BULLETIN 59
Geologic Series

Bibliography and Index of the Geology of New Jersey
by
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DIVISION OF FORESTRY, GEOLOGY, PARKS AND HISTORIC SITES

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Trenton, N. J. 1946
STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION
MORGAN F. LARSON, Commissioner

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LETTER OF TRANSMITTAL

Mr. Charles P. Wilber, Director,
Div. of Forestry, Geology, Parks & Historic Sites.

Sir:

Many people interested in the geology of New Jersey have expressed a desire for a bibliography and index of that subject such as many of the other states have made available. The attached manuscript is an answer to that demand and I recommend its publication as Bulletin 59 of the Geologic Series. It is a pleasure to acknowledge here the debt owed to Miss Agnes Grametbaur, the author, whose patience in compiling this very complete work has been exceeded only by her generosity in making it available for publication without charge. Acknowledgement of substantial financial support in meeting the present high cost of publication is also gratefully made to the Department of Geology of Princeton University, and the Bureau of Mineral Research at Rutgers University. In thus concretely recognizing the value of Miss Grametbaur's work, these agencies are also demonstrating a cooperation which is warmly appreciated, and which will be reciprocated in full measure.

Respectfully yours,

Meredith E. Johnson,
State Geologist.
INTRODUCTION

General Note

In this bibliography are listed books, bulletins, journals, articles, papers and reports on the geology of New Jersey that have been published from 1753 to July 1, 1945.

Part I, Bibliography, is a list of authors, arranged alphabetically. Each author's writings are listed under his name: (1) chronologically, and (2) alphabetically if there are several works in the same year, and are numbered.

Part II, Index, is an alphabetical list of subjects arranged: (1) according to a geographic area—either a major province or county; (2) a geologic period, and (3) numerous major heads. These heads are further subdivided according to the nature of the material indexed. Most of the papers are indexed under all three categories. In each instance, the name of the author and the serial number of his paper follow under the appropriate heading. Thus, the reader can find the title and reference of the paper in the Bibliography, Part I.

Sources of Information

The papers listed have, in a large part, been taken from the Bibliography of North American Geology through 1941. Entries after 1941 have been taken from various lists of publications of the United States Government Printing Office in Washington, D. C. Although there may be some minor omissions, it is thought that the entries since 1941 include all major contributions.

Acknowledgments

The compiler expresses deep gratitude to the library staffs of the Science and Technology Department of the New York Public Library, the Library of the American Museum of Natural History, and the Engineering Societies Library for their untiring assistance in making the material available for consultation. She also desires to extend appreciation to Dr. Horace Elmer Wood, 2nd, and Dr. Herbert P. Woodward of the University of Newark, for their help in this work as well as their encouragement. The compiler is also grateful to Dr. H. B. Kummel for his advice and Mr. Meredith E. Johnson, State Geologist, for loaning her several papers from his personal library.
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Materials, general: Sanford, 2; Schrader,
1; Twitchell, 2.
Clay: Johnson, M. E., 1; Ries, 2; Twitchell, 1.
Copper: Smock, 19; Woodward, H. P., 1.
Gem stones: Williams, 2.
Iron: Cook, 73; Smock, 19.
PEAT: McCourt, 1; Parmalee, 2; Shalnin,
1; Soper, 1.
Sand and gravel: Lewis, J. V., 6; Smock, 19.
Stone: Cook, 71, 88; Hawes, 2; Kummel,
7, 69; McCourt, 3; Russell, 5.
Engineering geology, tunnels: Fluh, 1.
Floods and flood control, Passaic watershed:
Hamilton, W. L., 2; Vermeule, 93.
Geodesy.
Bench marks: Cook, 138; Plummer, 1;
Vermeule, 15, 29, 30; Anonymous, 24.
Boundaries: N. J. B., 1, 6.
Surveying: Bowser, 6; Cook, 127; Verme
ule, 15; Viele, 2; Anonymous, 23.
Geophysics, Magnetism and magnetic sur
veys: Locke, 1; Vermeule, 2, 15.
Glacial geology.
Hudson County—Continued.

Glacial geology—Continued.

Depositional features: Fluhr, 1; Russell, 5; Salisbury, 4.

Erosional features: Salisbury, 4.

Mineralogy.

Mineral groups, general: Canfield, 1; Chamberlin, 1; Darton, 1; Kato, 1; Kunz, 2; Manchester, 1; Robinson, 1; Sanford, 2; Schrader, 1; Seymour, 1.

Borates: Darton, 2.

Carbonates: Bruce, 4; Ferrari, 1; Joy, 1; Roth, 1; Rogers, A. F., 3; Whiilock, 2, 4.

Oxides: Nutall, 2.

Silicates: Bates, 1; Butler, 1; Clarke, 2; Dana, E. S., 1; Ford, 1; Leeds, 2; Martin, 2; Moses, 4; Nutall, 2; Peacock, 1; Rogers, 5; Selfridge, 1; Vanuxem, 5; Whielock, 3; Whitney, 2.

Sulphides: Rogers, A. F., 1; Wherry, 4.

Zeolites: Bourne, 1; Canfield, 3; Manchester, 1; Whielock, 3.

Mineral, localities, general: Canfield, 1; Sanford, 2; Schrader, 1; Seymour, 1.

Bergen Hill: Bates, 1; Beck, 8; Bourne, 1; Canfield, 1, 3; Clarke, 2; Credner, 1; Dana, E. S., 1; Darton, 2; Ford, 1; Kato, 1; Kunz, 2; Leeds, 2; Manchester, 1; Moses, 4; Peacock, 1; Roth, 1; Rogers, A. F., 2, 5; Russell, 5; Seymour, 1; Valiant, 3; Wherry, 4; Whielock, 3; Whitney, 2.

Hoboken: Bruce, 4; Canfield, 1; Chester, 4; Cozens, 1; Ferrari, 1; Finch, 4; Joy, 1; Leeds, 2; Manchester, 2; Mitchell, 4; Nutall, 2; Robinson, 1; Rogers, A. F., 3; Russell, 5; Sanford, 2; Schrader, 1; Selfridge, 1; Seymour, 1; Smith, E. S., 1, 3; Valiant, 3; Vanuxem, 5; Walker, 2.

Jersey City: Manchester, 2; Rogers, A. F., 2; Selfridge, 1; Whielock, 2.

Snake Hill: Levison, 2; Manchester, 2; Perry, 1; Rogers, A. F., 2; Valiant, 3; Whielock, 2.

Weehawken: Canfield, 1; Chamberlin, 1; Darton, 1; Kato, 1; Martin, 2; Rogers, A. F., 1, 5; Sanford, 2; Schrader, 1; Seymour, 1; Valiant, 3; Walker, 2.

Mineral springs: Peale, 1.

Paleontology.

Indeterminate remains, footprints: Gratacap, 1.

Plants, Thaliiophyta: Edwards, 1.

Animals, Mollusca: Richards, 2.

Chordata, Fishes: Eastman, 2; Gratacap.

Petrology.

Igneous rocks.

Intrusive rocks, diabase: Andrease, 1; Butler, 1; Dana, 4, 5; Hawes, 1; Irving, 2.

Metamorphie rocks.

Horafi: Andrease, 1; Darton, 4; Irving, 2.

Serpentine: Julien, 1; Newland, 1; Nutall, 2.

Sedimentary rocks.

Rock types, sandstone: Dana, 8; Dar-
HUNTERDON COUNTY—Continued.

ECONOMIC GEOLOGY—Continued.

MATERIALS—Continued.

Graphite: Bailey, 4; Kummel, 45; Nason, 2; Smock, 19.

Iron: Bailey, 8; Boyer, Charles Shimer, 1; Cook, 23, 35, 42, 48, 74, 76, 102, 111, 193; Fackenthal, 1; Larson, 1; Nason, 7; Putnam, B. T., 1; Smock, 19; Anonymous, 4.

 Lime: Cook, 73; Kummel, 20.

Manganese: Harder, 1; Longhlin, 2; Williams, 1.

Sand and gravel: Cook, 50; Lewis, J. V., 6; Smock, 19.

Stone: Cook, Ti, 88; Eckel, 1, 2; Hawes, 2; Kummel, 7, 69; Lewis, 10; McCourt, 3; Smock, 19.

Zinc: Kummel, 10.

ENGINEERING GEOLOGY, RESERVOIRS AND DAMS:

Hamilton, W. I., 8.

FLOODS AND FLOOD CONTROL, DELAWARE WATERSHED: Vermeule, 20.

GEODESY.

Bench marks: Cook, 37, 127, 136; Plummer, 1, 16; 1; Vermeule, 15, 30.

Surveying: Howser, 5; Cook, 127; Vermeule, 15; Anonymous, 23.

GEOPHYSICS, MAGNETISM AND MAGNETIC SURVEYS: Vermeule, 2, 15, Anonymous, 23.

