential commercial source of dolomite. (McFarlan, 1943; Stokley, 1949; Stokley and McFarlan, 1952; Stokley and Walker, 1953)

Laurel dolomite.—The Laurel is predominantly a fine-grained light- or bluish-gray dolomitic limestone or dolomite. The thickness of the formation ranges from 35 to 45 feet. The Laurel crops out in a southward-trending belt that extends from southern Indiana through parts of

Oldham, Jefferson, Bullitt, and Nelson Counties. Chemical analyses of samples of the Laurel dolomite show that the rock contains less than 40 percent of magnesium carbonate on the average and excessive silica. The Laurel has been quarried at several localities in Jefferson County. (McFarlan, 1943; Stokley, 1949; Stokley and Walker, 1953)

Ste. Genevieve limestone.—Thin beds of dolomite occur locally in the Ste. Genevieve limestone (Mississippian), generally a good-quality limestone, in Breckenridge and Meade Counties. (Stokley and McFarlan, 1952)

The shaded area on the map (pl. 2) represents a generalization of the outcrop areas of the more important dolomitic formations of Silurian age east and west of the Cincinnati Arch, which are shown on the State geologic map. (Ky. Geol. Survey, 1954)

Dolomite and dolomitic limestone quarries and occurrences in Kentucky

County	*Locality*	*Formation*	*Reference*
Breckenridge	Webster; quarry	Ste. Genevieve limestone.	Stokley and McFarlan, 1952.
Fayette	Grimes Mill; quarry	Oregon limestone	Richardson, 1923.
Jefferson	Avoca; quarry	Laurel dolomite	Stokley, 1949.
	Fern Creek; quarry 3 miles southwest.	do	Do.
	Louisville; quarry 1.2 miles northeast.	Louisville limestone	Stokley and McFarlan, 1952.
	Middletown; quarry 3.5 miles northeast.	Laurel dolomite	Stokley and Walker, 1953.
Meade	Brandenburg; quarry 7 miles northwest.	Ste. Genevieve limestone.	Stokley and McFarlan, 1952.
Nelson	Bardstown; quarry 7 miles west	Laurel dolomite	Stokley and Walker, 1953.
Oldham	La Grange; 2 miles east	Osgood formation	Richardson, 1923.

MAINE

Dolomite deposits in Maine are limited, so far as is known, to Knox County. The deposits generally are small and occur as elongate lenses or belts of dolomite marble in the Rockland formation, of Cambrian or Ordovician age, in areas near Rockport, Thomaston, and Warren. Because of their limited extent, the deposits probably are not potentially important sources of high-grade dolomite. (Bastin, 1906; Allen, 1951)

Rockland formation.—Dolomite marble deposits occur in the Rockport limestone member of the Rockland formation southwest of Rockland. The dolomites are in lenses that crop out southeast of the main limestone belt that extends from Thomaston to a point about 1.5 miles north of Rockland. These lenses, as much as 1.5 miles in length, are from 100 to 200 feet wide, and chemical analyses of the rock from 2 quarries show high-magnesia rock moderately high in silica. The country rock is shown on the State geologic map as quartzite and slate of Cambrian and Ordovician age. (Bastin, 1906; Allen, 1951; Keith, 1933)

An important occurrence of dolomite is about 2 miles northwest of Warren, where it is in a lens similar to those in the Rockland-Thomaston area but wider and probably extending to greater depth. The dolomite is surrounded by schist, and in places it has been cut through by granite dikes. The metamorphism that accompanied the emplacement of the granite recrystallized and purified the dolomite to a greater degree than in the Rockland area, which resulted in a rock of better quality than that near Rockland. (Bastin, 1906; Keith, 1933; Trefethen, 1945)

Dolomite quarries and occurrences in Maine

County	*Locality*	*Formation*	*Reference*
Knox	Rockland area:		
	a. quarry 1 mile southwest	Rockland formation	Bastin, 1906.
	b. quarry 2 miles southwest	do	Do.
	Warren; quarry 2 miles northwest	do	Do.
	Warren Station; 2.25 miles north	do	Trefethen, 1945.

MARYLAND

The dolomite deposits of Maryland are restricted to the limestone formations of Cambrian and Ordovician age in Washington County and the Cockeysville marble, of Precambrian(?) age, in Baltimore County. Little detailed information is available regarding the size and purity of most of the deposits, although nearly pure dolomite is known to occur in some localities. (Mathews and Grasty, 1910; Weitz, 1942)

Cockeysville marble.—The Cockeysville marble is a white crystalline marble of varied grain size. The formation is about 400 feet thick, but by repeated folding it locally attains thicknesses approaching 1,000 feet. It occurs in central Baltimore County, and it has been quarried in the vicinity of Cockeysville and Texas. Chemically the rock ranges from calcitic to highly dolomitic and contains silica in quantities ranging from less than 1 to more than 5 percent, sometimes showing both extremes in the same quarry. For this reason, it seems doubtful that the formation could be used as a source of high-purity dolomite, even with selective quarrying. (Mathews and others, 1929; Weitz, 1942)

Tomstown dolomite.—The Cambrian and Ordovician formations include the Tomstown dolomite, the Waynesboro formation, and the Elbrook and Conococheague limestones, all of Cambrian age, and the Beekmantown and Stones River groups, of Ordovician age. These formations, together with the overlying Martinsburg shale, crop out across Washington County in a broad northeastward-trending belt the width of which extends from the vicinity of Harpers Ferry, W. Va., on the southeast to McCoys, Md., on the northwest. Each of these formations is more or less dolomitic in part, but chemical analyses indicate that the Tomstown is probably the most promising potential source of high-grade dolomite. The Tomstown is a massive drab dolomitic limestone, generally high in magnesium carbonate and cherty near the top. Certain beds, however, approach pure dolomite in composition and contain less than 1 percent of silica. The Tomstown is about 1,000 feet thick, and it occupies a belt about 1.5 miles wide in the eastern part of Washington County. (Mathews and Grasty, 1910; Weitz, 1942)

Dolomite quarries and occurrences in Maryland

County	*Locality*	*Formation*	*Reference*
Baltimore	Cockeysville; quarries	Cockeysville marble	Weitz, 1942; Mathews and others, 1929.
	Loch Raven	do	Weitz, 1942.
	Summerfield	do	Do.
	Texas; quarries	do	Weitz, 1942; Mathews and others, 1929.
Washington	Cavetown; quarry	Tomstown dolomite	Mathews and Grasty, 1910.
	Eakles Mill; quarry	do	Do.
	Hagerstown Valley	do	Do.

MASSACHUSETTS

Deposits of dolomite in Massachusetts are confined chiefly to the Stockbridge limestone, of Cambrian and Ordovician age. This formation, which occurs in a belt of discontinuous outcrops in western Berkshire County, is the extension of the Stockbridge limestone belt of western Connecticut. Because of the heavy cover of glacial drift over much of the area, the interbedding of limestone and dolomite facies, and the irregular distribution of impurities, it is not possible to obtain detailed information regarding the extent of high-purity deposits. (Dale, 1923; Weitz, 1942)

Stockbridge limestone.—The Stockbridge limestone ranges from a gray mottled limestone to a white highly crystalline marble, which at some places is very coarse grained. Chemically the rock varies from nearly pure calcite to dolomite, the dolomitic phase predominating, and generally has an abundance of secondary minerals. The formation may be divided into two, perhaps three, members: a lower member comprising dolomite marble 500 to 800 feet thick, an upper member principally of calcite marble 200 to 400 feet thick, and, at least locally, a middle member composed of quartzite. (Apfel, 1944; Dale, 1923; Emerson, 1917)

Recent studies of the area around Lee, where quarrying of rock from the Stockbridge has been extensive, have shown that the faulting and complex folding in the formation make difficult the tracing of favorable beds over more than short distances. Some of the examined quarry areas contain high-grade dolomite in rather large quantities, but chemical analyses do not show the amount of potassium that the reportedly abundant mica would furnish. Excessive quantities of the alkali metals would preclude the use of the dolomite in the production of magnesium by the ferrosilicon reduction process. (Apfel, 1944)

Other formations.—At places in southern and eastern Worcester County and in central Middlesex County, thin limestone beds, generally coarsely marbleized, occur interbedded with mica gneiss. Most of these limestones contain many secondary minerals and probably contain no high-purity dolomite in commercial quantities. One analyses of white marble from Webster shows dolomite containing less than 2 percent of impurities. (Emerson, 1917)

Dolomite quarries and occurrences in Massachusetts

County	Locality	Formation	Reference
Berkshire	Adams area:		
	a. 0.5 mile west	Stockbridge limestone	Dale, 1923.
	b. 0.5 mile north	do	Do.
	c. 1.5 miles north	do	Do.
	Lee area:		
	a. quarries 0.5 mile south	do	Apfel, 1944.
	b. quarries 1 mile south	do	Do.
	c. quarry 0.45 mile west-southwest of "b".	do	Do.
	d. 0.7 mile south of "c"	do	Do.
	South Egremont; 0.5 mile northeast.	do	Dale, 1923.
	Stockbridge; 1 mile north at Rattlesnake Hill.	do	Do.
	West Stockbridge; 2 miles south	do	Do.
Worcester	Webster; quarries	Bolton gneiss (as used by Emerson, 1917).	Emerson, 1917.

MICHIGAN

Practically unlimited supplies of high-purity dolomite occur in Michigan, principally in the Niagaran series (Silurian) of limestones and dolomites of the northern peninsula. The reserves of dolomite probably are measurable in billions of tons. Dolomites occur also in rocks of Precambrian, Ordovician, and Devonian ages. In addition to the deposits of the northern peninsula, chiefly in the southeastern part, dolomite is found also in the extreme northwestern and southeastern parts of the southern peninsula. Much of the high-purity dolomite of the State is accessible to roads, railroads, and harbors, and in many places the usually heavy overburden of glacial drift is thin or absent. (Smith, 1916; Weitz, 1942)

Lower Huronian group.—The Lower Huronian group (Precambrian), present in the iron-bearing districts of the northern peninsula, contains dolomitic limestones that sometimes approach the composition of true dolomite. The formations generally are interbedded with quartzite and and slate and contain chert and other impurities. Thick pure dolomite beds are reported to occur locally. Because of the large amounts of high-grade dolomite in other formations, these rocks are not important as a source of high-grade dolomite. Their areal extent is not shown on the map (pl. 2). (Martin, 1936; Smith, 1916)

Hermansville limestone.—Dolomite occurs locally in the Hermansville limestone, of Late Cambrian and Early Ordovician age. The Hermansville is composed of white dolomite that is generally sandy and white sandstone, and gradations between the two. Because of its sandy nature, the Hermansville probably is not a potential source of high-grade dolomite and therefore it is not shown on the map (pl. 2). It occurs in Menominee, Marquette, Alger, Schoolcraft, Luce, and Chippewa Counties. (Martin, 1936; Smith, 1916)

Black River-Trenton rocks.—The Black River-Trenton sequence, of Middle Ordovician age, is composed of a series of limestones, ranging from low- to high-magnesian, variably colored, and generally argillaceous. The thickness varies from about 250 feet in the vicinity of Green Bay to 100 feet or less along the St. Marys River. The broad belt occupied by these formations is represented on the map (pl. 2) by the shaded area that extends along the west side of Green Bay and Little Bay de Noc, through central Menominee County and parts of Delta, Schoolcraft, Luce, and Chippewa Counties to the St. Marys River. Analyses do not confirm the presence of high-purity dolomite, although in Wisconsin this sequence is the source of some dolomite. (Martin, 1936; Smith, 1916; Steidtmann, 1924)

Manistique and Engadine formation of Smith (1916).—The Niagara group consists of the Mayville formation, the Burnt Bluff formation as used by Ver Wiebe (1928), the Manistique series of Smith (1916), and the Engadine formation of Smith (1916). These formations range from high-calcium limestone to very high-purity dolomite. The important dolomite formations are the Manistique and Engadine. The Manistique comprises a thick succession of dolomite and magnesian limestone, ranging from 150 to 275 feet, and varying widely in color and degree of bedding. Some of the beds contain cherty bands and nodules. The Engadine is a hard bluish crystalline dolomite, about 55 feet thick, and nearly free from impurities. The extremely massive beds are uniformly high-purity dolomite both vertically and laterally. This is the most important potential source of high-purity dolomite in the State. The dolomites of Niagaran age are in the northern peninsula in a belt along the north shores of Lakes Michigan and Huron, extending from Big Bay de Noc, Delta County, through Schoolcraft County, southern Chippewa County, and Mackinac County to the easternmost point of Drummond Island in Lake Huron. Analyses show that high-purity dolomite is present in many localities in the northern peninsula. (Martin, 1936; Smith, 1916; Weitz, 1942)

Bass Island dolomite.—The overlying Bass Island dolomite, of Silurian age, consists of four members: the Greenfield dolomite member, the Tymochtee shale, the Put-in-Bay dolomite member, and Raisin River dolomite member. These members generally are too impure to be used as a source of high-grade dolomite, although high-grade deposits occur locally. The Bass Island is absent in the northern peninsula. The

Raisin River member is exposed in Monroe County, southeastern Michigan. (Landes, 1951; Martin, 1936; Smith, 1916)

Detroit River group.—The Detroit River group, of Middle Devonian age, consists of two formations—the Amherstberg and Lucas—which are magnesian limestone or dolomite, gray to brown, and generally moderately impure. This group occurs in parts of Wayne and Monroe Counties; it is exposed along the Detroit River and in several localities in western Monroe County. (Landes, 1951; Martin, 1936; Smith, 1916)

Traverse group.—The Traverse group, of Devonian age, generally is high-calcium limestone. In the area around Little Traverse Bay in Emmet and Charlevoix Counties, however, it contains a 40-foot layer of almost completely dolomitized rock, analyses of which indicate some high-grade dolomite. The areal extent of the Traverse group is represented on the map (pl. 2) in the northwestern part of the southern peninsula. (Martin, 1936; Smith, 1916)

Dolomite quarries and occurrences in Michigan

County	Locality	Formation	Reference
Alger	Munising	Hermansville limestone	Smith, 1916.
Arenac	Umstead; quarry	(?)	Do.
Charlevoix	Norwood; 1 mile north	Traverse group	Do.
Chippewa	Detour area; quarries	Engadine formation of Smith (1916).	Do.
	Drummond Island; quarries mainly in south and west parts:	do	Do.
	Goetzville:	do	
	a. 3 miles southeast	do	
	b. 5 miles west	do	
	Lime Island; quarry	Mayville formation or Burnt Bluff formation as used by Ver Wiebe (1928).	Do.
	Ozark; 2 miles north	Engadine formation of Smith (1916).	
	Pickford; 5 miles south	do	
	Trout Lake; 4 miles east	do	Do.
	West Neebish Rapids on St. Marys River.	Hermansville limestone	Do.
Delta	Burnt Bluff; sec. 24, T. 38 N., R. 19 W.	(?)	Do.
Emmet	Petosky; quarry	Traverse group	Do.
Gogebic	Ross; northwest	Bad River dolomite	Do.
Jackson	Jackson; southwest	Rock of Mississippian age.	Do.
Mackinac	Caffey	Engadine formation of Smith (1916).	
	Cedarville area:		
	a. 1.5 miles east	do	
	b. 3 miles east	do	
	c. 4.5 miles northeast	do	
	d. 5 miles northeast	do	
	Charles area:		
	a. 1 mile north	Rock of Upper Monroe age of Smith (1916).	Do.
	b. 6.5 miles north	Engadine formation of Smith (1916).	

County	*Locality*	*Formation*	*Reference*
Mackinac—Con.	Cordell area:		
	a. 3.5 miles southeast	Engadine formation of Smith (1916).	
	b. 5 miles southeast	do	
	c. 5 miles south	do	
	Corinne; 5.5 miles east	do	
	East Lake; 3 miles south	do	
	Engadine area:		
	a. 1 mile west	do	Smith, 1916.
	b. 2 miles west	do	
	Garnet area:		
	a. 1 mile northwest	do	
	b. 1 mile south	do	
	Hendricks Quarry; quarry	Burnt Bluff formation as used by Ver Wiebe (1928).	Do.
	Hessel	Engadine formation of Smith (1916).	
	a. 2 miles northwest	do	
	Kenneth	do	Do.
	a. 1 mile south	do	
	b. 2 miles east	do	
	c. 3 miles southwest	do	
	Mackinac Island; east side	Rock of Upper Monroe age of Smith (1916).	Do.
	Ozark; quarry	Engadine formation of Smith (1916).	Do.
	a. 1 mile south	do	
	Pike Lake area:		
	a. 5 miles southeast	do	
	b. 6 miles southeast	do	
	c. 6 miles east	do	
	Secs. 9 and 28, T. 43 N., R. 2 W.	do	
	Secs. 2, 7, and 10, T. 42 N., R. 2 W.	do	
Menominee	Menominee; quarry 2 miles north	Trenton limestone	Do.
Monroe	Carleton	Rock of Upper Monroe age of Smith (1916).	Do.
	Lulu; quarry	Detroit River group	Do.
	Monroe; quarries	Raisin River dolomite member.	Do.
	a. quarry 2 miles north	do	Do.
	Raisinville; quarries	Detroit River group	Do.
	Scofield; quarry	do	Do.
Schoolcraft	Blaney Jct.; quarry 2.5 miles north	Mayville formation	Do.
	Cooks	Burnt Bluff formation as used by Ver Wiebe (1928).	Do.
	Manistique; quarry	Manistique series of Smith (1916).	Do.
	a. quarry 6 miles northeast	do	Do.
	b. 11 miles northeast	Burnt Bluff formation as used by Ver Wiebe (1928).	Do.
Wayne	Gibralter; quarry	Detroit River group	Do.

MINNESOTA

Dolomites and dolomitic limestones are restricted to southeastern Minnesota. Although the rock in many of the deposits contains enough magnesium carbonate to allow it to be classified as dolomite, in most places the high silica content makes it unsuitable as a commercial source of high-purity dolomite. Dolomite and dolomitic limestone are found in the St. Lawrence formation, the Oneota and Shakopee dolomites, the

Platteville and Galena formations, and the Cedar Valley limestone. In the eastern part of the area of occurrence (pl. 2), principally in Winona and Houston Counties and in eastern Fillmore County, the overburden of glacial drift is negligible or absent, but it thickens to the west where outcrops generally are restricted to drainage cuts. (Stauffer and Thiel, 1933; Stauffer and Thiel, 1941; Weitz, 1942)

Oneota and Shakopee dolomites.—The Oneota and Shakopee dolomites, of Early Ordovician (Beekmantown) age, probably are the most important sources of high-purity dolomite. The Oneota is primarily a thick-bedded, drab to buff and in places pink dolomite, sometimes sandy or shaly, and commonly cherty, especially in the upper part. The thickness varies from 45 to more than 150 feet. The Shakopee, overlying the Oneota and separated from it by the Root Valley sandstone of Stauffer and Thiel (1941), is less dolomitic, much of the rock being a drab massive dolomitic limestone. Locally it closely resembles the Oneota and crops out over much the same area. The average thickness is less than 60 feet. These formations form a northeastward-trending belt extending from southeast of Mankato, Blue Earth County, through parts of Nicollet, Le Sueur, Sibley, Scott, Carver, Hennepin, Ramsey, Washington, and Dakota Counties. They are present also to the east in parts of Goodhue, Wabasha, Olmsted, Winona, Fillmore, and Houston Counties. Chemical analyses show that, although many samples contain excessive silica, high-purity dolomite occurs at least in Fillmore, Goodhue, and Scott Counties. (Stauffer and Thiel, 1933; Stauffer and Thiel, 1941)

Platteville formation and Galena dolomite.—Certain beds in both the Platteville and Galena formations, of Ordovician age, are dolomitic limestones. The McGregor (middle) member of the Platteville contains 8 to 10 feet of thin-bedded gray to bluish-gray brittle dolomitic limestone having a high impurity content. The Stewartville (upper) member of the Galena formation is a mottled gray to yellow or tan, thick-bedded dolomitic limestone, usually about 50 feet thick. These formations occur in parts of Faribault, Waseca, Rice, Goodhue, Dodge, Olmsted, and Fillmore Counties. Neither appears to offer any possibilities as a potential source of high-grade rock. Their areal distribution has been represented on the map (pl. 2) to show their extension from northeastern Iowa. (Stauffer and Thiel, 1933; Stauffer and Thiel, 1941)

Cedar Valley limestone.—The Cedar Valley limestone, of Devonian age, is extremely variable lithologically. The rock ranges from high calcium to high magnesium; it is hard to soft and earthy and usually heavy bedded. The total thickness in Minnesota is about 130 feet. It occurs in parts of Fillmore, Mower, Freeborn, and Faribault Counties. Chemical analyses of samples from Fillmore and Mower Counties show the presence of some high-purity dolomite. (Stauffer and Thiel, 1933; Stauffer and Thiel, 1941)

Dolomite quarries and occurrences in Minnesota

County	Locality	Formation	Reference
Blue Earth	Mankato; quarries	Oneota and Shakopee dolomites.	Stauffer and Thiel, 1933; Stauffer, 1950.
Dakota	Hastings; quarry 4 miles down-river	do	Do.
Fillmore	Choice; quarry 0.5 mile south	Oneota dolomite	Stauffer and Thiel, 1933.
	Etna; quarry	Cedar Valley limestone	Stauffer, 1950.
	Lanesboro; quarry	Oneota and Shakopee dolomites.	Stauffer and Thiel. 1933; Stauffer, 1950,
	Rushford; quarry	Oneota dolomite	Stauffer and Thiel, 1933.
	a. quarry 2.5 miles north	do	Stauffer, 1950.
	Spring Valley; quarry	Cedar Valley limestone	Stauffer and Thiel, 1933; Stauffer, 1950.
	Tawney; 1.5 miles south	Shakopee dolomite	Stauffer and Thiel, 1933.
Goodhue	Cannon Falls; quarry	do	Stauffer and Thiel, 1933; Stauffer, 1950.
	Frontenac; quarries	Oneota dolomite	Do.
	Red Wing; quarries	do	Stauffer, 1950.
Houston	Egbert	do	Do.
	La Crescent; quarry 1.5 miles northwest.	do	Do.
	Spring Grove; quarry	Shakopee dolomite	Do.
Le Sueur	Kasota; quarries	Oneota dolomite	Stauffer and Thiel. 1933; Stauffer, 1950.
	Ottawa; quarry	do	Stauffer and Thiel, 1933.
Mower	Lyle; quarry 3 miles west	Cedar Valley limestone	Stauffer, 1950.
	Racine; 2.5 miles south	do	Stauffer and Thiel, 1933.
Nicollet	Judson; across river	St. Lawrence formation.	Do.
	North Mankato; quarry	Oneota dolomite	Stauffer, 1950.
Olmsted	Oronoco	Shakopee dolomite	Do.
Scott	Merriam Junction; quarry	Oneota dolomite	Stauffer and Thiel, 1933; Stauffer, 1950.
	St. Lawrence; quarries	St. Lawrence formation.	Stauffer and Thiel, 1933.
	Shakopee; quarries	Oneota and Shakopee dolomites.	Do.
Wabasha	Lake City; 4 miles south	Oneota dolomite	Stauffer, 1950.
	Wabasha; 2 miles southeast	do	Do.
	Zumbro Falls	Oneota and Shakopee dolomites.	Do.
	a. quarry 4.5 miles east	Oneota dolomite	Do.
Washington	Gray Cloud Island	do	Stauffer and Thiel, 1933.
	Stillwater; quarry	do	Stauffer, 1950.
Winona	Dresbach; quarry	do	Do.
	Elba; quarry 4 miles southeast	do	Do.
	Winona; quarries	do	Stauffer and Thiel, 1933; Stauffer, 1950.

MISSOURI

Dolomites and dolomitic limestones underlie large areas in central and southeastern Missouri. From the few chemical analyses given in the literature, it seems probable that sizable reserves of dolomite are available in the region. Much of the dolomite in the thick sequence of Cambrian and Ordovician rocks is, however, known to be too cherty or otherwise unsuitable as a source of high-grade rock. The more important dolomite formations, as indicated by chemical analyses, are the Bonneterre and Eminence dolomites and, perhaps, parts of the Potosi and Gasconade dolomites. Dolomite and dolomitic limestone containing some impurities occur at least locally also in the Derby and Doe Run dolomites, of Cambrian age, and in the Van Buren formation, Jefferson City (Cullison's (1944) Rich Fountain and Theodosia formations), Cotter, Powell, and Joachim dolomites, of Ordovician age.

Bonneterre dolomite.—The Bonneterre dolomite (Cambrian), oldest of the dolomite formations, is generally a massive gray to buff crystalline dolomite, essentially chert free, but containing varying amounts of silica in the form of sand or in clay, glauconite, and other silicates. The formation underlies the greater part of the Ozark uplift, but outcrops are confined principally to the vicinity of the St. Francois Mountains in Washington, St. Francois, Ste. Genevieve, Iron, and Madison Counties. Chemical analyses of samples from Washington County indicate a fairly high grade dolomite containing about 2.5 percent or less of silica. Analyses from Madison County, representative of a 150-foot zone in the vicinity of Fredericktown, show a high-grade rock with a lower silica content. Sizable reserves probably are in the Fredericktown area. (Bridge, 1930; Dake, 1930; McQueen, 1943; Mo. Geol. Survey, 1939)

Potosi dolomite.—The Potosi dolomite, of Cambrian age, is characteristically a massive fine- to medium-crystalline light to dark chocolate-brown dolomite or dolomitic limestone. It generally contains abundant quartz and chalcedony druses, and its thickness varies from a thin wedge up to about 400 feet. The formation forms the bedrock over large areas in and around the St. Francois Mountains. Analyses of the Potosi dolomite from Washington County show that it is a high-purity dolomite at least locally, but the general abundance of quartz and chalcedony throughout much of the formation probably precludes its use as a source of high-grade rock in most areas. (Bridge, 1930; Dake, 1930; Mo. Geol. Survey, 1939)

Eminence dolomite.—The Eminence dolomite, of Cambrian age, is essentially a massively bedded gray moderately crystalline dolomite or dolomitic limestone. The formation averages about 300 feet thick and is divided into a lower cherty member and an upper noncherty member (Josiah Bridge, 1952, oral communication). The upper noncherty zone is still officially designated the Proctor dolomite by the U. S. Geological Survey. The Eminence crops out mainly in the valleys of each of the drainage systems radiating from the St. Francois Mountains. It appears in St. Francois, Ste. Genevieve, Madison, Iron, Wayne, Carter, Shannon, Reynolds, Washington, Crawford, and Franklin Counties. It underlies most of the Ozark region and appears at the surface again to the west in Morgan and Camden Counties. Analyses from Shannon, Washington, Camden, and Morgan Counties show the presence of high-purity dolomite through at least the upper 30 feet of the noncherty zone (Proctor). It seems probable that large reserves of high-grade rock are available. (Bridge, 1930; Dake, 1930; Mo. Geol. Survey, 1939; Weitz, 1942)

Gasconade dolomite.—The Gasconade dolomite, of Ordovician age, is essentially a well-bedded light-gray medium- to coarse-crystalline very

Dolomite quarries and occurrences in Missouri

County	Locality	Formation	Reference
Benton	Warsaw; quarry 1.5 miles north	Jefferson City dolomite	Buehler, 1907.
Bollinger	Lutesville; quarries	do	Buckley and Buehler, 1904.
Camden	Camdenton	Eminence dolomite	Weitz, 1942.
Cole	Elston; quarries 2.5 miles west	Jefferson City dolomite	Buckley and Buehler, 1904.
	Jefferson City; quarries	do	Do.
Douglas	Ava; quarry 0.5 mile east	Rock of Cambrian age	Buehler, 1907.
Franklin	Union; quarry 1 mile east	Jefferson City dolomite	Buckley and Buehler, 1904.
Greene	Ash Grove; quarry	Burlington limestone	Buehler, 1907.
Jefferson	DeSoto; quarry	Jefferson City dolomite	Buehler, 1907; Buckley and Buehler, 1904.
	Hematite; quarry 0.25 mile south	do	Buckley and Buehler, 1904.
Madison	Fredericktown; quarry	Bonneterre dolomite	Buckley and Buehler, 1904; McQueen, 1943.
Miller	Eldon; quarry 3 miles east	Jefferson City dolomite	Buckley and Buehler, 1904.
Morgan	Proctor	Eminence dolomite(?)	Weitz, 1942.
Osage	Koeltztown; quarry 0.75 mile east	Jefferson City dolomite	Buckley and Buehler, 1904.
Phelps	Rolla; quarries	do	Do.
Polk	Bolivar; quarries	do	Do.
Shannon	Eminence	Eminence dolomite	Bridge, 1930.
	a. 3 miles north	Van Buren formation	Do.
	b. 4 miles southeast	Eminence dolomite	Do.
	Round Spring	Eminence and Gasconade dolomites.	Do.
St. Francois	Bonneterre; quarry	Bonneterre dolomite	Mo. Geol. Survey, 1944.
	Desloge; quarry 2 miles north	do	Buehler, 1907.
	Farmington; quarries	do	Buckley and Buehler, 1904.
St. Louis	Glencoe	Joachim dolomite	Hinchey and others, 1947.
Washington	Caledonia area:		
	a. 2 miles south	Bonneterre dolomite	Dake, 1930.
	b. 3 miles west	Derby dolomite	Do.
	Irondale area:		
	a. south	Bonneterre dolomite	Do.
	b. 6 miles southwest	do	Do.
	Potosi; 7 miles northwest	Potosi dolomite	Do.
	Shirley	Gasconade dolomite	Do.
	a. 4 miles north	Potosi dolomite	Do.
	b. 5 miles north	Eminence dolomite	Do.
	c. 2 miles east	Van Buren formation	Do.
Wayne	Patterson; quarry	Eminence dolomite(?)	Mo. Geol. Survey, 1944.
	Piedmont; quarry	Eminence dolomite	Do.

cherty dolomite. The Gasconade is present over much of the Ozark region, although its outcrops are confined principally to stream channels where the rock sometimes forms large cliffs. Analyses from Shannon and Washington Counties show a dolomite moderately high in impurities. (Bridge, 1930; Dake, 1930; Mo. Geol. Survey, 1939)

Other formations.—The other Cambrian and Ordovician formations mentioned contain dolomite locally, much of it with excessive impurities, and in all probability none of these would contain large deposits of uniformly pure dolomite. The shaded portion on the map (pl. 2) shows the general distribution of all the formations named, except that of the Joachim dolomite, in the eastern part of the State. (Bridge, 1930; Buckley and Buehler, 1904; Buehler, 1907; Dake, 1930; Hinchey and others, 1947; Mo. Geol. Survey, 1939)

MONTANA

Dolomite and dolomitic limestone occur principally in the Upper Cambrian rocks, extensively exposed in western and southwestern Montana, and in certain of the Ordovician rocks in the Bighorn and Little Rocky Mountains. The more important dolomitic formations include the Hasmark formation, the Pilgrim limestone, the Bighorn dolomite, and the Jefferson formation. Of these formations, the Hasmark probably is the most important as a potential source of high-grade dolomite, although each of the other formations mentioned may contain local deposits of high-grade rock. Other formations, of doubtful value because of the limited extent of the dolomite, the impurity content, or relative inaccessibility, include certain of the Precambrian limestones, the Devils Glen dolomite, of Cambrian age, and the Hannan limestone, of Mississippian age.

