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BIBLIOGRAPHY

OF

NORTH AMERICAN GEOLOGY

FOR

1916

WITH SUBJECT INDEX

BY

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BIBLIOGRAPHY OF NORTH AMERICAN GEOLOGY FOR 1916, WITH SUBJECT INDEX.

By JOHN M. NICKLES.

INTRODUCTION.

The bibliography of North American geology, including paleontology, petrology, and mineralogy, for the year 1916 follows the plan and arrangement of its immediate predecessors. It includes publications bearing on the geology of the Continent of North America and adjoining islands; also Panama and the Hawaiian Islands. Papers by American writers on the geology of other parts of the world are not included. Textbooks and papers general in character by American authors are included; those by foreign authors are excluded unless they appear in American publications.

As heretofore, the papers, with full title and medium of publication and explanatory note when the title is not fully self-explanatory, are listed under the authors, arranged in alphabetic order. The author list is followed by an index to the literature listed. In this index the entries in one alphabet are of three kinds—first, subject, with various subdivisions, to enable the specialist to ascertain readily all the papers bearing on a particular subject or area; second, titles of papers, many of them abbreviated or inverted, under their leading words; and third, cross references, which have been freely used to avoid too much repetition. The subjects have been printed in black-faced type, the titles of papers and cross references in ordinary type. As it may not be always obvious which subject headings have been adopted, an outline of those used immediately precedes the index.

The bibliography of North American geology is comprised in the following bulletins of the United States Geological Survey: No. 127 (1732–1892); Nos. 188 and 189 (1892–1900); No. 301 (1901–1905); No. 372 (1906–7); No. 409 (1908); No. 444 (1909); No. 495 (1910); No. 524 (1911); No. 545 (1912); No. 584 (1913); No. 617 (1914); No. 645 (1915); and No. 665 (1916).

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Conecuh County, pp. 753–796.
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California, Fresno area, pp. 2089–2166.
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Florida, Ocala area, pp. 669–724.
Georgia, Ben Hill County, pp. 495–517.
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Dougherty County, pp. 573–631.
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Arkansas, Ashley County, pp. 1185–1219.
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OUTLINE OF SUBJECT HEADINGS.

In the following index the subject headings are printed in black-faced type. An outline of these is here given that it may be quickly seen which subject heading of two or more synonyms has been adopted. Thus "petroleum" and not "oil" nor "rock oil" has been chosen. That the specialist may see at a glance under what headings to find cognate literature, subject headings that are more or less closely related have been grouped together under the following heads: Areal or regional, general, economic, dynamic and structural, physiographic, stratigraphic or historical, paleontology, petrology, mineralogy, underground water. In the index the specific entries under the areal or regional subject headings are alphabeted under these same heads arranged in the same order, namely, general, economic, etc.

AREAL OR REGIONAL.

The States and Territories of the Union, Alabama, Alaska, etc.; The Provinces of Canada, Alberta, etc.; Greenland; Arctic regions; Mexico; the countries of Central America; the West Indies, and the single islands; the Hawaiian Islands.

GENERAL.

Associations, meetings; Addresses; Philosophy; History; Biography; Bibliography; Education; Textbooks.

Surveys; Fieldwork; Excursions; Technique; Cartography.

Classification; Nomenclature.

Geochemistry; Chemical analyses (list); Geophysics; Atmosphere; Radioactivity.

Experimental investigations; Borings; Miscellaneous.

ECONOMIC.

Ore deposits, origin; Contact phenomena.

Gold; Placers; Black sands; Silver; Quicksilver; Nickel; Cobalt; Copper; Lead; Zinc; Iron; Magnetite; Manganese; Tin.

Aluminum; Bauxite; Antimony; Bismuth; Tungsten; Vanadium; Uranium; Carnotite ores; Molybdenum; Chromic iron ore.

Platinum; Palladium; Titanium; Rutile; Rare earths; Monazite; Zircon.

Coal; Anthracite; Lignite; Peat.

Petroleum; Natural gas; Oil shales; Asphalt; Albertite; Gilsonite; Bituminous rock.

Stone; Building stone; Granite; Trap; Bluestone; Limestone; Marble; Lime; Gypsum.

Sand; Glass sand; Silica; Quartz; Quartzite; Sandstone; Gravel; Cement and cement materials; Concrete materials; Road materials.

Clay; Kaolin; Bentonite; Fire clay; Ganister; Slate; Shale; Pyrophyllite.

Serpentine; Asbestos; Steatite; Soapstone; Talc.

Precious stones; Diamonds; Sapphires; Turquoise; Tourmaline; Onyx.

Abrasive materials; Corundum; Emery; Garnet; Diatomaceous earth; Tripoli; Volcanic ash; Pumice; Millstones; Whetstones; Novaculite; Feldspar.

Phosphate; Apatite; Potash; Alunite; Nitrate; Glauconite; Marl.

Salt; Salines; Bromine; Calcium chloride; Borax; Fluorspar.

Barite; Strontium; Mineral paints.

Arsenic; Fuller's earth; Infusorial earth; Magnesite; Mica; Graphite.

Phosphorus: Sulphur; Pyrite.

Soils.

DYNAMIC AND STRUCTURAL.

Earth, genesis of; Earth, age of; Earth, interior of; Earth, temperature of.

Volcanism; Volcanoes; Earthquakes; Seismology; Seismographs; Mud volcanoes.

Isostasy; Orogeny; Changes of level.

Magmas; Magmatic differentiation; Laccoliths; Intrusions; Dikes; Contact phenomena.

Deformation; Folding; Faulting; Unconformities.

Conglomerates; Concretions; Stalactites; Jointing; Cleavage.

Denudation; Erosion; Coast changes; Coral islands and reefs; Weathering; Caves; Sink holes; Wind work; Dunes; Loess; Landslides.

Glaciers; Glacial erosion; Glacial striæ; Potholes; Kettle holes.

Sedimentation; Eskers; Kames; Moraines.

Drainage changes.

PHYSIOGRAPHIC.

Geomorphy; Relief maps.

Plains; Prairies; Peneplains; Valleys; Cirques; Deserts; Alluvial fans; Deltas; Mounds, natural; Sink holes; Karsts; Natural bridges.