GLACIAL GEOLOGY.

DEPOSITIONAL FEATURES: Salisbury, 1, 28.

WRIGHT, A. A., 1.

EROSIONAL FEATURES: Salisbury, 1.

MINERALOGY.

MINERAL GROUPS, GENERAL: Canfield, 1, 2; Hawkins, 3; Sanford, 2; Schrader, 1; Wherry, 2.

Carbonates: Everman, 2.

Borosilicates: Totalmanco, 1.

Silicates: Hess, 1, 2; Shannon, 1.

Sulphides: Beck, 2, 1; Honess, 1.

Zeolites: Honess, 1, 2.

MINERAL LOCALITIES, GENERAL: Canfield, 1, 2; Valiant, 8.

FLEMINGTON: Beck, 2.

PALEONTOLOGY.

Indeterminate remains, footprints: Everman, 1, 2.

Plants, general: Lewis, H. C., 4.

Pterodactyla: Newberry, 12.

PETROLOGY.

IGNEOUS ROCKS.

intrusive rocks.

Diabase: Totalmanco, 1.

Dike rocks: Ranson, 1.

Nepheline syenite: Ranson, 1.

Sedimentary rocks, rock types, argillite: Hawkins, 4.

SOILS, COMPOSITION: Blair, 4, 6; Burke, 1, 2; Cook, 72, 72; Patrick, 2, 2.

STRATIGRAPHY.

PRE-CAMBRIAN: Bailey, 4.

CAMPBRIAN: Bailey, 4; Ludlam, 1.

ORDOVICIAN: Bailey, 4.

TRIASSIC: Bascom, 3, 5; Bailey, 4; Ludlam, 1; Salisbury, 117.

QUATERNARY: MacClintock, 14.

STRUCTURAL GEOLOGY.

Local structures, faults: Flemington: Bascom, 5; Lyman, 1; Wheeler, 1.

HUNTERDON COUNTY—Continued.

WATER SUPPLY.

Ground water, wells: Cook, 74; Darton, 12, 13; Kummel, 54; N. J. S. W. P. C., 5; Smock, 9; Upson, 1; Woolman, 6, 18, 16, 17, 18, 19, 20.

MINERAL CONTENT: Collins, 1; Dole, 1; Myers, 2.

Surface water, general: Barrows, 1, 2; Cook, 63, 93; Critchlow, 1; Grover, 16, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28; Hamilton, W. L., 3; Hartwell, 1; Horton, 1, 2; Hoyt, 1; Newell, 1, 2, 8; N. J. S. W. P. C., 6; Parker, G. L., 1, 2, 3; Paulsen, 1.

Stream gauging and gauging stations: Barrows, 1, 2; Critchlow, 1; Grover, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29; Hartwell, 2; Horton, 1, 2; Hoyt, 1; Newell, 1, 2, 8; Parker, G. L., 1, 2, 3; Paulsen, 1.

WEATHERING: MacClintock, 4.

HYDROCARBONS. See Mineralogy: mineral groups.

Influvial sands. See Economic geology: materials, diatomaceous earth.

Inlets. See Engineering geology.

Intrusive rocks. See Petrology: igneous rocks.

Iron. See Economic geology: materials; Mineralogy: native elements.

JENNY JUMP MOUNTAIN. See Warren County; Mineralogy: mineral localities.

JERSEY CITY. See Hudson County; Mineralogy: mineral localities.

JURASSIC PERIOD.

PALEONTOLOGY.

Plants, general: Hollick, 7, 9, 10.

Animals, Chordata, Piscis: Redfield, 10.

Peneplains: Kummel, 78; Stone, 5.

Stratigraphy: Kummel, 75; Lewis, H. C., 2; Lewis, J. V., 11; Marsh, 12; Merrill, 6; Russell, 3; White, 1.

Kames and kettle lakes. See Glacial geology: depositional and erosional features.

KITTLEFINNY LIMESTONE. References included under Cambrian.

Lakes. See Glacial geology: glacial lakes.

Streams and surface drainage: lakes.

Lake Hackensack. See Glacial geology: glacial lakes.

Lake Passaic. See Glacial geology: glacial lakes.

Lake Pequannock. See Glacial geology: glacial lakes.


Limestone. See Economic geology: materials; stone; Petrology: sedimentary rocks.

Magnetism and magnetic surveys. See Geophysics.

Manasquan Inlet. See Monmouth County; Engineering geology: Inlets; Shoreline features: erosional and depositional.

Manganese. See Economic geology: materials.

Manganeseiferous residuum. See Economic geology: zinc.

Marble. See Economic geology: stone; Petrology: metamorphic rocks.

Marshes. See Coastal Plains: Conservation and development; reclamation of land; Shoreline features.

SUBJECT INDEX
Maurice River. See Conservation and development: reclamation of land.

Mercer County—Continued.

Stratigraphy:
Cretaceous: Bascom, 3; Salisbury, 17; Shattuck, 1.
Jurassic: Lewis, H. C., 3.
Triassic: Bascom, 3; Salisbury, 17.
Quaternary: Bascom, 3; Campbell, 1; Salisbury, 11, 17.

Structural geology:

Trenton gravels: Abbott, 1, 2; Belt, 1; Coman, 1; Cook, 61; Haynes, 1; Holmes, 1; Kummel, 1; Lewis, H. C., 1, 2, 5; Martin, 1; Mercer, 1; Putnam, F. W., 1; Richards, 1; Salisbury, 2, 3, 12, 14; Shaler, 1; Volk, 1; Wilson, T., 1; Woodman, 1; Woodworth, 2; Wright, G. F., 1, 2, 4, 5, 6.

Water supply.
Artificial recharge: Barkdale, 11.

Ground water, wells: Cook, 48, 66, 88; Critchlow, 2, 3; Darten, 11, 12, 18; Fuller, 2; Kummel, 27, 54; N. J. S. W. P. C., 5; Smock, 3, 9; Woodman, 9, 19, 13, 17, 13, 19.

Mineral content: Collins, 1.

Surface water, general: Cook, 96, 142; Critchlow, 1; Grover, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 25, 24, 26, 27; well, 1; Hazen, 1; Moore, 3; N. J. S. Water, 1; Parker, G. L., 1, 2, 3; Pauken, 1.

Stream gauging and gauging stations: Critchlow, 1; Grover, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28; Hartwell, 2; Parker, G. L., 1, 2, 3; Pauken, 1.

Windward depositions: Knapp, 1; Kummel, 6; Salisbury, 14.

Metallic paints. See Economic geology: materials, mineral paints.

Meteorites: Gay-Lussac, 1; Goldsmith, 2; Keeley, 1; Manchester, 2; Shepherd, 3; aux.

Misc. See Economic geology: materials.

Middlesex County.

Climate and weather, fulgurite: Barrows, W. L., 1; Myers, 1.
Precipitation: Barkdale, 1; Cook, 76.
Wells: Smock, 6.
Temperature: Berry, 19; Cook, 76.
Conservation and development, forestry: Cook, 112.

Economic geology.
Localities:
Mines, general: Bayley, 3; Cook, 78; Piggott, 1; Sanford, 2; Schrader, 1; Winterbotham, 1; Woodward, H. P., 1.
New Brunswick: Beck, 2; Hawkins, 15; Welf, 1; Whitney, J. D., 1; Winterbotham, 1; Woodward, H. P., 1.

Quarries: Clayton, 1; Cook, 71, 88; Parker, 10; Sanford, 2; Schrader, 1; Smock, 19.

Materials, general: Sanford, 2, Schrader, 1; Twitchell, 2.

Clay: Burchard, 1, 2, 3; Clayton, 1; Cook, 3, 26, 31, 35, 41, 64, 80, 83, 94, 97; Day, 1; Jenkins, 1; Johnson, M. E., 1; Kummel, 26; Kummel, 60, 64.
Middlesex County—Continued.

Economic geology—Continued.

Materialss—Continued.

Clay—Continued.

Loughlin, 1; Parker, 12, 14; Ries, 2,
4, 5, 6, 7; Smock, 3, 19; Stone, R. W.,
1; Twitchell, 1, 2, 3, 12.

Copper: Barber, 1; Beck, 2; Bishop, 1,
Clayton, 1; Hawkins, 18; Morse, 1;
Piggott, 1; Lewis, J. V., 4; Schäpf,
1; Smock, 19; Whitner, J. D., 1; Win-
terbootham, 1; Woodward, H. P., 1.

Gaz: Hawkins, 7.

Greensand marl: Cook, G. H., 1.

Iron: Bayley, 3; Boyer, Charles Shimen,
1; Clayton, 1; Cook, 78, 78, 99.

Oil: Hawkins, 7.

Petal: McCourt, 1; Parmelee, 2; Soper, 1.