Hasmark formation.—The Hasmark formation, of Late Cambrian age, contains probably the most promising dolomite deposits in the State. The general sequence of the Hasmark consists of a lower unit of interbedded limestone and dolomite, a middle unit of calcareous shale, and an upper unit of dolomite and dolomitic limestone. The formation has been studied in the Phillipsburg quadrangle in parts of Powell, Deer Lodge, and Granite Counties, and it is considered to be the approximate equivalent of the Pilgrim limestone. A series of exposures along the highway 7 to 13 miles west of Anaconda total 350 feet in thickness; this series may contain several million tons of readily accessible dolomite. Similar deposits may be present elsewhere in the Phillipsburg quadrangle. Southwest of Helena, Lewis and Clark County, a coarsely crystalline marbleized dolomite (Pilgrim? or Hasmark?), ranging in thickness from 360 to 450 feet, also contains a large tonnage of high-purity rock. Dolomite has been quarried in this area as a source of lime. (Emmons and Calkins, 1913; Perry, 1949)

Pilgrim limestone.—The Pilgrim limestone contains a middle member consisting of dolomitic limestone and dolomite interbedded with purer limestones. The formation crops out in south-central Montana, and it has been examined in the vicinity of Three Forks, western Gallatin County, and south of Livingston, central Park County. These rocks are more dolomitic in the Livingston area. Although no analyses are available, the dolomites probably are too impure to be useful as a source of high-grade material. (Deiss, 1936)

Bighorn dolomite.—The Bighorn dolomite, of Ordovician age, consists generally of light-colored massive rough-weathering dolomite, interbedded with pale-gray and buff, mottled dolomite. Its thickness ranges from about 100 to nearly 300 feet. The Bighorn crops out in the Little Rocky Mountains to the north, in the Pryor Mountains, and along the flanks of the Absaroka Range and Beartooth Mountains in the south-central part of the State. No chemical analyses are available, but the dolomite may be moderately siliceous. The Bighorn in Montana, because of its impurity content or its unfavorable locations, probably is not as promising a source of rock as it is in Wyoming. (Blackwelder, 1913)

Jefferson formation.—The Jefferson formation, of Devonian age, contains thick beds of dolomitic limestone and dolomite usually too arenaceous or argillaceous to be considered as a source of high-grade dolomite. The dolomites are exposed in the Lewis and Clark and Sawtooth Ranges of northwestern Montana and near Logan, Three Forks, and in the Bridger Range of south-central Montana. The Jefferson also may contain dolomite beds in the central part of the State. No representative analyses are available. (Deiss, 1933; 1943)

The shaded areas shown on the map (pl. 2) represent the general areal extent of the "dolomite, or dolomite and limestone undivided" as taken from Knechtel's map. (Knechtel and others, 1948)

Dolomite occurrences in Montana

County	Locality	Formation
Carbon	Red Lodge; south and southwest	Bighorn dolomite.
Deer Lodge	Anaconda; 7.5 miles west	Hasmark formation.
	Foster Gulch; mouth of	Do.
	Silver Lake; 0.25 mile east	Do.
Gallatin	Logan; north	Pilgrim limestone and Jefferson formation.
	Manhattan; 8 miles north	Do.
Lewis and Clark	Helena area:	
	a. south at Grizzly Gulch	Hasmark formation.
	b. 6 miles west at Colorado Gulch	Do.
	c. 6 miles west at Nelson Gulch	Do.
Park	Livingston; 5 miles south in Yellowstone Canyon.	Pilgrim limestone, Bighorn dolomite, and Jefferson formation.

NEVADA

Dolomites and dolomitic limestones, ranging in age from Cambrian to Tertiary, occur at several localities in Nevada. However, because the reports in which the rocks are described do not include many chemical analyses, little is known of their extent and uniformity of chemical composition. The dolomites of economic importance occur in the Monte Cristo dolomite in Clark County where, in the Sloan area, both dolomite and limestone are produced commercially. Dolomites of good quality are found also in the Goodsprings dolomite, the Luning formation, and the Horse Spring formation. Other formations, analyses of which indicate a relatively high percentage of impurities or for which no analyses are available, include the Highland Peak and Mendha limestones and the Ely Springs and Silverhorn dolomites of the Pioche district of Lincoln County, and the Sultan limestone, Muddy Peak limestone, and Bird Spring formation of Clark County. (Callaghan and Vitaliano, 1948; Deiss, 1952a; Hewett, 1931; Longwell, 1928; Muller and Ferguson, 1939; Roberts, 1943; Spurr, 1906; Westgate and Knopf, 1932)

Goodsprings dolomite.—The Goodsprings dolomite, containing beds ranging in age from Late Cambrian to Devonian(?), is composed principally of light- and dark-gray mottled thin-bedded dolomite and magnesian limestone. The formation attains a maximum thickness of approximately 2,450 feet. It is widely distributed throughout the Goodsprings quadrangle, in southwestern Clark County, extending in a broad belt along the west side of the Spring Mountains. Chemical analyses indicate that dolomite of excellent quality occurs at least locally in the formation. (Hewett, 1931)

Monte Cristo dolomite.—The Monte Cristo dolomite, of Mississippian age, comprises a series of limestones and dolomites. It has been divided into five members in the Goodsprings quadrangle; three of these members have been recognized in the Sloan area. Of these units, which include the Dawn and Anchor limestone members, the Bullion dolomite member, and the Arrowhead and Yellowpine limestone members, only the Bullion, because of its thickness, uniformity of composition, and accessibility, particularly at Sloan, is a potentially important source of high-grade dolomite. In the Sloan area the Bullion member is a thick (445 feet) dolomite, the lower 350 feet of which is pale gray, cream gray, and white, coarse crystalline, thick bedded, massive, and essentially chert free. The upper 100 feet contains more silica and limestone, and it is thought to be equivalent to the Arrowhead and Yellowpine members. Chemical analyses show that dolomite is in all the members, although many of the samples represent relatively pure areas in otherwise cherty zones and are not representative of the member as a whole. The Bullion member reportedly contains many millions of tons of readily accessible high-grade dolomite in the Sloan area. Both limestone and dolomite are produced commercially at Sloan. (Deiss, 1952a; Hewett, 1931)

Luning formation.—Dolomite of the Luning formation (Triassic) occurs in association with brucite and magnesite in the Paradise Range near

Gabbs, Nye County. In this area the uppermost of the three members of the formation is a dark-gray to black fine-grained dense dolomite, containing minor amounts of tremolite and talc. Chemical analyses of the recrystallized dolomite in this member show that some of the rock is of excellent quality. Only magnesite and brucite have been produced commercially from the area, and during World War II magnesite from these deposits supplied raw material for the magnesium plant near Las Vegas. (Callaghan and Vitaliano, 1948; Muller and Ferguson, 1939)

Horse Spring formation.—The Horse Spring formation, of Tertiary(?) age, comprises a thick, varied succession of limestone, dolomite, sandstone, clay, magnesite, and gypsum. The formation occurs in the ranges in southeastern Clark County. Pale-gray finely crystalline thick-bedded dolomite and dolomitic limestone, containing considerable iron stain and some chert nodules, form an isolated hill in the vicinity of Glendale. One chemical analysis shows that part of the rock is a good-quality dolomite, but the composition of the rock probably is not consistent throughout the deposit. (Longwell, 1928)

Dolomite quarries and occurrences in Nevada

County	*Locality*	*Formation*	*Reference*
Clark	Apex area:		
	a. quarry 1.5 miles north	Monte Cristo dolomite	
	b. 1.5 miles southwest	do	
	Glendale; 2.5 miles southeast	Horse Spring formation.	
	Goodsprings quadrangle	Goodsprings dolomite, Monte Cristo dolomite, and Bird Spring formation.	Hewett, 1931.
	Jean; east	Monte Cristo dolomite	
	Las Vegas; 10 miles east	do	
	Sloan; quarry	Monte Cristo dolomite and Sultan limestone.	Deiss, 1952a.
Esmeralda	Silver Peak district; northwest part of T. 2 S., R. 39 E.	Rocks of Cambrian age	Spurr, 1906.
Eureka	Eureka district	(?)	Weitz, 1942.
Lincoln	Pioche district	Highland Peak and Mendha limestones, Ely Springs and Silverhorn dolomites.	Weitz, 1942; Westgate and Knopf, 1932.
Nye	Gabbs	Luning formation	Callaghan and Vitaliano, 1948; Callaghan, 1933.
Pershing	Rose Creek	Rock of Triassic age	Roberts, 1943.

NEW JERSEY

Dolomite occurs locally in two formations in northwestern New Jersey: the Franklin limestone, of Precambrian age, and the Kittatinny limestone, of Cambrian and Ordovician age. Although high-grade deposits have been reported from several localities, commercial deposits are not known to be present. (Weitz, 1942)

Franklin limestone.—The Franklin limestone is predominantly a coarse white marble, usually high in calcite and silica, but in some places dolomitic. The dolomites probably are too local and irregular in distribution to be considered a potential source of high-grade rock. The Franklin crops out in an interrupted belt trending northeastward through Warren and Sussex Counties. Small isolated occurrences are found also in Morris and Passaic Counties. Some dolomite of excellent quality occurs at Franklin Furnace, as shown by chemical analyses of samples from the area. (Kummel and Gage, 1906; Lewis and Kummel, 1912; Weitz, 1942)

Kittatinny limestone.—The Kittatinny limestone consists primarily of massive blue-gray magnesian limestone, sometimes cherty, and scattered thin beds of shale and sandstone. Dolomite occurs in the upper portion of the formation, the total thickness of which is 2,500 to 3,000 feet. The Kittatinny crops out in several belts that trend northeastward through Warren and Sussex Counties and in small areas in Hunterdon, Morris, and Passaic Counties. Although many chemical analyses show a high magnesium carbonate content, the impurity content usually is moderately high. (Lewis and Kummel, 1912; Weitz, 1942)

Dolomite occurrences in New Jersey

County	*Locality*	*Formation*	*Reference*
Hunterdon	Vernoy	Kittatinny limestone	Lewis and Kummel, 1912; Weitz, 1942.
Morris	Montville	(?)	Do.
Passaic	Macopin	(?)	Do.
	West Milford	Kittatinny limestone	Do.
Sussex	Franklin Furnace; quarry	Franklin limestone	Kummel and Gage, 1906.
	Hamburg	Kittatinny limestone(?)	Do.
	Newton	do	Lewis and Kummel, 1912; Weitz, 1942.
	Ogdensburg	Franklin and Kittatinny limestones.	Do.
	Vernon Township	Kittatinny limestone	Do.
	Wantage Township	do	Do.
Warren	Belvidere	do	Do.
	Bushkill	do	Do.
	Columbia	do	Do.
	New Hampton	do	Do.
	Phillipsburg	do	Do.

NEW MEXICO

High-magnesian limestones are reported to be widespread in central and southern New Mexico. It is not known if commercial deposits of high-purity dolomite occur, although chemical analyses indicate that such rock might possibly be found in some localities. The formations containing beds of dolomite or dolomitic limestone include the El Paso, Montoya, and Fusselman limestones, and the Chupadera formation of former usage. (Talmage and Wootton, 1937; Weitz, 1942; Wells, 1937)

El Paso limestone.—The El Paso limestone, of Early Ordovician age, is primarily a thin-bedded limestone that contains some dolomitic beds. Some beds in the formation are sandy or cherty. At the type locality, in the Franklin Mountains near El Paso, Tex., the El Paso attains a thickness of about 1,000 feet. One analysis shows that the rock is magnesian limestone containing a high percentage of impurities. (Darton, 1928a; Dunham, 1935)

Montoya limestone.—The Montoya limestone, of Late Ordovician age, is predominantly a light- to dark-colored limestone, in places sandy or cherty, which attains a thickness of about 300 feet in the vicinity of Silver City. East of Silver City, in the vicinity of Hanover and Santa Rita, the basal member of the Montoya consists of quartzitic sandstone, and the upper member of massive beds of gray to pink and white dolomite that becomes cherty near the top. Available analyses are of magnesian limestone with a high-impurity content. (Darton, 1928a; Dunham, 1935; Lasky, 1936)

Fusselman limestone.—The Fusselman limestone, Silurian in age, consists generally of a lower member of compact fine-grained gray limestone that weathers nearly white and an upper member of hard dark massive dolomite. The formation ranges in thickness from 40 to about 1,000 feet. Analyses indicate a rock low in magnesium carbonate and high in impurities. (Darton, 1928a; Dunham, 1935)

This group of limestones occurs principally along the west side of the Sacramento Mountains southeast of Alamogordo, in the San Andres Mountains of Socorro and Dona Ana Counties, and in the Franklin Mountains extending from southern Dona Ana County southward to El Paso, Tex. The group occurs also in some of the smaller ranges of southwestern New Mexico. (Darton, 1928b)

Chupadera formation of former usage.—The Chupadera formation of former usage, of Permian age, consists principally of a thick series of limestone, gypsum, and red and gray sandstone. The formation contains a large amount of magnesia, and many oil wells in Chaves and

Dolomite and dolomitic limestone occurrences in New Mexico

County	*Locality*	*Formation*	*Reference*
Dona Ana	San Andres Canyon [1]	Fusselman limestone	Wells, 1937.
Eddy	Carlsbad area:		
	a. 13 miles north	Chupadera formation (?) of former usage.	Weitz, 1942.
	b. 18 miles northwest	do	Do.
	c. 20 miles west	Rock of Permian age	Wells, 1937.
	Queen; northwest [1]	Chupadera formation of former usage.	Do.
	Government test hole 18 (Carlsbad area?).	Carlsbad limestone	Do.
Socorro	Prairie Spring; 10 miles north [1]	Chupadera formation of former usage.	Do.

[1] Dolomitic limestone containing more than 38 percent magnesium carbonate.

Eddy Counties have encountered thick dolomitic beds close to the surface. Several analyses indicate the presence of dolomite, although the impurity content is moderately high in all the samples. The Chupadera extends over large areas in southern and central New Mexico; it is represented on the map (pl. 2) by the large shaded area and the two smaller areas to the northwest. (Darton, 1928a, 1928b; Talmage and Wootton, 1937; Weitz, 1942; Wells, 1937)

NEW YORK

Dolomites are not widespread in New York. They are confined chiefly to the southeastern part of the State, to the west in the counties bordering the southern shore of Lake Ontario, and to the north, principally in St. Lawrence County. The more important dolomitic units include the Grenville series and Inwood limestone, of Precambrian age, the Stockbridge limestone, of Cambrian and Ordovician age, and the Lockport dolomite, of Silurian age. Descriptions and chemical analyses of Cambrian and Ordovician dolomitic limestones north, east, and south of the Adirondack Mountains show the rocks generally to be siliceous and to contain little dolomite; these rocks probably are of no potential value as sources of high-grade dolomite. Quarrying of the dolomite has been most extensive in the southeastern New York area, and high-purity dolomite from Dutchess County has furnished raw material for the magnesium plant at Wingdale, N. Y. (Ries, 1901; Dale, 1923)

Inwood limestone.—The Inwood limestone is essentially a white coarse-crystalline marble high in magnesia. The formation underlies Manhattan Island and extends northward into Westchester County. The dolomite has been quarried in the vicinity of Ossining, Pleasantville, and Tuckahoe. Chemical analyses show that the Inwood at these localities is a fairly good dolomite, although moderately siliceous at places notably at Ossining. (Ries, 1901)

Grenville series.—Dolomite marbles occur in the Grenville series of St. Lawrence County. These marbles vary from snow white to bluish gray and are rather coarsely crystalline. They vary considerably in purity because of the presence of grains and masses of serpentine, tremolite, and other minerals. The distribution of these deposits is very irregular, outcrops are scarce, and some of the probable deposits are likely to be rather inaccessible. A very pure deposit about 3 miles north of Gouverneur contains many millions of tons of uniformly high-purity, dolomite. The deposit has been quarried in a small way. (Prucha, 1953; Ries, 1901)

Stockbridge limestone.—The Stockbridge limestone of southeastern New York is lithologically similar to that in Massachusetts and Connecticut. It ranges from almost pure limestone to equally pure dolomite, is highly marbleized locally, and generally is light colored. The Stockbridge crops out along the east boundary of New York in Rensselaer, Columbia, Dutchess, Putnam, and Westchester Counties and in several smaller belts extending southwestward across Dutchess, Putnam, and Westchester Counties. Small areas of dolomite in southwestern Orange County probably are extensions of the Kittatinny limestone of New Jersey, of equivalent age. Dolomite has been quarried from the Stockbridge chiefly in the vicinity of South Dover and Dover Furnace, Dutchess County, and has been used as an ore of magnesium at the Wingdale magnesium plant. Several chemical analyses show that this high-grade dolomite in places contains small quantities of the alkali metals, which are detrimental if magnesium is to be produced by the ferrosilicon reduction process. (Dale, 1923; Ries, 1901)

Lockport dolomite.—The Lockport dolomite contains zones that are at least locally a good grade of dolomite. The Gasport limestone member has a fairly low silica content but generally is dolomitic limestone rather than dolomite. Overlying the Gasport member is a 30- to 35-foot section of massive heavy-ledged dolomite that usually is of good grade and fairly low in silica. The upper portion of the Lockport, that part containing Guelph fauna, is a brown partly thin bedded dolomite about 45 feet of which is exposed at Shelby, Orleans County. Exposures of this zone are rare, but analyses indicate that the rock is consistently a dolomite with a low silica content. The Lockport dolomite occurs in a belt extending from the Niagara River eastward through Niagara, Orleans, Monroe, Wayne, and Cayuga Counties. A thin strip continues east as far as Utica, Oneida County. (Ries, 1901)

Dolomite quarries and occurrences in New York

County	*Locality*	*Formation*	*Reference*
Dutchess	Dover Plains; quarries	Stockbridge limestone	Ries, 1901; Dale, 1923.
	Wingdale; quarries 2 miles northeast.	do	
Lewis	Sterlingbush (Lewisburg); quarries 1.5 miles northeast.	Grenville series	
Monroe	East Penfield; quarries	Lockport dolomite	Ries, 1901.
	Penfield; quarries	do	Do.
	Rochester and vicinity; quarries	do	Do.
Niagara	Lockport; quarry 1.5 miles east	do	
	Niagara Falls; quarry south	do	Do.
St. Lawrence	Gouverneur; quarries 3 miles north	Grenville series	Prucha, 1953.
Westchester	Ossining; quarries	Inwood limestone	Ries, 1901.
	Pleasantville; quarries	do	Do.
	Tuckahoe; quarries	do	Do.

NORTH CAROLINA

Dolomitic rocks are confined to the western part of North Carolina and occur in the Shady dolomite, of Early Cambrian age, and its approximate equivalents, the Murphy marble in the extreme southwest and the Gaffney marble, some distance to the east. Lenses of dolomite marble occur also in the Carolina gneiss. Chemical analyses of samples from several localities show that dolomite occurs in each of these formations, although no information is available regarding its extent and uniformity in composition. It seems probable, however, that potentially commercial deposits of high-grade rock in the State are few. (Loughlin and others, 1921; Weitz, 1942)

Carolina gneiss.—The Bandana dolomite marble of Hunter and Gildersleeve (1946) occurs as a lens in the Carolina gneiss. It is a white extremely coarsely crystalline marble exposed in a railroad cut approximately 3.5 miles from Toecane (or 1.25 miles north of Bandana Station) along the Toe River, Mitchell County. The deposit is not particularly large, but chemical analyses indicate that it is an exceptionally pure dolomite. (Hunter and Gildersleeve, 1946; Loughlin and others, 1921)

Murphy marble.—The Murphy marble is a coarse- to fine-grained rock, ranging from a high-calcite to a high-dolomite marble, and varying in thickness from 150 to nearly 500 feet. It is predominantly white, but not uncommonly dark gray or blue, and contains layers of banded or mottled blue and white rock. The formation is present nearly the entire length of Cherokee County, extending as a narrow band along the valleys of the Nottely and Valley Rivers. It occurs also between Nantahala and Hewitt along the valley of the Nantahala River, Swain County, and as a group of narrow areas in the vicinity of Peachtree and Brasstown, Clay County. Outcrops of the Murphy marble generally are scarce, but analyses show the presence of dolomite locally. (Loughlin and others, 1921; Van Horn, 1948)

Gaffney marble.—The Gaffney marble is predominantly a fine-grained bluish-gray to white marble, ranging from 30 to about 120 feet thick, and usually has a banded or schistose appearance due in part to impurities. The white beds of the Gaffney generally are the more highly dolomitic, but the content of impurities commonly is somewhat higher than desirable. The formation forms a linear group of narrow bands extending across the southeastern part of Cleveland County into Gaston County. Minor occurrences of similar nature, in Catawba and Lincoln Counties, are presumably continuations of the Gaffney belt. Outcrops are principally along stream valleys and generally are obscure. It seems doubtful that commercial deposits of dolomite occur in the Gaffney marble. (Loughlin and others, 1921)

Shady dolomite.—The Shady dolomite, although sometimes a limestone, is almost wholly a dolomite in most areas. It is fine grained, somewhat crystalline, commonly gray, bluish gray, or white in color, and not uncommonly weathers to a dull gray or black. This formation occurs near Hot Springs, Madison County, where it has an apparent thickness of nearly 2,000 feet, and along the North Fork of the Catawba River from near Linville Falls southward to the vicinity of Sevier, McDowell

County. The rock has been quarried in the vicinity of Hot Springs and near Ashford, a few miles south of Linville Falls. Chemical analyses show that the Shady is a high-grade dolomite in these areas. (Loughlin and others, 1921; Oriel, 1950)

Dolomite quarries and occurrences in North Carolina

County	*Locality*	*Formation*	*Reference*
Catawba	Catawba area:		
	a. quarry 5 miles south	Gaffney marble	Loughlin and others, 1921.
	b. quarry 8 miles south	do	Do.
Cherokee	Andrews	Murphy marble	Do.
	Tomatla; 1 mile northeast	do	Do.
Madison	Hot Springs; quarries 1 mile northwest.	Shady dolomite	Do.
Mitchell	Toecane; 3.5 miles southwest	Carolina gneiss	Do.
McDowell	Ashford area; quarry	Shady dolomite	Do.
	Avery	do	Do.
	Woodlawn; quarry	do	Do.
Swain	Hewitt; quarries	Murphy marble	Do.
Yancey	Burnsville	(?)	Weitz, 1942.

OHIO

Very large quantities of high-purity dolomite are in surface or near-surface deposits in the western half of Ohio, where many thousands of square miles are underlain by carbonate rocks ranging in age from Ordovician to Devonian. Development of these resources has been extensive, and for many years Ohio has led in domestic production of lime. Nearly half the production from Ohio has been as refractory (dead-burned) dolomite, representing more than half the total quantity of refractory dolomite produced in the United States in recent years. (Stout, 1941; Chandler and Jensen, 1951)

The dolomites and dolomitic limestones are principally in the upper part of the Niagara group, of Silurian age. The dolomitic formations include the Euphemia dolomite of Foerste (1917), the Springfield, Cedarville, and Lockport dolomites. The overlying Bass Island, Amherstburg, and Lucas dolomites and parts of the Columbus limestone also are dolomitic. Chemical analyses show that several of these formations are uniformly pure dolomite over large areas. The beds are nearly flat lying, and most of the structural features are small and cause little difficulty for quarry operators. Although the overburden of glacial drift that covers most of the region ranges from 25 to 75 feet in thickness over large areas, it is thin or absent locally, and its removal apparently presents no great problem. Even where overburden is heavy and outcrops scarce, quarrying operations are carried out on a large scale. (Stout, 1941)

Euphemia dolomite of Foerste (1917).—The Euphemia dolomite, at the base of the dolomite sequence in the upper part of the Niagara group, is an irregularly bedded porous somewhat mottled dolomite averaging about 6 feet in thickness. It occurs principally in Preble, Montgomery, Greene, Clark, and Miami Counties and, where samples have been analyzed, is a high-purity dolomite. (Stout, 1941)

Springfield dolomite.—The Springfield dolomite is a uniformly bedded dull earthy dolomite having a porous texture and varying from buff to light brown. The formation averages about 10 feet in thickness. It is exposed in Preble, Montgomery, Miami, Clark, Greene, Clinton, Highland, and Adams Counties. Chemical analyses of the rock show that, although the magnesium carbonate content is nearly always high, the silica content also is moderately high. (Stout, 1941)

Cedarville dolomite.—The overlying Cedarville dolomite is a highly crystalline generally massive dolomite, open textured and varying from a light buff through light gray and bluish gray. Its thickness averages about 50 feet. The Cedarville occurs in southwestern Ohio in at least parts of the following counties: Adams, Highland, Clinton, Greene, Fayette, Clark, Champaign, Logan, Montgomery, Miami, Shelby, Auglaize, Preble, Darke, Mercer, and Van Wert. The chemical composition of the rock generally is that of a high-purity dolomite. In Adams and Highland Counties, this formation is the approximate correlative of the Peebles dolomite of Foerste (1929). (Stout, 1941; Wilmarth, 1938)

Dolomite of Niagaran age.—Dolomite of Niagaran age (the Guelph dolomite of former usage) is very similar to the Cedarville both physically and chemically, but it has been distinguished from it on the basis of certain faunal differences. The dolomite is highly crystalline, open and porous in texture, and varies from nearly white to light gray or bluish gray. The thickness ranges from 50 to 80 feet, and, locally, chert is in the lower portion. The unit is confined to northwestern Ohio, cropping out in parts of Marion, Hardin, Wyandot, Hancock, Seneca, Wood, Sandusky, and Ottawa Counties. This dolomite of Niagaran age (the Guelph of former usage) is an unusually pure dolomite, analyses often showing less than 1 percent total impurities. In western Sandusky County and southwestern Ottawa County, however, it contains from 1 to 4 percent celestite occurring as disseminated grains and in cavity fillings. Commercially this unit is the most important dolomite in Ohio. It has been used as a raw material in both the electrolytic and ferrosilicon reduction processes for the production of magnesium; it is also used extensively in the manufacture of refractory dolomite. Large reserves of very high-purity dolomite are present throughout the area underlain by this dolomite. (Stout, 1941)

Bass Island dolomite.—The Bass Island dolomite, of Silurian age, overlies the Niagara group and consists of four members, which are, in ascending order, the Greenfield dolomite, Tymochtee shale, Put-in-Bay dolomite, and Raisin River dolomite members. The Bass Island has an average thickness of about 570 feet, and the rock is generally a fair grade of dolomite but tends to be slightly siliceous. The formation ranges from thin bedded to massive, dense and hard to coarsely crystalline and open in texture, and generally is some shade of brown or dark bluish gray. It is in at least 23 counties in the western part of the State, but it does not occur in the southwest corner or the extreme northwest corner. The rock has been quarried in many localities. (Landes, 1951; Stout, 1941)

Amherstburg and Lucas dolomites.—The Detroit River group, of Devonian age, consists of two formations, the Amherstburg and Lucas dolomites. The Amherstburg is an open-textured dolomite, usually massively bedded, and varies from drab to brownish gray. Exposures are scarce because of the heavy drift cover, but the thickness apparently ranges from 50 to 75 feet. The formation is confined to two areas, one east of Cincinnati Arch in Ottawa, Erie, and Sandusky Counties and another west of the arch in Lucas, Wood, and Henry Counties. One analysis indicates that the rock is relatively free from impurities but slightly low in mangesium carbonate. The Lucas dolomite, although locally somewhat calcareous, is predominantly a light-blue to drab bedded dolomite, attaining a maximum thickness of 140 feet but usually ranging from 30 to 75 feet. This formation is coextensive with the Amherstburg. Chemical analyses show that the Lucas varies in composition, ranging from a magnesian limestone moderately high in silica to a high-purity dolomite. (Landes, 1951; Stout, 1941)

Monroe formation of former usage.—In some reports the Bass Island dolomite and the Detroit River group have been called the Monroe formation. The term has persisted to some extent, and analyses of samples shown as being from the Monroe formation could be from any one of the dolomites stratigraphically between the Niagara group and the Columbus limestone.

Columbus limestone.—The Columbus limestone (Middle Devonian), uppermost of the thick series of dolomites in Ohio, is a light-gray to light-brown massively bedded rock, rather earthy in appearance. It varies in composition both vertically and laterally, but generally it is a limy dolomite in the lower portion and a low-magnesium limestone in the upper. The thickness ranges from 80 to 125 feet where the formation is normally developed, and layers of chert are present locally. The formation is in three general areas. The first is a broad belt 10 to 15 miles wide extending northward from Pickaway County to Kelleys Island, in Lake Erie. The second, heavily drift covered, is a crescent-shaped area on the rim of the Michigan Basin, reaching from northern Paulding County through parts of Defiance, Putnam, Henry, and Wood Counties into western Lucas County. The third area is in eastern Logan County and north-central Champaign County. Several analyses, notably those of samples from Logan and Wood Counties, indicate the local presence of a good grade of dolomite with about 2 percent of silica. (Stout, 1941)

The shaded area on the map (pl. 2) shows the general distribution of the Niagara group, the Monroe formation of former usage, and the Columbus limestone as taken from the geologic map of Ohio. Because of the many quarries and sample localities in the dolomite, it is impracticable to show on the map or to list in the accompanying table anything but active or recently active quarries for which there are analyses, either specific or representative, showing high-grade dolomite. For a more complete listing of quarries and sample localities, special reference should be made to Stout's (1941) paper. (Bownocker, 1947; Stout, 1941)

Dolomite quarries in Ohio

[Data from Stout, 1941; all quarries in this reference are listed as active or recently active. Except for those localities marked with an asterisk (*), chemical analyses are available for locality shown or for representative area]

County	*Locality*	*Formation*
Adams	Locust Grove; quarry	Peebles dolomite.
	Lynx; quarry 1.25 miles east	Do.
Allen	Bluffton; quarry	Monroe formation (of former usage).[1]
	*Elida; quarry	Do.
	Herrod; quarry 1.75 miles south	Do.
	Lafayette; quarry	Do.
	Lima; quarry	Do.
	*Southworth; quarry	Do.
	*Westminster; quarry	Do.
Auglaize	*Buckland; quarry	Do.
Champaign	Salem Township; quarry	Do.
Clark	Springfield; quarry 4 miles west	Cedarville dolomite.
Clinton	Melvin; quarry 1 mile east	Niagara group.
	New Vienna; quarry 1.25 miles northwest	Do.
Darke	Greenville; quarry 4.5 miles east	Cedarville dolomite.
	Weavers; quarry	Do.
Fayette	Greenfield; quarry 2.75 miles north	Monroe formation (of former usage).
	Rock Mills; quarry	Do.
Greene	Cedarville; quarry	Cedarville dolomite.
	Jamestown; quarry 1.75 miles west	Niagara group.
Hancock	Arlington area:	
	a. quarry 3 miles south	Monroe formation (of former usage).
	b. quarry 2 miles east	Do.
	Findlay; quarry	Do.
	*Williamstown; quarry	Do.
Hardin	Ada; quarry 1.5 miles north	Do.
	Blanchard; quarry	Do.
	Dunkirk; quarry	Do.
	Kenton; quarry	Do.
	McVittys; quarry	Dolomite of Niagaran age (Guelph dolomite).
Highland	Highland; quarry 2 miles south	Bass Island dolomite.
	Hillsboro; quarry	Lilley dolomite of Foerste (1917) and Peebles dolomite of Foerste (1929).
	*Marshall; quarry	Niagara group.
	*New Market; quarry	Do.
	Samantha; quarry 2 miles west	Peebles dolomite of Foerste (1929).
	Sinking Spring area:	
	a. quarry 1.5 miles northwest	Lilley dolomite of Foerste (1917).
	b. quarry 1 mile north	Peebles dolomite of Foerste (1929).
	Willettville; quarry 1.25 miles southeast	Cedarville dolomite(?).

[1] Monroe formation includes Bass Island, Amherstburg, and Lucas dolomites.