Rivers; Stream piracy; Meanders; Falls; Lakes; Swamps; Marshes; Everglades.

Terraces; Beaches; Shore lines.

STRATIGRAPHIC OR HISTORICAL.

Geologic history; Geologic time; Paleogeography; Paleogeographic maps; Paleoclimatology.

Geologic maps; Geologic formations described (list); Tables of formations; Unconformities; Borings.

Pre-Cambrian; Paleozoic (undifferentiated); Cambrian; Ordovician; Silurian; Devonian; Carboniferous; Mesozoic (undifferentiated); Triassic; Jurassic; Cretaceous; Tertiary; Quaternary; Recent.

Glacial geology; Glaciation; Drift deposits; Glacial lakes; Erratic bowlders; Ice ages (ancient).

PALEONTOLOGY.

Geographic distribution; Evolution; Restorations.

Vertebrata; Man, fossil; Mammalia; Aves; Reptilia; Amphibia; Pisces; Footprints.

Invertebrata; Arthropoda; Crustacea; Trilobita; Ostracoda; Insecta; Arachnida; Myriapoda.

Mollusca; Cephalopoda; Gastropoda; Pelecypoda.

Molluscoidea; Brachiopoda; Bryozoa; Vermes.

Echinodermata; Echinoidea; Asteroidea; Crinoidea; Cystoidea.

Cœlenterata; Anthozoa; Hydrozoa; Graptolites.

Protozoa; Spongida; Foraminifera.

Paleobotany; Diatoms; Algæ.

Problematica.

PETROLOGY.

Rocks, origin; Rocks, structural features; Rocks described (list); Igneous and volcanic rocks; Rock-forming minerals; Lava; Oolite; Dolomite; Pebbles.

MINERALOGY.

Minerals described (list); Crystallography; Pseudomorphism; Paragenesis of minerals; Rock-forming minerals; Meteorites.

UNDERGROUND WATER.

Mineral waters; Thermal waters; Geysers; Springs; Mine waters.

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(The numbers refer to entries in the bibliography.)

CHEMICAL ANALYSES.[1]

[1] The analyses in entry no. 756 of the bibliography have not been included in this list.

ROCKS DESCRIBED.

GEOLOGIC FORMATIONS DESCRIBED.

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Archeozoic era, pre-Cambrian: Schuchert, 962.
Archuleta terrane, Tertiary, New Mexico: Keyes, 565.
Arecibo limestone, Tertiary, Porto Rico: Reeds, 891.
Arikaree(?) sandstone, Tertiary (Miocene), South Dakota: Winchester *et al.*, 1248.
Arikaree terrane, Tertiary, Kansas: Keyes, 565.
Arkadelphia clay, Cretaceous, Louisiana: Matson, 711.
Arkadelphia clay, Cretaceous, Texas: Udden *et al.*, 1107.
Arkansan series, Carboniferous, Kansas: Keyes, 565.
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Arriban series, Tertiary, New Mexico: Keyes, 565.
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Aux Vases sandstone, Mississippian, Illinois and Kentucky: Weller, 1185.
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Barton Creek limestone, Cretaceous, Texas: Udden *et al.*, 1107.
Bashi formation, Tertiary, Gulf States: Berry, 63.
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Beaumont clays, Pleistocene, Texas: Udden *et al.*, 1107.
Bechler conglomerate, Cretaceous(?), Idaho: Mansfield and Rouncy, 698.
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Belfast bed, Silurian, Ohio: Prosser, 870.
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Bellevue limestone member, Ordovician, Ohio: Fenneman, 352.
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Belly River formation, Cretaceous, Alberta: Sinclair, 1000; Slipper, 1006; Stewart, 1051.
Belt formation, pre-Cambrian, Montana: Haynes, 440.
Belt series, Algonkian, Montana: Walcott, 1146.
Belt terrane, Algonkian, Montana: O'Connell, 802.
Bend series, Pennsylvanian, Texas: Udden *et al.*, 1107.
Benson formation, Cretaceous, British Columbia: Clapp, 188.
Benton formation, Cretaceous, Alberta: Sinclair, 1000; Slipper, 1006; Stewart, 1051.
Benton shale, Cretaceous, Wyoming: Darton, 259.
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Berea formation, Carboniferous, Ohio and Pennsylvania: Verwiebe, 1137.
Berea sand, Mississippian, Ohio: Condit, 223.
Berenda terrane, Devonian, New Mexico: Keyes, 565.
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Bertie waterlime, Silurian, New York: O'Connell, 802.
Bexar formation, Cretaceous, Texas: Udden *et al.*, 1107.
"Big Clifty" sandstone, Mississippian, Kentucky: Butts, 150.
Big Sheep volcanics, British Columbia: Drysdale, 316.
Binnewater sandstone, Devonian, New York: Schuchert, 961.
Birmingham shale, Pennsylvanian, West Virginia: Reger, 892.
Biwabik iron formation, Algonkian, Minnesota: Wolff, 1253.
Black River group, Ordovician, Ontario: Baker, 29; Kindle, 577.
Black River limestone, Ordovician, New York: Miller, 766.