Sand and gravel: Johnson, M. E., 1, 3,
4, 7, 8, 9, 10; Kummel, 31, 63, 60;
Salsbury, 10; Twitchell, 1, 2, 10, 12.

Stone: Cook, 71, 88; Lewis, 10; Smock,
19.

Floods and flood control, Raritan watershed:
Vermeule, 5.

Geodesy.

Bench marks: Cook, 87, 119, 127, 136;
Plummer, 1; Vermeule, 15, 30, 31;
Anonymous, 21.


Surveying: Bowser, 5; Cook, 64, 89, 127;

Vermeule, 16; Anonymous, 23.

Geophysics.

Gravitational measurements and stations:
Bowie, 1.

Magnetism and magnetic surveys: Locks,
11; Vermeule, 2, 15; Anonymous, 25.

Glacial geology, general: Hawkins, 2.

Depositional features: Salsbury, 1, 28.

Erosional features: Salsbury, 1.

Mineralogy.

Mineral groups, general: Canfield, 1; Giordano, 1; Hawkins, 12; Sanford, 2;
Schrader, 1; Seymour, 1.

Native elements: Beck, 2; Chester, 4.

Carbonates: Beck, 2; Finch, 2; Hawkins,
5.

Oxides: Beck, 2; Hawkins, 14.

Silicates: Beck, 2; Gruner, 2; Hawkins,
10, 14, 18.

Sulphates: Hawkins, 6, 18; Manley, 2.

Sulphides: Giordano, 1; Hamilton, S. H., 1; Hoppling, 1, 2; Lee, H. R., 1;
Manley, 3, 4, 6; Marshall, 1.

Mineral localities, general: Canfield, 1;
Sanford, 2; Schrader, 1; Seymour, 1.

New Brunswick: Beck, 2; Canfield, 1;
Finch, 2; Gruner, 2; Hawkins, 6, 18;
Manchester, 2; Manley, 2; Sanford, 2;
Schrader, 1; Seymour, 1; Valiant, 3.

South Amboy: Canfield, 1; Manchester,
2; Seymour, 1; Valiant, 3.

Mineral springs: Peale, 1.

Paleontology.

Plants, general: Newberry, 9.

Thaellophyta: Berry, 17; Chrysalis, 3;
Edwards, 3; Newberry, 13.

Bryophyta: Newberry, 12.

Pteridophyta: Berry, 4, 17; Conrad, 14;
Newberry, 15.

Spermatophyta: Bailey, I. W., 1; Berry,
E. W., 1, 8, 9, 13, 17, 18, 19; Chrysalis,

Middlesex County—Continued.

Paleontology—Continued.

Plants—Continued.

Spermatophyta—Continued.

1, 2; Conrad, 14; Jeffrey, 1; New-
berry, 9, 10, 13.

Animals.

Mollusca: Conrad, 11, 16; Richards,
13, 15.

Arthropoda: Conrad, 14.

Petrology.

Sedimentary rocks.

Rock type Gravel:

Campbell, 1; Lucile, 4, 6.

Sand: Barksdale, 5.

Shoreline features, recent shoreline oscillations:

Cook, 112.

Soils, composition:

Blair, 6; Bonstead, 2; Burke, 1; Cook, 62, 72; Jenning, 2; Lee, L. L., 2; Patrick, 3.

Stratigraphy.

Triassic: Bascom, 3; Bayley, 1; Merrill,
6; Salsbury, 17.

Cretaceous: Bascom, 3; Clark, 8, 9; Eaton,
1; Merrill, 6; Salsbury, 17.

Tertiary: Clark, 9.

Quaternary: Bascom, 3; Campbell, 1;
Clayton, 1; Cook, 110; Hollick, 2; Mac-
Cintosh, 4; Salsbury, 11, 13, 17.

Streams and surface drainage.

Deposition: Lucile, 5.

Drainage history, 5.

Lakes, ponds, swamps: Vermeule, 8, 8, 15.

Structural geology.

Local structures.

Faults: Hawkins, 2; Ries, 6.

Folds: Hawkins, 2.

Regional features, Coastal Plain: Hawk-
ins, 7.

Techniques, field trips: Kato, 2.

Water supply.

Artificial recharge: Barksdale, 11.

Ground water, wells: Barksdale, 1, 3, 4,
6, 8, 9, 10; Cook, 66, 74, 82, 88, 124, 142;
Critchlow, 8; Darro, 11, 12, 13; Fuller,
1, 2; Kummel, 27, 54; N. J. S. W. P. C.,
5; Penho, 1; Schafer, 1; Silliman, 1;
Smock, 9; Woolman, 9, 10, 15, 17, 19,
20.

Ground water—Continued.

Mineral content: Barksdale, 5; Collins, 1.

Surface water, general: Cook, 45, 63, 99,
142; Critchlow, 1; Grover, 12, 13, 14,
15, 15, 17, 19, 20, 21, 22, 23, 24, 26,
26, 27, 28; Hamilton, W. L., 1, 3; Hart-
well, 1; Hazen, 1; Moore, 3; N. J. S.
W. P. C., 5; Parker, G. L., 1, 2, 3;
Paulson, 1.

Stream gauging and gauging stations:
Critchlow, 1, 2; Grover, 12, 13, 14, 15,
17, 18, 19, 20, 21, 22, 23, 24, 25, 26,
27, 28; Hartwell, 2; Parker, G. L., 1,
2, 3; Paulsen, 1.

Water fluctuations: Barksdale, 1, 3, 4, 5,
6, 8, 9, 10; Schafer, 1.

Weathering: MacCintosh, 4.

Wind work, storms (hurricane and tornado):

Bache, 1; Beck, 1; Clayton, 1; Egoy, 1;

Hare, 1; Johnson, W. R., 1; Redfield, 2.

Millington. See Morris County; Mineralogy:
mineral localities.

Mine Hill mine. See Franklin Furnace.
Mineralogy—Continued.

Mineral groups—Continued.

Chlorides: Hawkins, 6.
Fluorides: Bruce, 3; Gibba, 1.
Hydrocarbons: Abbott, 5; Beck, 2; Finch, 4; Goldsmith, 1; Kunz, 1; Russell, 2; Weaver, 1.
Oxides: Alger, 1, 3; Aminofof, 2; Bakley, 3; Beck, 2; Beco, 1; Berman, 1; Berthier, 1; Blake, 1; Breithaupt, 1; Bruce, 1; Brush, 3; Casperson, 1; Cook, 100; Cornwall, 1; Deacon, 1; Dittler, 1; Egleston, 1; Farrington, 1; Fonda, 1; Ford, 3; Fowler, 2; Frondel, 1; Grenzig, J. A., 1; Grosser, 1; Harecourt, 1; Hawkins, 14; Hayes, A. A., 1, 2; Leidy, 14; Levi, 1; Moore, 1, 2; Moses, 8, 5; Nutall, 1, 2; Palache, 6, 29; Papish, 1; Phillips, 9, 4; Reamer, 1; Ricketts, 1; Ries, 8; Roepper, 1; Schaller, 3; Seybert, 3; Seymon, 1; Shepard, 4; Stollman, 1; Stevens, 1; Stone, G. C., 1; Thomason, 1; Townsend, 1; Van Horn, 1; Van, C., 1; Whitney, F. L., 1; Anonymous, 1.
Phosphates: Alger, 2; Browne, 1; Cutbush, 1; Jackson, 6; Penfield, 1; Thomason, 1; Vanuxem, 1.
Silicates: Allen, 1; Aminofof, 1; Bates, 1; Bauer, 1, 3, 5, 7, 8; Beck, 2; Beco, 1; Berwerth, 1; Blix, 1; Bowen, 1; Brown, 1; Bruce, 2; Brush, 1; Butler, 1, 2; Canfield, 2; Chester, 1, 2, 3; Clark, 3; Clarke, 1, 2, 3; Conrad, 1; Cook, C. W., 1; Cook, G. H., 64; Cornwall, 1; Dana, E. S., 1; Dana, J. D., 2; Delesse, 1; Eakle, 1; Fenner, 4, 6, 8; Fisher, 1; Foot, 1; Ford, 1, 2, 4; Fosagh, 1, 4, 6; Fowler, 2; Gage, 1; Genth, 1; Glenn, 2; Gordon, 2, 3, 4; Grenzig, A. J., 1; Grenzer, 2, 3; Gunnell, 1; Hart, 1; Hawkins, 5, 10, 14, 15; Riess, 1; Hey, 1; Hillebrand, E., 1; Hillebrand, F., 1; Hillebrand, W. F., 1; Hzn., 2; Hunt, T. S., 1, 2; Hussack, 1; Jackson, C. T., 1, 3; Keeley, 1; Kloe, 1; Koenig, 1, 2, 3; Kummel, 70; Larsen, 1, 2, 3, 4, 5; Leeds, 1, 2; Levison, 4; Lewis, 15; Macadam, 1; Manchester, 3; Mansfield, 3, 5; Martin, 2; Mixter, 1; Moses, 4; Mason, 2, 4; Nichols, 3; Northrup, 3; Nutall, 1, 2; Palache, 2, 3, 4, 6, 9, 10, 11, 15, 16, 18; Papish, 1; Pardee, 1; Parsons, 1; Peacock, 1; Penfield, 3, 5, 6, 7, 8; Phillips, 2; Pirson, 1; Pianati, 1; Pough, 1; Pratt, 1; Rammekeuyx, 1; Renwick, 1; Ricketts, 1; Ries, 8; Riggs, 1; Roepper, 1, 2; Rogers, A. F., 4, 5; Schaller, 1, 6, 7; Schneider, 1; Selfridge, 1; Seybert, 1, 2, 4, 5; Shannon, 1, 2, 3, 4, 5; Shepard, 4; Smith, E. C., 1; Smith, L. T., 1; Spencer, L. J., 1, 2; Stone, G. C., 1; Storm, 1; Sundius, 1; Thomason, 1; Troest, 1, 3; Tyler, S. A., 1; Vanuxem, 2, 5; Warren, 1; Wherry, 1, 2, 3; Wholock, 3; Whitney, 2; Woff, 9, 10, 11; Wurts, 1, 2; Zachariasen, 1; Anonymous, 1.
Sulphates: Allen, 1; Bauer, 5; Chilton, 1; Flexer, 5; Hawkins, 5, 11, 16, 18; Manley, 2; Mitchell, 1; Schaller, 2, 5; Wherry, 1, 5; Wilson, E. H., 1.