County	*Locality*	*Formation*
Logan	Belle Center; quarry	Monroe formation (of former usage).
	Bellefontaine; quarry	Columbus limestone.
	*Big Springs; quarry	Monroe formation (of former usage).
	East Liberty; quarry 1.25 miles west	Columbus limestone.
	*Huntsville; quarry	Monroe formation (of former usage).
	Northwood; quarry	Do.
	Rushsylvania; quarry 2 miles southeast	Columbus limestone.
	West Liberty; quarry 2 miles east	Lucas dolomite.
Lucas	*Holland; quarry	Monroe formation (of former usage).
	*Maumee; quarry	Do.
	Monclova; quarry 1.75 miles north	Bass Island dolomite.
	*Silica; quarry	Lucas dolomite.
	Sylvania; quarry 2.5 miles southwest	Do.
	Waterville; quarry 1 mile south	Monroe formation (of former usage).
	*Whitehouse; quarry	Columbus limestone.
Marion	*Hepburn; quarry 3 miles east(?)	Niagara group.
	Marseilles; quarry 2 miles southwest	Monroe formation (of former usage).
Mercer	Celina; quarry 4.5 miles southwest	Niagara group.
	Rockford; quarry 1.5 miles northwest	Do.
Miami	Ludlow Falls	Euphemia dolomite of Foerste (1917).
	West Covington; 1 mile southwest	Springfield dolomite.
Ottawa	Clay Center; quarry	Dolomite of Niagaran age (Guelph dolomite).
	*Elmore; quarry	Do.
	Genoa; quarry	Do.
	*Port Clinton; quarry	Monroe formation (of former usage).
Paulding	Grover Hill; quarry 2.5 miles east	Do.
Preble	Lewisburg; quarry 1.25 miles northwest	Euphemia dolomite of Foerste (1917), and Springfield and Cedarville dolomites.
	New Paris; quarry	Euphemia dolomite of Foerste (1917) and Cedarville dolomite.
Putnam	*Cloverdale; quarry	Monroe formation (of former usage).
	*Fort Jennings; quarry	Do.
	*Ottawa; quarry	Do.
	Pandora; quarry	Do.
	Rimer; quarry	Do.
Ross	Greenfield; quarry	Bass Island dolomite.
Sandusky	Fremont; quarry	Niagara group.
	Gibsonburg area; quarries	Dolomite of Niagaran age (Guelph dolomite).
	*Millersville; quarry	Do.
	Woodville area; quarries	Do.
Seneca	Bascom; quarry 1.5 miles east	Monroe formation (of former usage).
	Maple Grove-Bettsville area; quarries	Dolomite of Niagaran age (Guelph dolomite).
Shelby	Kirkwood; 1 mile northwest	Cedarville dolomite.
Union	*Watkins; quarry	Monroe formation (of former usage).
	York Center; quarry	Do.
Van Wert	*Convoy; quarry	Do.
	Delphos; quarry	Do.
	Middlepoint; quarry 1 mile west	Do.
	Scott; quarry 3.5 miles southwest	Do.
Wood	Fostoria; quarry	Dolomite of Niagaran age (Guelph dolomite).
	Luckey; quarry	Do.
	North Baltimore; quarry	Monroe formation (of former usage).
	Portage; quarry	Dolomite of Niagaran age (Guelph dolomite).
	Rising Sun; quarry	Do.
	*Rudolph; quarry	Monroe formation (of former usage).
	West Millgrove; quarry	Do.
	Weston; quarry	Columbus limestone.

Dolomite quarries in Ohio—Continued

County	*Locality*	*Formation*
Wyandot	Carey; quarry	Guelph dolomite and Monroe formation (of former usage).
	Upper Sandusky area:	
	a. quarry 2.5 miles northeast	Monroe formation (of former usage).
	b. quarry 4.5 miles southeast	Do.

OKLAHOMA

Deposits of dolomite occur in several localities in Oklahoma in formations ranging in age from Cambrian to Permian. Large quantities are available in the Arbuckle and Wichita Mountains, in south-central and southwestern Oklahoma. The principal dolomitic formations belong to the Arbuckle group, of Cambrian and Ordovician age, and include, in ascending order, the Royer and Butterly dolomites and the Strange formation of Decker (1939). The Kindblade and West Spring Creek formations also contain some dolomite. Of these formations, the Royer is the only one that has been quarried on a large scale.

Royer dolomite.—The Royer dolomite, of Late Cambrian age, generally is a coarsely crystalline marblelike dolomite, which attains a thickness of more than 700 feet in the Arbuckle Mountains and about 200 feet in the Wichita Mountains. The formation is more widespread in the Arbuckles than in the Wichitas, where it occurs only in the northwestern part. In the Arbuckle Mountains the Royer is typically a thick-bedded gray locally brecciated dolomite, free of sand and chert. It contains several discontinuous beds of fine-grained light-gray limestone, but these beds constitute only a minor part of the total thickness. Chemical analyses of samples from Atoka, Johnston, Murray, and Kiowa Counties show that the Royer is in general a moderately good grade of dolomite. Locally the quality is excellent, notably in the Mill Creek-Ravia area, Johnston County, where quarrying operations were started in 1948 and large reserves of high-grade dolomite are readily accessible. (Decker, 1939; Ham, 1949)

Butterly dolomite.—The Butterly dolomite, overlying the Royer and separated from it by the Signal Mountain limestone, is a coarse- to fine-crystalline partly laminated rock, containing large quartz grains and thin layers of quartz conglomerate in the upper part. It is predominantly gray, although in places it is pink to yellow. Owing to the resistance of the rock to weathering, rough masses stand out in relief 4 to 6 feet above the general surface level. So far as is known, the formation occurs only in the Arbuckle Mountains, where it ranges in thickness from 150 feet in the western part to 365 feet in the east. One analysis of the Butterly dolomite from Murray County shows that the rock is of fairly high purity, but another from the same locality shows that it is somewhat low in magnesium carbonate and contains more than 10 percent impurities. (Beach and English, 1940; Decker, 1939)

Strange dolomite of Decker (1939).—The Strange dolomite of Decker (1939), of Early Ordovician age, is a massive coarse-grained pink to gray dolomite. It has been recognized only in the Wichita Mountains northwest of Lawton, Comanche County, where about 80 feet is exposed. Several analyses of the rock show that it is generally a good-quality dolomite, and large quantities of the rock are readily accessible. (Beach and English, 1940; Decker, 1939)

Kindblade and West Spring Creek formations.—The overlying formations, particularly the Kindblade and West Spring Creek formations, forming the upper part of the Arbuckle group, are predominantly limestone throughout most of the Arbuckle Mountain area. They tend to be more dolomitic in the eastern part of the mountains, however, particularly in the areas adjacent to faults. No analyses of samples from the Arbuckle Mountains are available, but it is reported that large quantities of dolomite may be obtained from the upper part of the West Spring Creek formation in the vicinity of Hickory, eastern Murray County. A few analyses of rocks from the Kindblade of the Wichita Mountains, in eastern Kiowa County, show that the rock is moderately high in impurities. (Beach and English, 1940; Decker, 1939)

Other formations.—Thin but widespread beds of generally impure dolomite and dolomitic limestone are in western Oklahoma. The beds are part of the Permian sequence of shales, sandstones, limestones, and gypsum. Among these dolomitic limestones are the Mangum dolomite

Dolomite quarries and occurrences in Oklahoma

County	*Locality*	*Formation*	*Reference*
Atoka	Coleman; 3.5 miles east	Royer dolomite	Ham, 1949.
Blaine	Greenfield	Relay Creek dolomite beds.	Beach and English, 1940.
	a. 6 miles northwest	do	Suffel, 1930.
	Watonga; 6 miles east	Blaine gypsum	Beach and English, 1940.
Comanche	Lawton area:		
	a. 6 miles northwest	Strange dolomite of Decker (1939).	Ham, 1949.
	b. 7 miles northwest	do	Do.
Delaware	Eucha; 2 miles southeast	Cotter dolomite	Beach and English, 1940.
	Flint	do	Do.
	Sycamore; 6 miles northeast	do	Do.
Jackson	Creta area:		
	a. 2 miles northwest	Mangum or Creta member.	Do.
	b. 2 miles southwest	do	Do.
Johnston	Mill Creek-Ravia area; quarry	Royer dolomite	Ham, 1949.
	Wapanucka; 3 miles south	do	Do.
Kiowa	Gotebo; 9 miles south	Kindblade formation	Beach and English, 1940.
	Sedan; 6 miles east	Royer dolomite	Do.
Murray	Davis area:		
	a. 7 miles south	do	Ham, 1949.
	b. 8 miles south	Royer and Butterly dolomites.	Do.

member, the Creta and Jester dolomite members (Suffel, 1930) of the Blaine gypsum, and the Relay Creek and Day Creek dolomites. Because of the variability in composition, the general impure nature, and the thinness of the beds, it is unlikely that any of these formations could be used for high-grade dolomite. Dolomite occurs in northeastern Oklahoma in the Cotter dolomite. (Beach and English, 1940; Ham, 1949; Okla. Geol. Survey, 1944; Suffel, 1930)

PENNSYLVANIA

Dolomites and dolomitic limestones are confined principally to southeastern Pennsylvania in several northeast-trending belts of Cambrian and Ordovician carbonate rocks. High-purity dolomite in these belts does not persist either vertically or laterally, and intricate structure often disrupts the normal sequence to such an extent that several formations may appear in the same quarry. This condition necessitates careful selective quarrying in order to recover rock of the desired composition. Dolomites of varied quality have been quarried in many areas. The dolomitic formations include the Tomstown dolomite, which, in the York, Lancaster, and Chester Valleys, has been subdivided into the Vintage dolomite, Kinzers formation, and Ledger dolomite; the Conococheague limestone, which is the Allentown limestone of Berks, Lehigh, and Northampton Counties, and the Gatesburg formation and Mines dolomite of Blair and Huntingdon Counties; the Beekmantown limestone, which is the Larke and Nittany dolomites, Axemann limestone, and Bellefonte dolomite in Blair and Huntingdon Counties; and the Conestoga limestone. Although these formations commonly are siliceous, intimately interlayered with low-magnesium limestone, or are otherwise impure, large reserves of high-purity dolomite probably exist in certain areas, notably in Chester and Montgomery Counties. Of the formations mentioned, the Ledger is perhaps the most nearly uniform in composition and generally contains the least amount of impurities. (Butts and others, 1939; Miller, 1934; Stose and Stose, 1944)

Tomstown dolomite.—The Tomstown dolomite, of Early Cambrian age, is predominantly a dolomitic limestone with varied quantities of silica and magnesia. In many places the formation contains considerable quantities of interbedded shaly material, which renders the rock undesirable for many uses. It is generally blue, but sometimes gray, quite massive and hard, and the thickness is about 1,000 feet. Outcrops of the Tomstown form a discontinuous belt extending through parts of Franklin, Adams, Cumberland, Lebanon, Berks, Lehigh, Northampton, and Bucks Counties. Chemical analyses show that the rock is generally moderately siliceous, although near Clayton, Berks County, and East Allentown, Lehigh County, some of the dolomite is of good quality. (Miller, 1934; Stose and Ljungstedt, 1931)

Vintage dolomite.—The Vintage dolomite which, in the York, Lancaster, and Chester Valleys, is equivalent to the lower part of the Tomstown, is rather poorly exposed. Its presence generally is indicated by the characteristic weathering product, a dark-red or maroon, granular soil. In addition to a basal unit of white quartzose marble, the formation consists of two major units, a lower one principally of dark-blue or gray, heavily bedded to massive, knotty dolomite and an upper one of mostly pure fine-grained limestone. The thickness of the formation varies considerably but probably never exceeds 1,000 feet. The Vintage is present in narrow interrupted belts that extend through parts of Adams, York, Lancaster, Berks, and Chester Counties. Analyses from Lancaster County, probably from the Vintage, show some dolomite of excellent quality. (Miller, 1934; Stose and Ljungstedt, 1931; Stose and Stose, 1944)

Kinzers formation.—The Kinzers formation, equivalent to the middle part of the Tomstown, is varied in character, but generally can be separated into three distinct members: a lower member of dark-colored argillaceous shale or argillite, a middle member that is predominantly a limestone of varied composition but locally a good-quality coarse-grained dolomite, and an upper member of earthy or fine-grained quartzose limestone containing dark argillaceous layers. The thickness of the formation varies with the locality and ranges from perhaps 150 feet or less in Lancaster County to about 500 feet in York County. The Kinzers is in the same general areas as the Vintage, and analyses of samples from York County, thought to be from the Kinzers formation, indicate the presence of some high-purity dolomite. (Miller, 1934; Stose and Ljungstedt, 1931; Stose and Stose, 1944)

Ledger dolomite.—The Ledger dolomite, equivalent to the upper part of the Tomstown, generally is a white to light-gray pure dolomite, which may be mottled with dark-gray or blue spots. It is thick bedded or massive, coarse grained, and in some places may merge laterally into high-calcium marble. The thickness of the Ledger is about 1,000 feet, and in many places, although poorly exposed, its presence is marked by the deep-red granular soil into which the rock weathers. The distribution is approximately the same as the Vintage dolomite and Kinzers formation, and in Chester, Lancaster, and Montgomery Counties good-quality rock has been quarried for use in magnesian products. (Miller, 1934; Stose and Ljungstedt, 1931; Stose and Stose, 1944)

Conococheague limestone.—The Conococheague limestone, of Late Cambrian age, generally is a dense massive or thick-bedded dolomite or dolomitic limestone, usually some shade of blue or light gray. This formation, having a maximum thickness of about 1,500 feet, comprises a series of alternating beds of limestone and dolomite and in places contains black chert layers, shaly beds, wavy argillaceous partings, and thin sandstone layers. Differential weathering causes the more highly magnesian beds to turn whiter than the others and the sandy layers to stand out in relief, thus imparting a banded appearance that is an excellent, almost diagnostic, criterion for recognizing the formation. The Conococheague and the underlying Elbrook limestones are combined as a single unit on the State geologic map and are shown in parts of Franklin, Cumberland, Lebanon, Berks, Lehigh, Northampton, Lancaster, Chester, Montgomery, and Bucks Counties. Although the rock from this formation commonly is moderately high in silica, some dolomite of good quality has been quarried in the areas south of Centerville, Lancaster County, and east of Bethlehem, Northampton County. (Miller, 1934; Miller and others, 1939; Stose and Ljungstedt, 1931)

Beekmantown limestone.—The Beekmantown limestone, of Early Ordovician age, ranges in composition from rather pure limestone to dolomite. The rock is dark blue to light blue and gray, and in many places the limestones and dolomites occur as alternating beds. The silica content of the rock is quite varied. The thickness of the formation approximates 1,000 feet. The Beekmantown occurs in the same general areas as the Conococheague, usually north and northwest of the older formation. It occurs also in Dauphin County, where the Conococheague apparently is absent. The silica content of the rock commonly is higher than desirable for most purposes, but good-quality dolomite has been quarried from the Beekmantown(?) in Blair and Montgomery Counties. (Gray, 1951; Miller, 1934; Miller and others, 1939; Stose and Ljungstedt, 1931)

Conestoga limestone.—The Conestoga limestone, of Cambrian(?) and Early Ordovician age, is principally a blue argillaceous limestone. It is thick bedded, blue to light gray in the lower part and thin bedded and dark blue in the upper part. In many localities a coarse limestone conglomerate or breccia occurs at the base of the formation. The Conestoga forms a broad belt through central Lancaster County, with narrower extensions through York and Adams Counties to the southwest and Chester and Montgomery Counties to the east. Chemical analyses show that good-quality dolomite occurs a short distance southeast of Columbia, Lancaster County. (Miller, 1934; Stose and Ljungstedt, 1931)

Dolomite quarries and occurrences in Pennsylvania

County	*Locality*	*Formation*	*Reference*
Adams	Bittinger area; quarries	Ledger dolomite	Miller, 1934.
Bedford	Colerain Township	Rocks of Cambrian and Ordovician age.	Do.
Berks	Bechtelsville area; quarries	Tomstown dolomite(?)	Do.
	Clayton; quarry	do	Do.
	Dale; quarry	do	Do.
	Earlville; quarries	do	Do.
	Greshville; quarry	do	Do.
	Rabbit Hill	do	Do.
	Reading; quarry	Conococheague limestone(?).	Do.
	Seisholtzville; quarries 2 miles east	Tomstown dolomite(?)	Do.

County	Locality	Formation	Reference
Blair	Birmingham; quarries	Beekmantown limestone(?)	Miller, 1934.
	Roaring Spring; quarries south	do	Do.
Bucks	Durham area; quarries	Tomstown dolomite and Conococheague limestone.	Do.
	New Hope; quarries 2.5 miles northwest.	Beekmantown limestone.	Do.
Chester	Cedar Hollow; quarries	Ledger dolomite(?)	Do.
	Mill Lane area; quarries	do	Do.
	Planebrook; quarry	do	Do.
Franklin	Mont Alto; quarry	Tomstown dolomite	Do.
	a. quarry 1.5 miles northeast	do	Do.
Fulton	McConnellsburg area; quarries	Beekmantown limestone.	Do.
Huntingdon	Spruce Creek; quarries	Beekmantown (Nittany) limestone.	Do.
	Union Furnace; quarries	Beekmantown (Bellefonte) limestone.	Do.
Lancaster	Billmeyer; quarries	Ledger dolomite	Do.
	Centerville; 0.5 to 0.75 mile south	Conococheague limestone.	Do.
	Chickies area; quarries	Ledger dolomite	Do.
	Columbia; quarry 1 mile southeast	Conestoga limestone	Do.
	Glenmanor; quarry	Ledger dolomite(?)	Do.
	Lancaster area; quarries	Ledger dolomite	Do.
	Landis Valley; quarry 0.5 mile southeast.	do	Do.
	Leaman Place—Kinzers area; quarries.	Vintage dolomite	Do.
	Newtown; quarry 0.75 mile southwest.	Ledger dolomite	Do.
	Rowenna P. O.	Ledger dolomite(?)	Do.
Lehigh	Alburtis area:		
	a. quarry 0.75 mile northwest	Beekmantown limestone.	Do.
	b. quarry 1 mile north	Allentown limestone	Do.
	Allentown; quarries	Allentown limestone	Do.
	Catasauqua; quarry across river	Beekmantown limestone.	Do.
	East Allentown; quarries	Tomstown dolomite	Do.
	Friedensville; quarry 0.5 mile north	Beekmantown limestone.	Do.
	Ormrod; quarry 0.5 mile south	Beekmantown limestone(?).	Do.
	Trexlertown; quarry 1.5 miles northeast.	Beekmantown limestone.	Do.
	Whitehall; quarry 0.75 mile west	do	Do.
Mifflin	Reedsville	(?)	Do.
Montgomery	Bridgeport-Shainline area; quarries	Ledger dolomite	Do.
	Fitzwatertown; quarries	do	Do.
	Mogee; quarries	do	Do.
	Plymouth Meeting area; quarries	Beekmantown limestone(?)	Do.
	Port Kennedy; quarry	Ledger dolomite(?)	Do.
	a. quarry 1.5 miles southwest	Ledger dolomite	Do.
	Williams; quarries	Beekmantown limestone(?)	Do.
Northampton	Bethlehem area; quarries	Conococheague limestone.	Do.
	a. quarry 2 miles east	do	Do.
	Bingen; quarry	do	Miller and others, 1939.
	Brodhead; quarry	Beekmantown limestone.	Do.

Dolomite quarries and occurrences in Pennsylvania—Continued

County	Locality	Formation	Reference
Northampton—Continued	Easton; quarry	Conococheague limestone.	Miller, 1934.
	Freemansburg; quarry	do	Do.
	Hellertown; quarry 0.5 mile southwest.	do	Do.
	Island Park; quarry	Tomstown dolomite	Do.
	Portland; quarry	Allentown and Beekmantown limestones.	Miller and others, 1939.
	Redington; quarry	Tomstown dolomite	Miller, 1934.
York	Menges Mills; quarries	(?)	Do.
	Saginaw; quarry	(?)	Do.
	Thomasville; quarries	Kinzers formation(?)	Do.
	York area:		
	a. 1 mile west	do	Do.
	b. 2 miles west	do	Do.
	c. quarry 1.5 miles southwest	do	Do.
	d. 2 miles north	do	Do.

SOUTH CAROLINA

Little information is available regarding dolomite in South Carolina. A few chemical analyses indicate the presence of dolomite in Cherokee, Laurens, and Oconee Counties, but practically nothing is known of the extent or average composition of the deposits. The best known dolomite deposits occur near Gaffney, Cherokee County, in the Gaffney marble; the occurrence northwest of Laurens, Laurens County, has not been assigned to a stratigraphic unit; and the occurrences northwest of Walhalla, Oconee County, have been assigned, at least tentatively, to the Brevard schist. It appears doubtful that any commercial deposits of high-purity dolomite occur in South Carolina. (Keith and Sterrett, 1931; Sloan, 1908)

Brevard schist.—Details concerning the dolomite in the Brevard schist sequence, in Oconee County, are lacking. Two analyses of samples from the area northwest of Walhalla, from "limestone" beds 3.5 and 6.5 feet thick associated with slates, are of dolomite, but they show that the silica content is higher than desirable. (Sloan, 1908)

Gaffney marble.—The Gaffney marble, of Cambrian age, is predominantly a fine-grained bluish-gray to white crystalline rock having a banded appearance due to impurities. The whiter beds generally overlie the gray ones and are more highly magnesian. The thickness of the Gaffney, usually poorly exposed, probably does not exceed about 120 feet. These outcrops extend in interrupted belts from the quarries south

Dolomite quarries and occurrences in South Carolina

[Data from Sloan, 1908]

County	Locality	Formation
Cherokee	Gaffney; quarries 1 mile south	Gaffney marble.
Laurens	Laurens; quarrry 7.5 miles northwest	(?).
Oconee	Walhalla area:	
	a. 8.1 miles northwest	Brevard schist(?).
	b. 9 miles northwest	Do.

of Gaffney northeastward through Blacksburg and into North Carolina. One analysis from a quarry south of Gaffney shows that the rock is a dolomite moderately high in silica. (Keith and Sterrett, 1931; Sloan, 1908)

SOUTH DAKOTA

Dolomite and dolomitic limestone are restricted to the Black Hills region of South Dakota in parts of Custer, Fall River, Lawrence, Meade, and Pennington Counties. The dolomites occur in three formations ranging in age from Late Ordovician to Permian(?) and include the Whitewood dolomite and Pahasapa and Minnekahta limestones. These formations are predominantly limestones that locally contain high concentrations of magnesium carbonate. Of these formations, the Pahasapa limestone and, possibly, the dolomitic sands derived from it probably are the most important potential sources of dolomite. Few analyses and no details concerning the extent of these localized deposits are available, but it is possible that large quantities of dolomite are in this region. (Darton and Paige, 1925; Rothrock, 1944)

Whitewood dolomite.—The Whitewood dolomite, of Late Ordovician age, is predominantly a hard massive limestone, generally buff colored or pinkish with pale-brownish spots. The maximum thickness is about 80 feet. The formation is principally in the northern part of the Black Hills uplift. One analysis of a sample from near Deadwood, Lawrence County, shows a dolomitic limestone. (Darton and Paige, 1925; Rothrock, 1944)

Pahasapa limestone.—The Pahasapa limestone, of Mississippian age, is a fine-grained massively bedded limestone, ranging from pale buff to light gray or white. It ranges in thickness from 300 to more than 600 feet, and it is reported to be highly magnesian locally. No analyses of the rock are available. Large deposits of dolomitic sand derived from the weathering of the Pahasapa limestone are reported at several places in the Black Hills, and an analysis from the largest deposit, near Piedmont, southwestern Meade County, shows a magnesium carbonate content approaching that of a pure dolomite. The Pahasapa is the most widespread of the formations mentioned. It surrounds almost completely the central part of the Black Hills uplift and forms the greater part of the broad limestone plateau on the west side of the uplift. Commercial deposits of dolomite may be available in the Pahasapa limestone. (Bryson and others, 1947; Darton and Paige, 1925; Rothrock, 1944)

Minnekahta limestone.—The Minnekahta limestone, of Permian(?) age, is a light-gray rock, usually exhibiting a pinkish or purplish tinge. Its average thickness is less than 40 feet, and it varies from limestone to dolomite. An analysis of a sample from near Hot Springs, Fall River County, shows that the rock is dolomite. The Minnekahta crops out in a narrow band that forms the front of the limestone ridge around the periphery of the Black Hills uplift. (Bryson and others, 1947; Darton and Paige, 1925; Rothrock, 1944)

Dolomite and dolomitic limestone occurrences in South Dakota

County	Locality	Formation	Reference
Fall River	Hot Springs	Minnekahta limestone	Darton and Paige, 1925.
Lawrence	Deadwood	Whitewood dolomite	Rothrock, 1944.
Meade	Piedmont	Pahasapa limestone	Do.

TENNESSEE

Dolomites and dolomitic limestones of Cambrian and Ordovician age extend through eastern Tennessee in several northeast-trending belts that are northward continuations of those that begin in northeastern Alabama and northwestern Georgia. The dolomitic strata include the Shady dolomite, of Cambrian age, and the Knox group, of Cambrian and Ordovician age. The Knox group consists of the Copper Ridge, Chepultepec, and Longview dolomites, the Kingsport limestone, and the Mascot dolomite. It is doubtful that the rocks of the Longview, Kingsport, and Mascot should be considered as sources of high-grade dolomite, owing to the general abundance of sand, chert, and limestone in the formations, although chemical analyses show that moderately siliceous dolomite may occur locally. (Oder, 1934; Pond, 1933; Rodgers, 1948, 1953; Rodgers and Kent, 1948)

Shady dolomite.—The Shady dolomite, of Early Cambrian age, is characteristically a dolomite with some interbedded limestone. The dolomite is white to light gray or blue gray, massive to well laminated, fine grained, and locally contains a little chert. The rock not uncommonly exhibits alternating bands or ribbons of light and dark dolomite. The thickness of the formation averages about 1,000 feet. Outcrops are not common, but they occur in parts of Blount, Monroe, Carter, Johnson, Cocke, Unicoi, and Washington Counties. Chemical analyses of samples from Johnson and Washington Counties indicate that the rock generally is moderately siliceous but that some good-quality dolomite occurs locally, notably near Wills Station and Erwin. (Pond, 1933; Rodgers, 1948, 1953; Secrist, 1924)

Knox group.—The Knox group comprises a thick series of limestones and dolomites, with dolomites predominating, in several northeast-trending belts that extend through the Great Valley region of eastern Tennessee. The group averages about 2,600 to 3,000 feet in thickness, and the rocks generally are dolomitic in the northwest side of the Valley, becoming progressively more calcareous toward the southeast. The Knox contains five formations where completely subdivided, but only the two lower formations—the Copper Ridge and Chepultepec dolomites—probably have any possibilities as sources of high-grade dolomite. (Josiah

Bridge, 1952, oral communication; Rodgers, 1953; Rodgers and Kent, 1948)

Copper Ridge dolomite.—The Copper Ridge dolomite, of Late Cambrian age, consists of two members. The lower one is massive knotty dark-gray asphaltic crystalline dolomite interbedded with light-gray silty dolomite and marked at the base by a striking black and white coarse-grained dolomitic oolite. The upper member is light-gray slightly silty dolomite having an exceptionally coarse oolite at the base, arenaceous zones at many levels, and marked near the top by prominent oolitic chert layers and beds of sandstone. The average total thickness of the Copper Ridge is about 900 feet, approximately 225 feet of which is represented by the upper member. Chemical analyses representing parts of the so-called lower Knox or of the Copper Ridge dolomite show that the rock generally is a siliceous dolomite or, more frequently, a siliceous dolomitic limestone. A moderately siliceous dolomite has been quarried at Norris Dam, Anderson County. (Oder, 1934; Benjamin Gildersleeve, 1946, written communication; Rodgers, 1953; Rodgers and Kent, 1948)

Chepultepec dolomite.—The overlying Chepultepec dolomite, of Ordovician age, also contains two rather distinct members. The lower member is generally sandy and is composed of interbedded sandstone or chert and light-gray to dark-gray fine-grained dolomite, which is in places silty or cherty. The upper member is predominantly dolomite, light gray to

Dolomite quarries and occurrences in Tennessee

County	*Locality*	*Formation*	*Reference*
Anderson	Norris Dam; quarry	Copper Ridge dolomite.	Benjamin Gildersleeve, 1946, written communication.
	Offrutt	do	Do.
Hamilton	Chattanooga; quarry	Knox group	Do.
	Soddy; 2.5 miles east	do	Do.
Jefferson	Dandridge; quarry	do	Do.
Johnson	Doe Valley	Shady dolomite	Jenkins, 1916.
	Mountain City area:		
	a. 3.5 miles north	do	Do.
	b. 4 miles north	do	Do.
	c. east of Wills Station; quarry	do	Do.
	d. Silver Lake	do	Do.
	Roane Creek Valley; quarries 0.75 miles east of Shouns, near Forge Creek.	do	Do.
	Shady Valley; quarry 0.5 mile northwest.	do	Do.
Roane	Harriman; quarry	Knox group	Benjamin Gildersleeve, 1946, written communication.
	Kingston	do	Do.
Union	Maynardsville; quarry 8.5 miles northwest.	(?)	Do.
	Sharps Chapel	Knox group	Do.
Washington	Bumpass Cove; quarries northwest of Erwin.	Shady dolomite	Rodgers, 1948.
	Erwin; 0.5 mile northwest	do	Do.

medium gray, although some dark beds are present, usually fine grained, and contains some silty layers. The average thickness of the formation is about 700 feet. Details concerning the chemical composition of the rock are not available. (Oder, 1934; Rodgers, 1953; Rodgers and Kent, 1948)

TEXAS

The dolomites of Texas range in age from Precambrian to Cretaceous and occur in several areas. The more important localities include the Central Mineral region, north-central Texas, and parts of western Texas. The formations that appear, from chemical analyses, to contain the best quality dolomite are the Tanyard, Gorman, and Honeycut formations of the Ellenburger group in the central region. These formations and the dolomite facies in them attain considerable thickness in certain areas. Other dolomites that may have commercial possibilities include lenses in the Packsaddle schist and, perhaps, parts of the Wilberns and Rustler formations. Dolomite belonging to the lower part of the Ellenburger group has been quarried as a source of magnesium. (Barnes and others, 1947; Cloud and Barnes, 1946; Warren, 1943)

Packsaddle schist.—Dolomite marble, associated with magnesitic dolomite and magnesite, occurs as lenses in the Packsaddle schist, of Precambrian age. The dolomite is coarsely crystalline, predominantly white, although in places cream colored, and contains varied amounts of silicate minerals. In the vicinity of Llano, Llano County, parts of one lens, more than one-half mile long and about 200 feet thick, have been quarried as a source of terrazzo chips. Chemical analyses of samples from several of these lenses in the same general area show the presence of good-quality dolomite, but they probably are not representative of the average composition of each lens. (Barnes and others, 1947)

Wilberns formation.—The Pedernales dolomite member of the Wilberns formation, of Late Cambrian age, is a fine- to medium-grained, medium- or brownish-gray dolomite, which contains some interstitial glauconite and is locally cherty. The member ranges in thickness from 70 to 150 feet. The Pedernales crops out in Blanco, Burnet, and Llano Counties. Analyses of samples of the dolomite from north of Johnson City, Blanco County, show the rock to range from high-silica to excellent-quality dolomite. (Barnes and others, 1947; Cloud and Barnes, 1946)

Ellenburger group.—The Ellenburger group, of Early Ordovician age, consists of three formations—the Tanyard, Gorman, and Honeycut—each of which contains some dolomite. In general, the Ellenburger group crops out around the periphery of the Llano uplift in Mason, Llano, and adjoining Counties.

Tanyard formation.—The Tanyard formation comprises the Threadgill member and the overlying Staendebach member. The Threadgill, 91 to 313 feet thick, is principally limestone in its western area of outcrop, grading eastward into dolomite. Locally there are abrupt lateral transitions between the two rock types. The dolomite is medium to coarse grained, locally cherty, and usually some shade of gray. Analyses of samples from the dolomitic parts of the Threadgill show that it ranges from dolomitic limestone to excellent-quality dolomite. It has been quarried in the vicinity of Sudduth, Burnet County, as a source of magnesium. The Staendebach member, ranging in thickness from 205 to 456 feet, also contains limestone and dolomite, the dolomites predominating in the western and southeastern areas of outcrop. This member generally is similar in appearance to the Threadgill; it has been distinguished from the Threadgill largely on its higher chert content and finer grained texture. Owing to its cherty nature, the silica content of the dolomite is somewhat higher than in the Threadgill member. (Barnes and others, 1947; Cloud and Barnes, 1946)

Gorman formation.—The Gorman formation is from 426 to 498 feet thick, where typically formed. The lower part generally is dolomitic, the upper calcitic with local interbedded dolomites. The lower dolomitic zone is as much as 230 feet thick. It consists of very fine grained to microgranular dolomite with yellowish, pinkish, and brownish hues predominating. A group of analyses of the dolomite in the vicinity of Johnson City, Blanco County, shows the rock to have a high average silica content. (Barnes and others, 1947; Cloud and Barnes, 1946)

Honeycut formation.—The overlying Honeycut formation is roughly divisible into three units. The lower unit is an alternation of limestone and dolomite, the middle predominantly microgranular dolomite, and the upper part is predominantly limestone. The maximum total thickness of the formation is 678 feet. The formation closely resembles the Gorman except that the light- or yellowish-gray colors generally are not so vivid. Silica sand is common in the lower 50 feet of the Honeycut formation, and siliceous limestone and chert also are common. Chemical analyses indicate that it is slightly low in magnesium carbonate and high in silica. (Barnes and others, 1947; Cloud and Barnes, 1946)

El Paso, Montoya, and Fusselman limestones.—Dolomites of Ordovician age occur in the Franklin Mountains of El Paso County. These include the El Paso and Montoya limestones which, together with the Fusselman limestone, of Silurian age, comprise the summit of the range. These limestones have been described in the section on New Mexico (p. 437), and the same lithologic character prevails in the Franklin Mountains.