Carrasco terrane, Cambrian, New Mexico: Keyes, 565.
Carrizo formation, Eocene, Texas: Udden *et al.*, 1107.
Carrizo formation, pre-Cambrian, Texas: Udden *et al.*, 1107.
Cason shale, Ordovician, Arkansas: Purdue and Miser, 879.
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Cedar Grove (Middle) sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Cedar Grove (Upper) sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
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Chattanooga shale, Devonian, Arkansas: Purdue and Miser, 879.
Chaves terrane, Carboniferous, New Mexico: Keyes, 565.
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Chetang formation, Cambrian, Alberta: Burling, 133.
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Chico group, Cretaceous, California: Packard, 820.
Chico formation, Cretaceous, Washington: Weaver, 1176.
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Chilton (Upper) sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Chilton (Upper) (?) or Cleveland sandstone, Pennsylvanian, West Virginia: Reger, 892.
Chinle formation, Triassic, Arizona and Utah: Gregory, 405.
Chipola marl member, Tertiary, Florida: Berry, 65.
Chiricahuan series, Cambrian, New Mexico: Keyes, 565.
Chisholm shales, Cambrian, Nevada: Walcott, 1147.
Chisos beds, Cretaceous, Texas: Udden *et al.*, 1107.
Chitistone limestone, Triassic, Alaska: Martin, 705; Moffit, 769.
Chloridian series, Cambrian, New Mexico: Keyes, 565.
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Chouteau limestone, Carboniferous, Missouri: Keyes, 568.
Chugwater formation, Triassic, Wyoming: Condit, 224; Hares, 424; Lupton and Condit, 662; Ziegler, 1275.
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Chuska sandstone, Tertiary, Arizona and New Mexico: Gregory, 405.
Cibolo beds, Permian, Texas: Udden *et al.*, 1107.
Cibola terrane, Silurian, New Mexico: Keyes, 565.
Cieneguita beds, Pennsylvanian, Texas: Udden *et al.*, 1107.
Cimarronian series, Carboniferous, Kansas: Keyes, 565.
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Cincinnati shale, Ordovician, Wisconsin: Weidman and Schultz, 1181.
Cintura limestone, Cretaceous, Arizona: Bonillas *et al.*, 90.
Cisco formation, Pennsylvanian, Texas: Udden *et al.*, 1107.
Citronelle formation, Pliocene, Gulf Coastal Plain: Matson, 713, 714.

City Bluffs shale, Carboniferous, Iowa: Smith, 1009, 1010.
Claiborne formation, Cretaceous, Mississippi: Logan, 650.
Claiborne formation, Tertiary, Arkansas: Stephenson and Crider, 1047.
Claiborne granite, Eocene, Texas: Udden *et al.*, 1107.
Claiborne group, Eocene, Georgia: Brantly, 105.
Claiborne group, Tertiary, Mississippi: Hopkins, 483.
Clallam formation, Miocene, Washington: Weaver, 1176.
Clarendon beds, Miocene, Texas: Udden *et al.*, 1107.
Clarion sandstone, Pennsylvanian, West Virginia: Reger, 892.
Clarksburg fire clay shale, Pennsylvanian, West Virginia: Reger, 892.
Clarksburg red shale, Pennsylvanian, West Virginia: Reger, 892.
Clarno formation, Eocene, Oregon: Collier, 218; Williams, 1229.
Clayton limestone, Tertiary, Gulf States: Berry, 63.
Clear Fork formation, Permian, Texas: Udden *et al.*, 1107.
Cleveland sandstone, Pennsylvanian, West Virginia: Reger, 892.
Clifty limestone, Devonian, Arkansas: Purdue and Miser, 879.
Clinton beds, Silurian, Wisconsin: Weidman and Schultz, 1181.
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Coalburg (Lower) sandstone, Carboniferous, West Virginia: Krebs and Teets, 602; Reger, 892.
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Cobalt series, Huronian, Ontario: Collins, 220.
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Cockfield formation, Eocene, Texas: Udden *et al.*, 1107.
Coconino sandstone, Pennsylvanian, Arizona: Ransome, 881.
Cody shale, Cretaceous, Wyoming: Lupton, 659.
Coeymans member, Devonian, West Virginia: Grimsley, 416.
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Colorado shale, Cretaceous, Montana: Barnett, 38; Stebinger, 1041, 1042.
Colorado shale, Cretaceous, New Mexico: Darton, 258; Paige, 824.
Columbia deposits, Pleistocene, Texas: Udden *et al.*, 1107.
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Comanchan series, Cretaceous, Missouri: Keyes, 565.
Comanchan series, Cretaceous, New Mexico: Keyes, 565.
Comanche Peak formation, Cretaceous, Texas: Udden *et al.*, 1107.
Conasauga formation, Cambrian, Alabama: Walcott, 1145.
Conemaugh formation, Carboniferous, Ohio: Condit, 223.
Conemaugh series, Pennsylvanian, West Virginia: Reger, 892.
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Corniferous limestone, Devonian, Indiana: Culbertson, 239.
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Corrigan formation, Oligocene (?), Texas: Udden *et al.*, 1107.
Corry sandstone, Pennsylvania: Verwiebe, 1137.
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Corsicana beds, Cretaceous, Texas: Udden *et al.*, 1107.
Cotter dolomite, Ordovician, Arkansas: Purdue and Miser, 879.
Cottonwood limestone, Carboniferous, Oklahoma: Heald, 441.

Cox formation, Cretaceous, Texas: Udden *et al.*, 1107.
Coyote terrane, Carboniferous, New Mexico: Keyes, 565.
Cranberry formation, Cretaceous, British Columbia: Clapp, 188.
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Culebra formation, Oligocene, Canal Zone: MacDonald, 671.
Cussewago sandstone, Pennsylvania: Verwiebe, 1137.
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Cynthiana formation, Ordovician, Kentucky: Fenneman, 352.
Cypress formation, Mississippian, Illinois: Brokaw, 111.
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Cyrene member, Silurian, Missouri: Rowley, 926.
Dakota group, Cretaceous, Wyoming: Ziegler, 1275.
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Dakota sandstone, Cretaceous, Colorado: Finlay, 357.
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Dayton limestone, Silurian, Ohio: Prosser, 870.
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De Courcy formation, Cretaceous, British Columbia: Clapp, 188.
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Delaware Mountain formation, Permian, Texas: Udden *et al.*, 1107.
Del Rio clay, Cretaceous, Texas: Udden *et al.*, 1107.
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Departure Bay calcarenites, Cretaceous, British Columbia: Clapp, 188.
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Des Moines series, Carboniferous, Missouri: Keyes, 565.
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DeWitt formation, Miocene-Pliocene, Texas: Udden *et al.*, 1107.
Dexter sands, Cretaceous, Texas: Udden *et al.*, 1107.
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Dry Creek shale, Cambrian, Montana: Walcott, 1146.
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Five Islands volcanics, Triassic, Nova Scotia and New Brunswick: Powers, 857a.
Flambeau quartzite, pre-Cambrian, Wisconsin: Hotchkiss *et al.*, 489.
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Fox Hills sandstone, Cretaceous, Colorado: Finlay, 357.
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Galena-Platteville limestones, Ordovician, Wisconsin: Weidman and Schultz, 1181.
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Genesee black shales, Devonian, Maryland: Grimsley, 416.
George River series, pre-Cambrian, Nova Scotia: Woodman, 1258.
Georgetown formation, Cretaceous, Texas: Udden *et al.*, 1107.
Gilan series, Quaternary, New Mexico: Keyes, 565.
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Glen Rose formation, Cretaceous, Texas: Udden *et al.*, 1107.
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Grapevine sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
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Greybull sand, Cretaceous, Wyoming: Lupton, 659.
Greyson shales, Algonkian, Montana: O'Connell, 802.
Guadaloupan series, Carboniferous, New Mexico: Keyes, 565.
Gulf series, Cretaceous, Louisiana: Matson, 711.
Guyandot sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Guyandot (Lower) sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Gym limestone, Carboniferous, New Mexico: Darton, 258.
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Hamilton formation, Devonian, West Virginia: Grimsley, 416.
Hamilton shale formation, Devonian, Wisconsin: Weidman and Schultz, 1181.
Hampton shale, Cambrian, Tennessee: Jenkins, 514.
Harding sandstone, Ordovician, Colorado: Finlay, 357.
Hardinsburg sandstone, Mississippian, Illinois: Brokaw, 111.
Harpers shale, Cambrian, West Virginia: Grimsley, 416.
Harvey conglomerate sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
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Hawkins terrane, Cambrian, New Mexico: Keyes, 565.
Haymond formation, Pennsylvanian, Texas: Udden *et al.*, 1107.
Hays terrane, Cretaceous, Kansas: Keyes, 565.
Hazelton formation, Jurassic, British Columbia: MacKenzie, 680.
Hedges shale, Carboniferous, West Virginia: Grimsley, 416.
Helderburg formation, Devonian, West Virginia: Grimsley 416.