NEW JERSEY GEOLOGICAL SURVEY
Mineralogy—Continued.

Subphases: Beck, 2; Black, 2; Eyerman, 2; Hamilton, S. H., 1; Harcourt, 4; Hillyard, 1; Homestead, 1; Hoping, 1; Giordano, 1; Kraus, 1; Lee, E. R., 1; Lewis, 1; Manley, 3, 4, 6; Marshall, 1; Mason, 2; Papiath, 1; Rogers, A. F., 1; Silliman, 1; Weeds, 2; Wherry, 4; Whitehill, 5.

Zeolites: Beck, 3; Benn, 1; Bourne, 1; Canfield, 3; Diegman, 1; Drake, 2; Fenner, 4; Gordon, S. G., 1; Harvey, 6; Hawkins, 15; Honess, 1; Hunt, J. H., 2; Manchester, 1; Moses, 1; Sachs, 5; Schaller, 2, 4; Whitehill, 3; Anonymous, 51.

Mineral localities—Continued.

Franklin Furnace—Continued.

1. Tarz, W. A., 1; Torrey, J., 1; Thomson, 1; Trop, 1, 2, 3; Valent, 5; Van Horn, 1; Vanuxem, 2, 3, 4, 6; Warren, 1; Wolff, 7, 9, 10, 11; Zachariasen, 1.

Great Notch: Brown, 1; Cook, C. W., 1; Fenner, 4, 5, 6; Gordon, S. G., 1; Johnson, M. E., 1; Levison, 2; Pape, 1; Manchester, 2; Rogers, A. F., 2; Sachs, 1, 2; Valent, 3; Whitehill, 4; Wilson, E. H., 1; Zodic, 1.

Hamburg: Fowler, 3; Hussack, 1; Manchester, 2; Riggs, 1; Robinson, 1; Seymour, 1; Torrey, J., 1; Valent, 3.

Hoboken: Bruce, 4; Chester, 4; Cosness, 1; Ferrari, 1; Finch, 4; Joy, 1; Leeds, 2; Manchester, 2; Mitchell, 4; Nutall, 2; Robinson, 1; Rogers, A. F., 3; Russell, 6; Sanborn, 2; Schrader, 1; Seifridge, 1; Seymour, 1; Smith, E. S. C., 1; Valent, 3; Vanuxem, 6; Walker, 2.

Hopewell—Levis, 14; Manchester, 2; Seymour, 1; Valent, 3.

Jenny Jump Mountain: Chester, 4; Manchester, 2; Sanford, 2; Schrader, 1; Seymour, 1; Valent, 2, 3; Westgate, 2; Jersey City: Manchester, 2; Rogers, A. F., 2; Seifridge, 1; Whitehill, 2.

Millington: Hawkins, 8; Manchester, 2.

Montville: Clarke, 1; Gruner, 3; Hilebrand, 3; Manchester, 2; Sanford, 2; Schrader, 1; Seifridge, 1; Seymour, 1; Shannon, 5; Valent, 3.

New Brunswick: Beck, 2; Finch, 2; Gruner, 4; Hawkins, 6, 15; Manchester, 2; Manley, 2; Sanford, 2; Schrader, 1; Seymour, 1; Valent, 3.

Newton: Bruce, 2; Chilton, 1; Fowler, 2; Manchester, 3; Manchester, 2; Seymour, 1; Shepard, 1; Valent, 3.

North Plainfield: Hawkins, 1, 5, 8, 15; Manchester, 2.

Oxford: Chester, 4; Manchester, 2; Valent, 3.

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Silicates: Allen, 1; Bates, 1; Brown, 1; Cook, C. W., 1; Fenner, 5, 6, 8; Glenn, 2; Grenz, A. J., 1; Manchester, 3; Northup, 2; Peacock, 1; Penfield, 5; Schaller, 1; Troost, 1; Wherry, 1, 3; Anonymous, 9.
Sulphates: Allen, 1; Fenner, 5; Hawkins, 11; Schaller, 2, 5; Wherry, 1, 5.
Sulphides: Lewis, 14; Whitlock, 3.
Zeolites: Benn, 1; Canfield, 8; Diegan, 1; Drake, 2; Gordon, S. G., 1; Hawkins, 13; Hunt, J. H., 2; Sachs, 1; Schaller, 2.
Mineral localities, general: Canfield, 1; Hawkins, 15; Manchester, 2; Sanford, 2; Schrader, 1; Seymour, 1.
Great Notch: Brown, 1; Cook, C. W., 1; Fenner, 4, 5, 6; Gordon, S. G., 1; Levison, 2; Manchester, 2; Peake, 1; Rogers, A. F., 2; Sachs, 1, 2; Schaller, 4; Valiant, 3; Whitlock, 4; Wilson, E. H., 1; Zodic, 1.
Paterson and West Paterson: Allen, 1; Bates, 1; Beck, 3; Benn, 1; Canfield, 1, 3, 4; Casper, 1; Diegan, 1; Eheman, 1; Fenner, 4, 5, 6, 8; Glenn, 2; Gordon, S. G., 1; Gordon, T. F., 1; Grenz, A. J., 1; Grenz, J. A., 1; Hawkins, 11, 13; Handley, 2; Hunt, J. H., 1, 2; Levison, 2; Lewis, 14; Manchester, 2, 3; Morton, J. F., 1; Northup, 2; Nutall, 1; Peake, 1; Peacock, 1; Penfield, 6; Pierson, 1; Robinson, 1; Rogers, A. F., 2; Schaller, 1, 2; Smith, 3; Torrey, J. J., 1; Valiant, 1; Wherry, 3, 6; Whitlock, 1, 4, 5.
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Mineral springs: Peales, 1.

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Rippled: Gilmore, 1; Redd., 1.

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Igneous rocks, extrusive, basin: Fenner, 3; Lewis, 13.

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Extrusive rocks—Continued.

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Intrusive rocks.

Dike: Andrease, 1; Bascom, 3; Bayley, 4; Britton, 5; Butler, 1, 2; Dana, 4, 5; Darton, 8, 9, 14; Davis, 2; Howes, 1; Hopcock, 1; Irving, 1, 2; Kummel, 3, 7, 9; Lewis, 8, 9, 12; Newberry, 1; Scoaman, 1; Tomlinson, 1; Westgate, 1; Worts, 4.

Dike rocks: Aurousamen, 1; Bayley, 8, 9; Britton, 5, 6; Cook, 92, 197; Davis, 1; Emerson, 1; Hawkins, 9; Kemp, 1, 2, 3, 5; Lewis, 10; Milton, 1; Nason, 6, 9; Phillips, 1; Ransome, 4; Ries, 8; Russell, 3; Smith, L. L., 1; Spencer, 4; Watson, 1; Westgate, 9; Wolff, 5, 52.

Nepheline syenite: Aurousamen, 1; Bascom, 3; Emerson, 8; Kemp, 2; Lewis, 9; Ransome, 1; Spencer, 4.

Trap (unclassed): Levison, 2; Nason, 1.

Metamorphic rocks.