Alibates dolomite lentil.—The Alibates dolomite lentil of the Quartermaster formation, of Permian age, occurs in Potter and Moore Counties, where it forms bluffs along the Canadian River. It is a massive white crystalline dolomite, usually separated by a shale member into 2 layers, 2 and 9 feet thick. Although the dolomite is locally cherty, analyses show that some good-quality dolomite is present. (Warren, 1943)

Other formations.—Certain of the limestones of Permian age in the northwestern part of Culberson County contain dolomite locally. A few of the available chemical analyses of the Victorio Peak member of the Bone Spring limestone, the Goat Seep limestone, and the Carlsbad limestone are of high-grade dolomite. The extent of the rock of this quality is not known, however. (King, 1948)

Thin, widespread dolomites of Permian age, similar in occurrence and character to those of western Oklahoma, occur in north-central Texas.

Dolomite quarries and occurrences in Texas

County	*Locality*	*Formation*	*Reference*
Blanco	Johnson City area:		
	a. 1 mile north	Wilberns and Tanyard formations.	Cloud and Barnes, 1946.
	b. 5 miles east	Gorman and Honeycut formations.	Do.
	c. quarry 7.7 miles west	Wilberns formation	Barnes and others, 1947.
	Round Mountain area:		
	a. 0.6 mile west	do	Do.
	b. 7 miles northwest	do	Do.
Burnet	Burnet; quarry	(?)	Do.
	a. 1 mile south	Rocks of Cambrian(?) age.	Do.
	Fairland; 5 miles east	Ellenburger group	Do.
	Kingsland; 7 miles northeast	Rocks of Precambrian age.	Do.
	Lake Victor; quarry, 2.5 miles north-northwest.	Gorman formation	Do.
	Marble Falls; 2 miles south	Honeycut formation	Do.
	Sudduth; quarry	Tanyard formation	Do.
	a. quarries 1 mile north	do	Do.
	b. quarry 3.1 miles south	Gorman formation	Do.
Culberson	Pine Springs area:		
	a. 4 miles west	Bone Spring limestone	King, 1948.
	b. 6 miles west	Goat Seep limestone	Do.
	c. 5.5 miles north-northwest	Carlsbad limestone	Do.
Gillespie	Fredericksburg area:		
	a. 7 miles east	Tanyard formation	Barnes and others, 1947.
	b. 9.5 miles east	Wilberns formation	Do.
Llano	Llano; quarry	Packsaddle schist	Do.
	a. quarry 3 miles southeast	do	Do.
	b. 1.5 miles south-southeast	do	Do.
	c. quarry 6 miles southeast	do	Do.
	Oxford area:		
	a. 2 miles southeast	do	Do.
	b. 3 miles southeast	do	Do.
Moore	Fritch; 3.5 miles southwest	Alibates dolomite lentil	Warren, 1943.
Potter	Fritch; 8 miles southwest	do	Do.
San Saba	Cherokee area:		
	a. 3 miles northeast	Tanyard formation	Cloud and Barnes, 1946.
	b. 9 miles east-northeast	Ellenburger group	Do.
	Harkeyville; 14 miles south-southwest.	Gorman formation	Barnes and others, 1947.
	Richland Springs; 2 miles south-southwest.	Ellenburger group	Do.

They are interbedded with gypsum, shale, sandstone, and limestone. They include the Merkel dolomite member of the Choza formation, and dolomites of the Blaine gypsum and the Dog Creek formation. Chemical analyses are not available, but, if the dolomites are similar in composition to those in western Oklahoma, they probably are not suitable as sources of high-grade rock. The Edwards limestone (Cretaceous) in the central region, although dolomitic in part, probably need not be considered as a source of dolomite, because of the thick beds of pure limestone with which the thin dolomites are interbedded. (Barnes and others, 1947; Cloud and Barnes, 1946; Weissenborn and Stenzel, 1948)

UTAH

Dolomites and dolomitic limestones occur principally in the western half of Utah in the Paleozoic sections exposed in the Wasatch Range and in the fault-block mountains of the Basin and Range province. They range in age from Cambrian to Mississippian, and they are best known in the mineralized areas such as the Tintic, Gold Hill, Oquirrh Mountain, San Francisco, and Cottonwood-American Fork mining districts. The formations have not been correlated between districts; this has resulted in different nomenclature for equivalent geologic sections in each of the districts. The dolomite deposits in these mining districts, those in Cache and Rich Counties, and several examined briefly during the war probably represent most, if not all, the more important deposits in Utah. In most of the areas, little information is available regarding the chemical composition, uniformity, or extent of the dolomite.

Dolomites and dolomitic limestones of Cambrian age have been described at many localities in northern and western Utah. These formations include the Langston, Blacksmith, Nounan, and St. Charles limestones in the Bear River Range and in the Blacksmith Fork area, eastern Cache County; the Bluebird and Cole Canyon dolomites, and the Opex formation in the Tintic district, Juab County; the Maxfield limestone in the Cottonwood-American Fork area, Salt Lake County; the Young Peak dolomite, Trippe limestone, Lamb dolomite, and Hicks formation in the Gold Hill district, western Tooele County; the lower part of the Grampian limestone in the San Francisco district, Beaver County; and the Lynch dolomite of the Oquirrh Mountain district (Stockton-Fairfield quadrangles), near Ophir, Tooele County. (Butler, 1913; Calkins and Butler, 1943; Deiss, 1938; Eardley, 1944; Gilluly, 1932; Lindgren and Loughlin, 1919; Nolan, 1935; Richardson, 1913)

Dolomites and dolomitic limestones of Ordovician age occur also in most of the districts mentioned. These formations include the Ajax limestone and Bluebell dolomite in the Tintic district; the Chokecherry dolomite in the Gold Hill district; the Fish Haven dolomite in the Gold Hill district, Blacksmith Fork area, Bear River Range, and probably south of Laketown, Rich County; and the upper part of the Grampian limestone in the San Francisco district. (Butler, 1913; Nolan, 1935; Lindgren and Loughlin, 1919)

Younger dolomitic rocks include the Laketown dolomite, of Silurian age, in the Gold Hill district, in the area south of Laketown, Rich County, and in the Bear River Range; the Red Warrior limestone, of Silurian(?) and Devonian(?) age, in the San Francisco district; the Sevy and Simonson dolomites, and the Guilmette formation, of Devonian age, in the Gold Hill district; the Jefferson dolomite (Devonian) in the Bear River Range, in eastern Rich County, in the Oquirrh Mountain area, and in the Cottonwood-American Fork district; the Gardner dolomite of Mississippian age, in the Tintic district; and the Madison and Deseret limestones, of Mississippian age, in the Cottonwood-American Fork district. (Butler, 1913; Calkins and Butler, 1943; Gilluly, 1932; Lindgren and Loughlin, 1919; Nolan, 1935; Richardson, 1913)

Of these 27 formations that have been described as dolomite or dolomitic limestone, 7 are shown to be dolomites by available chemical analyses. Brief descriptions of these rocks follow.

Grampian limestone.—The Grampian limestone, of Cambrian(?) and Ordovician age, occurs in the San Francisco district of north-central Beaver County. It consists of about 4,000 feet of heavy-bedded blue dolomitic limestone, with some beds of light-gray limestone and thin shales. Locally the dolomitic limestone is siliceous or cherty, but one analysis shows a "gray dolomitic limestone" that is high-grade dolomite. (Butler, 1913)

Blacksmith limestone.—The Blacksmith limestone, of Middle Cambrian age, consists predominantly of white-gray to dull steel-gray fine- to medium-grained thick-bedded dolomite and interbedded dolomitic limestone. Many of the beds are banded and contain irregular markings of white dolomite. In the Blacksmith Fork area, Cache County, the formation is about 450 feet thick. Chemical analyses of the rock in this locality show that it is a dolomite of excellent quality locally. (Deiss, 1938)

Nounan limestone.—The Nounan limestone, of Middle Cambrian age, consists of light-gray and some dark-gray, medium-grained, thin- and thick-bedded dolomite with about 150 feet of white-gray limestone in the lower part. The formation is about 900 feet thick in the Blacksmith Fork area. One chemical analysis of the rock shows that the sample is a dolomite of excellent quality. (Deiss, 1938)

Bluebird dolomite.—The Bluebird dolomite, of Middle Cambrian age, is typically a dark bluish-gray fine-grained dolomite that is characteristically spangled with short white calcite rods. The thickness of the formation is 175 to 200 feet, and it occurs in several places in the Tintic district, southwestern Utah County and northeastern Juab County. One chemical analysis shows the presence of good-quality dolomite in the area west of Eureka. (Lindgren and Loughlin, 1919)

Cole Canyon dolomite.—The Cole Canyon dolomite, of Middle Cambrian age, overlies the Bluebird and consists of a series of alternating beds, from 10 to 25 feet thick, with nearly white and dark-gray weathered surfaces. The white-weathering beds are medium gray to light gray on the fresh surface; some are dense and finely banded; others are very finely crystalline. The dense variety usually is rather argillaceous, and the finely crystalline variety reportedly is nearly pure dolomite. A few thin shale beds occur in the series. One chemical analysis shows that the darker beds are highly dolomitic, siliceous limestone. No analyses of the light-colored beds are available. (Lindgren and Loughlin, 1919)

Lynch dolomite.—The Lynch dolomite, of Middle(?) and Late Cambrian age, comprises the dolomite sequence of Cambrian age in the Oquirrh Mountains of eastern Tooele County. The formation consists of thick-bedded light-gray dolomite, the lower part of which contains layers of the distinctive dolomite that is characteristic of the Bluebird dolomite. A few limestone beds also occur in the lower part of the formation. The thickness of the Lynch ranges from 825 to 1,000 feet. One analysis of a sample from near Ophir shows that the dolomite has a moderately high silica content. (Gilluly, 1932)

Jefferson dolomite.—The Jefferson dolomite, of Devonian age, occurs in the Bear River Range, west of Garden City, where it is chiefly a massive fine-grained dark dolomite weathering with a brownish tint. The thickness of the formation here is 1,200 feet. A partial analysis shows more than 19 percent magnesia, but nothing is known of the purity

Dolomite quarries and occurrences in Utah

County	Locality	Formation	Reference
Beaver	San Francisco district	Grampian limestone	Butler, 1913.
Cache	Hyrum; 12 miles east, at Blacksmith Fork Canyon.	Blacksmith limestone	
	a. 1 mile west of above	Nounan limestone	
	Logan; east in Logan Canyon	(?)	
Juab	Eureka; west	Bluebird and Cole Canyon dolomites.	
	Leamington; 5 miles east	Rocks of Cambrian(?) or Mississippian(?) age.	
Rich	Laketown; 3 miles south	Laketown and Jefferson dolomites.	Richardson, 1913.
Salt Lake	Alta	Maxfield limestone and Jefferson dolomite(?)	Calkins and Butler, 1943.
Tooele	Dolomite; quarry	Jefferson dolomite(?)	
	Ophir	Lynch and Jefferson(?) dolomites.	
Utah	Santaquin area:		
	a. quarry 3 miles west	Rocks of Devonian(?) or Mississippian(?) age.	
	b. quarry 2 miles northwest	Bluebird(?) and Cole Canyon dolomites.	

of the rock. The formation tentatively identified as Jefferson in the Cottonwood-American Fork area is a thick-bedded light- to medium-gray dolomite, in places faintly mottled. Near the base and near the middle of the formation are layers of thin-bedded impure dolomite with a little shale and chert. It is about 150 feet thick. No analyses of the rock are available. Chemical analyses of rock from formations identified as Jefferson(?) near Ophir and Dolomite, Tooele County, show the presence of some good-quality dolomite. (Calkins and Butler, 1943; Richardson, 1913)

VERMONT

The dolomitic formations in Vermont are mainly in the partly metamorphosed Cambrian and Ordovician sedimentary rocks that occur in north-south belts in the extreme western part of the State. These rocks are west of the Green Mountain front where, in northern Vermont, they occupy the eastern part of the Champlain lowland. The belts extend from the Canadian border southward through Addison County, the narrow Rutland Valley east of the Taconic Range, and into northwestern Massachusetts. The geology is complicated by thrusting, folding, varied degrees of metamorphism, and lack of uniformity in the formations both vertically and laterally. Metamorphism has been greater in the southern part of the belt, and the areas around Proctor, Rutland, and Danby, all in Rutland County, contain the high-grade marbles of the State. The dolomitic formations worthy of mention include the Dunham dolomite of Clark (1934), Winooski marble, Rutland dolomite, the Danby formation, and the Clarendon Springs dolomite. Owing to the lack of uniformity and the siliceous nature of the rocks, the extent of high-purity dolomite seems to be small. Commercial deposits of dolomite are not known. (Cady, 1945; Prindle and Knopf, 1932)

Dunham dolomite of Clark (1934).—The Dunham dolomite of Clark (1934), of Early Cambrian age, is mainly a buff-weathering siliceous dolomite with well-rounded sand grains irregularly distributed throughout. North of Malletts Bay, the upper part of the Dunham is represented by the Mallett member of Cady (1945), typically a smooth gray sandy dolomite interbedded with buff dolomite having siliceous partings and several flaggy, shaly dolomite beds. The thickness of the Dunham varies from 1,700 to 2,000 feet. Commercial quantities of high-grade dolomite may be present in the Dunham(?) in the gorge of Mill River just east of Clarendon, Rutland County. (Cady, 1945)

Winooski marble.—The Winooski marble, of Early Cambrian age, is separated from the underlying Dunham dolomite of Clark (1934) by the Monkton quartzite in west-central Vermont. The rock typically is pink on the fresh surface, becoming less so upward in the section and finally becoming buff or gray. The beds, usually less than 1 foot thick, are separated by siliceous partings. The thickness of the formation ranges from about 100 feet on Snake Mountain, west-central Addison County, to at least 800 feet in the vicinity of Pittsford, north-central Rutland County. No analyses of the dolomites in the formation are available. (Cady, 1945; Keith, 1932)

Rutland dolomite.—The Rutland dolomite, of Early Cambrian age, is composed of a series of heavy-bedded snow-white dolomite; gray dolomite; thin-bedded white grayish-streaked dolomite interbedded with quartzose and shaly layers; and dark-blue to gray carbonaceous dolomite, the uppermost beds of which contain considerable chert. The formation occupies the southern part of the narrow valley bounded on the east by the Green Mountains and on the west by the Taconic Range. South of Pittsford, where the Monkton quartzite apparently pinches out, the Rutland probably is the formational equivalent of the Dunham-Monkton-Winooski sequence. (Cady, 1945; Prindle and Knopf, 1932)

Danby formation.—The lower part of the Danby formation, of Late Cambrian age, contains protruding beds of sandstone separated by beds of dolomite 10 to 12 feet thick. The thickness of this unit is from 400 to 800 feet. The upper part of the Danby is represented by the Wallingford member of Cady (1945). It consists of dark iron-gray magnesian limestone, somewhat siliceous, with some of the beds approaching the composition of sandstone. The thickness of the Wallingford is about 300 to 400 feet where typically formed. (Cady, 1945)

Clarendon Springs dolomite.—The Clarendon Springs dolomite, which overlies the Wallingford member of Cady (1945), is a rather uniform massive smooth-weathering gray dolomite, containing numerous geodes and knots of white quartz. Locally, near the top of the formation, sandy beds and masses of black chert occur. The thickness of the formation varies from 50 to 200 feet and generally is greater to the west. (Cady, 1945; Keith, 1932)

Other formations.—At many places in the eastern part of the State, lenses of calcite marble or dolomite marble occur in the schists and gneisses. These masses are not continuous nor are they uniform in composition from one locality to another. An analysis of a sample from one such lens, near Plymouth, Windsor County, shows that the rock is excellent-quality dolomite, but this is by no means typical of the dolomite in these areas. (Dale, 1915)

Dolomite quarries in Vermont

[Data from Dale, 1915]

County	*Locality*	*Formation*
Windsor	Plymouth; quarry	(?).

VIRGINIA

Dolomite and dolomitic limestone in Virginia are in the Cambrian and Ordovician carbonate rocks that occur in nearly continuous northeast-trending belts throughout the length of the Appalachian Valley. The principal dolomitic formations include the Tomstown and Shady dolomites, Honaker dolomite, Elbrook limestone, Copper Ridge dolomite, and the Beekmantown dolomite. Northwest of Clinch Mountain in Tazewell, Russell, and Scott Counties, the Copper Ridge and Beekmantown, together with the intervening Chepultepec dolomite, constitute the Knox dolomite. Dolomite also occurs locally in the Rome formation. The Honaker appears to be the most promising source of high-purity dolomite, and large quantities are reported to occur in Tazewell and Russell Counties. (Cooper, 1944; Cooper, 1945; Edmundson, 1945)

Tomstown and Shady dolomites.—Dolomite of Early Cambrian age is represented by the Tomstown dolomite northeast of Roanoke and by its equivalent, the Shady dolomite, to the southwest. The upper part of the Tomstown in the northern part of the Valley is predominantly a light- to dark-gray fine- to medium-grained dolomite or dolomitic limestone; some of the beds are cream colored and saccharoidal. The lithologic character of the lower part is less well known. The formation generally is poorly exposed but crops out in parts of Clarke, Rockbridge, and Botetourt Counties. The thickness ranges from 1,000 to 1,500 feet in Clarke County, where large reserves of dolomite may be present along the Shenandoah River. Chemical analyses of samples from near Berryville and Shepherd Ford show the presence of good- to excellent-quality dolomite. The Shady dolomite occupies parts of the Valley southwest of Roanoke. The formation has been divided into three members: the Patterson limestone member, Austinville dolomite member of Butts (1940), and Ivanhoe limestone member. The Austinville is probably the only member that need be considered a potential source of dolomite. It is composed principally of gray and white, usually saccharoidal dolomite, containing some thin limestone beds. Its thickness ranges from perhaps 600 to more than 1,000 feet. It is exposed south of Roanoke and in a nearly continuous belt extending from near Allisonia, Pulaski County, southwestward to Damascus, Washington County. (Butts, 1933; Butts, 1940; Currier, 1935; Edmundson, 1945)

Rome formation.—The Rome formation, of Early Cambrian age, is principally a series of shales, siltstones, and limy sandstones, but it contains local beds of dolomite, one of which is prominent in the vicinity of Roanoke. In this area the dolomite member consists of medium-bedded fine-grained dark-gray dolomite, ranging in thickness from 135 to 155 feet. Chemical analyses show that the rock normally averages about 5 percent impurities, but that some of the dolomite, notably at Roanoke, is of excellent quality. (Cooper, 1944)

Honaker dolomite.—The Honaker dolomite, of Middle Cambrian age, is predominantly dark bluish-gray dolomite, usually finely granular but in places medium grained. The formation contains a few intercalated zones of brecciated dolomite and, locally, minor quantities of limestone and shale. The Honaker crops out in narrow, nearly continuous, northeast-trending belts that extend through parts of Giles, Bland, Tazewell, Russell, Wythe, Smyth, Scott, and Washington Counties. South of Castlewood, Russell County, the dolomite gives way to an equally thick succession of dark bluish-gray limestone (Maryville limestone). The maximum thickness of the Honaker is about 1,400 feet. Analyses show that deposits of excellent-quality rock are in Russell and Tazewell Counties. Large reserves of high-grade dolomite are reported between Carterton and Honaker, Russell County, in the southern part of Cedar Bluff, and in the vicinity of Wittens Mills, both in Tazewell County. (Butts, 1933; Butts, 1940; Cooper, 1944; Cooper, 1945)

Elbrook limestone.—The Elbrook limestone, of Middle and Late Cambrian age, is in part equivalent to the Honaker dolomite and somewhat resembles the Honaker. The formation generally is composed of limestone and dolomitic limestone, but it contains zones of medium- to dark-gray dolomite. Locally these zones attain a thickness of more than 80 feet. Dolomite of good quality is restricted principally to zones of this type. The Elbrook occurs on either side of the Shenandoah Valley and in counties to the south, which include Botetourt, Roanoke, and Montgomery. In Wythe County the formation crops out in a belt that extends from the vicinity of Pierce Mill northeastward nearly to Bertha. The dolomites of the Elbrook have been sampled in several counties, and chemical analyses show them to range from high-silica rock in Augusta County to good-quality rock in Rockingham and Shenandoah Counties. (Butts, 1940; Cooper, 1944; Currier, 1935; Edmundson, 1945)

Copper Ridge dolomite.—The Copper Ridge dolomite, of Late Cambrian age, is equivalent to the lower part of the Knox dolomite northwest of Clinch Mountain and to the Conococheague limestone in the southeastern half of the Valley. It is separated from the underlying Honaker by the Nolichucky shale. The rock is coarser in texture than the Honaker, prevailingly medium gray but varying from bed to bed. The thickness of the formation is from 1,400 to 1,650 feet in Giles County and is probably somewhat less in Clinch Valley. Locally sandstone beds as much as 70 feet in thickness, along with thin layers of chert and silty material, occur. The Copper Ridge crops out in discontinuous belts paralleling the trend of the Valley in parts of Roanoke, Botetourt, Montgomery, Giles, Bland, Wythe, Smyth, Tazewell, Russell, Washington, Scott, and Lee Counties. Chemical analyses show that some of the rock is dolomite but that the content of silica generally is greater than 3 percent. (Butts, 1933; Butts, 1940; Cooper, 1944; Cooper, 1945)

Beekmantown dolomite.—The Beekmantown dolomite, of Early Ordovician age, is predominantly rather fine-grained pearl-gray very compact dolomite containing beds of light- or bluish-gray limestone associated with, or grading into, beds of coarse-grained dolomite. Chert, occurring as masses or beds, is common locally. The thickness of the formation is varied, attaining a maximum of about 3,000 feet. It occurs in belts that extend through nearly every county in the Appalachian Valley.

Dolomite quarries and occurrences in Virginia

County	*Locality*	*Formation*	*Reference*
Augusta	Churchville; 1.25 miles northwest	Elbrook limestone	Edmundson, 1945.
	Staunton; quarry	Beekmantown dolomite.	Do.
	a. 6 miles west	Elbrook limestone(?)	Do.
Clarke	Berryville area:		
	a. 3.5 miles southeast	Tomstown dolomite	Do.
	b. 5.5 miles east, or 1.5 miles northeast of Castleman Ferry.	do	Do.
	Shepherd Ford; 1.5 miles west	do	Do.
Frederick	Meadow Mills	Beekmantown dolomite.	Do.
	Winchester; 0.5 mile south	do	Do.
Giles	Berton; along Norfolk & Western Railroad.	Copper Ridge dolomite	Cooper, 1944.
	Bluff City; east, along Norfolk & Western Railroad.	Beekmantown dolomite.	Do.
	Eggleston	Copper Ridge dolomite.	Do.
	Goodwins Ferry; along Virginian Railroad.	Copper Ridge and Honaker dolomites.	Do.
	Klotz; quarry 0.5 mile northwest	Beekmantown dolomite.	Do.
	Narrows; northwest, along Norfolk & Western Railroad.	Copper Ridge dolomite	Do.
	Pembroke; quarry 1 mile southwest	Beekmantown dolomite.	Do.
Montgomery	Montgomery Station	Copper Ridge dolomite	Do.
	Radford-Peppers Ferry area	do	Do.
	Yellow Sulphur; 0.75 mile southeast.	do	Do.
Page	"along Shenandoah River"	(?)	Bassler, 1909.
Roanoke	Roanoke; quarry	Rome formation	Cooper, 1944.
	Rockydale; quarry	do	Do.
Rockingham	Cootes Store area:		
	a. quarry 1.5 miles northeast	Elbrook limestone	Edmundson, 1945.
	b. 3 miles southwest	do	Do.
	Mount Clinton; 2.5 miles north	do	Do.
	Mount Crawford	Beekmantown dolomite.	Do.
Russell	Boody; quarry	Honaker dolomite	Cooper, 1945.
	Cleveland area:		
	a. 1 mile southeast	do	Do.
	b. 2 miles southeast	do	Do.
	Honaker; 1 mile southeast	do	Do.
	Hubbard Junction; along Norfolk & Western Railroad.	Knox dolomite	Do.
Scott	Clinchport	Honaker dolomite(?)	Bassler, 1909.
	Glenita; quarry	Knox dolomite	Cooper, 1945.
	Speers Ferry; north	do	Do.
Shenandoah	Mount Clifton; 3.5 miles southwest	Elbrook limestone	Edmundson, 1945.
	Strasburg; 2 miles northeast	Beekmantown dolomite.	Do.
Smyth	Glade Spring; northeast, at Lyon Gap.	Knox dolomite	Bassler, 1909.

County	*Locality*	*Formation*	*Reference*
Tazewell	Cedar Bluff; south, along State Route 4.	Honaker and Knox dolomites.	Cooper, 1945.
	Wittens Mills area:		
	a. north	Honaker dolomite	Do.
	b. south	Knox dolomite	Do.
Wythe	Wytheville	Beekmantown dolomite.	Bassler, 1909.

Northeast of Augusta County the formation becomes more dominantly limestone. The Beekmantown has been quarried at many places, and chemical analyses show that the silica content generally is higher than desirable for a high-grade dolomite. (Butts, 1933; Cooper, 1944; Cooper, 1945; Edmundson, 1945)

WASHINGTON

Commercially important dolomite deposits are restricted to northeastern Washington in Okanogan, Stevens, Pend Oreille, and Lincoln Counties. The deposits in Stevens County have been the most important. The dolomitic formations include the Stensgar dolomite of Weaver (1920), which is the host rock of the magnesite deposits, the Old Dominion limestone of Weaver (1920), the Metaline and Northport limestones (perhaps equivalent in age), and the limestone at Riverside. Each of these formations varies in composition, ranging from dolomitic limestone to high-purity dolomite. Much of the dolomite is readily accessible for quarrying, and the Northport limestone northeast of Marble, Stevens County, has been used as the raw material for the production of magnesium at the ferrosilicon reduction plant at Spokane, Spokane County.

Stensgar dolomite of Weaver (1920).—The Stensgar dolomite of Weaver (1920), of Paleozoic(?) age, is predominantly thin-bedded bluish- or pinkish-gray dolomitic limestone and dolomite, which weathers to medium gray or light buff. It generally is fine grained to dense, but in places it is a medium- to coarse-grained marble. Chert, as lenses or nodules, is not uncommon. The formation ranges from 300 to 350 feet in thickness, except in its northern exposures where the apparent thickness is more than 700 feet, due probably to repetition of beds by faulting. The Stensgar crops out in many places in a belt that extends from northwest of Chewelah, Stevens County, southwestward nearly to the Spokane River. Chemical analyses indicate that the impurity content is too high for the rock to be used as a source of high-purity dolomite. (Bennett, 1941; Weaver, 1920)

Old Dominion limestone of Weaver (1920).—The Old Dominion limestone of Weaver (1920), of Paleozoic(?) age, varies considerably in composition and appearance locally. It ranges from nearly pure limestone to white or black coarse-crystalline dolomite that is commonly strongly marbleized and somewhat thick bedded. Near Dunn Mountain, northwest of Addy, Stevens County, dolomite and dolomitic limestone comprise all but the lower 400 feet of the 4,000-foot section. The formation crops out intermittently in a belt extending from Addy northwestward for 5 miles along the Stranger Creek Valley, and then northeastward, passing east of Colville, to a point north of Aladdin. The dolomite in the Miles area, northern Lincoln County, probably is part of the Old Dominion Chemical analyses show the presence of some excellent-quality dolomite. perhaps in large quantities, in the Addy district, the Miles area, and, east of Colville, although the impurity content may be moderately high, generally. (Bennett, 1944; Valentine, 1949; Weaver, 1920)

Northport limestone.—The Northport limestone, of Middle Cambrian(?) age, generally is massive, fine-grained although in places rather coarse, usually white limestone, which is dolomitic locally. The dolomite phase northeast of Marble is light gray and has large areas that are banded or mottled dark gray or black, hard, dense, and finely cyrstalline. In this area the exposed dolomite section is about 725 feet in thickness. The formation crops out in a belt along the Columbia River Valley, from the mouth of Kettle River northeastward nearly to the Canadian border. Analyses of the dolomite from the Marble deposit show that the rock ranges from dolomitic limestone to excellent-quality dolomite. The rock has been quarried from this deposit for use as magnesium ore at the Spokane plant. (Deiss, 1955)

Metaline limestone.—The Metaline limestone, of Middle Cambrian age, has a total thickness of about 3,000 feet, of which approximately 1,200 feet is dolomitic. The base of the dolomitic zone is 1,200 feet above the base of the formation. The upper part of the dolomite generally is fine grained, massive, cream colored to gray, and contains a few intercalated layers of black dolomite with white spots. Lower in the section the texture becomes coarser, and the black layers become more plentiful until, near the base of the dolomite, they constitute perhaps 50 percent of the section. The black layers are usually 5 feet or less in thickness. The general lithologic character of the dolomite is similar to that of the dolomite in the Northport, which is one of the bases for the tentative correlation of the two formations. The Metaline is exposed only in northern Pend Oreille County, extending from Ione northward through the Pend Oreille Valley to the Canadian border. Chemical analyses of the dolomite in the vicinity of Crescent Lake (sec. 12, T. 40 N., R. 44 E.) show that both the light- and dark-colored rock is excellent-quality dolomite. (Park and Cannon, 1943)

Unnamed limestone.—Dolomite and dolomitic limestone of Carboniferous(?) or Triassic age occur in the unnamed unit at Riverside, Okanogan County. These rocks are part of a 10,000-foot succession of limestones, dolomites, and subordinate amounts of shaly limestone, sandstone, conglomerate, quartzite, and siltstone. The main body of dolomite appears to form a stratigraphic zone more than 500 feet thick at or near the base of the series. This rock is mostly white to gray, fine grained, and thick bedded to massive; it contains a few thin interbeds of buff dolomitic limestone. Sand or silt and thin veinlets of quartz occur locally. The dolomitic zone extends from sec. 36, T. 35 N., R. 26 E., southwest of Riverside, northwestward to sec. 3 of the same township. It becomes less evident toward the north, due to folding, faulting, and lateral gradation into sandy and limy phases. Chemical analyses show that the rock ranges from dolomitic limestone to excellent-quality dolomite. (Bennett, 1944)

Dolomite quarries and occurrences in Washington

County	*Locality*	*Formation*	*Reference*
Lincoln	Miles area	Old Dominion limestone(?) of Weaver (1920).	Bennett, 1944.
Okanogan	Riverside area:		
	a. 0.5 mile southwest	Unnamed limestone at Riverside.	Do.
	b. quarry 1.25 miles west	do	Do.
	c. 1.5 miles west	do	Do.
	d. 2.5 miles northwest	do	Do.
	e. 2 miles northwest	do	Do.
	f. north of "e"	do	Do.
	g. 3 miles northwest	do	Do.
	h. 1.25 miles northwest	do	Do.
	i. 3.5 miles northwest	do	Do.
	j. 4.5 miles southwest	do	Do.
Pend Oreille	Metaline Falls; 11 miles north	Metaline limestone	Park and Cannon, 1943.
Stevens	Addy area:		
	a. just northwest	Old Dominion limestone of Weaver (1920).	Bennett, 1944.
	b. quarry 11 miles west-northwest, at Dunn Mt.	do	Do.
	Chewelah; 4.7 miles northwest	Stensgar dolomite of Weaver (1920).	Do.
	Colville area:		
	a. quarry 4.6 miles east	Old Dominion limestone of Weaver (1920).	Do.
	b. just west of "a"	do	Do.
	c. 6.5 miles east	do	Do.
	Fruitland; 5 miles east	Stensgar dolomite(?) of Weaver (1920).	Do.
	Marble; quarry 2 miles northeast	Northport limestone	Deiss, 1955.
	Valley area:		
	a. quarry 1 mile southwest	(?)	Stebbins, 1951.
	b. 7 miles west	Old Dominion limestone(?) of Weaver (1920).	Bennett, 1944.
	c. quarry 10.6 miles west	Stensgar dolomite of Weaver (1920).	Do.
	d. 14.5 miles west	do	Do.