Helderbergian series, Devonian, Missouri: Keyes, 565.
Helderbergian series, Devonian, New York: Schuchert, 961.
Helena limestone, Algonkian, Montana: Walcott, 1146.
Hernshaw sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Hickory sandstone, Cambrian, Texas: Udden *et al.*, 1107.
Higham grit member, Triassic or Jurassic, Idaho: Mansfield, 693.
High Falls shale, Silurian, New York: Schuchert, 961.
Hillsboro sandstone, Silurian, Ohio: Prosser, 869, 870.
Hoh formation, Jurassic (?), Washington: Weaver, 1176.
Holtsclaw sandstone, Mississippian, Kentucky: Butts, 150.
Homewood sandstone, Carboniferous, West Virginia: Krebs and Teets, 602; Reger, 892.
Honna formation, Cretaceous, British Columbia: MacKenzie, 679.
Horsethief sandstone, Cretaceous, Montana: Stebinger, 1041.
Houten terrane, Tertiary, New Mexico: Keyes, 565.
Hudson River group, Ordovician, New York: Foerste, 365.
Hudson River series, Ordovician, New York: Schuchert, 961.
Hueco limestone, Pennsylvanian, Texas: Udden *et al.*, 1107.
Hundred sandstone, Pennsylvanian, West Virginia: Reger, 892.
Huron shale, Devonian, Ohio: Stauffer, 1040.
Hypozoic, pre-Cambrian: Schuchert, 962.
Iaegar (Lower) sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Iaegar (Lower) shale, Carboniferous, West Virginia: Krebs and Teets, 602.
Iaegar (Middle) sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Iaegar (Upper) sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Idaho Springs formation, pre-Cambrian, Colorado: Bastin and Hill, 51.
Ilo formation, Cretaceous, Wyoming: Hintze, 468.
Index granodiorite, Jurassic, Washington: Smith, 1022.
Index granodiorite, Jurassic or Cretaceous, Washington: Weaver, 1176.
Intermediate formation, Devonian, Alberta: Allan, 6.
Ione formation, Eocene, California: Dickerson, 294.
Iowan drift, Pleistocene, Iowa: Leighton, 626.
Iron Mountain terrane, pre-Cambrian, Missouri: Keyes, 565.
Ironton terrane, pre-Cambrian, Missouri: Keyes, 565.
Jacalitos formation, Pliocene, California: Nomland, 795, 796.
Jackson formation, Tertiary, Arkansas: Stephenson and Crider, 1047.
Jackson formation, Tertiary, Gulf States: Matson, 714.
Jackson formation, Tertiary, Mississippi: Hopkins, 483.
Jackson group, Eocene, Georgia: Brantly, 105.
Jackson marls, Cretaceous, Mississippi: Logan, 650.
Jackson stage, Eocene, Texas: Udden *et al.*, 1107.
Jane Lew sandstone, Pennsylvanian, West Virginia: Reger, 892.
Jasper limestone, Ordovician, Arkansas: Purdue and Miser, 879.
Jennings formation, Devonian, West Virginia: Grimsley, 416.
Joachim limestone, Ordovician, Arkansas: Purdue and Miser, 879.
Joachim terrane, Ordovician, Missouri: Keyes, 565.
John Day formation, Tertiary, Oregon: Collier, 218; Williams, 1229.
Jollytown sandstone, Pennsylvanian, West Virginia: Reger, 892.
Jordan sandstone, Cambrian, Minnesota: Sardeson, 937.
Jornadan series, Quaternary, New Mexico: Keyes, 565.
Juana Diaz shale, Tertiary, Porto Rico: Reeds, 891.
Juniata formation, Ordovician, Pennsylvania: Schuchert, 961.
Kaibab limestone, Pennsylvanian, Arizona: Gregory, 405; Ransome, 881.
Kamishak chert, Triassic, Alaska: Martin, 705.
Kamloops volcanic group, Miocene, British Columbia: Drysdale, 316.
Kanawha black flint, Carboniferous, West Virginia: Krebs and Teets, 602; Reger, 892.
Kanawha granite, Carboniferous, West Virginia: Krebs and Teets, 602.
Kano quartz diorite, Jurassic (?), British Columbia: MacKenzie, 679.
Kansan drift, Pleistocene, Iowa: Leighton, 626.
Kansan drift, Quaternary, Minnesota: Sardeson, 937.
Keechelus series, Tertiary, Washington: Smith, 1022.
Keefer sandstone, Silurian, West Virginia: Grimsley, 416.
Keewatin, pre-Cambrian, Ontario: Hopkins, 140.
Keewatin system, pre-Cambrian, Ontario: Hopkins, 485.
Kemp clay beds, Cretaceous, Texas: Udden *et al.*, 1107.
Kenwood sandstone, Mississippian, Kentucky: Butts, 150.
Kessler limestone, Pennsylvanian, Arkansas: Purdue and Miser, 879.