Gneiss: Bayley, 2, 3, 4, 6; Britton, 3, 5; Cook, 190, 107; Darton, 14; Finney, 9; Hinds, 1; Lewis, 16; Nason, 2; Ries, 3; Smith, L. L., 1; Spencer, 4; Westgate, 9; Wolff, 2, 5.

Hornfels: Andrease, 1; Darton, 4; Irving, 2; Kummel, 3, 7, 9; Lewis, 9.

Marble (crystalline limestone): Bayley, 2, 4, 6; Britton, 3, 5; Cook, 190; Darton, 14; Kummel, 3, 5; Lewis, 16; Nason, 2; Ries, 6; Spencer, 4; Westgate, 1, 2, 3; Wolff, 5.

Schist: Bayley, 6; Britton, 3, 5.

Serpentine: Britton, 3; Julien, 1; Lewis, 18; Merrill, G. F., 1, 2; Newland, 1; Nuttall, 2; Peck, 1, 2.

Slate: Kummel, 3, 15; Lewis, 19.

Quartzite: Ludum, 1; Wolff, 5.

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Rock types, general: Bayley, 5; Raymond, 2; Russell, 6, 8.

Archean: Hawkins, 4; Kummel, 3, 7; Lewis, 10.

Clay: Cook, 64; Hawkins, 14; Prather, 2; Ries, 7; Saltbury, 6, 13; Smock, 8; Storm, 1.

Conglomerate: Fenner, 1; Kummel, 3, 7, 9; Miller, R. L., 1; Nason, 5, 8; Schuchert, 1; Spencer, 4.

Gravel: Campbell, 1; Lucke, 4, 6; Newberry, 3; Saltbury, 7, 9, 9, 10, 12, 20; Volk, 1; Wright, 6.

Greensand marl: Ashley, 1; Clark, 3; Cook, 128; Haldeman, 1; Mansfield, 3; Prather, 1; Rogers, H. D., 2.

Limestone: Kummel, 1; Lewis, 9; Miller, R. L., 1; Nason, 11; Rogers, H. D., 2; Wolff, 6.

Sand: Backdale, 6; Colony, 1; Kummel, 3, 13; Lucke, 7; Prather, 1; Saltbury, 7, 9, 9, 10, 19, 29.

Sandstone: Dana, 3; Darton, 5, 5; Fenner, 1, 2; Finne, 1, 2; Kummel, 3, 7.

Weather, 2; Lewis, 9, 10; Nason, 1; Newberry, 1; Schweitzer, 1, 2, 3; Scoaman, 1; Worts, 4, 5.


Petrology.

Igneous rocks—Continued.
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Sedimentary rocks—Continued.
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Shale: Fenker, 1; Kummel, 3, 7, 9; Nas
son, 1; Schuchert, 1; Schwetzler, 3.
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Till: MacClintock, 3, 4; Salisbury, 2, 3.
6, 7, 10, 22, 23, 24, 25; Ward, 3.
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Geodes: Grenz, J. A., 1; Manley, 1.
Mud cracks: Hawkins, 4.
Rain drop and hail prints: Gratacap, 1.
Lewis, H. C., 4; Lyall, 2; Redfield, 4.
5, 6, 7; Russell, 3.
Bipple marks: Gratacap, 1; Redfield, 5.
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Varmes: Antevs, 1; Reeds, 1, 2, 3, 4, 5.
Anonymous, 18.
Phillipsburg. See Warren County: Mineralogy: mineral localities.
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Physical geography. See also counties.
General: Davis, 3; F. W. P., 1; Gordon.
T. F., 1; Kummel, 84; Morse, 1, 2; Salisbury, 7; Viele, 2; Ward, 3; Winterbrook.
Major provinces.
Appalachian region: Bascom, 5; Bayley, 4.
Cole, 1; Cook, 17; Cummans, 1.
Davis, 6; Johnson, D. W., 4, 6; Kitchell, 2.
Kummel, 78; Larson, 1; Lewis, 11.
Loback, 1; McGee, 1; Messler, 1; Mitchell.
Nason, 8; Peck, 2; Rogers, H. D., 2.
Salisbury, 10, 15, 23; Schöpf, 1.
Smock, 4; Snell, 2; Stone, 1; Vermeule, 3.
11; Wolff, 5; Wright, A. A., 2.
Coastal Plain: Bascom, 2, 3; Bayley, 4.
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Cox, 11; Davis, 4, 6; Hartman, 14.
Johnson, D. W., 6; Kummel, 77, 78; Lewis, 11.
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23; Schöpf, 1; Shattuck, 2; Smock, 4.
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Hayes, A. O., 1; Johnson, D. W., 4, 6.
Kummel, 3, 7, 78; Lewis, 11; Loback, 1.
Merrill, 3; Messler, 1; Mendenke, 1.
Nason, 1; Pierce, 2; Rogers, H. D., 2.
Salisbury, 2, 3, 4, 5, 10, 15, 25; Smock, 4.
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Franklin Furnace: Alger, 1; Hartman, 14.
Fitch, 1; Groth, 1; Haight, 1; Nason, 13.
Palache, 17; Rastall, 1; Res, 8.
Spurr, 1; Stevens, 1; Wetherill, 1.
Wolff, 15; Anonymous, 7, 8.
Ringwood: Nason, 14.
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Res, 8; Salton, 1; Spurr, 1; Stevens, 1;
Wetherill, 1; Wolff, 15; Anonymous, 7.
Materials.
Cement: Eckel, 3.
Copper: Woodward, H. P., 1.
Graphite: Nason, 14.
Iron: Baker, G. W., 1; Bayley, 2, 3.
Blake, 2; Cook, 37, 45, 100; Credner, 2.
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Fowler, 3; Kemp, 4; Kummel, 43;
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1, 5; Stevens, 1; Tarr, R. S., 1; Anonymous, 4, 7, 8.
Mineral wool: Van Voorhis, 1.
Stone: Haves, 2; Kummel, 33; Lewis,
10; Nason, 2; Wolff, 8.
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1; Haight, 1; Jackson, 4; Kemp, 4, 7.
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on, 3; Chester, 3; Nutall, 1; Palache, 17; Westgate, 2.
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Borates: Bauer, 5; Herman, 2.
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Silicates: Bauer, 1, 3, 7, 8; Blix, 1;
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Sulphates: Bauer, 5.
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ger, 1; Chester, 1, 2, 3; Cornwall, 1,
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Genth, 1; Gibbe, 1; Gordon, 3, 4, 5,
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Harecourt, 1; Palache, 17; Schaller, 6;
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Sterling Hill: Alger, 1; Bauer, 5; Corn
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Marble (crystalline limestone): Bayley, 4, 6; Britton, 3, 5; Cook, 100; Darton, 14; Kummel, 53; Nasson, 2, 11; Westgate, 2, 3.

Schist: Bayley, 6; Britton, 3, 6.

Sedimentary rocks, rock types, general: Bayley, 5.

Stratigraphy: Bayley, 2, 3, 4, 5, 6; Britton, 3, 5; Cook, 7, 8, 17, 27, 100; Credner, 4; Dana, 7; Darton, 14; Emmons, E., 1; Farrington, 3; Jackson, 8; Johnson, 11; Kemp, 4; Kerr, 1; Kitchell, 4; Kummel, 26, 50, 78; Larson, 1; Lesley, 1; Lewis, 11; MacClintock, 1; Mather, 1; Meek, 1; Nasson, 2, 5, 10, 12; Puck, 1, 2; Ries, 5, 6; Russell, 8; Shepard, 1; Snell, 2; Spencer, A. C., 2, 3, 4; Van Hise, 1, 2; Vanuexen, 4; Westgate, 1, 3; Williams, K. C., 1; Wolf, 5, 8.

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Local structures.

Dikes: Milton, 1; Nasson, 3.

Faults: Britton, 5; Farrington, 1; Nasson, 2, 3.

Folds: Britton, 5; Wolf, 1.

Water supply, wells: Cook, 124; Kummel, 54.

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Climate and weather, glacial climate: MacClintock, 1.

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Clays: Cook, 77; Day, 5; Johnson, M. E., 5; Bies, 1, 2, 4, 5, 6; Smock, 3.

Peat: McCourt, 1; Kummel, 41; Soper, 1.


White marl: Cook, 56.

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Geophysical, seismic explorations: Ewing, 1.

Glacial geology, general: Anteau, 1; Davis, 4; Hawkins, 2; Kummel, 75; MacClintock, 5; Reeds, 5; Salisbury, 22, 23, 24.

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Climate evidence of: MacClintock, 1, 2, 5; Reeds, 1, 2, 4; Richards, 5, 7, 8; Taylor, 1; Anonymous, 18.

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Uplift: Ward, F. W., 1, 2, 3; Winchell, 1; Wright, A. A., 1, 2; Wright, G. F., 2, 3.

Erosional features: Belt, 1; Cook, 57, 61; 70, 81; Darton, 14; Dwight, 1; Jackson.