WEST VIRGINIA

Dolomite and dolomitic limestone are restricted principally to relatively small areas in the extreme southeastern and northeastern parts of

West Virginia. They occur chiefly in the Cambrian sequence of carbonate rocks, although dolomitic limestone and some dolomite occur also in the Lower Ordovician strata. The dolomitic formations include the Tomstown dolomite, perhaps parts of the Waynesboro formation, the Beekmantown limestone, and lower Stones River limestone (Murfreesboro limestone). Quarrying has been rather extensive in the areas around Millville, Jefferson County, and Martinsburg, Berkeley County. The Tomstown probably contains the only deposits of high-grade dolomite that might be of commercial interest. (Grimsley, 1916; McCue and others, 1939)

Tomstown dolomite.—The Tomstown dolomite, of Cambrian age, is composed mainly of light blue-gray to white fine-grained splintery dolomite, medium bedded and weathering to dark brown. The formation contains some zones of limestone and shale. The total thickness of the formation is about 1,000 feet. The only exposures of the Tomstown are in eastern Jefferson County, and a belt of high-purity dolomite has been quarried about 1 mile east of Bakerton. Chemical analyses show that the dolomite in this area, although low in impurities, contains more than 0.5 percent sodium and potassium oxides, the presence of which might prove deleterious in some processes. It is probable that most of the rock quarried in the Millville area and assigned questionably to the Waynesboro formation is of Tomstown age. The division between the two formations is not clearly marked in this area. (Grimsley, 1916; McCue and others, 1939; Stose and Ljungstedt, 1932)

Copper Ridge dolomite and Beekmantown limestone.—Dolomitic limestone of Cambrian and Ordovician age is present in southeastern and northeastern West Virginia. In the southeast, in Mercer and Monroe Counties, they are represented by a lower division—the Copper Ridge dolomite—consisting of medium- to massive-bedded dolomitic limestone that weathers into red soil containing small blocks of sandstone; and an upper division—the Beekmantown limestone—consisting of irregularly to massively bedded gray and light-blue magnesian limestones that are dense, hard, and commonly cherty. This sequence in adjoining parts of Virginia contains dolomite that is moderately high in silica, but analyses of the rock in Mercer and Monroe Counties do not show the presence of rock of comparable quality. (McCue and others, 1939)

Conococheague and Chepultepec limestones and Nittany and Bellefonte dolomites.—In northeastern West Virginia the series described above is represented by the Conococheague and Chepultepec limestones and the Nittany and Bellefonte dolomites (Beekmantown). The group comprises a succession of massive dark-blue limestones with dark dolomitic lenses; fairly pure dove-colored to dark-gray limestone; medium- to thick-bedded fine-grained light-blue to dove-colored magnesian limestone; and dark-blue to bluish-gray thick-bedded magnesian limestone and dolomite. The aggregate thickness varies, and its maximum is about 3,600 feet. These rocks crop out in two broad, northeast-trending belts in western Jefferson County and eastern Berkeley County. The Beekmantown has been quarried in the Martinsburg area, and chemical analyses show that it contains some dolomite that is moderately high in silica. (Grimsley, 1916; McCue and others, 1939)

Murfreesboro limestone.—The Murfreesboro limestone probably is not a potential source of dolomite, although it has been quarried in the Martinsburg area, and analyses show that it contains some high-silica dolomite. (Grimsley, 1916)

Dolomite quarries and occurrences in West Virginia

County	*Locality*	*Formation*	*Reference*
Berkeley	Martinsburg area; quarries	Beekmantown limestone and Murfreesboro limestone.	Grimsley, 1916.
Jefferson	Bakerton; quarry 1 mile east	Tomstown dolomite	Grimsley, 1916; McCue and others, 1939.
	Millville area; quarries	Waynesboro formation(?).	Do.
	a. 2.25 miles north	do	Do.
	b. south of town	do	Do.
	c. quarry 1 mile east	(?)	Do.

WISCONSIN

Dolomitic rocks, ranging from dolomitic sandstones, shales, and limestones to high-purity dolomites, are in the formations of Ordovician and Silurian ages that crop out in an arcuate pattern extending through western, southern, and eastern Wisconsin. The most important source of high-purity dolomite probably is the Niagara dolomite, which crops out along the eastern margin of the State. Older rocks, including those of the Prairie du Chien and Black River groups and the Galena dolomite, vary considerably in composition, are generally impure, and probably contain only very local areas in which high-grade rock is to be found. Owing to overburden, exposures of the dolomites are mostly confined to hill and ridge tops, bluffs, and stream valleys. Quarrying has been relatively widespread, and most of the rock has been used locally. Because the dolomitic rocks are not uniform chemically, only those quarries represented by chemical analyses showing dolomite are located on the map (pl. 2). (Steidtmann, 1924)

Prairie du Chien group.—The Prairie du Chien group or Lower Magnesian of former usage, of Early Ordovician age, consists of the Oneota dolomite, a series of shaly, sandy, cherty, gray and light-buff dolomitic limestones; the New Richmond sandstone; and the Shakopee dolomite, which is locally cherty and resembles the lower part of the Oneota. The thickness of the group is about 250 feet where typically formed. These formations crop out in a U-shaped area that extends from Polk County on the west, southward through the southern counties then northeastward to the west of Lake Winnebago and Green Bay, into Marinette County. Chemical analyses indicate that the dolomites of the group generally contain excessive silica, although some good-quality rock occurs in Grant, Outagamie, and Polk Counties. (Behre and others, 1948; Kay, 1935; Powers, 1935; Steidtmann, 1924)

Black River group.—The Black River group, which includes the Platteville and Decorah formations, overlies the Prairie du Chien group and is separated from it by the St. Peter sandstone. The Platteville is principally a limestone and shale series, but one member, the Pecitonica dolomite, is composed of heavy ledges of rather dense blue or gray buff-weathering dolomite. Pecitonica attains a maximum thickness of about 30 feet. The overlying Decorah formation also is a shale and limestone series. Its uppermost member, the Ion dolomite member, is composed of gray argillaceous dolomite. These formations, together with the overlying Galena dolomite, are shown on the State geologic map as a single unit present in the following counties: Grant, Iowa, Lafayette, Green, Rock, Walworth, Dane, Jefferson, Waukesha, Columbia, Dodge, Washington, Green Lake, Fond du Lac, Winnebago, Calumet, Outagamie, Brown, Oconto, and Marinette. They occur also in the western part of the State in parts of Pierce and St. Croix Counties. Generally these formations are too high in impurities, usually silica, to be considered a source of high-purity dolomite. (Behre and others, 1948; Kay, 1935; Steidtmann, 1924)

Galena dolomite.—The Galena dolomite, of Middle Ordovician age, consists of three members: the Prosser cherty member, the Stewartville massive member, and the Dubuque shaly member. The Prosser generally makes up the bulk of the formation; it is a white to gray-buff rather fine-textured cherty dolomitic limestone or dolomite, the thickness of which is commonly more than 125 feet. The Stewartville is composed of buff or gray, mottled thick-bedded dolomite or dolomitic limestone, usually about 80 feet thick. The Dubuque member is composed of thin-bedded ledges of yellow or light-buff dolomite with interbedded shale. Analyses indicate that the Galena generally also is too high in impurities to be considered a source of high-purity dolomite, except possibly in the Watertown area, Dodge County. (Bays and Raasch, 1935; Behre and others, 1948; Kay, 1935; Steidtmann, 1924)

Niagara dolomite.—The Niagara dolomite, of Silurian age, is the most promising source of high-purity dolomite in Wisconsin. The rocks generally are light colored, fine to coarse grained, thin to thick bedded, sometimes cherty, and attain a maximum thickness of about 700 feet. The formation occurs along the eastern margin of the State in a broad belt that extends from the Illinois border northward to the tip of the peninsula separating Green Bay from Lake Michigan. Analyses show that the silica content of the dolomite varies from more than 8 percent to 0.24 percent. It seems likely that large quantities of high-purity dolomite are available from the Niagara. (Behre and others, 1948; Steidtmann, 1924; Sutton, 1935)

Waubakee dolomite.—The Waubakee dolomite (Silurian), which crops out only in Milwaukee and Ozaukee Counties, contains some good-quality dolomite in the vicinity of Wauwatosa, although the impurity content generally is moderately high. The rock is a hard brittle thin-bedded dolomite and usually light gray. The formation is 10 to 12 feet thick. (Steidtmann, 1924; Sutton, 1935)

Dolomite quarries and occurrences in Wisconsin

[Data from Steidtmann, 1924]

County	*Locality*	*Formation*
Brown	Duck Creek; quarries	Galena dolomite.
Buffalo	Alma; quarries	Prairie du Chien group, (the Lower Magnesian dolomite of former usage).
	Cochrane; quarry	Do.
	Fountain City; quarries	Do.
Calumet	Brillion; quarries	Niagara dolomite.
	Hayton; quarries	Do.
	High Cliff; quarries	Do.
Columbia	Columbus; quarries	Galena dolomite.
Crawford	DeSoto; quarry	Prairie du Chien group (the Lower Magnesian dolomite of former usage).
	Soldiers Grove; quarry	Do.
Dane	Oregon; quarry 2 miles west	Galena dolomite.
	Sun Prairie; quarries 2 miles northeast	Do.
Dodge	Iron Ridge; quarry	Niagara dolomite.
	a. quarry 3 miles north	Do.
	Knowles	Do.
	Mayville; 2 miles southwest	Do.
	Nasbro; quarry	Do.
	Richwood; quarry	Galena dolomite.
	Watertown area; quarries	Do.
Door	Sturgeon Bay area; quarries	Niagara dolomite.
Fond du Lac	Hamilton; quarries	Do.
	Marblehead; quarries	Do.
	Oakfield; quarry	Do.
	Ripon; quarry	Prairie du Chien group (the Lower Magnesian dolomite of former usage) and Black River group.
	Taycheedah	Niagara dolomite.
Grant	Woodman	Prairie du Chien group (the Lower Magnesian dolomite of former usage).
Jefferson	Fort Atkinson; quarry 2 miles southeast	Black River group and Galena dolomite.
	Jefferson; quarry 4 miles northwest	Do.
	Milford; quarry 3 miles northwest	Do.
Kewaunee	Kewaunee; quarry 2 miles west	Niagara dolomite.
La Crosse	La Crosse; quarries 2 miles east	Prairie du Chien group (the Lower Magnesian dolomite of former usage).
Lafayette	Darlington; quarry	Black River group and Galena dolomite.
Manitowoc	Cooperstown; quarry	Niagara dolomite.
	Grimms; quarry	Do.
	Quarry; quarry	Do.
Milwaukee	Milwaukee	Waubakee dolomite.
	Wauwatosa; quarry	Waubakee and Niagara dolomites.
Oconto	Oconto Falls	Prairie du Chien group (the Lower Magnesian dolomite of former usage).
Outagamie	Black Creek; quarry 3 miles north	Do.
	Kaukauna; quarries	Black River group and Galena dolomite.

Dolomite quarries and occurrences in Wisconsin—Continued

County	*Locality*	*Formation*
Ozaukee	Druecker; quarry	Niagara dolomite.
	Fredonia; 1 mile west	Waubakee dolomite.
	Grafton; quarry	Niagara dolomite.
Pierce	Elmwood; quarry 2 miles west	Prairie du Chien group (the Lower Magnesian dolomite of former usage).
	Prescott; 6 miles north	Do.
Polk	Little Falls	Do.
Racine	Ives; quarry	Niagara dolomite.
	Racine; quarries	Do.
Rock	Beloit; quarry	Black River group and Galena dolomite.
	a. quarry 1 mile west	Do.
	b. quarry 2 miles north	Do.
	Janesville; quarry	Do.
St. Croix	New Richmond; quarry 2 miles northwest.	Prairie du Chien group (the Lower Magnesian dolomite of former usage).
	Wilson; quarry	Do.
Sauk	Sauk City area:	
	a. 5 miles west	Do.
	b. 5 miles southwest	Do.
Sheboygan	Sheboygan; quarries 1 mile northwest	Niagara dolomite.
	Sheboygan Falls; quarry	Do.
Walworth	Whitewater; quarry	Black River group and Galena dolomite.
Waukesha	Delafield; quarry 1 mile southeast	Niagara dolomite.
	Genesee; quarry 1 mile northeast	Do.
	Lannon; quarry	Do.
	Pewaukee; quarry	Do.
	a. quarry 2 miles northeast	Do.
	Templeton; quarry	Do.
	Waukesha; quarry 0.5 mile north	Do.
Winnebago	Mehasha; quarry 2 miles northwest	Black River group and Galena dolomite.
	Oshkosh; quarry	Do.

WYOMING

Dolomites and dolomitic limestones occur rather extensively in the Absaroka, Wind River, Owl Creek, and Bighorn Mountains of west-central and north-central Wyoming and, to a lesser extent, in the southeastern part of the State. Potentially the most important of the dolomitic formations is the Bighorn dolomite, although it is not everywhere a high-purity dolomite. Other dolomitic formations include those of the Whalen group, the Darby formation, the Madison limestone, and the Amsden, Casper, and Phosphoria formations. These formations locally contain dolomite, but deposits of high-grade rock in commercial quantities probably are few. The Wyoming dolomites have not been exploited; many of the deposits are somewhat inaccessible and rather distant from marketing areas.

Whalen group.—The dolomites of the Whalen group, of Precambrian age, are maroon and salmon pink to tan gray, fine grained, thick bedded, and siliceous and contain bands and nodules of chert in the lower part. In the upper part the colors change to dull gray and white, and the dolomite becomes extremely siliceous. These rocks have been studied in the vicinity of Guernsey, Platte County. South and southwest of Guernsey, dolomite, which might belong to the same group, occurs as isolated masses, probably roof pendants, partly surrounded by granite. The dolomite is coarsely crystalline, nearly pure white, thick and thin bedded, and contains abundant tremolite. Chemical analyses of these dolomites are not available, but they are reported to range from slightly magnesian limestone to nearly pure dolomite. (Clabaugh and others, 1946; Osterwald and Osterwald, 1952)

Bighorn dolomite.—The Bighorn dolomite (Ordovician), most widespread of the dolomites, is generally tan-gray or gray, usually strongly mottled, fine- to medium-grained, very thick bedded dolomite which weathers to extremely rough surfaces. The formation generally is from 150 to 300 feet thick, but thins rapidly to the south and, consequently, is not present in the mountains in southern Wyoming. The most favorable areas of the Bighorn are in the Absaroka, Wind River, and Owl Creek Mountains. Chemical analyses indicate that the Bighorn is consistently a dolomite of moderately good quality, except in the Bighorn Mountains where limestone and shale are more common than elsewhere. One deposit of the Bighorn dolomite at the south end of Wind River Canyon, about 20 miles south of Thermopolis, appears to be a promising source of excellent-quality dolomite. (Blackwelder, 1913; Osterwald and Osterwald, 1952)

Darby formation.—The Darby formation, of Devonian age, is principally a drab-brown impure dolomitic limestone, locally containing dolomite, with interbedded limestones and shale partings. The formation is chiefly in the Wind River Mountains. Although some good-quality dolomite has been examined in the area west of Lander, Fremont County, the Darby probably does not contain commercially important deposits of high-purity dolomite. (Osterwald and Osterwald, 1952)

Madison limestone.—The Madison limestone, of Mississippian age, comprises a limestone series, but in certain areas it contains dolomite and dolomitic limestone, either as a basal zone or as lenticular masses. In Wind River Canyon south of Thermopolis, in the area southwest of Lander, and in Shoshone Canyon west of Cody, the basal zone of dolomite and dolomitic limestone is present in thicknesses as much as 200 feet. In the area south of Thermopolis the dolomites so closely resemble the underlying Bighorn dolomite that separation of the two formations is extremely difficult. Chemical analyses indicate that the dolomites of the Madison are, in a few localities, of good quality. (Osterwald and Osterwald, 1952)

Casper formation.—The Casper formation, of late Pennsylvanian and Permian(?) age, equivalent in part to the Amsden, is principally in the Laramie Range and the Casper Mountains, southeastern Wyoming. It is predominantly an alternating series of limestones, dolomites, sandstones, and shales. The dolomite beds in the lower part of the formation are usually 5 to 20 feet thick in the vicinity of Casper, and analyses indicate the presence of some good-quality dolomite in this area. In the Laramie Mountains, however, the dolomites probably are too siliceous and calcareous to be considered high-purity dolomite. (Osterwald and Osterwald, 1952)

Phosphoria formation.—The Phosphoria formation, of Permian age, contains beds of dolomite that range from 3 to 16 feet in thickness separated by considerably thicker units of cherty limestones, sandstones, and sandy shales. The formation is in the Bell Springs and Casper Mountain areas, the Owl Creek Mountains, the Lovell area, and west of Cody. Chemical analyses show that the rock is a dolomitic limestone generally, although some good-quality dolomite occurs south of Thermopolis and west of Cody. (Osterwald and Osterwald, 1952)

Dolomite occurrences in Wyoming

[Except for Casper area (a), data taken from Osterwald and Osterwald, 1952]

County	*Locality*	*Formation*
Albany	Bosler; 12 miles east	Precambrian rocks.
	Centennial; 8 miles northwest	Ranger marble of Blackwelder.
	Laramie; 8.5 miles northeast, in Rogers Canyon.	Casper formation.
Bighorn	Greybull; 21.8 miles east, in Shell Creek Canyon.	Bighorn dolomite.
	Lovell area:	
	a. 5 miles east	Phosphoria formation.
	b. 29 miles by road east	Bighorn dolomite.
Carbon	Bell Springs	Phosphoria formation.
	a. 2 miles south	Amsden formation.
Fremont	Bull Lake	Bighorn dolomite.
	Lander area:	
	a. 10 miles southwest	Bighorn dolomite, Darby formation, and Madison limestone.
	b. 36 miles by road west, at Bald Mountain.	Bighorn dolomite and Darby formation.
	Thermopolis; 20 miles south	Bighorn dolomite and Madison limestone.
Hot Springs	Thermopolis area:	
	a. 5 miles south	Phosphoria formation.
	b. 6 miles south	Embar formation.
	c. 9 miles south	Bighorn dolomite.
	d. 13 miles south	Do.
Johnson	Buffalo; 7.5 miles west	Do.
Natrona	Casper area:	
	a. 5.5 miles south	Madison limestone.
	b. 10.5 miles southwest, in Jackson Canyon.	Casper formation and Madison limestone.
	c. 40 miles southwest, in Platte Canyon.	Casper formation.
Park	Cody area:	
	a. 4 miles west	Bighorn dolomite.
	b. 7 miles west	Phosphoria formation.
	c. west of Shoshone Dam	Bighorn dolomite.
Platte	Guernsey; 2 miles northeast	Whalen group.
	Wheatland area:	
	a. 18.5 miles by road west	Do.
	b. 16.3 miles southwest	Do.
	c. 26 miles southwest	Do.
	d. 30.4 miles by road southwest	Do.
Sheridan	Dayton; 14 miles by road west	Bighorn dolomite.
Sublette	Gros Ventre Range:	
	a. Lebarge Mountain	Do.
	b. Shoal Creek, upper falls	(?).
Teton	Teton Mountains; Leigh Creek	(?).

RESERVES

Very little information has been published regarding reserves of dolomite in the United States. For this and many other reasons any attempt to record an estimate of reserves in a report of this type would be futile. To determine with any degree of accuracy the reserves of even a single deposit would require systematic drilling and sampling, because of the common vertical and lateral variations in chemical composition of the rocks. This fact must be kept in mind by a potential quarry operator in his appraisal of an otherwise desirable quarry site.

A figure representing tons of available dolomite in the United States would be astronomical. A tonnage estimate of inferred "ore" in 125 deposits in California, Wyoming, Idaho, Montana, Washington, Arizona, Nevada, and Utah, examined by the U. S. Geological Survey during World War II, amounts to nearly 2 billion tons of dolomite available by open-pit quarrying (Deiss, 1945, p. 1). This figure by no means represents the total quantity of dolomite available in these States, but it conveys some idea of the order of magnitude of reserves. For all practical purposes, it appears that reserves of dolomite in the United States are unlimited, or at least inexhaustible for any foreseeable time.

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Describes briefly the stratigraphy, structure, distribution of the limestone in the main Rockland-Thomaston belt of Knox County and several areas potentially useful for the production of agricultural lime, flux stone, and cement. No analyses are included.

2 Apfel, E. T., 1944, Dolomite in the vicinity of Lee, Mass., as an available source of metallic magnesium: Mass. Dept. Public Works and U. S. Geol. Survey Cooperative Geol. Proj., Inf. Circ. 4, open-file rept., 34 p.

Describes in detail the Stockbridge limestone, as it occurs in the Lee area, including geology, lithologic character, and structure of the dolomite marbles, and several of the quarries in the area. Includes many analyses and a geologic map, scale 1 inch = 1,150 feet. Estimated reserves of indicated ore in the area are at least 3 million tons of high-purity dolomite.

3 Argall, G. O., Jr., 1949, Industrial minerals of Colorado: Colo. School Mines Quart., v. 44, no. 2, 477 p.

Catalogs industrial minerals (nonmetallics) of Colorado and summarizes properties, uses, occurrence, and production of each mineral. Includes in the section on dolomite (p. 144–149) 13 analyses of samples, most of which are not precisely located, describes general distribution, contains a brief bibliography and a copy of the U. S. Geol. Survey Missouri Basin Studies map, "Construction materials and nonmetallic mineral resources of Colorado," scale 1:500,000. Geology of the deposits is not described.

Index no.

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5 Ball, C. J. P., 1944, The Basic Magnesium enterprise: Am. Inst. Min. Metall. Eng. Trans., v. 159, p. 285–292.

Gives a general description of the entire process for the preparation of magnesium from the mining of magnesite at Gabbs, Nev., to the production of magnesium metal at the Basic Magnesium, Inc., plant near Las Vegas.

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Includes general descriptions of locations, geology, and reserves of serpentine in Texas; description of mineralogy of serpentine; experimental data; and a review of possible industrial uses.

9 Bassler, R. S., 1909, The cement resources of Virginia west of the Blue Ridge: Va. Geol. Survey Bull. 2–A, 309 p.

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10 Bastin, E. S., 1906, The lime industry of Knox County, Maine: U. S. Geol. Survey Bull. 285, p. 393–400.

Discusses briefly the distribution, utilization, and character of the limestone and dolomite in the vicinity of Rockland, Thomaston, and Rockport and includes seven analyses of the rocks in the area.

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Discusses the stratigraphic boundaries of the St. Peter, Platteville, Decorah, and Galena formations, and describes briefly the 5 members in the Platteville, 2 in the Decorah, and 3 in the Galena, some of which are dolomites.

12 Beach, J. O., and English, S. G., 1940, Dolomite and magnesium limestone: Okla. Geol. Survey Min. Rept. 6, 18 p.

Index
no.

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13 Behre, C. H., Jr., Heyl, A. V., Jr., and McKnight, E. T., 1948, Zinc and lead deposits of the Mississippi Valley, *in* Dunham, K. C., ed., Symposium on the geology, paragenesis, and reserves of the ores of lead and zinc: London, 18th Internat. Geol. Cong., p. 46–61.

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16 ——— 1944, Dolomite resources of Washington: Wash. Dept. Conserv. and Devel., Div. Geology Rept. Inv. 13, 35 p.; 1945, Supp. Pt. 1, Preliminary report on Okanogan, Lincoln, and Stevens Counties, chemical analyses, 15 p.

Describes the general geology of the Riverside, Old Fort Spokane (Miles), and Addy districts and specific deposits including their location, property ownership, topography, structure, estimates of tonnage available, and potential quarry sites. Supplement lists more than 300 analyses of the dolomites. Twelve maps, scale 1 inch = 200 feet, show the topography and outcrop areas of the dolomite deposits.

17 Beyer, S. W., and Williams, I. A., 1907, The geology of quarry products, *in* Quarry products of Iowa: Iowa Geol. Survey, v. 17, p. 185–525.

Presents a summary, by counties, of each formation of any economic importance, including distribution, lithologic descriptions of quarry exposures and outcrops, uses, and general evaluation of the rocks in the formation, several analyses, and many measured sections.

18 Beyer, S. W., and Wright, H. F., 1914, Road and concrete materials in Iowa: Iowa Geol. Survey, v. 24, p. 33–685

Index no.

Includes a brief summary of the formations and the evaluation of each for use as road material, a detailed discussion of the sand, gravel, and limestone resources of each county, measured sections and descriptions of quarries and outcrops, a directory of stone and sand and gravel producers, and a list of 112 analyses of limestone and dolomite.

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22 Bowles, Oliver, 1939, The stone industries: New York, McGraw-Hill Book Co., Inc., 519 p.

Describes the various phases of the stone industries: Pt. 1—General features of the stone industries; Pt. 2—Dimension stone; Pt. 3—Crushed and broken stone. Discusses dolomite with limestone in Pt. 3, p. 377–472, including uses of dolomite and high-magnesian limestone, crushed limestone industry by States, and quarry methods and equipment.

23 Bowles, Oliver, and Jensen, M. S., 1941, Limestone and dolomite in the chemical and processing industries: U. S. Bur. Mines Inf. Circ. 7169, 15 p.

Summarizes very briefly the principal uses of limestone and dolomite where the chemical composition of the rock is important, mentions principal producing areas, and includes statistical history, 1920–39, giving quantities used and sold in the various consuming industries.

24 Bownocker, J. A., Compiler, 1947, Geologic map of Ohio. Reprinted 1947 with revision of glacial boundary by G. W. White and changes in base map: Ohio Geol. Survey, scale 1:500,000.

25 Bradley, W. W., 1925, Magnesite in California: Calif. State Min. Bur. Bull. 79, 147 p.

Summarizes briefly the industrial uses, tests, and production of magnesite; lists, by counties, the occurrences, both commercial and noncommercial, giving locations, brief descriptions of the mines and deposits, and the status of operations; and includes several analyses.

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26 Branner, G. C., 1941, Limestones of northern Arkansas: Little Rock, Ark., Ark. Geol. Survey, 24 p.

Includes a brief summary of the composition, uses, occurrence, and production of limestone and dolomite in northern Arkansas; 114 analyses; small-scale maps showing general distribution of the limestones, sample localities, and quarries; and a generalized stratigraphic section, which briefly describes the lithologic character, areas of exposure, and thicknesses of the limestone formations. Mentions the dolomite quarries near Rogers and Sulphur Springs, Benton County.

27 ——— 1942, Mineral resources of Arkansas: Ark. Geol. Survey Bull. 6, 101 p.

Includes a general summary of the mineral resources of the State with special emphasis on occurrence and production, a short general section on limestone and dolomite (p. 62–63) (which contains no geology), and a small-scale map, 1 inch = about 43 miles, showing the general distribution of dolomite in the northern part of the State.

28 Branner, G. C., and others, 1940, Mineral resources of Benton, Carroll, Madison, and Washington Counties: Ark. Geol. Survey County Min. Rept. 2, 55 p.

Briefly describes the geology and summarizes the mineral resources, giving composition, uses, occurrence, and production. Section on dolomite (p. 25–33) states that the only surface occurrences of possible importance belong to the Cotter dolomite in Benton and Carroll Counties. Mentions two quarries near Sulphur Springs. Includes small-scale geologic and mineral localities maps.

29 Bridge, Josiah, 1930, Geology of the Eminence and Cardareva quadrangles: Mo. Bur. Geology and Mines, 2d ser., v. 24, 228 p.

Gives a detailed report on the geology of this part of the Ozark region, including descriptions of the stratigraphy, structure, economic geology, and paleontology. Of special interest are the discussions of the Bonneterre, Potosi, and Eminence dolomites and the Van Buren, Gasconade, Jefferson City, and Cotter formations. Includes analyses of 5 samples of carbonate rocks and a geologic map, scale 1:62,500.

30 Bryson, R. P., and others, 1947, Map showing construction materials and nonmetallic mineral resources of South Dakota: U. S. Geol. Survey Missouri Basin Studies Map 12.

Map, scale 1:500,000, shows the areal distribution of the Whitewood, Pahasapa and Minnekahta limestones, all of which are reportedly dolomitic. Shows several quarries in the limestone areas but does not indicate that any are in dolomite. Text briefly describes the areas of occurrence.

31 Buckley, E. R., and Buehler, H. A., 1904, The quarrying industry of Missouri: Mo. Bur. Geology and Mines, 2d ser., v. 6, 371 p.

A general survey of the quarrying industry in the State, giving a brief summary of the operations and geology of the important quarries. Also contains general information on uses, selection of stone, properties, and results of laboratory tests on stone. Includes about 80 analyses and a geologic map, scale 1 inch = 18 miles.

32 Buehler, H. A., 1907, The lime and cement resources of Missouri: Mo. Bur. Geology and Mines, 2d ser., v. 6, 255 p.

Discusses the character, uses, and manufacture of cements and concrete, and the necessary raw materials, including limestone, clay, and shales; summarizes

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the lime and cement raw materials by counties, gives brief, general descriptions of the geologic formations; and includes more than 200 analyses of limestone and dolomite.

33 Burchard, E. F., and Butts, Charles, 1910, Iron ores, fuels, and fluxes of the Birmingham district, Alabama, with chapters on the origin of the ores, by E. C. Eckel: U. S. Geol. Survey Bull. 400, 204 p.

Treats comprehensively the geology, character and origin of the ores, and sources of fuels and fluxes in the district. Of interest to the study of dolomites is the section on the "Ketona dolomite member," which briefly outlines its distribution and character, quarries and quarrying methods and contains analyses from the Ketona and North Birmingham quarries. Includes map, scale 1 inch = about 7 miles, showing economic geology of the area and a geologic map of the Birmingham Valley, scale 1:125,000.

34 Butler, B. S., 1913, Geology and ore deposits of the San Francisco and adjacent districts, Utah: U. S. Geol. Survey Prof. Paper 80, 212 p.

Discusses in detail the stratigraphy and structure of the region and describes the mineralogy and nature of the ore deposits of the several mining districts studied. Includes two analyses of limestone and dolomite. Of interest is the description of the Grampian limestone and the analysis, which indicate the presence of high-grade dolomite. Includes also geologic map, scale 1:62,500.

35 Butts, Charles, 1911, Dolomite for flux in the vicinity of Montevallo, Shelby County, Ala.: U. S. Geol. Survey Bull. 470, p. 525–527.

Describes briefly the occurrences of the Ketona dolomite in the area north of Montevallo, Ala. Includes six analyses. In this area the Ketona dolomite is reportedly much purer than in the Birmingham Valley.

36 ——— 1926, Geology of Alabama—The Paleozoic rocks: Ala. Geol. Survey Special Rept. 14, p. 41–230.

Describes in general the lithologic character, distribution, thickness, structure, age, and stratigraphic relations of the Paleozoic formations and gives descriptions of the Brierfield, Ketona, Bibb, Copper Ridge, and Chepultepec dolomites. No analyses are given. Includes a geologic map of Alabama, scale 1:500,000.

37 ——— 1933, Geologic map of the Appalachian Valley of Virginia with explanatory text: Va. Geol. Survey Bull. 42, 56 p.

Geologic map, scale 1:250,000, shows general distribution of the geologic formations of the region. Accompanying text gives general discussion of the formations, including their lithologic character and distribution. No analyses are given. [Some of the stratigraphy has since been revised.]