Longfellow limestone, Ordovician, Arizona: Ransome, 881.
Longwood shales, Silurian, New York and New Jersey: Schuchert, 961.
Lorrain quartzite, pre-Cambrian, Ontario: Collins, 220.
Lorraine formation, Ordovician, Ontario and Quebec: Foerste, 365.
Lorraine formation, Ordovician, Pennsylvania: Schuchert, 961.
Lorraine shales, Ordovician, New York: Foerste, 365.
Loudoun formation, Cambrian, West Virginia: Grimsley, 416.
Loupian series, Tertiary, Kansas: Keyes, 565.
Lowville limestone, Ordovician, New York: Miller, 766.
Lowville limestone, Ordovician, Ontario: Baker, 29; Kindle, 577.
Lucas dolomite, Devonian, Michigan and Ohio: Stauffer, 1038.
Ludlow lignite member, Tertiary(?), South Dakota: Winchester *et al.*, 1248.
Lunasan series, Carboniferous, New Mexico: Keyes, 565.
Lyman schists, New Hampshire: Lahee, 607.
Lyman series, New Hampshire: Lahee, 607.
Lykins formation, Permian(?), Colorado: Finlay, 357.
Lyons sandstone, Pennsylvanian, Colorado: Finlay, 357.
Lytton formation, Eocene, Texas: Udden *et al.*, 1107.
McBean formation, Eocene, Georgia: Brantly, 105.
McCarthy formation, Triassic, Alaska: Martin, 705; Moffit, 769.
McCune terrane, Ordovician, Missouri: Keyes, 565.
McElmo formation, Jurassic(?), Arizona, Utah, and New Mexico: Gregory, 405.
McElmo terrane, Jurassic, New Mexico: Keyes, 565.
McElmo formation, Jurassic(?), Utah: Lupton, 660.
McKenzie formation, Silurian, West Virginia: Grimsley, 416.
McKissick's Grove shales, Carboniferous, Iowa: Smith, 1009.
McLeansboro formation, Pennsylvanian, Illinois: Cady, 156; Rich, 900; Savage, 940; Young, 1272.
McMicken member, Ordovician, Ohio: Braun, 107.
McMillan formation, Ordovician, Ohio: Braun, 107; Fenneman, 352.
McNairy sand member, Cretaceous, Tennessee: Berry, 74.
Maderan series, Carboniferous, New Mexico: Keyes, 565.
Madison beds, Ordovician, Indiana: Culbertson, 239.
Madison limestone, Cambrian, Wisconsin: Shipton, 994.
Madison limestone, Carboniferous, Montana: Haynes, 440; Walcott, 1146.
Madison limestone, Carboniferous, Wyoming: Mansfield, 694.
Madison limestone, Mississippian, Montana: Barnett, 38.
Magdalena formation, Carboniferous, New Mexico: Darton, 258.
Magothy formation, Cretaceous, Atlantic coast: Clark *et al.*, 198.
Magothy formation, Cretaceous, Maryland: Clark, 195.
Mahoning sandstone, Carboniferous, Ohio: Condit, 223.
Mahoning sandstones, Pennsylvanian, West Virginia: Reger, 892.
Mainstreet limestone, Cretaceous, Texas: Udden *et al.*, 1107.
Malone formation, Jurassic, Texas: Udden *et al.*, 1107.
Maloney series, Ordovician, Washington: Smith, 1022.
Manasquan formation, Cretaceous, Atlantic coast: Clark *et al.* 198.
Mancos shale, Cretaceous, Arizona and New Mexico: Gregory, 405.
Mancos shale, Cretaceous, Utah: Lupton, 660.
Mancos shale, Cretaceous, Wyoming: Ziegler, 1275.
Mangas terrane, Cambrian, New Mexico: Keyes, 565.
Manitou limestone, Ordovician, Colorado: Finlay, 357.
Mannington sandstone, Pennsylvanian, West Virginia: Reger, 892.
Manzano terrane, Carboniferous, New Mexico: Keyes, 565.
Maquoketa beds, Ordovician, Iowa: Slocom, 1007.
Maquoketa shale, Illinois: Savage, 944.
Maquoketa shale, Ordovician, Illinois: Trowbridge and Shaw, 1090.
Maquoketa shale, Ordovician, Illinois and Iowa: Shaw and Trowbridge, 982.
Maquoketan series, Ordovician, Missouri: Keyes, 565.
Marathon series, Ordovician, Texas: Udden *et al.*, 1107.
Maravillas chert, Ordovician and Silurian, Texas: Udden *et al.*, 1107.
Marble Falls limestone, Pennsylvanian, Texas: Udden *et al.*, 1107.
Marcellus formation, Devonian, West Virginia: Grimsley, 416.
Marcellus shale, Devonian, New York: Smith, 1008.
Marianna limestone, Tertiary. Florida: Matson, 714.
Marietta (Lower) sandstone, Pennsylvanian, West Virginia: Reger, 892.
Marietta (Upper) sandstone, Pennsylvanian, West Virginia: Reger, 892.
Maricopa shale, Tertiary, California: English, 344.
Marks Head marl, Miocene, Georgia: Brantly, 105.