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2; Kummel, 1; Salisbury, 1, 2, 3, 5, 7, 10; Ward, 2, 3; Wright, A. A., 2.

Glacial lakes, ponds, and rivers, general: Cook, 51; Merrill, 6; Salisbury, 3, 25, 28.

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Sulphates: Hawkins, 11.

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Plants, general: Baker, 2; Hollick, 9, 10; Thalidophyta: Edwards, 1; MacClintock, 6.

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Animals, general: Merrill, F. J. H., 1; Richards, 6.

Coelenterata: Richards, 6.

Mollusca: Baker, F. C., 1, 2; Conrad, 14; Copo, 4; Ledy, 1; Richards, 2, 11; Woolman, 15.

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Till: MacClintock, 3, 4; Salisbury, 2, 3, 19; Ward, 3.

Sedimentary features, varves: Anteau, 1; Reeds, 1, 2, 3, 4; Anonymous, 18.

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Beaches: Haupt, 3; Wheeler, 1.

Erosional and depositional: Cook, 51, 96; Flint, 1; Haupt, 2, 3; Hitchcock, 1; Johnson, D. W., 1; Kummel, 1; Lucke, 1; MacClintock, 2, 5.

Marshes: Cook, 54; Wheeler, 1.

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Submarine canyons: Dana, 6; Lindenhoff, 1; Spencer, J. W. W., 1, 2.

Terraces (marine): Anteau, 2; Flint, 1, 2; Fuller, 7; Merrill, 5; Richards, 9.

Soils, composition: Salisbury, 13, 19; Wherry, 6.

Stratigraphy: Baker, 2; Bascom, 3, 4; Bayley, 4; Berry, 19; Campbell, 1; Clark, 13; Clayton, 1; Conrad, 14; Cook, 4, 17; 54, 81, 110; Copo, 22; Darton, 14; Hollick, 2; Flint, 1; Flury, 1; Fuller, 5; Kummel, 26, 58, 78; Larson, 1; Lewis, H.; Mac-
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Gravel and marl: Clark, 19; Cook, G. H., 1, 3, 75, 80, 129; Mansfield, 4, 5; Smock, 19; Thoenen, 1.
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Beaches: Cook, 4, 7, 17, 23; Haupt, 3; Merrill, F. J. H., 1; N. J. C. N. B., 1, 2, 3; Salisbury, 17; Wheeler, 1.
Erosional and depositional: Cook, 81, 96; Davis, 6; Flint, 1, 2; Haupt, 1, 2, 3, 5; Hayes, A. O., 1; Hitchcock, C. B., 1; Johnson, D. W., 1; Kummel, 1, 49; Lucke, 1, 2, 3; MacClintock, 1, 2, 5, 6; Merrill, F. J. H., 1; N. J. C. N. B., 1, 2, 3; Richards, 1, 7; Salisbury, 9, 15, 25; Vermeule, 27, 28; Wheeler, 1; Woodman, 1, 2.
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Submarine canyons: Akerly, 1; Anteva, 1; Dann, 6; Johnson, D. W., 1; Kummel, 77; Lindenkohl, 1, 2; Russell, 5; Spencer, J. W. W., 1, 2; Stone, 3.
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Stratigraphy: Bascom, 2, 3; Britton, 1; Clark, 1, 3, 4, 5, 7, 9, 10, 13; Coman, 1; Conrad, 1, 4; Cook, 128, 15, 105, 113, 125, 128; Cooke, G. W., 1; Credner, 2; Dall, 1; Fowler, H. W., 1; Fuller, 3; Gresacen, 1; Harris, 1; Heilprin, 1, 4; Johnson, 11; Kummel, 26, 50, 58, 78; Lewis, 11; McGee, 1; Manfield, 1, 5; Meek, 2; Morton, 6; Richards, 8, 14; Salisbury, 7, 9, 10, 11, 17, 21, 29; Shattuck, 1, 2; Toulin, 1; Vanuxem, 7; Weller, 5; Wheeler, 1; White, 1; Wood, 2; Woolman, 4.

Techniques, field trips: Clark, 2.

Ground water, general: Barkerdale, 2; Thompson, 2, 3; Twitchell, 11.

Wells: Barkerdale, 2; Cook, 83, 88, 116, 124; Critchlow, 3; Barton, 11; Knapp, 3, 4; Kummel, 27, 54; N. J. S. W. P. C., 5; Sanford, 1; Smock, 5, 9, 12; Thompson, 1; Woolman, 1, 2, 3, 5, 6, 7, 9, 10, 15, 18, 19, 19, 20, 21.

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Topography: See Geodesy; Physical geography.

Trap rock. See Petrology; igneous rocks.

Trenton gravels. See Also Mercer County: Quaternary.

Abbott, 1, 2, 3, 5; Belt, 1; Coman, 1; Cook, 61; Lewis, H. C., 1, 2, 6; Haynes, 1; Holmes, 1; Kummel, 6; Martin, 1; Mercer, 1; Putnam, F. W., 1; Richards, 10; Salisbury, 2, 3, 12, 14, 28, 29; Shaler, 1; Volk, 1; Wilson, T., 1; Woodman, 3; Woolworth, 2; Wright, G. F., 1, 2, 4, 5, 6.

Triassic basin. See Structural geology: regional features: Triassic Period.

Triassic Lowland. See also Physical geography: Triassic Period.

Climate and weather.

Precipitation: Lebanon, 2.

Temperature: Cook, 31; Smock, 4, 5.

Conservation and development, forestry: Vermeule, 10, 11.

Economic geology.

Localities.

Mines, general: Credner, 2.

Quarries: Nason, 1.

Materials.

Clay: Johnson, M. E., 5.

Copper: Agood, 1; Cook, 99; Credner, 2; Barton, 14; Emmons, S. F., 1; Knapp, 4; Lewis, J. V., 3; Manchester, 2; Newhouse, 1; Weed, 4; Woodward, H. P., 1.

Iron: Kemp, 4; Newhouse, 1.

Peat: Wakaman, 2.

Stone: Barton, 14; Johnson, M. E., 5; Merrill, 8.
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6; Kummel, 3, 7, 78; Lewis, 13; Lobeck, 1; Merrill, 6; Meesler, 1; Moldenke, 1; Pierce, 1; Rogers, H. D., 2; Salisbury, 2; 5, 8, 10; Smock, 4; Vermeule, 3; Westervelt, 1; Wickers, 1.

Shoreline features, marshes: Waksman, 2.

Soils, composition: Bascom, 3; Cook, 58, 79, 95; Kummel, 3; Salisbury, 18.

Stratigraphy, general: Rogers, H. D., 1, 2.

Triassic: Cook, 7, 71, 66, 103, 114, 116, 149; Credner, 2, 4; Darton, 14; Fenner, 2; Finlay, 1; Hayes, A. O., 1; Kummel, 2, 7, 9, 69; Lewis, J. V., 6; Lyman, 2, 3; Mather, 1; Mawby, 1; Merrill, 6; Nason, 1, 2, 5; Redfield, 8; Russell, 8, 5, 6; Schöpf, 1.

Jurassics: Merrill, 6.

Quaternary: Cook, 81; Salisbury, 2.

Streams and surface drainage, general: Darton, 14.

Drainage history: Russell, 4.

Water gaps and wind gaps: Cook, 95.

Structural geology.

& Localities: Darton, 9.

Faulds: Bayley, 4; Cook, 71, 95, 103, 149; Darton, 9; Davis, 2; Hawkins, 4; Kummel, 2, 3, 4, 7, 8, 9; Lewis, J. V., 1, 2, 6; Merrill, 6; Stone, 2.

Folds: Davis, 2; Kummel, 2, 3, 7, 9; Lewis, J. V., 2, 7.

Sheets and silts: Appogood, 1; Bayley, 4; Cook, 95; Darton, 9, 14; Davis, 2; Fenner, 2; Johnson, 11; Kummel, 7, 8; Lewis, J. V., 2, 5, 9; Lyman, 3; Merrill, 6; Nason, 5; Woodill, 1; Wurts, 8.

Minor structures.

& Columns: Coating: Cook, 114; Darton, 9; Davis, 2; Lewis, 9.

Unconformities: Redfield, 8.

Regional features, Triassic basin: Bascom, 3; Bayley, 4; Cook, 95; Darton, 14; Davis, 1; Hawkins, 4; Hobbs, 1; Lewis, 7; Lyman, 3; Merrill, 6; Newhouse, 1; Russell, 3, 4, 8; Stone, 2; Wheeler, 1.

Techniques, field trips: Johnson, D. W., 4, 5; Lobeck, 1; Torrey, R. H., 1.

Water supply.

Ground water: general: Critchlow, 3; Knapp, 4; Thompson, 2; Twitchell, 11; Vermeule, 17.