38 ——— 1940, Geology of the Appalachian Valley in Virginia, Part 1, Geologic text and illustrations: Va. Geol. Survey Bull. 52, Pt. 1, 568 p.

Gives general descriptions, including measured sections, of the rocks, structure, and geologic history of the Appalachian Valley, also descriptions of the Shady and Tomstown dolomites, the Honaker and Elbrook dolomites, the Conococheague limestone, and the Copper Ridge dolomite. No analyses are included. For geologic map, see Butts, 1933.

39 Butts, Charles, and Gildersleeve, Benjamin, 1948, Geology and mineral resources of the Paleozoic area in northwest Georgia: Ga. Geol. Survey Bull. 54, 176 p.

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Presents the geology, including stratigraphic descriptions and structure, and a summary of the mineral resources of northwest Georgia. Includes for each mineral a description, along with sections on uses, location of deposits, character of the ores, and remarks on production and reserves. Section on limestone and dolomite (p. 127–137) includes brief descriptions of the formations and 21 analyses. Maps, scale 1 inch = about 4 miles, show the geology of the area and mine, quarry, and prospect locations.

40 Butts, Charles, Schwartz, F. M., and Willard, Bradford, 1939, Geology and mineral resources, Tyrone quadrangle [Pennsylvania]: Pa. Geol. Survey, 4th ser., Topog. and Geol. Atlas of Pennsylvania 96, 118 p.

Gives detailed description of the stratigraphy, structure, geologic history, and mineral resources of the Tyrone quadrangle, covering parts of Blaire, Centre, and Huntingdon Counties, and a few analyses. Report is of interest principally for the descriptions of the formations equivalent to the Elbrook, Conococheague, Beekmantown, and Conestoga limestones. Includes geologic map, scale 1 inch = 1 mile.

41 Cady, W. M., 1945, Stratigraphy and structure of west-central Vermont: Geol. Soc. America Bull., v. 56, p. 515–587.

Gives a comprehensive discussion of stratigraphy and structure and a detailed discussion of lithologic character, correlation, nomenclature, and revisions in the stratigraphy. No analyses are included. Includes geologic maps, scale 1:62,500.

42 Calkins, F. C., and Butler, B. S., 1943, Geology and ore deposits of the Cottonwood-American Fork area, Utah: U. S. Geol. Survey Prof. Paper 201, 152 p.

Describes in detail the stratigraphy, structure, and ore deposits of the district. No analyses of the carbonate rocks are given. Lithologic descriptions of the Maxfield limestone, Jefferson(?) dolomite, and Madison limestone indicate that parts of these formations are dolomite or dolomitic limestone. Includes geologic map, scale 1:25,000.

43 Callaghan, Eugene, 1933, Brucite deposit, Paradise Range, Nev.: Nev. Univ. Bull., v. 27, 34 p.

Preliminary report includes brief sections on the general geology, metamorphism, and structure; more detailed descriptions of the brucite and magnesite deposits, with preliminary reserve estimates; log of diamond-drill core; sample analyses; and a geologic map, scale 1 inch = about 475 feet.

44 Callaghan, Eugene, and Vitaliano, C. J., 1948, Magnesite and brucite deposits at Gabbs, Nye County, Nev.: U. S. Geol. Survey open-file rept., 18 p.

Brief preliminary report of the deposits at Gabbs summarizes the general geology and occurrence of the ore deposits, including their distribution, composition, origin, and reserves of magnesite. Reserves are estimated to be 27 million tons of magnesite containing less than 5 percent CaO. Includes 10 analyses of magnesite, brucite, and associated rocks, and geologic map, scale 1 inch = 100 feet, showing distribution of dolomite, magnesitic dolomite, magnesite, hydromagnesite, and brucite.

45 Calvin, Samuel, 1895, The Leclaire limestone: Iowa State Univ. Bull. Lab. Nat. History, v. 3, p. 183–189.

Presents a detailed description of the Leclaire limestone, which "constitutes the second stage of the Niagara formation as it is developed in Iowa." Also

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includes brief description of beds of the Anamosa stage, which overlies the Leclaire.

46 Case, F. O., Satterthwaite, H. G., Coulter, L. R., and Harden, B., 1944, Process improvements at the Henderson plant of Basic Magnesium, Incorporated: Am. Inst. Min. Metall. Eng. Trans., v. 159, p. 293–295.

Gives brief summary of improvements in pellet mixing, metal handling, and metallurgical recovery and of production from September 1942 to July 1944 at the Basic Magnesium, Inc., plant near Las Vegas, Nev.

47 Chandler, H. P., and Jensen, N. C., 1954, Stone: U. S. Bur. Mines Minerals Yearbook, 1951, p. 1180–1211.

Summarizes general statistics of the stone industry in 1951. Data on dolomite generally included with those on limestone. Table (p. 1205) shows quantity of dolomite used for basic magnesium carbonate, refractory uses, dead-burned dolomite, and paper mills during 1950–51.

48 Chelf, Carl, 1941, Magnesite mining in Llano County, Tex.: Tex. Univ. Bur. Econ. Geology, Min. Res. Survey Circ. 40, 6 p.

Describes briefly the magnesite deposits at the Texas Mines and Meramec mines, southeast of Llano. Includes cross-section sketches of the mines, brief summary of the uses and consumption of magnesite, and a bibliography.

49 Clabaugh, S. E., and others, 1946, Construction materials and nonmetallic mineral resources of Wyoming: U. S. Geol. Survey Missouri Basin Studies Map 9.

Map, scale 1:500,000, shows areal distribution of rock types and nonmetallic minerals, including dolomite and dolomitic limestone. Brief explanatory text lists the following units as containing dolomite: Whelan, Bighorn, Madison, Darby, Amsden, Casper, and "Permian." States that "reserves are almost inexhaustible."

50 Clark, T. H., 1934, Structure and Stratigraphy of southern Quebec: Geol. Soc. America Bull., v. 45, p. 1–20.

Uses the term Dunham dolomite to identify certain dolomite beds of Early Cambrian age in the Sutton quadrangle, Quebec and Vermont.

51 Clemmer, J. B., and Cooke, S. R. B., 1936, Flotation of Vermont talc-magnesite ores: U. S. Bur. Mines Rept. Inv. 3314, 12 p.

Talc concentrates and tailings rich in magnesite were obtained in experimental concentration of the ores. Describes results of batch-tests; magnesite, containing 8 to 14 percent impurities, comprised the tailings. Concludes that this material might be suitable for some uses and constitute a source of extra income for talc producers.

52 Cloud, P. E., Jr., and Barnes, V. E., 1946, The Ellenburger group of central Texas: Tex. Univ. Bur. Econ. Geology Pub. 4621, 473 p. [1948].

Describes in detail the stratigraphy, including measured sections, general geology, and structure of central Texas and discusses the lithologic character, facies changes, and thicknesses of the formations ranging in age from Precambrian to Pennsylvanian. Includes analyses of 113 samples of limestone and dolomite from Johnson City and Cherokee areas, analyses of samples from 32 drill holes on the Victoria Gravel Co. properties near Sudduth, small-scale index map

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showing where Ellenburger was mapped, and large-scale (1 in. = about 800 ft.) geologic maps of these areas.

53 Colby, S. F., 1941, Occurrences and uses of dolomite in the United States: U. S. Bur. Mines Inf. Circ. 7192, 21 p.

Discusses briefly the composition, properties, and uses of dolomite, and gives a very brief survey of occurrence and uses of dolomite by States. Includes a small-scale map showing "location of high-grade dolomite quarries in the U. S." and a bibliography.

54 Colorado Bureau of Mines, 1945, 1945 list of operating mines, mills, smelters, quarries, etc.: Colo. State Bur. Mines, 14 p.

55 Comber, A. W., 1937, Magnesite as a refractory: Philadelphia and New York, J. B. Lippincott Co., 114 p.

Presents a general discussion of magnesite, its composition and properties, sources, methods of calcination, the chemical and physical properties of refractory magnesite, manufacture of refractory brick, and the industrial application of refractory magnesite. Includes a bibliography.

56 Comstock, H. B., 1954, Magnesium: U. S. Bur. Mines Minerals Yearbook, 1951, p. 791–800.

Reviews the magnesium industry for 1951. Summarizes status of Government-owned magnesium plants and the ferrosilicon reduction process; points out the advantages of this type of plant for standby production facilities.

57 Cooper, B. N., 1944, Industrial limestones and dolomites in Virginia, New River—Roanoke River district: Va. Geol. Survey Bull. 62, 98 p.

Describes in detail limestone and dolomite occurrences in parts of Giles, Montgomery, Pulaski, Roanoke, and Botetourt Counties. Includes columnar sections, about 90 analyses of limestones and dolomites, and brief descriptions of some quarries and potential quarry sites. Maps (scales range from 1 in. = 250 ft. to 1 in. = 1 mi.) show quarry locations and geology of some of the areas discussed.

58 ——— 1945, Industrial limestones and dolomites in Virginia; Clinch Valley district: Va. Geol. Survey Bull. 66, 259 p.

Describes in detail the limestone and dolomite formations in Tazewell, Russell, and Scott Counties, also quarries and potential quarry sites. Includes 144 geologic sections and 241 analyses of limestones and dolomites. Maps show the distribution of the carbonate rocks in the 3 counties.

59 Crawford, A. L., 1941, Magnesite—a new economic mineral for Utah [abs.]: Utah Acad. Sci. Proc., v. 18, p. 18.

Brief note on geology of magnesite deposit in the Fish Springs district, Juab County, Utah.

60 Crawford, R. D., 1913, Geology and ore deposits of the Monarch and Tomichi districts, Colorado: Colo. Geol. Survey Bull. 4, 317 p.

Describes the stratigraphy, structure, lithologic character of the formations, and economic geology of the area, in southwestern Chaffee County. Most important to a dolomite study is the description of the Ouray limestone, nine analyses from the vicinity of Garfield, and a geologic map, scale 1:62,500.

61 Crawford, R. D., and Gibson, Russell, 1925, Geology and ore deposits of the Red Cliff district, Colorado: Colo. Geol. Survey Bull. 30, 89 p.

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Describes the stratigraphy, structure, and mineral deposits of the district, in southeastern Eagle County. Gives a lithologic description of the Leadville limestone, which here includes the dolomite portion (Dyer dolomite) assigned to the Chaffee formation of later reports, and six analyses of the limestone.

62 Cullison, J. S., 1944, The stratigraphy of some Lower Ordovician formations of the Ozark uplift: Mo. Univ. School Mines and Metallurgy Bull. Tech. Ser., v. 15, no. 2, 112 p.

Discusses in detail the areal distribution, thickness, lithologic character, and paleontology of the Jefferson City-Cotter-Powell sequence in central and south-central Missouri. The Jefferson City is raised to group status with two formations, the Rich Fountain and Theodosia, on the basis of its lithologic character and fauna. Includes a geologic map, scale 1 inch = about 16 miles, of the area studied and 18 measured sections. No analyses of the limestone and dolomite are given.

63 Cumings, E. R., 1922, Nomenclature and description of the geological formations in Indiana, *in* Handbook of Indiana geology: Ind. Dept. Conserv. Pub. 21, p. 403–570.

Gives a summary of the stratigraphy, including general descriptions of the formations, their distribution, fauna, and historical sketches of the nomenclature. Small-scale maps, 1 inch = about 43 miles, show the distribution of the formations. No analyses are included.

64 Cumings, E. R., and Shrock, R. R., 1928, The geology of the Silurian rocks of northern Indiana: Ind. Div. Geology, Conserv. Comm. Pub. 75, 226 p.

Discusses in detail the physiography, stratigraphy, structure, and economic geology of the Silurian area of northern Indiana. Describes lithologic character, thickness, general outcrop area, and quarries and outcrops of each formation. Of particular interest is the discussion of the Huntington dolomite. Includes geologic and outcrop maps, scale 1 inch = about 5 miles, and 8 analyses of the Huntington.

65 Currier, L. W., 1935, Zinc and lead region of southwestern Virginia: Va. Geol. Survey Bull. 43, 122 p.

Presents a general description of the stratigraphy, structure, economic geology, and occurrences of lead and zinc and a rather detailed description of the Shady dolomite, which is divided into three members in this region. No analyses are given. Includes geologic map, scale 1:62,500.

66 Dake, C. L., 1930, The geology of the Potosi and Edgehill quadrangles: Mo. Bur. Geology and Mines, 2d ser., v. 23, 233 p.

Includes a detailed report on the stratigraphy, structure, and economic geology of the area, which comprises parts of Washington, Iron, and Reynolds Counties; detailed discussions of the Bonneterre dolomite, Derby-Doerun formation, Potosi and Eminence dolomites, and the Van Buren and Gasconade formations; 11 analyses of limestone and dolomite; and a geologic map, scale 1:62,500.

67 Dale, T. N., 1912, The commercial marbles of western Vermont: U. S. Geol. Survey Bull. 521, 170 p.

Discusses limestones, dolomites, marble, also general geology of the marble belt; describes individual quarries and the character of the marbles. Includes some analyses and geologic maps, scales 1:125,000 and 1:31,250.

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68 Dale, T. N., 1915, The calcite marble and dolomite of eastern Vermont: U. S. Geol. Survey Bull. 589, 67 p.

Describes occurrences of calcite and dolomite marbles in the eastern part of the State. The term "dolomite" is used in a rather broad sense and is not restricted to the rocks approaching the theoretical composition of dolomite. Includes 4 analyses. Small-scale map, 1:750,000, shows the location of the deposits.

69 ——— 1923, The lime belt of Massachusetts and parts of eastern New York and western Connecticut: U. S. Geol. Survey Bull. 744, 71 p.

Briefly describes the general geology and areal distribution of the limestones and dolomites in the area. Includes many of the structural details of the quarries and textural and mineralogical descriptions of thin sections, chemical analyses of 13 samples, and geologic maps, scale 1:62,500.

70 Darton, N. H., 1928a, "Red Beds" and associated formations in New Mexico, with an outline of the geology of the State: U. S. Geol. Survey Bull. 794, 356 p.

Summarizes the geology of the State, giving descriptions of the principal formations, including their general features, lithologic character, and distribution. Discusses in more detail the stratigraphy and structure of several regions and gives brief summaries of the geology of many more. Of particular interest are the general and local descriptions of the El Paso, Montoya, and Fusselman limestones and of the Chupadera formation.

71 ——— 1928b, Geologic map of New Mexico: U. S. Geol. Survey, scale 1:500,000.

72 Darton, N. H., and Paige, Sidney, 1925, Description of the central Black Hills [with contributions by J. D. Irving]: U. S. Geol. Survey Geol. Atlas, folio 219, 34 p.

Discusses the geology of the central Black Hills, including general and local descriptions of the dolomitic Whitewood, Pahasapa, and Minnekahta limestones. Includes analysis of one sample of the Minnekahta limestone from near Hot Springs.

73 Dawson, T. A., 1941, The Devonian formations of Indiana; Pt. 1, Outcrop in southern Indiana: Ind. Dept. Conserv., Div. Geology, 48 p.

Describes in detail the Devonian formations of southern Indiana, including history of names, lithologic character, distribution, and discussion of age. Of interest are the descriptions of the Geneva formation and Jeffersonville limestone. No analyses are included.

74 Decker, C. E., 1939, Progress report on the classification of the Timbered Hills and Arbuckle group of rocks, Arbuckle and Wichita Mountains, Okla.: Okla. Geol. Survey Circ. 22, 62 p.

Gives a detailed discussion of the stratigraphy of the Timbered Hills and Arbuckle groups and brief discussion of the structure and economic features of the areas studied. Includes 17 detailed columnar sections and geologic map of the Wichita Mountains, scale 1 inch = about 2 miles.

75 Deiss, C. F., 1933, Paleozoic formations of northwestern Montana: Mont. Bur. Mines and Geology Mem. 6, 51 p.

Gives detailed descriptions of 10 measured stratigraphic sections, in parts of the Swan, Flathead, and Lewis and Clark Ranges and a tentative correlation

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of the sections. The sections lie stratigraphically between the top of the Precambrian Missoula group and the top of the Mississippian Madison limestone. Also gives summary descriptions of the formations and their type localities.

76 Deiss, C. F., 1936, Revision of type Cambrian formations and sections of Montana and Yellowstone National Park: Geol. Soc. America Bull., v. 47, p. 1257–1342.

Includes detailed descriptions of 11 measured stratigraphic sections in central and southern Montana just west of the central part of the State and in the northwestern part of Yellowstone Park; historical summary of Cambrian stratigraphic nomenclature in the area; original and emended definitions and general descriptions of the Cambrian formations, and a tentative correlation of the 11 sections.

77 ——— 1938, Cambrian formations and sections in part of Cordilleran trough: Geol. Soc. America Bull., v. 49, p. 1067–1168.

Gives detailed descriptions of 7 measured sections of the Cambrian in the Cordilleran region, 2 of which, the Blacksmith Fork and House Range areas, are in Utah. Summarizes the previous studies in each area. Describes and, in some instances, redefines the Langston, Blacksmith, Nounan, and St. Charles limestones; each of these formations are reportedly dolomitic. No analyses are included.

78 ——— 1943, Stratigraphy and structure of southwest Saypo quadrangle, Montana: Geol. Soc. America Bull., v. 54, p. 205–262.

Includes a general description of the sedimentary and igneous rocks and of the structure of the area, which covers parts of the Sawtooth and Lewis and Clark Ranges, and a few measured sections. General descriptions of the Devils Glen, Devonian (Jefferson age) limestones and dolomites, and Hannan limestone are of interest.

79 ——— 1945, Distribution of dolomite deposits in the Western States: U. S. Geol. Survey Prelim. Rept. and Map, 4 p.

Summarizes very briefly the geologic and geographic distribution of dolomite deposits and describes the 10 most important ones. Index map shows the location of 125 deposits in the Western United States.

80 ——— 1952a, Dolomite deposit near Sloan, Nev.: U. S. Geol. Survey Bull. 973-C, p. 107–141.

Gives a detailed study of the stratigraphy and structure at Sloan Hill, Clark County, Nev., and a description of the dolomite deposit and the formations involved, including the Sultan limestone, Monte Cristo dolomite, and Bird Spring formation. Estimated reserves of dolomite total about 70 million tons. Includes an annotated bibliography and a geologic map, scale 1 inch = 400 feet.

81 ——— 1952b, Geologic formations on which and with which Indiana's roads are built: Ind. Dept. Conserv. Geol. Survey Circ. 1, 17 p.

Gives a general outline of geologic history, distribution of limestones, glacial drift, potential quarry sites, and types of road subgrades in Indiana. Small-scale maps, 1 inch = about 42 miles, show distribution of crushed rock quarries, sand and gravel areas, and bedrock formations. No analyses are included.

82 ——— 1955, Dolomite deposit near Marble, Wash.: U. S. Geol. Survey Bull. 1027-C, p. 119–141.

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Includes detailed description of the dolomite deposit in the Northport limestone, about 2 miles northeast of Marble, Stevens County; descriptions of quarrying operations; estimate of reserves; analyses of 53 samples, and a geologic map, scale 1 inch = 400 feet.

83 Dow, D. H., and others, 1945, Mineral resources of the Missouri Valley region; Pt. 4, Construction materials: U. S. Geol. Survey Missouri Basin Studies Map 1, 4 sheets.

The map, scale 1:2,500,000, outlines the general areal distribution of the "sedimentary rocks of Paleozoic age" in the Black Hills region. These rocks include the dolomitic Whitewood, Pahasapa, and Minnekahta limestones. The map does not indicate any dolomite occurrences in this area.

84 Dungan, T. A., 1944, Production of magnesium by the carbothermic process at Permanente: Am. Inst. Min. Metall. Eng. Trans., v. 159, p. 308–314.

Describes the process used by Permanente Metals Corp. at their plant at Permanente, Calif. The process involved reduction of magnesium oxide obtained from dolomite by carbon (coke) in electric furnaces.

85 Dunham, K. C., 1935, The geology of the Organ Mountains, with an account of the geology and mineral resources of Dona Ana County, N. Mex.: N. Mex. School Mines Bull. 11, 272 p.

Includes detailed description of the geology and mineral deposits of the Organ Mountains; outline of the geology of Dona Ana County, along with brief discussions of the geology of other mountain ranges in the county, mineral districts, and mines; 6 analyses of dolomitic limestones, and geologic maps of Dona Ana County, scale 1 inch = 5 miles, Organ Mountains, scale 1 inch = 1 mile, and Organ mining district, scale 1:24,000.

86 Eardley, A. J., 1944, Geology of the north-central Wasatch Mountains, Utah: Geol. Soc. America Bull., v. 55, p. 819–894.

Contains general description of the stratigraphy, structure, and physiography of the Wasatch Range east and southeast of Ogden; very brief description of a sequence of more than 1,300 feet of Cambrian limestone and dolomite, mentioning the occurrence of rocks of the "Bluebird type" and "Lynch type". No analyses are given. Includes a geologic map, scale 1 inch = about 2 miles.

87 Edmundson, R. S., 1945, Industrial limestones and dolomites in Virginia, northern and central parts of Shenandoah Valley: Va. Geol. Survey Bull. 65, 195 p.

Includes general discussion of the geology of the Valley from Augusta County northward; more detailed descriptions of the limestone and dolomite areas in parts of Frederick, Shenandoah, Rockingham, Augusta, Page, Warren, and Clarke Counties; descriptions of 130 sections and 224 analyses of limestones and dolomites; and geologic maps, scale 1 inch = 2 miles.

88 Emerson, B. K., 1917, The geology of Massachusetts and Rhode Island: U. S. Geol. Survey Bull. 597, 289 p.

Discusses in general the sedimentary and igneous rocks, their distribution, character, and geologic relationships. Mentions several localities where the "Bolton" gneiss contains lenses of marbleized magnesian limestone (p. 83–84). Includes analysis of dolomite marble from near Webster, Mass., and a geologic map, scale 1:250,000, of the States.

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89 Emmons, S. F., Irving, J. D., and Loughlin, G. F., 1927, Geology and ore deposits of the Leadville mining district, Colorado: U. S. Geol. Survey Prof. Paper 148, 368 p.

Gives a comprehensive treatment of the stratigraphy, petrology, structure, and ore deposits of the district. Of particular interest are lithologic descriptions of the "White" limestone (now Manitou limestone) and the Leadville limestone (including Dyer dolomite member of the Chaffee formation) and 6 analyses of the Leadville limestone.

90 Emmons, W. H., and Calkins, F. C., 1913, Geology and ore deposits of the Philipsburg quadrangle, Montana: U. S. Geol. Survey Prof. Paper 78, 271 p.

Describes in detail the sedimentary and intrusive rocks, structure, mineralogy, ore deposits, and mines of the area. Of particular interest to dolomite study is the original description of the Hasmark formation (p. 57–61). Includes a geologic map, scale 1:125,000.

91 Esarey, R. E., and Bieberman, D. F., 1948, Correlation of the Waldron and Mississinewa formations [Indiana]: Ind. Dept. Conserv., Div. Geology Bull. 3, 38 p.

Contains a brief description of the physiography and regional structure of Indiana; more detailed descriptions of the rocks and faunal assemblages upon which the formation correlations are made; and a discussion of geologic history. No analyses are included. Small-scale map, 1 inch = 40 miles, shows Silurian outcrop areas.

92 Faust, G. T., and Callaghan, Eugene, 1948, Mineralogy and petrology of the Currant Creek magnesite deposits and associated rocks of Nevada: Geol. Soc. America Bull., v. 59, p. 11–74.

Gives a detailed discussion of the megascopic and microscopic character of the rocks of the area, their mineralogy and chemistry, and the origin of the magnesite deposits.

93 Foerste, A. F., 1917, Notes on Silurian fossils from Ohio and other central States: Ohio Jour. Sci., v. 17, p. 17, 201–202.

Proposes the name Euphemia dolomite for the lowest of the beds that make up the dolomitic Niagaran series north of Cedarville, Ohio; formerly regarded as the Mottled Zone of Prosser and, to the south, as part of the West Union formation.

94 ——— 1923, Notes on Medina, Niagaran, and Chester fossils: Denison Univ., Sci. Lab. Jour., v. 20, p. 41–43.

Discusses very briefly the Bisher formation, formerly treated as the Bisher member of the West Union formation.

95 ——— 1929, Correlation of the Silurian section of Adams and Highland Counties with that of the Springfield area [abs.]: Ohio Jour. Sci., v. 29, p. 168–169.

States that the Peebles dolomite is equivalent to the Guelph of Canada and belongs above the Cedarville of the Springfield, Ohio, area.

96 Ford, W. E., 1932, Dana's textbook of mineralogy: New York, John Wiley & Sons, Inc., p. 516–518, 805–806.

Describes the physical and chemical characteristics of dolomite and magnesite. Lists about 150 minerals of which magnesium is a basic constituent.

Index no.

97 Franke, H. A., 1935, Mines and mineral resources of San Luis Obispo County: Calif. Jour. Mines and Geology, v. 31, p. 402–461.

Presents a survey of the mineral resources of the county, listed alphabetically and including metals and nonmetals, with specific mines and occurrences for each mineral. Includes a very brief description of each locality and state of activity at the time of compilation. Lists one occurrence and one analysis for dolomite.

98 Furcron, A. S., 1942, Dolomites and magnesian limestones in Georgia: Ga. Geol. Survey Inf. Circ. 14, 30 p.

Outlines the general distribution of the dolomites and magnesian limestones and describes in some detail outcrops of the Talladega(?) marble in the Gainesville belt, the Murphy marble of the Whitestone–Marble Hill belt, the general occurrence of the Shady and Knox dolomites, the Chickamauga formation, and the magnesian limestones of the Coastal Plain area. Includes chemical analyses of 76 samples, some of which are not precisely located.

99 Gale, H. S., 1914, Late developments of magnesite deposits in California and Nevada: U. S. Geol. Survey Bull. 540-S, p. 483–520.

Gives summary descriptions of certain magnesite deposits in Sonoma, Santa Clara, Placer, San Benito, Fresno, Tulare, Kern, and Riverside Counties, Calif.; mentions reported occurrences in Nye and Esmeralda Counties, Nev.; and includes 18 chemical analyses and small-scale maps showing location of the deposits.

100 Georgia Division Mines, Mining, and Geology, 1939, Geologic map of Georgia, prepared in cooperation with the U. S. Geological Survey: Atlanta, Ga. Geol. Survey, scale 1:500,000.

101 Gibbs, Ralph, 1949, Manufacturing refractory dolomite: Rock Products, v. 52, no. 4, p. 129–131, 161–163.

Summarizes the requirements of refractory dolomites; outlines the steps in production—quarrying, crushing and grinding, sizing, storage, kiln feeding, burning, screening; and considers plant and manufacturing costs.

102 Gilluly, James, 1932, Geology and ore deposits of the Stockton and Fairfield quadrangles, Utah: U. S. Geol. Survey Prof. Paper 173, 171 p.

Discusses in detail the stratigraphy, structure, rock alteration, mineralogy, ore deposits and mines of the area, which covers parts of Tooele, Utah, and Salt Lake Counties. The dolomitic formations described include the Lynch and Jefferson dolomites. Includes 2 analyses of dolomitic limestone and a geologic map, scale 1:62,500.

103 Goldbeck, A. T., 1949, Crushed stone, *in* Industrial minerals and rocks: New York, Am. Inst. Min. Metall. Eng., 2d ed., p. 245–293.

Presents a general discussion of crushed stone, including classification of rocks, mineral composition, physical properties, uses, production and consumption, prospecting, stripping, quarrying, crushing, etc. Includes a bibliography.

104 Gray, Carlyle, 1951, Preliminary report of certain limestones and dolomites of Berks County, Pa.: Pa. Topog. and Geol. Survey, 4th ser., Progress Rept. 136, 85 p.

Contains detailed descriptions of the Ordovician formations, including the Beckmantown limestone and dolomite, Annville limestone, and Jacksonville

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formation; summaries of the structure and economic possibilities of the limestones; brief descriptions of 81 quarries and outcrops; and analyses of 378 samples. Dolomite, usually siliceous, occurs locally in the Beekmantown. Index map, scale 1 inch = 2 miles, shows principal limestone areas and sample localities.

105 Grimsley, G. P., 1916, Jefferson, Berkeley, and Morgan Counties: W. Va. Geol. Survey, 644 p.

Includes general treatment of the history, industrial development, physiography, climate, general geology, structure, and mineral deposits of the eastern panhandle counties; general lithologic descriptions; measured sections; and many analyses of limestones and dolomites. The dolomitic formations include the Stones River limestones, Beekmantown limestone, Conococheague limestone, Waynesboro formation, and Tomstown limestone. Briefly describes many of the quarry operations.

106 Gross, W. H., 1949, The story of magnesium: Cleveland, Ohio, Am. Soc. Metals, 260 p.

Gives a nontechnical summary of the sources, methods of production, alloying and refining, casting, fabrication, machining, jointing, finishing, physical metallurgy, and uses of magnesium. Of particular interest are the brief, clear outlines (with flow sheets) of the more important methods of metal production.

107 Gwinn, G. R., 1943, Olivine: U. S. Bur. Mines Inf. Circ. 7239, 11 p.

Summarizes briefly the occurrence and use of olivine, particularly in refractories, and the properties of forsterite refractories.

108 Ham, W. E., 1949, Geology and dolomite resources, Mill Creek–Ravia area, Johnston County, Okla.: Okla. Geol. Survey Circ. 26, 104 p.

Describes in detail the stratigraphy of the area, giving distribution of the formations, their general character, origin, and their characteristics helpful for field identification. Includes detailed columnar sections. Discusses physical and chemical properties of the Royer dolomite and shows that it compares favorably with the best dolomites of northwestern Ohio. Briefly mentions other dolomite occurrences in Oklahoma and shows their location on small-scale map. Gives analyses of 22 samples. Reserves are estimated to be at least 150 million tons of readily accessible dolomite. Includes a geologic map, scale 1 inch = ½ mile.

109 Harness, C. L., and Jensen, N. C., 1943, Marketing magnesite and allied products: U. S. Bur. Mines Inf. Circ. 7269, 25 p.

Summarizes magnesia raw materials, mining methods, calcination, specifications for crude, dead-burned, and caustic-calcined magnesia, uses, and mineral industry statistics (to 1941).

110 Hatmaker, Paul, 1931, Utilization of dolomite and high-magnesium limestone: U. S. Bur. Mines Inf. Circ. 6524, 18 p.

Includes a brief description of the uses of dolomite, some production statistics for 1920–29, general chemical requirements for dolomite, and a bibliography. Contains substantially the same information as in the later paper by Colby (1941).

111 Hershey, H. G., and others, 1947, Mineral resources of Iowa: Iowa Geol. Survey, index map, scale 1:500,000.

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112 Hess, F. L., 1908, The magnesite deposits of California: U. S. Geol. Survey Bull. 355, 67 p.

Contains brief descriptions of magnesite occurrences in several counties, and brief sections on uses, markets, and the origin of the magnesite. Small-scale map, 1 inch = about 60 miles, shows location of deposits.

113 Hewett, D. F., 1931, Geology and ore deposits of the Goodsprings quadrangle, Nevada: U. S. Geol. Survey Prof. Paper 162, 172 p.

Describes in detail the stratigraphy, structure, rock alteration, ore deposits, and mines in this part of Clark County. Discusses the lithologic character and distribution of the dolomite and dolomitic limestone formations which include the Goodsprings dolomite, the Sultan and Monte Cristo limestones, and the Bird Spring. Includes a good, detailed discussion on dolomitization, analyses of 42 limestone and dolomite samples, and a geologic map, scale 1:62,500.

114 Hinchey, N. S., Fisher, R. B., and Calhoun, W. A., 1947, Limestones and dolomites in the St. Louis area: Mo. Geol. Survey and Water Res. Rept. Inv. 5, 80 p.

Gives brief descriptions of 17 selected limestone and dolomite deposits, including location, transportation facilities, stratigraphic position, measured section, and analyses of representative samples. Only one locality, that near Glencoe, contains dolomite (more than 40 percent magnesium carbonate).