Marlbrook marl, Cretaceous, Louisiana: Matson, 711.
Marlbrook marls, Cretaceous, Texas: Udden *et al.*, 1107.
Marsh shale, Algonkian, Montana: Walcott, 1146.
Martin limestone, Devonian, Arizona: Bonillas *et al.*, 90; Ransome, 881.
Martinian series, Devonian, New Mexico: Keyes, 565.
Martinsburg shale, Ordovician, West Virginia: Grimsley, 416.
Mascall formation, Miocene, Oregon: Collier, 218.
Masset formation, Tertiary, British Columbia: MacKenzie, 679.
Matawan formation, Cretaceous, Atlantic coast: Clark *et al.*, 198.
Matawan formation, Cretaceous, Maryland: Clark, 195.
Matewan sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Maude formation, Jurassic, British Columbia: MacKenzie, 679.
Maya terrane, Tertiary, New Mexico: Keyes, 565.
Mayville limestone, Silurian, Wisconsin: Savage, 944.
Maysville group, Ordovician, Ohio: Fenneman, 352.
Maxville limestone, Mississippian, Ohio: Lamb, 609.
Maxwell terrane, Tertiary, New Mexico: Keyes, 565.
Meade terrane, Pleistocene, Kansas: Keyes: 565.
Meagher limestone, Cambrian, Montana: Walcott, 1146.
Medina formation, Silurian, West Virginia: Grimsley, 416.
Medina quartzites, Silurian, Pennsylvania: Schuchert, 961.
Medina series, Silurian, New York: Schuchert, 961.
Medina (white) sandstone, Silurian, West Virginia: Grimsley, 416.
Meeteetse formation, Cretaceous, Wyoming: Hintze, 468.
Menard formation, Mississippian, Illinois: Brokaw, 111.
Mendez marls, Eocene, Mexico: Huntley, 503.
Mendota limestone, Cambrian, Wisconsin: Shipton, 994.
Mentor terrane, Cretaceous, Kansas: Keyes, 565.
Merced series, Pliocene, California: Martin, 704.
Mesaverde formation, Cretaceous, Arizona and New Mexico: Gregory, 405.
Mesaverde formation, Cretaceous, Utah: Lupton, 660.
Mesaverde formation, Cretaceous, Wyoming: Lupton, 659; Ziegler, 1275.
Mesaverde formation, New Mexico: Bauer, 52.
Mesa Verde terrane, Cretaceous, New Mexico: Keyes, 565.
Mescal limestone, Cambrian (?), Arizona: Ransome, 881.
Midway formation, Eocene, Georgia: Brantly, 105.
Midway formation, Eocene, Texas: Matson, 712.
Midway formation, Tertiary, Arkansas: Stephenson and Crider, 1047.
Midway formation, Tertiary, Louisiana: Matson, 711.
Midway formation, Tertiary, Gulf States: Berry, 63.
Midway stage, Eocene, Texas: Udden *et al.*, 1107.
Milesburg formation, Devonian, Pennsylvania: Schuchert, 961.
Millican formation, pre-Cambrian, Texas: Udden *et al.*, 1107.
Mimbresan series, Ordovician, New Mexico: Keyes, 565.
Minnesotan series, Ordovician, Missouri: Keyes, 565
Mississagi quartzite, pre-Cambrian, Ontario: Collins, 220.
Mississippian series, Carboniferous, Missouri: Keyes, 565.
Mississippian series, Carboniferous, Virginia: Hinds, 467.
Missourian series, Carboniferous, Kansas: Keyes, 565.
Missourian series, Carboniferous, Missouri: Keyes, 565.
Modoc limestone, Carboniferous, Arizona: Ransome, 881.
Modoc terrane, Carboniferous, New Mexico: Keyes, 565.
Moencopi formation, Permian (?), Utah and Arizona: Gregory, 405.
Mohawkian series, Ordovician, Missouri: Keyes, 565.
Monitor ("Logan") sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Monmouth formation, Cretaceous, Atlantic coast: Clark *et al.*, 198.
Monmouth formation, Cretaceous, Maryland: Clark, 195.
Monongahela formation, Carboniferous, Ohio: Condit, 223.
Monongahela series, Pennsylvanian, West Virginia: Reger, 892.
Monroe formation, Silurian, Ohio: Prosser, 869, 870.
Montana granite, Cretaceous, Colorado: Finlay, 357.
Montanan series, Cretaceous, Kansas: Keyes, 565.
Montanan series, Cretaceous, New Mexico: Keyes, 565.
Monterey group, Tertiary, California: English, 344.
Montesano formation, Miocene, Washington: Weaver, 1176.
Montesano group, Mississippian, Illinois and Kentucky: Ulrich, 1112.