Wells: Bascom, 3; Knapp, 3; Vermeule, 4, 9, 17.

Surface water, general: Cook, 46; Hollister, 1; Leighton, 4, 2; Merrill, 8; Vermeule, 3, 4, 9.

Stream flow: Vermeule, 6, 8, 11.

Water power: Leighton, 1; Vermeule, 3, 5, 8, 9.

Triassic Period.

Economic geology.

Localities.


American: Appogood, 1; Lewis, J. V., 1; Woodward, H. P., 1.

Chimney Rock: Appogood, 1; Keith, 1; Lewis, J. V., 1; Woodward, H. P., 1.

Flemington: Clemson, 1; Lewis, J. V., 1; Woodward, H. P., 1.

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Triassic Period—Continued.
Economic geology—Continued.
Localities—Continued.
Mines—Continued.
Grignton Town: Appood, 1; Woodward, H. P., 1.
New Brunswick: Hawkins, 18; Woodward, H. P., 1.
Rocky Hill: Lewis, J. V., 1.
Schuyler: Appood, 1; Black, 2; Granberry, 1, 2; Keith, 1; Lewis, J. V., 1; Pierce, 1; Woodward, H. P., 1; Anonymous, 10.
Quarries: Jodings, 1; Northup, 1; Sache, 2.
Materials, general: Pierce, 1.
Clay: Ris, 2, 5.
Copper: Appood, 1; Black, 2; Bond, 1; Clayton, 1; Clemons, 1; Cook, 92; Credner, 2; Emmens, S. F., 1; Granberry, 1, 2; Hawkins, 18; Keith, 1; Kemp, 4, 7; Kummel, 45; Lewis, J. V., 1, 3, 4; Merrill, 6; Newhouse, 1; Phillips, 1; Taylor, 1; Whitney, J. D., 2; Weed, 1, 2, 3, 4; Whitney, J. D., 1; Woodward, H. P., 1; Anonymous, 10.
Iron: Newhouse, 1.
Manganese: Harder, 1; Williams, 2.
Stone: Akery, 1; Cook, 71; Hawes, 2; Johnson, M. E., 8; Lewis, J. V., 10; Merrill, 6; Russell, 5.
Zinc: Cook, 42.
Geology, general: Moldenke, 1; Pierce, 1.
Magnetism and magnetic surveys: Locke, 1; Wootallard, 7.
Seismic explorations: Ewing, 1; Wootallard, 1.
Glacial geology, depositional features: Russell, 7; Wright, A. A., 1.
Mineralogy.
Mineral groups, general: Coxezz, 1; Fenner, 4; Hawkins, 1, 3, 6, 8, 13; Hunt, J. H., 2; Kuns, 2; Levisan, 2; Lewis, 12; Manchaster, 1; Newhouse, 1; Northup, 1; Nuttall, 1; Pierce, 1; Vallant, 1; Vanartdalen, 1; Woodward, H. P., 1.
Native elements: Chester, 4; Darton, 7; Lewis, 16; Woodward, H. P., 1.
Barates: Darton, 2.
Barosilicates: Tomlinson, 1.
Carbonates: Diegnan, 3; Hawkins, 15; Hoadley, 2; Rogers, A. F., 2; 3; Whitehock, 1, 2, 4.
Hydrocarbons: Russell, 2.
Oxides: Moses, 3; Reamer, 1.
Silicates: Bates, 1; Beck, 3; Bowen, 1; Brown, 1; Butler, 1; Clarke, 5; Dana, E. S., 1; Fenner, 5, 6, 8; Glenn, 1, 2; Grenzis, A. J., 1; Hawkins, 18; Heim, 1; Leeds, 2; Martin, 2; Rogers, 5; Wherry, 1, 3; Whitney, 2; Whitehock, 3.
Sulphates: Fenner, 6; Hawkins, 16, 18; Schaller, 6; Wherry, 1; Wilson, E. H., 1.
Sulphides: Lewis, 14; Wherry, 4; Whitehock, 3.
Zeolites: Beck, 3; Bourne, 1; Fenner, 4; Gordon, S. G., 1; Hawkins, 18; Hunt, J. H., 2; Manchester, 1; Moses, 1; Schaller, 2, 4; Whitehock, 3; Anonymous, 81.
Triassic Period—Continued.
Mineralogy—Continued.
Mineral localities.
Bergen Hill: Bates, 1; Beck, 3; Bourne, 1; Dana, E. S., 1; Darton, 2; Kuns, 2; Manchester, 1; Rogers, 5; Wherry, 4; Whitehock, 3.
Bedrock: Beck, 3; Hawkins, 8.
Great Notch: Fenner, 5, 6; Glenn, S. G., 1; Papke, 1; Schaller, 4; Wilson, E. H., 1.
Hoboken: Cozzens, 1; Leeds, 2; Rogers, A. F., 3.
Hopewell: Lewis, 14.
Millington: Hawkins, 8.
New Brunswick: 18.
North Plainfield: Hawkins, 8, 15.
Paterson and West Paterson: Bates, 1; Beck, 3; Canfield, 4; Caspermon, 2; Fenner, 5, 6, 8; Glenn, S. G., 2; Gordon, S. G., 1; Grenzis, A. J., 1; Hawkins, 11, 13; Hoadley, 2; Hunt, J. H., 1, 2; Lewis, 14; Papke, 1; Pierce, 1; Schaller, 4; Vallant, 1; Valiant, 1; Whitney, J. D.; Whitehock, 1, 2.
Plainfield: Hawkins, 1.
Rocky Hill: Clarke, 3.
Schuyler: Darton, 7; Hawkins, 8.
Short Hills: Glenn, 1.
Somerville: Bowen, 4.
Snake Hill: Perry, 1.
Upper Montclair: Moses, 1, 3; Schaller, 4.
Weehawken: Martin, 2; Rogers, 5.
Taleontology.
General: Cook, 71.
Indeterminate remains.
Footprints: Cape, 7, 12; Edwards, 4; Eyerman, 1, 2; Groatcap, 1; Nason, 1; Newberry, 4, 11; Redfield, 6, 6; Woodworth, 1.
Trails: Abel, 1, 2; Carter, 1.
Plants, general: Berry, 7; Hollick, 9, 10; Lewis, H. C., 4; Newberry, 11.
Thelypodya: Edwards, 2.
Pterodiphtya: Newberry, 12.
Spermatopha: Newberry, 12.
Animals.
Mollusca: Conrad, 11.
Chordata: Poecies: Eastman, 1, 2; Gale, 1; Groatcap, 1; Newberry, 4, 5, 11, 12; Redfield, 3, 5, 6, 7, 9, 10; Sheenan, 1.
Reptilia: Cape, 2, 10; Edwards, 4; Gilmore, 1; Hene, 1; Rapp, 1.
Petrology.
Igneous rocks.
Extensive rocks, basalt: Boscum, 3; Bayley, 4; Darton, 9, 14; Davis, 1, 2; Fenner, 1, 3, 4; Hawkins, 9; Eddings, 1; Kummel, 7, 9; Lewis, 9, 12, 13; Russell, J. C., 1; Schweitser, 3; Weed, 2.
Intrusive rocks.
Basalt: Andresen, 1; Boscum, 3; Bayley, 4; Butler, 1, 2; Dana, 4, 5; Darton, 9, 9, 14; Davis, 2; Hawes, 1; Hoppock, 1; Irving, 1, 2; Kummel, 7, 9; Lewis, 8, 9, 12; Newberry, 1; Seaman, 1; Tomlinson, 1; Walker, 1, 2; Wutra, 4.
Triassic Period—Continued.

Water supply.

Artificial recharge: Bordentown, 11.

Ground water; general: Critchlow, 3; Twitchell, 11.

Wells: Cook, 74, 89, 124; Knapp, 3; Kummel, 37, 54, 72; N. J. S. W. P. C., 5; Stillman, 1; Upsom, 1; Vermeule, 23; Woolman, 9, 13, 16, 17, 29.

Weathering: Raymond, 2.

Trilobites. See Paleontology: animals, arthropods.

Tunnels. See Engineering geology.

Union County.

Climate and weather.

Precipitation: Critchlow, 4; Smock, 4.

Tables: Smock, 6.

Conservation and development.

Forestry: Cook, 115.

Reclamation of land. Newark Meadows: Vermeule, 12, 14, 15.

Economic geology.

Localities.

Mines, general: Honeymoon, 1; Woodward, H. P., 1.

Quarries: Johnson, M. E., 1; Kummel, 7; Lewis, 10; Parker, 19; Sanford, 2; Schrader, 1.

Materials, general: Sanford, 2; Schrader, 1; Twitchell, 2.

Clay: Johnson, M. E., 1; Jenkins, 3; Ries, 2.

Copper: Appgood, 1; Honeymoon, 1; Kahl, 1; Woodward, H. P., 1.