115 Hodge, E. T., 1938, Market for Columbia River hydroelectric power using northwest minerals; Sec. 1, Northwest magnesia ores: War Dept., Corps of Engineers, U. S. Army, Office of Div. Engineer, North Pacific Div., Portland, Oreg., v. 1, Pt. 2, p. 33–131.

Presents a brief survey of areas of magnesite occurrence, both United States and foreign, with particular emphasis on the Washington deposits, and a brief description of the deposits, including economic considerations, such as transportation facilities and estimates of mining costs. Paper is principally a survey of the available literature on the subject.

116 Holmes, G. H., Jr., 1949, Mining methods at the brucite deposit, Basic Refractories, Inc., Gabbs, Nye County, Nev.: U. S. Bur. Mines Inf. Circ. 7543, 10 p.

Describes briefly the plant operations and mining methods at the brucite deposit, which is the only commercial deposit in production in the United States.

117 Holmes, G. H., Jr., and Matson, E. J., 1950, Investigation of the magnesite deposit of the Ala-Mar Magnesium Co., Inc., and Nevada Magnesite Co., White Pine County, Nev.: U. S. Bur. Mines Rept. Inv. 4608, 13 p.

Includes a summary discussion of the deposits, an account of the exploratory drilling program carried on by the Bureau of Mines in 1942, sample analyses from 13 drill holes, and 196 analyses of trench samples.

118 Hopkins, R. H., 1942, The dolomitic limestones of Florida: Fla. Geol. Survey Rept. Inv. 3, 105 p.

Presents a summary of the properties, modes of occurrence in Florida, and uses of dolomite and dolomitic limestone. Gives locations, drill-hole logs, drill-core analyses (at about 5-ft. intervals), and brief descriptions of the rocks for about 80 test holes which were drilled to determine the character of the dolomites in Taylor, Dixie, Levy, Citrus, Pasco, Manatee, and Sarasota Counties.

Index no.

119 Huddle, J. W., and Dobrovolny, Ernest, 1952, Devonian and Mississippian rocks of central Arizona: U. S. Geol. Survey Prof. Paper 233-D, p. 67–112.

Gives a detailed description of the Martin formation (Devonian) and Redwall limestone (Mississippian), including descriptions of facies and their distribution and correlation with formations to the north and south. Includes several detailed stratigraphic sections, a bibliography, an index map (scale 1 in. = approx. 35 mi.) of area studied, and an outline map of the State (scale 1 in. = about 50 mi.) showing the general distribution of outcrops of Devonian and Mississippian rocks.

120 Humes, W. B., 1944, Vacuum engineering as related to the dolomite ferrosilicon process: Am. Inst. Min. Metall. Eng. Trans., v. 159, p. 353–362.

Describes in detail vacuum technology as applied to the retorts used in the ferrosilicon reduction process for producing magnesium from dolomite.

121 Hunter, C. E., and Gildersleeve, Benjamin, 1946, Minerals and structural materials of western North Carolina and north Georgia: Tenn. Valley Authority, Commerce Dept., Regional Products Research Div., Rept. C, p. 23–29.

Presents brief descriptions and several chemical analyses of some dolomites in North Carolina and Georgia; includes description of the Bandana dolomite marble at Bandana Station, N. C.

122 Irving, D. R., and Uswald, F. P., 1954, Magnesium compounds: U. S. Bur. Mines Minerals Yearbook, 1952, preprint, 16 p.

Presents a general summary and statistics of domestic and foreign industry.

123 Jenkins, O. P., 1916, Phosphates and dolomites of Johnson County, Tenn.: Tenn. Geol. Survey, Res. Tenn., v. 6, p. 51–106.

Describes in general the geology and mineralogy of the phosphate deposits. Briefly mentions the formations in the area, including the Shady limestone. Includes 19 analyses of dolomitic limestones, along with more detailed descriptions of the occurrences from which the samples were taken.

124 ——— 1938, Geologic map of California: Calif. Div. Mines, six sheets, scale 1:500,000.

125 Jewett, J. M., and Schoewe, W. H., 1942, Kansas mineral resources for wartime industries: Kans. Geol. Survey Bull. 41, pt. 3, p. 69–180.

Summarizes the mineral resources of the State, with brief statements concerning occurrence, uses, production and reserves. Section on magnesium (p. 104–112) discusses the possibility of producing magnesium from oilfield brines, listing several specific fields and the magnesium content of the brines. Discusses briefly the occurrence of the Stone Corral and Day Creek dolomites and gives 6 analyses from Clark and Rice Counties. Reserves are estimated to be about 16 million tons of readily accessible dolomite in these counties.

126 Jones, W. B., 1926, Index to the mineral resources of Alabama: Ala. Geol. Survey Bull. 28, 256 p.

Presents a survey of the mineral resources of the State, with sections on the location of each of the minerals. Of interest to the subject of dolomite are 2 analyses of the Chewacla dolomite from Chewacla, Lee County, and the section on fluxing materials, page 49 and pages 120–128. Describes the lithologic character and areal distribution of the Ketona dolomite.

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127 Kay, G. M., 1935, Ordovician system in the upper Mississippi Valley: Kans. Geol. Soc. Guidebook, 9th Ann. Field Conf., p. 281–295.

Describes briefly the Ordovician formations in the upper Mississippi Valley. Of interest are the descriptions of the dolomite units in the Prairie du Chien group, Platteville formation, and Galena group. No analyses are included.

128 Keith, Arthur, 1932, Stratigraphy and structure of northwestern Vermont: Washington Acad. Sci. Jour., v. 22, p. 357–379; v. 22, p. 393–406.

Discusses in detail the Cambrian and Ordovician rocks that occur in three sequences in northwestern Vermont and correlates them. No analyses are included. Outline map shows the distribution of the rocks in the region. [Some of the stratigraphy has since been revised.]

129 ——— 1933, Preliminary geologic map of Maine: Maine Geol. Survey, scale 1:100,000.

130 Keith, Arthur, and Sterrett, D. B., 1931, Description of the Gaffney and Kings Mountain quadrangles: U. S. Geol. Survey Geol. Atlas, folio 222, 13 p.

Describes the general and economic geology of the area. Of interest is the general description of the Gaffney marble, which in places is highly magnesian. Includes topographic, areal geology, and economic geology maps, scale 1:62,500.

131 Kentucky Geological Survey, 1954, Geologic map of Kentucky, prepared in cooperation with Ky. Agr. Indus. Devel. Board: Lexington, Ky. Geol. Survey, scale 1:1,000,000.

132 King, P. B., 1948, Geology of the southern Guadalupe Mountains, Tex.: U. S. Geol. Survey Prof. Paper 215, 183 p.

Describes in detail the Permian stratigraphy, structure, and Cenozoic deposits of the area. Includes descriptions of the dolomites of the Bone Spring, Goat Seep, and Carlsbad limestones, a few analyses, and a geologic map, scale 1:48,000.

133 Knechtel, M. M., and others, 1948, Map showing construction materials and nonmetallic mineral resources of Montana: U. S. Geol. Survey Missouri Basin Studies Map 11, 2 sheets.

Map outlines the general areal distribution of dolomite and limestone in the State. Brief text on map gives very general description of the geographic and geologic distribution of the carbonate rocks and mentions a few of the more important limestone formations. Scale 1:750,000 or about 1 inch = 12 miles.

134 Krey, Frank, and Lamar, J. E., 1925, Limestone resources of Illinois: Ill. Geol. Survey Bull. 46, 392 p.

Contains sections on limestone and dolomite for road materials, properties of Illinois limestone and dolomite, quarry practice, a comprehensive survey of the resources (by counties) that describes the quarries and outcrops in each county, and a table of about 300 analyses, most of which are well located. Page-size county maps show the locations of quarries and sample sites.

135 Kummel, H. B., and Gage, R. B., 1906, The chemical composition of the white crystalline limestones of Sussex and Warren Counties: N. J. Geol. Survey Ann. Rept. State Geologist, 1905, p. 173–191.

Describes the distribution, lithologic character, and chemical composition of the "white limestone" (Franklin limestone). Includes 108 analyses of limestones and dolomites, many of which represent drill-hole samples. Map, scale 1 inch = 1 mile, shows the distribution of the limestone in Sussex County.

Index no.

136 Ladoo, R. B., and Meyers, W. M., 1951, Nonmetallic minerals: New York, McGraw-Hill, 2d ed., 605 p.

Catalogs commercial nonmetallic minerals. The summary of each mineral includes brief sections on composition, description, physical properties, occurrence, production, uses, and a bibliography. Describes dolomite on pages 194–202 and magnesite and magnesium compounds on pages 298–311.

137 Lamar, J. E., and Willman, H. B., 1938, A summary of the uses of limestone and dolomite: Ill. Geol. Survey Rept. Inv. 49, 50 p.

Summary of more than 50 uses of limestone and dolomite, briefly describes how the material is used and outlines the general chemical and physical requirements of the rock for each use. Gives a bibliography.

138 Landes, K. K., 1951, Detroit River group in the Michigan basin: U. S. Geol. Survey Circ. 133, 12 p.

Discusses in detail the nomenclature and stratigraphy of the Detroit River group. Presents revised section of the type locality and correlates it with the subsurface strata explored by wells in the Michigan basin. Includes stratigraphic column, cross sections, and isopach maps, scale about 1:2,500,000, of Detroit River formations as they occur in the southern peninsula of Michigan.

139 Larrabee, D. M., and others, 1947, Map showing construction materials and nonmetallic mineral resources of Colorado: U. S. Geol. Survey Missouri Basin Studies Prelim. Map 10.

Shows the general areal distribution of dolomite and dolomitic limestone in Colorado. Text briefly mentions the Manitou, Ouray, Leadville, and Madison limestones as containing dolomite. Also briefly describes the general areas of outcrop of the dolomite and summarizes quarrying activity and uses of Colorado dolomite.

140 Lasky, S. G., 1936, Geology and ore deposits of the Bayard area, Central mining district, New Mexico: U. S. Geol. Survey Bull. 870, 144 p.

Describes in detail the stratigraphy, igneous rocks, and structure of this area, about 9 miles east of Silver City, Grant County. Discusses rock alteration and ore deposits, giving descriptions of individual mines and prospects. Also briefly describes on page 17 the Montoya and Fusselman limestones. No dolomite analyses are given. Includes a geologic map, scale 1:12,000.

141 Lenhart, W. B., 1953, Heavy media separation removes friable granite from dolomite: Rock Products, v. 56, no. 2, p. 89–93, 152.

Presents a general description of the heavy media separation process used by Kaiser Aluminum & Chemical Corp. at their Natividad, Calif., plant to upgrade quarry-run dolomite by removing granite.

142 Lewis, J. V., and Kummel, H. B., 1912, Geologic map of New Jersey, 1910–1912: N. J. Geol. Survey, scale 1:250,000.

143 Lindgren, Waldemar, and Loughlin, G. F., 1919, Geology and ore deposits of the Tintic mining district, Utah: U. S. Geol. Survey Prof. Paper 107, 282 p.

Describes in detail the stratigraphy, structure, ore deposits, and mines of the district. Formations described as being dolomites or dolomitic limestones include the Bluebird, Cole Canyon, and Opex dolomites, the Ajax limestone, and the Bluebell and Gardner dolomites. Gives 4 carbonate rock analyses; 1 is of dolomite. Includes a geologic map, scale 1:62,500.

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144 Lloyd, R. R., Rawles, W. T., and Knickerbocker, R. G., 1944, Pilot-plant production of magnesia from Sloan dolomite: Am. Inst. Min. Metall. Eng. Trans., v. 159, p. 296–307.

Describes in detail the pilot-plant operation for producing cell-grade magnesia from dolomite quarried at Sloan, Nev. Pilot plant was at U. S. Bureau of Mines experiment station at Boulder City, Nev.

145 Logan, C. A., 1947, Limestone in California: Calif. Jour. Mines and Geology, v. 43, p. 175–357 [1948].

Summarizes the uses of lime and limestone (including dolomite) and describes, by counties, limestone and dolomite deposits, which are precisely located. Includes brief summary of production from each deposit, many analyses, and a brief description of the controlling structure for most of the more important deposits. A map, scale 1 inch = about 34 miles, shows locations of 307 limestone and dolomite deposits.

146 Logan, C. A., and Wright, L. A., 1950, Dolomite, *in* Mineral commodities of California: Calif. Dept. Nat. Res., Div. Mines Bull. 156, p. 155–158.

The report comprises a summary of the mineral resources of the State, including fuels, metallics, and nonmetallics, and describes their geographic and geologic occurrence, economic development, and uses. The section on dolomite briefly summarizes some of the more important occurrences. No analyses are given. Small-scale map, 1:5,000,000, shows distribution of the principal mineral resources.

147 Longwell, C. R., 1928, Geology of the Muddy Mountains, Nev.: U. S. Geol. Survey Bull. 798, 152 p.

Discusses in general the physiography, structure, and stratigraphy of the Muddy Mountains and parts of the Virgin Mountains and Grand Wash Cliffs. Dolomite occurs in the Muddy Peak limestone; magnesite occurs with limestone, dolomite, and other sediments in the Horse Spring formation (Tertiary) near Overton. Also discusses the origin of the magnesite and gives 2 magnesite analyses.

148 Loughlin, G. F., Berry, E. W., and Cushman, J. A., 1921, Limestones and marls of North Carolina: N. C. Geol. and Econ. Survey Bull. 28, 211 p.

Includes general descriptions of the limestone, dolomite, and marl formations of the State; more detailed descriptions of specific occurrences in quarries and outcrops; and summaries of the uses, character, and production of limestones and marls. The principal formations that contain dolomite include the Murphy and Gaffney marbles and the Shady limestone. Gives analyses of 36 limestone and dolomite samples. Maps of specific areas (scale, generally 1 in. = 1 mi.) show areal distribution of the carbonate rocks.

149 McAllister, J. F., 1952, Rocks and structure of the Quartz Spring area, northern Panamint Range, Calif.: Calif. Dept. Nat. Res., Div. Mines Special Rept. 25, 38 p.

Describes in general the stratigraphy and structure of the area, which covers about 50 square miles in east-central Inyo County. Dolomite occurs in the Racetrack dolomite, Nopah formation, Pogonip limestone, Ely Springs and Hidden Valley dolomites, and Lost Burro formation. Does not mention the quality of the dolomite, although much of it apparently is siliceous or cherty Includes a geologic map, scale 1 inch = about 2,700 feet.

Index no.

150 McCammon, J. H., 1941, Report on tin and magnesite deposits in Mason County, Tex.: Tex. Univ. Bur. Econ. Geology, Min. Res. Survey Circ. 32, 8 p.

Gives a description and 1 analysis of the small magnesite deposit 3 miles northwest of Mason. Map, scale 1 inch = 660 feet, shows location of the deposit.

151 McCue, J. B., Lucke, J. B., and Woodward, H. P., 1939, Limestones of West Virginia: W. Va. Geol. Survey, v. 12, 560 p.

Includes general descriptions of the limestone formations in West Virginia, discussion of the geographic distribution of the formations, along with brief descriptions of quarries and outcrops, section on quarrying and grinding methods and on uses of limestone, and nearly 1,500 chemical analyses. Accompanying map, scale 1:500,000, shows the areal distribution of the Cambrian and Ordovician limestones and of sample localities.

152 McFarlan, A. C., 1943, Geology of Kentucky: Lexington, Ky., Ky. Univ., 531 p.

Presents a comprehensive treatment of the geology of the State, including stratigraphy, regional geology, and mineral resources. Includes a very general reference to resources of "limestone (including dolomite)." Of interest are the lithologic descriptions in the section on Ordovician-Devonian stratigraphy (p. 8–55). Small-scale map, 1 inch = about 97 miles, shows general geology.

153 McQueen, H. S., 1943, Occurrence of dolomite in the Fredericktown area, Madison County, Mo.: Mo. Geol. Survey and Water Res. 62d Bienn. Rept., App. 2, 16 p.

Describes briefly the Bonneterre dolomite near Fredericktown and includes 18 analyses and descriptions of the samples. The dolomite is appraised as being suitable for the production of magnesium by the ferrosilicon reduction process. Geologic map, scale 1 inch = about ¾ mile, shows distribution of the various zones of the Bonneterre.

154 Martin, H. M., 1936, Geologic maps of the southern and northern peninsulas of Michigan: Mich. Dept. Conserv., Geol. Survey Div. Pub. 39, Geol. ser. 33.

155 Mathews, E. B., and Grasty, J. S., 1910, The limestones of Maryland with special reference to their use in the manufacture of lime and cement: Md. Geol. Survey Special Pub., v. 8, pt. 3, p. 227–484.

Discusses the uses of limes and cements, and describes the geology and distribution of lime and cement materials as they occur in the Piedmont Plateau, Frederick Valley, and in Washington, Allegany, and Garrett Counties. Includes many analyses of limestones and dolomites and a map, scale 1 inch = 3 miles, showing the distribution of the limestones in the State and sample localities.

156 Mathews, E. B., and others, 1929, Baltimore County: Md. Geol. Survey, 420 p.

Presents a report on the physical features of Baltimore County, including physiography, geology, mineral resources, soils, climate, and forests. Describes the lithologic character and areal distribution of the Cockeysville marble. Includes three analyses and descriptions of quarrying operations in the Cockeysville-Texas area. Map, scale 1 inch = 3 miles, shows location of "quarries and open workings" in the county.

157 Mayer, Andrew, 1944, Plant for production of magnesium by the ferrosilicon process: Am. Inst. Min. Metall. Eng. Trans., v. 159, p. 363–376.

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Gives a summary description of the plant operated by National Lead Co. at Luckey, Ohio.

158 Miller, B. L., 1934, Limestones of Pennsylvania: Pa. Geol. Survey, 4th ser., Bull. M 20, 729 p.

Discusses the composition, mineral associations, physical properties, origin, weathering, uses, and distribution of limestones, dolomites, and marbles. Describes in some detail the occurrences, in outcrops and quarries, of limestone and dolomite by counties. Gives many analyses, some of which are not precisely located. County maps, scale, generally about 1 inch = 9 miles, show distribution of the limestones. State map, scale 1 inch = about 26 miles, shows the general areal distribution of the limestones.

159 Miller, B. L., Fraser, D. M., and Miller, R. L., 1939, Northampton County, Pa.: Pa. Geol. Survey, 4th ser., Bull. C 48, 496 p.

Gives a detailed description of the geography and geology of the county, including sections on stratigraphy, structure, and economic geology; analyses of limestones and dolomites from many localities; an annotated bibliography; and a geologic map, scale 1 inch = 1 mile.

160 Missouri Geological Survey, 1939, Geological map of Missouri: Rolla, Mo. Geol. Survey and Water Res., scale 1:500,000.

161 ——— 1944, Mineral resources of Missouri: Rolla, Mo. Geol. Survey and Water Res., map, scale 1:600,000.

162 Moore, F. H., 1935, Marbles and limestones of Connecticut: Conn. Geol. Nat. History Survey Bull. 56, 56 p.

Describes in detail the marbles of western Connecticut, by areas of occurrence, giving their general distribution, structural relations, and physical character. Mentions localities where marble is quarried, and includes 18 analyses of the calcite and dolomite marbles. Summarizes the requirements of marble for its varied uses.

163 Moore, R. C., Frye, J. C., Jewett, J. M., Lee, Wallace, and O'Connor, H. G., 1951, The Kansas rock column: Kans. Geol. Survey Bull. 89, 132 p.

Contains brief, general descriptions of the lithologic character, thickness, and distribution of the formations of Kansas; generalized columnar sections; and small-scale maps showing areal distribution of the formations. Of interest are the descriptions of the Day Creek and Stone Corral dolomites.

164 Muller, S. W., and Ferguson, H. G., 1939, Mesozoic stratigraphy of the Hawthorne and Tonopah quadrangles, Nevada: Geol. Soc. America Bull., v. 50, p. 1573–1624.

Describes in detail the stratigraphy and paleontology of the Triassic and lower Jurassic formations in the mountain ranges in these quadrangles. Of particular interest is the description of the Luning formation, the dolomite host rock for the magnesite and brucite deposits at Gabbs. Map, scale 1:125,000, shows the distribution of the formations in the area.

165 Noble, L. F., 1922, A section of the Paleozoic formations of the Grand Canyon at the Bass Trail: U. S. Geol. Survey Prof. Paper 131-B, p. 23–73.

Gives a detailed stratigraphic section at Bass Trail, Grand Canyon, and general descriptions of the lithologic character and distribution of each of the

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Paleozoic formations. Correlates the section with other Grand Canyon sections. Includes 10 analyses. Of interest are the descriptions of the Muav, Temple Butte, and Redwall limestones.

166 Nolan, T. B., 1935, The Gold Hill mining district, Utah: U. S. Geol. Survey Prof. Paper 177, 172 p.

Describes in detail the stratigraphy, structure, ore deposits, and mines of the district. No analyses are included, but the lithologic descriptions of the Young Peak, Trippe, Lamb, Hicks, Chokecherry, Fish Haven, Laketown, Sevy, Simonson, and Guilmette indicate that each of these formations are dolomite, at least in part. Includes a geologic map, scale 1:62,500.

167 Norton, G. H., 1939, Permian red beds of Kansas: Am. Assoc. Petroleum Geologists Bull., v. 23, p. 1751–1819.

Describes in detail the Permian red bed formations of Kansas. Of interest are the descriptions of the Stone Corral and Day Creek dolomites. No analyses are included. Small-scale map, 1 inch = about 23 miles, shows the distribution of the red beds in Kansas and northern Oklahoma.

168 Norton, W. H., 1899, Geology of Scott County: Iowa Geol. Survey, v. 9, p. 422–440.

Refers the beds of Niagaran age in Scott County to a single formation—the Gower stage; treats the Le Claire and Anamosa beds as members—or substages—of approximately equivalent ages. Includes measured sections and brief descriptions of Le Claire and Anamosa beds at several quarries.

169 ——— 1920, Wapsipinicon breccias of Iowa: Iowa Geol. Survey, v. 27, p. 355–547.

Describes in detail the lithologic character and the breccias of the several subdivisions (which have since been revised) of the Wapsipinicon limestone. Includes a discussion of the origin of the breccias, several measured sections, and 12 analyses of the limestones and dolomites.

170 Oder, C. R. L., 1934, Preliminary subdivision of the Knox dolomite in east Tennessee: Jour. Geology, v. 42, p. 469–497.

Subdivides the Knox dolomite and describes each of the proposed formations. Includes the Maynardville limestone at the base. [The subdivisions above the Chepultepec have since been revised.] Includes two detailed sections and a small-scale map showing the areal distribution of the Knox dolomite.

171 Oklahoma Geological Survey, 1944, Minerals of Oklahoma: Norman, Okla. Geol. Survey, index map with text, scale about 1:554,000.

Outlines the distribution of minerals by colors, patterns, and symbols. Text very briefly summarizes areas of occurrence of each mineral. Shows distribution of dolomite in the State in a very general way.

172 Oriel, S. S., 1950, Geology and mineral resources of the Hot Springs window, Madison County, N. C.: N. C. Dept. Conserv. Devel., Div. Min. Res. Bull. 60, 70 p.

Discusses the name, limits and thickness, distribution, character, and correlation of the rocks in the area, also the structure and mineral resources. Describes the Shady dolomite (p. 9–12) and briefly discusses quarrying operations in the Shady near Hot Springs (p. 52–54). Lists 7 chemical analyses of the Shady. Includes a geologic map, scale 1:24,000.

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173 Osterwald, F. W., and Osterwald, D. B., 1952, Wyoming mineral resources: Wyo. Geol. Survey Bull. 45, 215 p.

Catalogs minerals of Wyoming, listing producing areas, plants, prospects, and reported occurrences for each mineral. Lists prospects and occurrences of dolomite by section, township, and range (p. 50–56). Includes analyses for 16 of the localities.

174 Pabst, Adolph, 1938, Minerals of California: Calif. Dept. Nat. Res., Div. Mines Bull. 113, 344 p.

Catalogs minerals of California, giving their physical properties, descriptions, and general modes of occurrence. Lists occurrences of dolomite in 14 counties, including minor, uneconomic deposits, and 1 analysis of a sample from San Bernardino County.

175 Palache, Charles, Berman, Harry, and Frondel, Clifford, 1951, Dana's system of mineralogy: New York, John Wiley & Sons, Inc., v. 2, p. 162–166.

176 Park, C. F., Jr., and Cannon, R. S., Jr., 1943, Geology and ore deposits of the Metaline quadrangle, Washington: U. S. Geol. Survey Prof. Paper 202, 81 p.

Describes in detail the general geology, stratigraphy, structure, and ore deposits of the quadrangle, northern Pend Oreille County. Of interest is the detailed description of the Metaline limestone, including 4 analyses of dolomite samples from Crescent Lake. Includes a geologic map, scale 1:96,000.

177 Parker, J. L., 1945, Open-pit mining of magnesite ore: Explosives Engineer, v. 23, p. 9–11.

Describes in general the Anaconda operations at Gabbs, Nev.

178 Partridge, E. P., and Davis, A. E., 1935, Magnesium and its compounds: U. S. Bur. Mines Minerals Yearbook, 1935, p. 1165–1176.

Presents a general summary and statistics of foreign and domestic industry.

179 Patton, J. B., 1949, Crushed stone in Indiana: Ind. Dept. Conserv. Div. Geology, Rept. Progress 3, 47 p.

Describes the lithologic character of 29 formations quarried in Indiana for use as crushed stone. Includes brief descriptions of 92 quarries, giving their locations, geologic formation quarried, and the quarry products; analyses of 103 samples from 32 quarries; and a map, scale 1 inch = about 10 miles, showing the locations of the quarries and the rock quarried.

180 Pennsylvania Department Internal Affairs, 1944, Pennsylvania's mineral heritage: Pa. State Coll., Bur. Statistics, Topog. and Geol. Survey, 248 p.

Summarizes the mineral resources of the State, both by commodity and by counties. Includes production statistics and general section on technology, trends, and possibilities for future development of the industries. Mentions briefly magnesite and dolomite and their use in the production of magnesium.

181 Perry, E. S., 1949, Gypsum, lime, and limestone in Montana: Mont. Bur. Mines and Geology Mem. 29, 45 p.

Contains brief summary discussions of the preparation and uses of lime, the limestone formations, and production of limestone and lime in Montana; description of quarrying of the Pilgrim limestone in the vicinity of Helena, with a generalized geologic map of the Helena area, scale 1 inch = 1 mile; a few lime-

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stone analyses; and a page-size map of Montana showing exposures of Madison limestone.

182 Perry, J. B., and Kirwan, G. M., 1938, The Bald Eagle magnesite mine, California: Am. Inst. Min. Metall. Eng. Tech. Pub. 861, p. 1–15.

Describes briefly the geology of the deposit, the mining methods used, and the plant of the Bald Eagle mine, about 20 miles southwest of Gustine. Magnesite occurs as a blanket deposit in an accumulation of serpentine breccia, rather than in association with solid serpentine as in the typical "California type" deposits.

183 Pettijohn, F. J., 1949, Sedimentary rocks: New York, Harper & Bros., 526 p.

Textbook deals with the properties, composition, descriptions, etc., of sedimentary rocks. Brief section on dolomites (p. 312–317) defines dolomite in terms of percent of dolomite in the carbonate fraction, describes general characteristics, and outlines theories of origin.

184 Pidgeon, L. M., and Alexander, W. A., 1944, Thermal production of magnesium—pilot-plant studies on the retort ferrosilicon process: Am. Inst. Min. Metall. Eng. Trans., v. 159, p. 315–352.

Gives a detailed discussion of the ferrosilicon reduction process for producing magnesium from dolomite, including discussions of the character of the dolomite, the retorts used, and the effects of varying conditions of time, temperature, grade of ferrosilicon, etc.

185 Pidgeon, L. M., and others, 1946, Magnesium: Cleveland, Ohio, Am. Soc. Metals, 265 p.

Contains a series of five papers covering (1) extractive metallurgy, (2) magnesium structural design, (3) magnesium castings, (4) wrought magnesium alloy fabrication, and (5) corrosion protection of magnesium. Paper on extractive metallurgy contains summary descriptions of the several methods of metal production including electrolytic, carbothermic, and ferrosilicon processes as they are used in various installations. Includes a bibliography.

186 Pierce, W. M., Waring, R. K., Fetterolf, L. D., and Mahler, G. T., 1944, Some developments in the production of magnesium from dolomite by the ferrosilicon process: Am. Inst. Min. Metall. Eng. Trans., v. 159, p. 377–391.

Discusses the advantages and disadvantages of wet and dry briquetting and the effect of time, temperature, and grade of ferrosilicon on the efficiency of the ferrosilicon reduction process.

187 Pond, W. F., 1933, Geologic map of Tennessee: Tenn. Dept. Education, Div. Geology, 4th ed., scale 1:500,000.

188 Powers, E. H., 1935, Stratigraphy of the Prairie du Chien [upper Mississippi Valley]: Kans. Geol. Soc. Guidebook, 9th Ann. Field Conf., p. 390–394.

Discusses in general the Prairie du Chien group and its subdivisions. Treats the Prairie du Chien here as a formation with 3 members—the Oneota, New Richmond, and Willow River. Small-scale map, 1 inch = about 37 miles, shows the areal distribution of the Prairie du Chien.

189 Price, P. H., Tucker, R. C., and Haught, O. L., 1938, Geology and natural resources of West Virginia: W. Va. Geol. Survey, v. 10, 462 p.

Contains a brief discussion of the general geology and stratigraphy of the State, a catalog of the mineral resources, briefly outlining their character, uses,

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occurrence in the State, and production, a section on dolomite (p. 330–331) which states that it occurs in Monroe, Jefferson, Berkeley, and Morgan Counties, and a geologic map, scale 1 inch = about 16 miles. No analyses are included.

190 Prindle, L. M., and Knopf, E. B., 1932, Geology of the Taconic quadrangle: Am. Jour. Sci., 5th ser., v. 24, p. 257–302.

Discusses in general the stratigraphy and structure of the Taconic quadrangle, which includes the southwest corner of Vermont, the northwest corner of Massachusetts, and the adjoining portion of eastern New York. Of interest is the description of the Rutland dolomite in the vicinity of Bennington, Vt. Includes a geologic map, scale 1 inch = about 4½ miles. No analyses are given.

191 Prucha, J. J., 1953, The White Crystal dolomite deposit near Gouverneur, N. Y.: N. Y. Univ., N. Y. State Sci. Service Rept. Inv. 9, 13 p.

Includes a general description of the dolomite deposit about 3 miles north of Gouverneur, St. Lawrence County; a summary of chemical analyses of composite chip samples and of uses of dolomite; and a geologic map, scale 1 inch = 600 feet. Reserves are estimated at 68 million tons.

192 Rankama, Kalervo, and Sahama, T. G., 1950, Geochemistry: Chicago, Ill., Univ. of Chicago Press, 911 p.

Surveys in general the broad science of geochemistry. Discusses on pages 448–456, the abundance, geochemical character, minerals, occurrence in igneous rocks, biogeochemistry, and cycle of magnesium.

193 Richardson, C. H., 1923, The building stones of Kentucky: Ky. Geol. Survey, ser. 6, v. 11, 355 p.

Contains discussion, by counties, of the building stones of the State, which include limestone, dolomite, marble, and sandstone; brief descriptions of stone found in quarries and in outcrops that might have potential value; about 100 analyses of building stones of all types, listing location, description of the rock, and original source of the information.

194 Richardson, G. B., 1913, The Paleozoic section in northern Utah: Am. Jour. Sci., 4th ser., v. 36, p. 406–416.

Gives a general description of the Paleozoic section in the Blacksmith Fork area; more detailed descriptions of the Fish Haven, Laketown, and Jefferson dolomites; and 1 partial analysis.

195 Ries, Heinrich, 1901, Lime and cement industries of New York: N. Y. State Mus. Bull., v. 8, p. 641–968.

Includes a detailed discussion of the origin, properties, uses, geology, and occurrence of New York limestones, and the cement industry in New York, and nearly 1,000 analyses of limestones and dolomites in the United States. Maps (1) scale 1 inch = about 12 miles, shows locations of limestone and marl deposits, limestone quarries, and cement plants; and (2) scale 1 inch = about 24 miles, shows areal distribution of limestone in the State.