Nikolai greenstone, Triassic or Permian, Alaska: Martin, 705.
Ninos terrane, pre-Cambrian, New Mexico: Keyes, 565.
Niobrara formation, Cretaceous, Colorado: Finlay, 357.
Niobrara formation, Cretaceous, Wyoming: Ziegler, 1275.
Niobrara shale, Cretaceous, Wyoming: Darton, 259.
Nishnabotna sandstone, Carboniferous, Iowa: Smith, 1010.
Nishnabotna terrane, Cretaceous, Missouri: Keyes, 565.
Nizina limestone, Triassic, Alaska: Martin, 705.
Noix oolite, Silurian, Missouri: Rowley, 926.
Nonesuch formation, pre-Cambrian, Wisconsin: Weidman and Schultz, 1181.
Normanskill sandstones, Ordovician, New York: O'Connell, 802.
North Fork shale, Carboniferous, West Virginia: Krebs and Teets, 602.
North Mountain basalt, Triassic, Nova Scotia and, New Brunswick: Powers, 857a.
Northumberland formation, Cretaceous, British Columbia: Clapp, 188.
Norton formation, Carboniferous, Virginia: Hinds, 467.
Nugget sandstone, Jurassic or Triassic, Idaho: Mansfield, 693.
Nugget sandstone, Jurassic or Triassic, Wyoming: Mansfield, 694.
Nuttall (Lower) sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Oak Creek formation, Miocene, South Dakota: Troxell, 1093.
Oak Grove sand, Tertiary, Florida: Berry, 65.
Oakville formation, Miocene, Texas: Udden *et al.*, 1107.
Oakville sandstone, Tertiary, Texas: Deussen and Dole, 289.
Ocala formation, Eocene, Georgia: Brantly, 105.
Ocala limestone, Tertiary, Florida: Matson, 714.
Octoraro schist, Ordovician, Pennsylvania: Bliss and Jonas, 88.
Ogalalla terrane, Tertiary, Kansas: Keyes, 565.
Ohara, Mississippian, Illinois: Brokaw, 111.
Ohio shale, Ohio: Prosser, 869.
Ojo Alamo sandstone, New Mexico: Bauer, 52.
Okefenokee formation, Pleistocene, Georgia: Brantly, 105.
Oklahoman series, Carboniferous, Kansas: Keyes, 565.
Oneota dolomite, Ordovician, Iowa: Howell, 492.
Oneota dolomite, Ordovician, Minnesota: Sardeson, 937.
Onondaga formation, Devonian, West Virginia: Grimsley, 416.
Olentangy shale, Devonian, Ohio: Stauffer, 1040.
Oriskanian series, Devonian, Missouri: Keyes, 565.
Oriskany sandstone formation, Devonian, West Virginia: Grimsley, 416.
Orlando limestone, Pennsylvanian, West Virginia: Reger, 892.
Osgood beds, Silurian, Ohio and Indiana: Prosser, 870.
Osgood shale, Silurian, Indiana: Culbertson, 239.
Ottertail limestone, Cambrian, Alberta: Burling, 133.
Outer formation, pre-Cambrian, Wisconsin: Weidman and Schultz, 1181.
Ozarkian series, Cambrian, Missouri: Keyes, 565.
Palestine sandstone, Mississippian, Illinois: Brokaw, 111.
Palestine sandstone, Mississippian, Illinois and Kentucky: Weller, 1185.
Palomasan series, Quaternary, New Mexico: Keyes, 565.
Paluxy formation, Cretaceous, Texas: Udden *et al.*, 1107.
Paluxy sand, Cretaceous, Texas: Matson, 712.
Pamelia formation, Ordovician, Ontario: Baker, 29; Kindle, 577.
Panama formation, Oligocene, Canal Zone: MacDonald, 671.
Panhandle beds, Miocene, Texas: Udden *et al.*, 1107.
Panther sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Park shale, Cambrian, Montana: Walcott, 1146.
Park City formation, Carboniferous, Wyoming: Condit, 224.
Parkhead sandstone, Devonian, West Virginia: Grimsley, 416.
Pascagoula clay, Tertiary, Gulf States: Matson, 714.
Pascagoula formation, Cretaceous, Mississippi: Logan, 650.
Paskapoo formation, Tertiary, Alberta: Sinclair, 1000.
Paskapoo formation, Tertiary and Cretaceous, Alberta: Slipper, 1006.
Patapsco formation, Cretaceous, Maryland: Clark, 195.
Pato red member, Tertiary, California: English, 344.
Patuxent formation, Cretaceous, Maryland: Clark, 195.
Pawpaw beds, Cretaceous, Texas: Udden *et al.*, 1107.
Payette formation, Eocene(?), Idaho: Jones, 536.
Pearlette terrane, Pleistocene, Kansas: Keyes, 565.
Peay sandstone member, Cretaceous, Wyoming: Lupton, 659.
Pecosian series, Tertiary, New Mexico: Keyes, 565.
Pecurisan series, pre-Cambrian, New Mexico: Keyes, 565.

Peerless sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Pella beds, Carboniferous, Iowa: Weller and Van Tuyl, 1187.
Pella limestone, Mississippian, Iowa: Van Tuyl, 1122.
Pennington shale, Carboniferous, Virginia: Hinds, 467.
Pennsylvanian series, Carboniferous, Virginia: Hinds, 467.
Penasco terrane, pre-Cambrian, New Mexico: Keyes, 565.
Percha shale, Devonian, New Mexico: Darton, 258; Paige, 824.
Perchan series, Devonian, New Mexico: Keyes, 565.
Pete terrane, Cretaceous, Kansas: Keyes, 565.
Peterson limestone, Cretaceous(?), Idaho: Mansfield and Roundy, 698.
Phosphoria formation, Carboniferous, Wyoming: Mansfield, 694.
Pictured Cliffs sandstone, New Mexico: Bauer, 52.
Pictured Cliffs terrane, Cretaceous, New Mexico: Keyes, 565.
Pierpont sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Pierre shale, Cretaceous, Colorado: Finlay, 357.
Pierre shale, Cretaceous, Montana: Rowe and Wilson, 925.
Pierre shale, Cretaceous, Saskatchewan: Rose, 922.
Pierre shale, Cretaceous, South Dakota: Winchester *et al.*, 1248.
Pierre shale, Cretaceous, Wyoming: Hintze, 468.
Pierre formation, Cretaceous, Wyoming: Ziegler, 1275.
Pikes Peak granite, pre-Cambrian, Colorado: Finlay, 357.
Pilgrim limestone, Cambrian, Montana: Walcott, 1146.
Pilot Knob terrane, pre-Cambrian, Missouri: Keyes, 565.
Pinal schist, pre-Cambrian, Arizona: Bonillas *et al.*, 90; Ransome, 881.
Pina Vititos terrane, Cretaceous, New Mexico: Keyes, 565.
Pine Creek limestone, Pennsylvania, West Virginia: Reger, 892.
Pineville sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Pinkerton sandstone, Carboniferous, West Virginia: Grimsley, 416.
Pinto limestone, Cretaceous, Texas: Udden *et al.*, 1107.
Pioneer shale, Cambrian(?), Arizona: Ransome, 881.
Pitkin limestone, Mississippian, Arkansas: Purdue and Miser, 879.
Pittsburgh red shale, Pennsylvanian, West Virginia: Reger, 892.
Pittsburgh (Lower) limestone member, Carboniferous, Ohio: Condit, 223.
Pittsburgh (Lower) sandstone, Pennsylvanian, West Virginia: Reger, 892.
Pittsburgh (Upper) limestone, Pennsylvanian, West Virginia: Reger, 892.
Pittsford shale, Silurian, New York: O'Connell, 802.
Platte shales, Carboniferous, Iowa: Smith, 1009, 1010.
Platteville formation, Ordovician, Iowa: Howell, 492.
Platteville limestone, Ordovician, Illinois: Shaw and Trowbridge, 982; Trowbridge and Shaw, 1090.
Platteville limestone, Ordovician, Minnesota: Sardeson, 937.
Platteville-Galena limestone, Ordovician, Illinois: Sauer, 938.
Plattsmouth limestone, Carboniferous, Iowa: Smith, 1009.
Pocahontas group, Carboniferous, West Virginia: Krebs and Teets, 602.
Pocahontas (Lower) sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Pocahontas (Upper) sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Pocono formation, Carboniferous, West Virginia: Grimsley, 416.
Poinsettan series, Tertiary, Missouri: Keyes, 565.
Point Pleasant limestone, Ordovician, Ohio: Fenneman, 352.
Pokegama quartzite, Algonkian, Minnesota: Wolff, 1253.
Portage formation, Devonian, West Virginia: Grimsley, 416.
Porter horizon, Oligocene, Washington: Weaver, 1176.
Porters Creek formation, Tertiary, Tennessee: Purdue, 877.
Port Hudson clays, Pleistocene, Texas: Udden *et al.*, 1107.
Portneuf limestone, Triassic, Idaho: Mansfield, 693.
Potomac group, Cretaceous, Maryland: Clark, 195.
Potsdam sandstone, Cambrian, Illinois: Trowbridge and Shaw, 1090.
Potsdam sandstone, Cambrian, New York: Miller, 766.
Potsdam sandstone, Cambrian, Wisconsin: Weidman and Schultz, 1181.
Potsdam series, Cambrian, Ontario: Baker, 29.
Pottsboro subgroup, Cretaceous, Texas: Udden *et al.*, 1107.
Pottsville formation, Pennsylvanian, Illinois: Brokaw, 111; Cady, 156; Rich, 900; Savage, 940; Young, 1272.
Pottsville series, Carboniferous, West Virginia: Krebs and Teets, 602; Reger, 892.
Powell limestone, Ordovician, Arkansas: Purdue and Miser, 879.
Prairie du Chien, Ordovician, Illinois: Trowbridge and Shaw, 1090.
Prairie du Chien formation, Ordovician, Iowa: Howell, 492.
Prairie du Chien group, Illinois: Sauer, 938.