Peat: McCourt, 1; Parmele, 2; Soper, 1.


Stone: Hawes, 2; Kummel, 7; Lewis, 10.

Floods and flood control. Passaic watershed: Hamilton, W. I., 2; Vermeule, 33.

Geodyssey.

Bench marks: Cook, 183; Plummer, 1; Vermeule, 15; Anonymous, 22, 24.

Boundaries: N. J. R., 1, 5, 6.

Surveying: Bowser, 3; Cook, 127; Vermeule, 15; Anonymous, 23.

Geophysics, magnetism and magnetic surveys: Vermeule, 2, 18.

Glacial geology.

Local structures.

Dikes: Darton, 9; Hawkins, 9; Rogers, 11, 13, 13.

Faults: Caspermon, 3; Cook, 71, 95, 103, 140; Darton, 9; Davis, 2; Fenner, 1; Fluhry, 1; Hawkins, 17; Kummel, 4; Lewis, J. V., 2; Lyman, 1; Merrill, 6; Stoua, 2; Wheeler, 1; Willard, 1.

Folds: Davis, 2; Lewis, J. V., 2, 7.

Sheets and sills: Cook, 95; Darton, 9, 14; Davis, 2; Fenner, 1; Iddings, 1; Irving, 2; Johnson, 11; Julien, 2; Kummel, 14; Lewis, J. V., 2, 7, 9; Merrill, 6; Nason, 5; Walker, 1, 2; Wurts, 4.

Stocks: Cook, 95; Merrill, 6.

Minor structures.

Columnar Jointing: Cook, 95, 114; Darton, 9; Davis, 2; Helfprin, 2; Iddings, 1; Lewis, 9; Merrill, 6.

Unconformities: Lewis, 7.

Regional features, Triassic basin: Cook, 95; Darton, 14; Davis, 1; Lewis, J. V.; Lyman, 3; Merrill, 6; Russell, 4; Stoua, 2; Wheeler, 1.

Volcanism: Darton, 14.
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Economic geology—Continued.
Localities—Continued.
Quarries—Continued.
Fisher, 16; Peck, 2; Sanford, 2; Schrader, 1; Smock, 19; Anonymous, 16, 17.
Materials, general: Day, 2; Sanford, 2; Schrader, 1; Twitchell, 2; Williams, A., 1.

t: Bayley, 6; Cummins, 1; Day, 6; Eckel, 1, 2, 3; Hamilton, S. H., 2; Johnson, M. E., 3, 4, 7, 9; Kimmel, 15, 45, 51, 53, 60, 86; Lewis, F. H., 1; Peck, 2; Smock, 19; Twitchell, 1, 2, 5, 7, 8, 9, 10; Anonymous, 16, 17.
Clay: Jenkins, 3, 5; Johnson, M. E., 1; Kimmel, 26; Ries, 2; Smock, 19.
Copper: Barber, 1; Cummins, 1; Dickerson, 3; Hamilton, S. H., 3; Honeyman, 2; Keith, 1; Kimmel, 26, 51, 53; Parker, 7, 8, 11; Shampanore, 1; Shuster, 1; Smock, 19; Twitchell, 1; Weed, 4; Woodward, H. F., 1.
Graphite: Cook, 26.
Iron: Barber, 1; Bayley, 3, 8; Bishop, 1; Boyer, Charles, 8; Smock, 20, 29, 31, 55, 62, 68, 73, 78, 93, 97, 102, 105, 139; Cummins, 1; Fackettall, 3; Gordon, T. F.; Hamilton, S. H., 9; Honeyman, 2; Hughes, 2, 3; Jackson, 9; Jenkins, 1, 2, 7; Johnson, M. E., 6, 10, 13; Kiessling, 9; Kittche, 6; Kummel, 12, 18, 21, 30, 43, 66; Nason, 7; Needham, 1, 2; O'Hara, 1, 2; Peck, 1, 2, 13; Putnam, B. T.; Raum, 1; Ridgeway, 1; Scrafont, 1; Shampanore, 1; Shore, 1; Smock, 15, 19; Twitchell, 1, 6, 10; Anonymous, 4.
Lime: Bayley, 6; Cook, 12, 31, 73, 97; Kimmel, 60.
Mineral wool: Van Voorhis, 1.
Pent: Bayley, 4; Kimmel, 41; McCourt, 1, 2, 13; Parmelee, 2; Soper, 1; Twitchell, 8, 9, 12.
Sand and gravel: Johnson, M. E., 1, 3; Kimmel, 21.
Silver: Smock, 19.
Stone: Bayley, 6; Cook, 31, 88; Eckel, 5; Kimmel, 33; Lewis, 10; McCourt, 3; Smock, 19; Twitchell, 1, 2, 8, 10, 12.
Talc and soapstone: Kummel, 69; Peck, 1, 2; Smock, 19; Twitchell, 3, 8, 16, 12.
White marble: Cook, 56; Eckel, 3; Kimmel, 15; Van Voorhis, 1.
Zinc: Cook, 69.
Engineering geology, canals: Cummins, 1.
Floods and flood control, Delaware watershed: Vermeule, 20.
Geology.
Bench marks: Cook, 87, 136; Plummer, 1; Vermeule, 15, 29, 36.
Surveying: Bowser, 2, 5; Cook, 89, 127; Vermeule, 15; Viele, 2; Anonymous, 23.
Geophysical magnetism and magnetic surveys: Cook, 68; Vermeule, 2, 14; Anonymous, 23.
Glacial geology, general: Salisbury, 23.
Depositional features: Salisbury, 1, 25; Ward, F., 1, 2, 3; Wright, A. A., 1.
Erosional features: Salisbury, 1, Ward, 2, 3.
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Glacial geology—Continued.
Glacial lakes, ponds, and rivers, general: Salisbury, 10.
Mineralogy.
Mineral groups, general: Canfield, 1; Day, 2; Sanford, 2; Schrader, 1; Seymour, 1; Vallant, 2; Westgate, 2; Williams, A., 1.
Native elements: Eyerman, 2; Smock, 19.
Oxides: Roepker, 1.
Sulfides: Eyerman, 2.
Mineral localities, general: Canfield, 1; Day, 2; Schrader, 1; Seymour, 1; Vallant, 2; Westgate, 2.
Jenny Jump Mountain: Canfield, 1; Chester, 4; Manchester, 2; Sanford, 2; Schrader, 1; Seymour, 1; Vallant, 2; Westgate, 2.
Oxford: Chester, 4; Manchester, 2; Vallant, 3.
Phillipsburg: Canfield, 1; Sanford, 2; Schrader, 1; Seymour, 1; Vallant, 3.
Washington: Vallant, 3.

Paleoontology.
Animals, general: Kindle, 1.
Mollusca: Baker, F. C., 1, 2; Leidy, 1.
Arthropoda: Weiler, 1.
Chordata: Mannuel: Baker, 2; Maxwell, 1; Scott, 1, 2, 3.

Petrology.
Igneous rocks.
Intrusive rocks.
Diabase: Westgate, 3.
Dike rocks: Westgate, 3.
Metamorphic rocks.
Gneiss: Westgate, 3.
Marble (crystalline limestone): Kummel, 33; Westgate, 1, 2, 3.
Serpentine: Peck, 1.
Sedimentary rocks.
Till: Ward, 3.
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Sedimentary features, geodes: Manley, 1.
Solls, composition: Blair, 1, 4, 8; Cook, 62, 72; Jenning, 1; Patrick, 2.

Stratigraphy, general: Snell, 2.
Pre-Cambrian: Bayley, 4; Emmons, E., 1; Nason, 8; Westgate, 1, 3.
Cambrian: Bayley, 4; Emmons, 1, 2; Ludum, 1; Nason, 8, 9; Weiler, 1; Westgate, 3.
Ordovician: Bayley, 4; Ludum, 1.
Triassic: Salisbury, 17.
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Streams and surface drainage.
Drainage history: Walter, 1.
Lakes, ponds, swamps: Vermeule, 3, 8, 15.
Water gaps and wind gaps: Cummings, 1; Stone, 1; Walter, 1.

Structural geology.
Local structures.
Faults: Peck, 1.
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Water supply.
Ground water, wells: Fuller, 1, 2; Kummel, 64; N. J. S. W. P. C. 5; Woolman, 13, 15, 17, 20.
Mineral content: Collins, 1.
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sen, 1; Spencer, 4; Thompson, 2, 3, 4;
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Stream flow: Bascom, 1; Cook, 132; Croes,
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Stream gauging and gauging stations:
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Critchlow, 1, 2; Grover, 1, 2, 3, 4, 6, 7,
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ton, W. L., 1; Hartwell, 2; Hollister, 1;
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Wind work.
Deposition: Bache, 2; Cook, 23; Haupt, 2;
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