196 Roberts, R. J., 1943, The Rose Creek tungsten mine, Pershing County, Nev.: U. S. Geol. Survey Bull. 940-A, p. 1–14.

Describes briefly the geology, structure, ore deposits, and mine workings in the area, 11 miles southwest of Winnemucca, Nev.; also describes downfaulted blocks of generally silicified dolomite, indicating from its lithologic character

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that the dolomite is Triassic in age. Geologic map, scale 1 inch = 2,000 feet, shows the distribution of the dolomite.

197 Rodgers, John, 1948, Geology and mineral deposits of Bumpass Cove, Unicoi, and Washington Counties, Tenn.: Tenn. Dept. Conserv., Div. Geology Bull. 54, 82 p.

Describes in general the geology and mineral deposits of the area. Of interest is the description of the Shady dolomite, which was studied in greater detail than the other formations because the Shady and the residual clay derived from it contain all the commercial ore deposits. Gives two chemical analyses of the dolomite. Mentions several flux-stone quarries.

198 ——— 1953, Geologic map of East Tennessee with explanatory text: Tenn. Dept. Conserv., Div. Geology Bull. 58, pt. 2, 168 p.

Includes general descriptions of the rock units of the Unaka Mountains and the Valley of East Tennessee and of the larger structural features, descriptions of the Shady dolomite (p. 42–43) and the Knox dolomite (p. 53–64), and geologic maps, scale 1:125,000. No analyses are given.

199 Rodgers, John, and Kent, D. F., 1948, Stratigraphic section at Lee Valley, Hawkins County, Tenn.: Tenn. Dept. Conserv., Div. Geology Bull. 55, 47 p.

Describes in detail the geologic section at Lee Valley; section extends from the Rome formation to the Martinsburg shale. Treats the Knox as a group, including in it the Copper Ridge, Chepultepec, and Longview dolomites, the Kingsport limestone, and Mascot dolomite. Index map shows location of the section and the generalized geology.

200 Rogers, J. K., 1936, Geology of Highland County: Ohio Geol. Survey, 4th ser., Bull. 38, 148 p.

Describes the general and economic geology of Highland County; treats the Lilley dolomite as a formation rather than as a member of the West Union formation. Includes also descriptions of the Bisher, Peebles, and Greenfield dolomites. Gives several chemical analyses of these dolomites and mentions localities where sizable quarries have been operated.

201 Ross, C. P., and Forrester, J. D., 1947, Geologic map of the State of Idaho: U. S. Geol. Survey, scale 1:500,000.

202 Rothrock, E. P., 1944, Mineral resources, Pt. 3 *of* A geology of South Dakota: S. Dak. Geol. Survey Bull. 15, 255 p.

Briefly mentions the Whitewood, Pahasapa, and Minnekahta limestones as being dolomites locally and therefore a potential source of magnesium. Mentions dolomite sands near Piedmont. Includes the analysis of the Minnekahta given in U. S. Geological Survey Geologic Atlas, folio 219.

203 Rubey, W. W., and Callaghan, Eugene, 1936, Magnesite and brucite, *in* Hewett, D. F., and others, Mineral resources of the region around Boulder Dam: U. S. Geol. Survey Bull. 871, 93 p.

Bulletin 871 summarizes metallic and nonmetallic mineral occurrences in the Boulder Dam area. The section on magnesite and brucite (p. 113–144) describes in some detail the magnesite deposit near Overton, Nev., with detailed discussion of the mineralogy and probable origin of the deposit. Reserves are estimated

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to be greater than 5 million tons. Includes a geologic map, scale 1 inch = about 2,000 feet, and several analyses. Briefly mentions the occurrences near Bauer, in the Currant Creek district, and near Gabbs.

Section on limestone and dolomite (p. 163–165) gives a very brief summary of a few of the occurrences in the region.

204 Savage, T. E., 1926, Silurian rocks of Illinois: Geol. Soc. America Bull., v. 37, p. 525–526, 531–533.

Defines and briefly describes the Port Byron limestone, of Niagaran age, which overlies the Racine dolomite in northern Illinois.

205 Schallis, Alvin, 1942, Dolomite-base refractories: U. S. Bur. Mines Inf. Circ. 7227, 11 p.

Describes briefly some of the chemical and physical properties of and methods of producing calcined and stabilized dolomite refractories. Briefly touches on the separation of lime and magnesia in dolomite. Small-scale map of the United States shows general distribution of high-purity dolomite.

206 ——— 1943, Economic considerations in the recovery of magnesia from dolomite: U. S. Bur. Mines Inf. Circ. 7247, 53 p.

Discusses briefly the thermal decomposition of dolomite and methods of producing half-burned dolomite. Includes brief descriptions of mechanical and chemical methods by means of which magnesia can be separated from dolomite, short general section on cost and applicability of certain processes in the production of magnesia for selected end uses, and a bibliography.

207 Schallis, Alvin, and Warner, K. G., 1942, Magnesium compounds and miscellaneous salines: U. S. Bur. Mines Minerals Yearbook, 1941, p. 1497–1508.

Presents a general review of the industry in 1941, giving statistics on the magnesite industry in particular. States that crude magnesite mined amounted to nearly 375,000 tons.

208 Schlocker, J., 1942, Magnesium-bearing minerals in the Boulder Dam area for the production of magnesium metal: U. S. Bur. Mines Inf. Circ. 7216, 15 p.

Summarizes the magnesite deposits at Bissell, Afton, Needles, and Cima, Calif., and at Overton and Indian Springs, Nev. Mentions some of the dolomite occurrences in the area.

209 Schoch, E. P., 1918, Chemical analyses of Texas rocks and minerals: Tex. Univ. Bull. 1814, 256 p.

Contains several analyses of Texas dolomites (p. 60–61, 182). Most locations are not given exactly.

210 ——— 1938, High magnesia marble from Sharp Mountain area of Llano County, Tex.: Tex. Univ., Div. Nat. Res., Min. Res. Circ., 5 p.

Gives chemical analyses of high-magnesia rock samples collected in Llano County, Tex.

211 Seaton, M. Y., 1942, Production and properties of the commercial magnesias: Am. Inst. Min. Metall. Eng. Tech. Pub. 1496, 21 p.

Includes a general discussion of the production of magnesia from its several sources, which include magnesite, silicates, natural brines, sea water, and sea-water bitterns, and descriptions of the magnesite industries in California, Washington, and Nevada.

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212 Secrist, M. H., 1924, Zinc deposits of east Tennessee: Tenn. Dept. Education, Div. Geology Bull. 31, 165 p.

Includes brief descriptions of the stratigraphy and structure of the Great Valley area of eastern Tennessee and of districts and of the mines and prospects within them, discussions of chemistry and genesis of the ores, and a geologic map, scale 1:500,000, of eastern Tennessee.

213 Shreve, R. N., 1945, The chemical process industries: New York, McGraw-Hill Book Co., Inc., 1st ed., 957 p.

Textbook gives somewhat detailed summaries of many of the more important chemical processes used in industry. Each summary outlines the chemical and physical changes and how they are brought about, physical chemistry, economics, and energy and power requirements. Of interest are the sections on magnesium compounds (p. 209–216) and magnesium (p. 306–311), which briefly outline magnesium chloride electrolysis, carbon reduction, and ferrosilicon reduction processes for magnesium production, and present several flow sheets illustrating production of magnesium compounds from sea water, bitterns, sea water and dolomite, and dolomite.

214 Sloan, Earle, 1908, Catalogue of the mineral localities of South Carolina: S. C. Geol. Survey, 4th ser., Bull. 2, 505 p.

Lists mineral localities and includes brief description of each deposit. Delineates the so-called petrographic zones and briefly describes the geology of each. Gives column of "tentative sub-divisions" of geologic formations in the State. Map, scale about 1 inch = 15 miles, shows mineral localities. Includes analyses of 20 limestone samples.

215 Smith, E. A., and others, 1926, Geologic map of Alabama, prepared in cooperation with the U. S. Geological Survey, scale 1:500,000: Ala. Geol. Survey.

216 Smith, J. E., 1926, The fertilizer materials of Iowa: Iowa Geol. Survey, v. 31, p. 91–151.

Discusses the fertilizer resources of Iowa, which include salt, gypsum, marl, pyrites, phosphates, peat, limestone, and dolomite. Contains brief notes on quarries in and outcrops of limestone and dolomite suitable for use as a fertilizer. Small-scale maps, 1 inch = about 12 miles, show the location of quarries and outcrops. Gives about 160 analyses, along with several measured sections.

217 Smith, R. A., 1916, Limestones of Michigan: Mich. Geol. Biol. Survey Pub. 21, pt. 2, p. 109–311.

Presents a general summary of the origin, classification, and uses of limestone and descriptions of the lithologic character and distribution of the limestone and dolomite formations in the State. Includes a more detailed discussion of their character, development, and distribution by counties and descriptions of occurrences as seen in quarries and outcrops. Outline map, scale 1 inch = about 26 miles, shows distribution of formations and location of limestone quarries. Gives analyses of 724 samples.

218 Spurr, J. E., 1906, Ore deposits of the Silver Peak quadrangle, Nevada: U. S. Geol. Survey Prof. Paper 55, 174 p.

Gives a very general reference to dolomitic limestone and marble occurring in the Cambrian sequence in this portion of Esmeralda County. Includes 4 analyses, 2 of which are dolomite, from "lower Cambrian carbonate rocks," and a geologic map, scale 1:125,000.

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219 Stainbrook, M. A., 1944, The Devonian system in Iowa, *in* Symposium on Devonian stratigraphy: Ill. Geol. Survey Bull. 68, p. 182–188.

Summarizes Iowa Devonian stratigraphy, including brief lithologic descriptions of the formations. Discusses general outcrop areas. Of interest are the descriptions of the Wapsipinicon and Cedar Valley limestones.

220 Stauffer, C. R., 1950, The high magnesium dolomites and dolomitic limestones of Minnesota: Minn. Geol. Survey Summary Rept. 4, 27 p.

Describes briefly the dolomites, which include the Nicollet Creek member of the St. Lawrence formation, Oneota dolomite, Shakopee dolomite, Stewartville member of the Galena formation, and the Cedar Valley limestone, and 36 sample localities, usually accompanied by measured sections. Gives 196 chemical analyses of the dolomites.

221 Stauffer, C. R., and Thiel, G. A., 1933, The limestones and marls of Minnesota: Minn. Geol. Survey Bull. 23, 193 p.

Summarizes the nature and origin of limestones, dolomites, and marls, and their occurrence in Minnesota in quarries and outcrops. Contains many measured sections, 160 analyses of limestones and dolomites including location, geologic formation, and, in some instances, a brief description of the rock sampled.

222 ——— 1941, The Paleozoic and related rocks of southeastern Minnesota: Minn. Geol. Survey Bull. 29, 261 p.

Describes in detail the stratigraphy of southeastern Minnesota, including descriptions of the lithologic character, general distribution, and measured sections of the formations. Includes about 90 selected analyses taken from Minnesota Bulletin 23, well records, small-scale county index maps, and faunal lists; also small-scale, 1 inch = about 35 miles, geologic map of southeastern Minnesota.

223 Stebbins, R. H., 1951, Directory of Washington mining operations, 1951: Wash. Dept. Conserv. and Devel., Div. Mines and Geology Inf. Circ. 19.

Lists all active mines and quarries and products of each, including 2 dolomite quarries active in 1951.

224 Steidtmann, Edward, 1911, The evolution of limestone and dolomite: Jour. Geology, v. 19, p. 323–345, 392–428.

Discusses in detail the decrease in proportion of dolomite to limestone going up the geologic time scale. Presents evidence for the origin of dolomite in the sea, evidence for the origin of dolomite by the alteration of limestones after their emergence from the sea, discusses calcium and magnesium in the products of metamorphism, and presents the conclusion that most dolomites are formed in the sea and that changes in life processes and changes in the chemical composition of the sea are the two factors primarily responsible for a decrease in the quantity of dolomite with the advance of geologic time.

225 ——— 1917, Origin of dolomite as disclosed by stains and other methods: Geol. Soc. America Bull., v. 28, p. 431–450.

Discusses the principles and methods of distinguishing calcite and dolomite by stains and of the time and manner of dolomitization as disclosed by direct observation. Staining shows that pure limestones and dolomites predominate over mixed beds of limestone and dolomite. Concludes that most dolomites

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were formed in the sea and that replacement of lime carbonate is an important process in the formation of dolomite.

226 Steidtmann, Edward, 1924, Limestones and marls of Wisconsin: Wis. Geol. and Nat. Hist. Survey Bull. 66, 208 p.

Discusses in general the occurrence of limestone, dolomite, and marl, arranged by counties. Includes many sections, quarry locations, and characteristics of the deposits, brief discussions of origin and uses of limestones and marls and of the general geology of Wisconsin; 225 analyses of limestones and dolomites; also analyses of marls, clays, slates, and shales. Geologic map of Wisconsin, scale 1:1,000,000, shows general geology and sample localities.

227 Stokley, J. A., 1949, Industrial limestones of Kentucky: Ky. Geol. Survey Rept. Inv. 2, 51 p.

Summarizes the uses of limestone and dolomite, along with approximate specifications for each use; briefly describes distribution, thickness, and character of the carbonate rocks. Includes sets of chemical analyses representing 30 quarries. At only one locality, Avoca, Jefferson County, does the magnesium carbonate content exceed 39 percent.

228 Stokley, J. A., and McFarlan, A. C., 1952, Industrial limestones of Kentucky, no. 2: Ky. Geol. Survey Rept. Inv. 4, 95 p.

Includes brief notes on the stratigraphy of the middle and upper Mississippian beds and summaries of several areas that seem favorable for the production of high-calcium limestone. Lists 23 quarries, drill holes, and road cuts with logs, analyses, and lithologic descriptions of the more important limestone units. The analyses indicate that in the quarries examined, dolomite exists only locally, mainly in the Ste. Genevieve limestone.

229 Stokley, J. A., and Walker, F. H., 1953, Industrial limestones of Kentucky no. 3: Ky. Geol. Survey Rept. Inv. 8, 62 p.

Includes brief notes on areas favorable for the production of high-calcium limestone and near high-magnesium dolomite, description of the formations involved, and discussion of quarrying conditions. Lists 12 quarries with logs, chemical analyses, and lithologic descriptions of the quarryable units. Magnesian limestone and dolomite occur principally in the Laurel dolomite in Jefferson, Oldham, Bullitt, and Nelson Counties.

230 Stone, R. W., 1918, Magnesite deposits of Washington: Eng. Min. Jour., v. 105, p. 665–668.

Includes a description of magnesite quarries and plant facilities in Stevens County, Wash., production figures, and a brief note on uses. Map, scale about 1 inch = 3 miles, shows location of deposits.

231 ——— 1922, Magnesite in Pennsylvania: Pa. Bur. Topog. and Geol. Survey Bull. 28, 3 p.

Presents a brief treatment of the history, description, and evaluation of the small magnesite deposits in Chester and Lancaster Counties, near the Pennsylvania-Maryland State line. The deposits are too small to be considered commercial.

232 Stose, A. J., and Stose, G. W., 1944, Geology of the Hanover-York district, Pennsylvania: U. S. Geol. Survey Prof. Paper 204, 84 p.

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Gives a detailed account of the stratigraphy and structure of the area, which lies in York County, and a brief section on the mineral resources of the district. No analyses of the carbonate rocks. Includes a geologic map, scale 1 inch = 1 mile. Paper is of particular interest for the descriptions of the Vintage, Kinzers, Ledger, and Conestoga formations.

233 Stose, G. W., and Ljungstedt, O. A., 1931, Geologic map of Pennsylvania: Pa. Geol. Survey, scale 1 inch = 6 miles.

234 ——— 1932, Geologic map of West Virginia, by the West Virginia Geological Survey, James D. Sisler, State geologist. Scale 1:500,000.

235 Stout, W. E., 1941, Dolomites and limestones of western Ohio: Ohio Geol. Survey, 4th ser., Bull. 42, 468 p.

Discusses the general features of western Ohio geology and describes in detail the formations, including lithologic character, thickness, areal distribution, and commercial importance. Discusses in detail the carbonate rocks by counties and gives chemical and mineralogical data on samples obtained from quarries and outcrops. Includes chapter on utilization, a list of operators, and analyses of about 300 well-located samples.

236 Suffel, G. G., 1930, Dolomites of western Oklahoma: Okla. Geol. Survey Bull. 49, 155 p.

Discusses in detail the dolomites of the Blaine gypsum and the Permian dolomites overlying the Blaine. Describes the lithologic character and distribution of the dolomites, giving detailed descriptions of individual occurrences. Includes only a few analyses. Small-scale maps show distribution of the Day Creek dolomite, the Blaine escarpment in northwestern Oklahoma, and the dolomite members of the Blaine in southwestern Oklahoma.

237 Surplus Property Administration, 1945, Magnesium plants and facilities: Rept. to Congress, Washington, D. C., 48 p.

Report discusses the magnesium industry and the Government's investment therein and outlines the economic problems involved in the disposition of the Government-owned magnesium plants.

238 Sutton, A. H., 1935, Stratigraphy of the Silurian system of the upper Mississippi Valley: Kans. Geol. Soc. Guidebook, 9th Ann. Field Conf., p. 268–280.

Discusses the Alexandrian and Niagaran series of Illinois, Iowa, and Wisconsin. Of interest are the brief descriptions of the Mayville and Byron formations of the Alexandrian, the Waukesha formation, Coral beds, and Racine-Guelph formation of the Niagaran, and the Waubakee formation. Includes correlation charts and a sketch map showing general distribution of these formations.

239 Taft, H. H., 1936, Magnesite in Dona Ana County, N. Mex.: Eng. Min. Jour., v. 137, p. 137.

Describes magnesite locality.

240 Talmadge, S. B., and Wootton, T. P., 1937, The nonmetallic mineral resources of New Mexico and their economic features (exclusive of fuels): N. Mex. School Mines Bull. 12, 159 p.

Presents a brief summary of the geologic history of the State and a survey of the nonmetallic minerals, including their general features, occurrences, and uses. Section on magnesite and dolomite (p. 110–112) mentions that the El

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Paso, Montoya, and Fusselman limestones contain many dolomite and dolomitic beds and that the Chupadera formation contains a large amount of magnesia. Briefly describes 3 magnesite deposits, giving 5 analyses of magnesite.

241 Tester, A. C., 1937, Geologic map of Iowa: Iowa Geol. Survey, scale 1:500,000.

242 Trefethen, J. M., 1945, Report of the State Geologist 1943–44: [Maine Devel. Comm.], 64 p.

Section on limestone and dolomite (p. 13–18) gives brief description of the dolomite around Warren, Knox County, with suggestions for utilization. Two maps, scale 1 inch = 4/5 mile; 1 inch = about 3/7 mile, show general distribution and sample localities. Six partial analyses show high magnesia content but do not indicate amount or type of impurities present.

243 Tucker, W. B., and Sampson, R. J., 1943, Mineral resources of San Bernardino County [Calif.]: Calif. Jour. Mines and Geology, v. 39, p. 427–549 [1944].

Sections on limestone, dolomite, and magnesite (p. 516–535) give locations of deposits by section, township, and range. Includes brief descriptions of each deposit and analyses of samples from a few of the deposits.

244 Tweto, O. L., 1949, Stratigraphy of the Pando area, Eagle County, Colo.: Colo. Sci. Soc. Proc., v. 15, p. 149–235.

Includes detailed description of the stratigraphy of the area and measured sections. Of interest are the descriptions of the dolomite members of the Chaffee formation (Dyer dolomite member), the Leadville dolomite, and the Minturn formation (Wearyman, Hornsilver, and Resolution dolomite members).

245 Tyler, P. M., 1931a, Magnesium compounds (other than magnesite): U. S. Bur. Mines Inf. Circ. 6406, 19 p.

Summarizes the uses and methods of production and presents statistical data for magnesium carbonate, magnesium sulphate, magnesia, and magnesium chloride. Includes a list of manufacturers of these compounds.

246 ——1931b, Magnesite: U. S. Bur. Mines Inf. Circ. 6437, 53 p.

Describes magnesite, its geologic occurrence, methods of mining, calcining, and brickmaking, and gives summary descriptions of domestic and foreign sources of supply. Includes export, import, and consumption statistics, a bibliography, and lists of producers, brick manufacturers, importers, and dealers.

247 United States Bureau of Mines and United States Geological Survey, 1948, Mineral resources of the United States: Washington, D. C., Public Affairs Press, p. 127–129.

Gives a summary appraisal of the United States resources of magnesium raw materials. Section on reserves of sea water, brines, magnesite, dolomite, olivine, and serpentine is very general. States that magnesite reserves are adequate for 250 years at 1941 rate of consumption.

248 United States Geologic Survey, 1935, Geologic map of Colorado, in cooperation with the Colorado State Survey Board and Colorado Metal Mining Fund, compiled by W. S. Burbank and others, edited by G. W. Stose. Scale 1:500,000.

249 Utley, H. F., 1952, Wartime Nevada brucite plant now producing dead-burned magnesite: Pit and Quarry, v. 44, no. 9, p. 96–98.

Describes briefly the new dead-burning operations of Basic Refractories, Inc., at Gabbs, Nev.

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250 Valentine, G. M., 1949, Inventory of Washington minerals; Part 1, Nonmetallic minerals: Wash. Dept. Conserv. and Devel., Div. Mines and Geology Bull. 37, 113 p.

Shows the general distribution and specific locations of the nonmetallic minerals of Washington, using maps of the State (scale 1 in. = about 24 mi.) and brief descriptive texts, along with a key for each map giving specific localities by section, township, and range. Includes a separate map for each mineral or group of related minerals and lists the source of information for each location.

251 Vanderwilt, J. W., Burbank, W. S., and Traver, W. M., Jr., 1947, Mineral resources of Colorado; foreword by W. E. Scott, Jr., Pt. 1, Metals, non-metals, and fuels, by J. W. Vanderwilt; Pt. 2, Summaries of mining districts and mineral deposits, by W. S. Burbank and others; Pt. 3, Investigations of strategic mineral resources, by W. M. Traver, Jr.: Colo. Min. Res. Board [Bull.], 547 p.

Report summarizes the occurrences of metallic and nonmetallic minerals, outlines their general distribution and geology, and gives brief descriptions of many of the mining districts. Small- and large-scale maps show mineral resources of the State and the geology of the mining districts described. Brief section on dolomite mentions only general areas of occurrence. No analyses are given.

252 Van Horn, E. C., 1948, Talc deposits of the Murphy marble belt: N. C. Dept. Conserv. Devel., Div. Min. Res. Bull. 56, 54 p.

Includes a general description of the stratigraphy, structure, geology of the talc deposits, and of the individual talc deposits and a general discussion of the distribution, extent, and character of the Murphy marble (p. 8–13). Of interest is the concept of zoning of lithologic character in the marble. Also includes geologic maps, scale 1:24,000.

253 Van Tuyl, F. M., 1916, The origin of dolomite: Iowa Geol. Survey, v. 25, p. 251–421.

Gives an excellent summary of the various theories of origin of dolomite. Presents theories in three groups: (1) primary deposition theories, (2) alteration theories, and (3) leaching theories. Cites positive and negative evidence—experimental, field and chemical, and petrographic—bearing on the various theories. Concludes that the majority of stratified dolomites have resulted from the alteration of limestones before their emergence from the sea.

254 Vernon, J. W., 1950, Magnesite, magnesium, and magnesium compounds, *in* Mineral commodities of California: Calif. Dept. Nat. Res., Div. Mines Bull. 156, p. 177–184.

Summarizes the status of production of magnesium compounds in California, history of production, raw materials (mentioning the larger magnesite deposits), uses, and markets.

255 Vernon, R. O., 1951, Geology of Citrus and Levy Counties, Fla.: Fla. Geol. Survey Bull. 33, 256 p.

Describes in detail the physiography, structure, and stratigraphy of Citrus and Levy Counties. Summary of economic geology includes brief section on dolomite (p. 221–224); 1 analysis of sample from near Lebanon, Levy County; brief discussion of mining methods, uses of the dolomite, and reserves. Includes

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geologic map, scale 1 inch = 1.5 miles, and small-scale map, scale 1 inch = about 14 miles, showing distribution of the dolomite.

256 Ver Wiebe, W. A., 1928, Stratigraphy of Chippewa County, Mich.: Mich. Acad. Sci. Papers, v. 9, p. 309–331.

Presents general descriptions of the strata, consisting in part of the rocks of Niagaran age, which include the Engadine, Manistique, and Burnt Bluff formations.

257 Vitaliano, C. J., 1950, Needles magnesite deposit, San Bernardino County, Calif.: Calif. Jour. Mines and Geology, v. 46, p. 357–382.

Describes in detail the geology, structure, and mineral deposits of 2 magnesite areas near Needles. Reserves of indicated and inferred ore are estimated to be 521,000 tons of magnesite containing less than 10 percent lime at 1 deposit. Includes analyses and a geologic map, scale 1 inch = about 400 feet.

258 ——— 1951, Magnesium-mineral resources of the Currant Creek district, Nevada: U. S. Geol. Survey Bull. 978-A, 25 p.

Gives a general description of the geology, petrology, structure, and occurrence of magnesite and more detailed descriptions of the several individual deposits. Reserves are estimated to be 10,000 tons of commercial-grade magnesite and 350,000 tons of magnesium silicate-bearing material. Includes a geologic map of the district, scale 1 inch = 1 mile, and geologic maps of individual deposits, scale generally 1 inch = 200 feet.

259 Ware, Louis, 1944, Magnesium from potash ores: Am. Inst. Min. Metall. Eng. Trans., v. 159, p. 280–284.

Summarizes the process for extraction of magnesium from magnesium chloride discharge liquor from Carlsbad, N. Mex. Process involved magnesium chloride liquor and treated, calcined dolomite to produce magnesium chloride cell feed for electrolytic cells. Plant was located near Austin, Tex., and operated by International Minerals & Chemical Co.

260 Warren, L. E., 1943, Notes on dolomite in Potter and Moore Counties, Tex.: Tex. Univ. Bur. Econ. Geology Pub. 4301, p. 258–264 [1946].

Includes a detailed description of the Alibates dolomite lentil which is exposed along the bluffs of the Canadian River in Potter and Moore Counties; descriptions of 4 measured sections, and 8 analyses of the dolomite. Accompanying the publication is an index map, scale 1:1,000,000, that shows metallic and nonmetallic mineral localities of the State.

261 Watkins, D. G., 1951, Ohio's lime industry: Ohio Chamber of Commerce Indus. Devel. Dept. [Rept.] no. 12, 9 p.

Gives a summary of the lime industry, including uses, production, consumption, location of resources, production methods, and future possibilities for the industry. A map, scale 1 inch = about 32 miles, shows the areal distribution of the limestone formations.

262 Weaver, C. E., 1920, The mineral resources of Stevens County: Wash. Geol. Survey Bull. 20, 350 p.

Presents general descriptions of the geography, stratigraphy, structure, and economic geology of the county; includes brief descriptions of the Stensgar dolomite member of the Deer Trail argillite and of the old Dominion limestone,

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both of the Stevens series of Paleozoic(?) age. Includes also general descriptions of the magnesite mines and a geologic map of the county, scale 1:125,000.

263 Weissenborn, A. E., and Stenzel, H. B., eds., 1948, Geological resources of the Trinity River tributary area in Oklahoma and Texas: Tex. Univ. Bur. Econ. Geology Pub. 4824, 252 p.

Includes brief summary of the geology of the area; catalog of metallic and nonmetallic mineral deposits, with maps (scale 1 in. = about 75 mi.) showing the general distribution of these resources; and general discussion of dolomite and magnesian limestone on pages 93–99. Mentions the dolomite beds of the Permian in north-central Texas. Gives 8 analyses of the dolomite in Potter and Moore Counties and 15 analyses of Oklahoma dolomites.

264 Weitz, J. H., 1942, High-grade dolomite deposits in the United States: U. S. Bur. Mines Inf. Circ. 7226, 86 p.

Includes a compilation of information from published and unpublished sources, summarizing dolomite occurrences by States; brief descriptions, including some structural details, of some of the deposits in each State; tables containing nearly 1,000 analyses; a bibliography; and a small-scale map showing distribution of high-purity dolomite in the United States.

265 Weller, J. M., 1945, Geologic map of Illinois: Ill. Geol. Survey, scale 1:500,000.

266 Wells, R. C., 1937, Analyses of rocks and minerals from the laboratory of the U. S. Geological Survey, 1914–1936: U. S. Geol. Survey Bull. 878, 134 p.

Catalogs more than 1,500 chemical analyses of rock and mineral samples made by the chemistry laboratory, arranged by composition. Gives analyses of carbonate rocks of New Mexico on page 57.

267 Westgate, L. G., and Knopf, Adolph, 1932, Geology and ore deposits of the Pioche district, Nevada: U. S. Geol. Survey Prof. Paper 171, 79 p.

Describes in detail the stratigraphy, structure, and ore deposits of this section of Lincoln County. The lithologic descriptions indicate that the following formations are dolomites or dolomitic limestones: the Highland Peak, and Mendha limestones and the Ely Springs and Silverhorn dolomites. No analyses are included. Includes a geologic map, scale 1:62,500.

268 Whitlatch, G. I., 1948, Minerals, *in* Forests, agriculture, and minerals, industrial resources of Tennessee: Tenn. State Plan. Comm., revised ed., v. 2, p. 61–100.

Brief section on limestone and dolomite (p. 81–83) includes general comments on the distribution and quality of carbonate rocks of Tennessee; the dolomites include the "Knox" and Shady. Gives 1 dolomite analysis (average of 5 "Knox" samples) from TVA quarry at Norris, Anderson County.

269 Whitwell, G. E., and Patty, E. N., 1921, The magnesite deposits of Washington; their occurrence and technology: Wash. Geol. Survey Bull. 25, 194 p.

Briefly discusses the geologic occurrence and origin of the magnesite and describes individual deposits, mining methods, and the occurrence of dolomite. Includes sections dealing with world occurrences, production, uses, technology, and research for new uses of magnesite and a geologic map, scale 1 inch = about 1½ miles, of the magnesite area.

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270 Willman, H. B., 1943, High-purity dolomite in Illinois: Ill. Geol. Survey Rept. Inv. 90, 89 p.

Includes general descriptions of the high-purity dolomites in the Chicago, Savanna-Port Byron, Rockford, and Grafton-Hardin regions; detailed descriptions of each of the dolomite formations in each region, along with small-scale index maps showing the general distribution of the dolomite quarries and outcrops; and analyses of 58 samples, well located both as to geography and stratigraphy.

271 Wilmarth, M. G., 1938, Lexicon of geologic names of the United States (including Alaska): U. S. Geol. Survey Bull. 896, pt. 1, A-L, pt. 2, M-Z, 2396 p.

Lists and defines geologic names.

272 Wilson, E. D., 1942, Magnesium: Ariz. Bur. Mines, Ariz. Univ., Circ. 11, 9 p.

Summarizes dolomite occurrences in Arizona. Primary emphasis is on northwestern Arizona where, in general, "portions of the lower Redwall and underlying limestone formations are dolomitic." Cites several localities and gives partial analyses; also cites the occurrence of Tertiary dolomite in the Agua Fria-Humbug area. Mentions the dolomitic portions of Martin, Mescal, and Abrigo limestones and includes a few representative analyses.

273 Yale, C. G., and Stone, R. W., 1921a, Magnesite: Min. Res. U. S., 1919, pt. 2, p. 227–234 [1922].

Presents a general review of industry with production and import statistics, general discussion of deposits in California and Washington, and a brief note on the geology of an undeveloped deposit 30 miles north of Lordsburg, N. Mex.

274 ——— 1921b, Magnesite: Min. Res., U. S. 1920, pt. 2, p. 1–16 [1923].

Presents a general review of industry with production, consumption, and import statistics, discussions on deposits in California, Washington, and Nevada, and a brief description of undeveloped hydromagnesite deposits in Idaho, near Soda Springs, Bannock County, with one analysis.

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