Pre-Kansan drift, Quaternary, Minnesota: Sardeson, 937.
Presidio beds, Cretaceous, Texas: Udden *et al.*, 1107.
Preston beds, Cretaceous, Texas: Udden *et al.*, 1107.
Preuss sandstone, Jurassic, Idaho: Mansfield and Roundy, 698.
Protection formation, Cretaceous, British Columbia: Clapp, 188.
Proterozoic era, pre-Cambrian: Schuchert, 962.
Prout limestone, Devonian, Ohio: Stauffer, 1040.
Puerco formation, New Mexico: Bauer, 52.
Puerco terrane, Tertiary, New Mexico: Keyes, 565.
Pulaski shales, Ordovician, New York: Foerste, 365.
Pulliam formation, Cretaceous, Texas: Udden *et al.*, 1107.
Purgatoire formation, Cretaceous, Colorado: Finlay, 357.
Purissima formation, Pliocene, California: Martin, 704.
Purslane sandstone, Carboniferous, West Virginia: Grimsley, 416.
Quaco conglomerate, Triassic, Nova Scotia and New Brunswick: Powers, 857a.
Quadrant formation, Carboniferous, Montana: Haynes, 440; Walcott, 1146.
Quadrant formation, Pennsylvanian(?), Montana: Barnett, 38.
Queen Charlotte series, Cretaceous, British Columbia: MacKenzie, 679.
Queen Charlotte Islands formation, Cretaceous, British Columbia: Drysdale, 316.
Queen City formation, Eocene, Texas: Udden *et al.*, 1107.
Queenston shales, Ordovician, New York and Ontario: Foerste, 365.
Quinnimont sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Quitman bed Cretaceous, Texas: Udden *et al.*, 1107.
Raleigh (Lower) sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Raleigh (Upper) Sandstone, Carboniferous, West Virginia: Krebs and Teets, 602.
Rancocas formation, Cretaceous, Atlantic coast: Clark *et al.*, 198.
Rancocas formation, Cretaceous, Maryland: Clark, 195.
Raritan formation, Cretaceous, Atlantic coast: Clark, *et al.*, 198.
Raritan formation, Cretaceous, Maryland: Clark, 195.
Ratonan series, Tertiary, New Mexico: Keyes, 565.
Rattlesnake beds, Cretaceous, Texas: Udden *et al.*, 1107.
Rattlesnake formation, Pliocene, Oregon: Collier, 218.
Red Eagle limestone, Carboniferous, Oklahoma: Heald, 441.
Redrock Canyon sandstone, Tertiary, California: English, 344.
Redstone limestone, Pennsylvanian, West Virginia: Reger, 892.
Redwall limestone, Mississippian, Arizona: Ransome, 881.
Renault limestone, Mississippian, Illinois: Brokaw, 111.
Rexmont volcanics, Eocene (?), British Columbia: Drysdale, 316.
Reynosa formation, Pleistocene, Texas: Udden *et al.*, 1107.
Richmond formation, Ohio: Braun, 107.
Richmond formation, Ordovician, Ohio and Indiana: Prosser, 870.
Richmond formation, Ordovician, Ontario and Quebec: Foerste, 365.
Richmond formation, Ordovician, Quebec: Dresser, 313.
Richmond group, Ordovician, Ohio: Fenneman, 352.
Richmond limestone, Ordovician, Illinois: Sauer, 938.
Rideau beds, Ordovician, Ontario: Baker, 29; Kindle, 577.
Ripley formation, Cretaceous, Tennessee: Berry, 74; Purdue, 877.
Ripley marls, Cretaceous, Mississippi: Logan, 650.
Ripleyan series, Cretaceous, Missouri: Keyes, 565.
Roberval formation, pre-Cambrian, Quebec: Dresser, 313.
Rociada terrane, pre-Cambrian, New Mexico: Keyes, 565.
Rock Creek beds, Pleistocene, Texas: Udden *et al.*, 1107.
Rockwell formation, Carboniferous, West Virginia: Grimsley, 416.
Rondout waterlime formation, Silurian, West Virginia: Grimsley, 416.
Rosewood shale, Mississippian, Kentucky: Butts, 150.
Rosiclare, Mississippian, Illinois: Brokaw, 111.
Ross limestone, Triassic, Idaho: Mansfield, 693.
Royal shale, Carboniferous, West Virginia: Krebs and Teets, 602.
Rush Run sandstone, Pennsylvanian, West Virginia: Reger, 892.
Rustler formation, Permian, Texas: Udden *et al.*, 1107.
Saguenay anorthosite, pre-Cambrian, Quebec: Dresser, 313.
Ste. Genevieve formation, Carboniferous, Iowa: Weller and Van Tuyl, 1187.
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