

CHAPTER V.

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- Stratigraphical location of named trans-Mississippian coals. C. R. Keyes. (Eng. and Mining Jour., LXXII, 198, 1901.)
- Structure of coal deposits of Trans-Mississippian field. C. R. Keyes. (Eng. and Mining Jour., LXV, 253-254, and 281, 1898.)

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Sundry provincial and local phases of general geological section of Iowa. C. R. Keyes. (Proc. Iowa Acad. Sci., XIX, 147-151, 1912.)

Apparent anomalies of stratification of Postville well. S. Calvin. (American Geologist, XVII, 195-203, 1896.)

Aqueous origin, is loess? B. Shimek. (Proc. Iowa Acad. Sci., V, 32-45, 1898.)

Aragonite.

Annotated catalogue of minerals. C. R. Keyes. (Iowa Geol. Surv., I, 181-196, 1893.)

Geology of Dubuque county. S. Calvin and H. F. Bain. (Iowa Geol. Surv., X, 379-651, 1900.)

Geology of Lee county. C. R. Keyes. (Iowa Geol. Surv., III, 305-407, 1894.)

Arey, Melvin F. Geology of Black Hawk county. (Iowa Geol. Surv., Vol. XVI, pp. 407-452, Des Moines, 1906.) The following subjects are discussed in detail:

Introduction, location and area, previous geological work. Physiography, topography, altitudes, drainage.

Geological formations, general relations of strata, table of formations; Devonian system, Wapsipinicon stage, Cedar Valley stage, general section of the Cedar Valley limestone; geest; Pleistocene system, Kansan stage, Kansan drift, Buchanan gravels, Iowan stage, Iowan drift, loess, alluvium and terraces, Cretaceous material in drift; soils, deformations, unconformities; economic products, building-stones, limes, brick-clays, road materials, water-supplies, water powers.

Arey, Melvin F. Geology of Butler county. (Iowa Geol. Surv., Vol. XX, pp. 1-59, Des Moines, 1910.) The following topics are considered:

Introduction, location and area, previous geological work.

Physiography, topography, preglacial, Kansan area, New Hartford recessional moraine, paha, Iowan area, altitudes, drainage, Shell Rock river, West Fork of Cedar river, Beaver creek.

Stratigraphy, general relations of strata, table of formations; Devonian system, Middle Devonian series, Cedar Valley stage, exposures and sections, Upper Devonian series, Lime Creek shales, Owen beds, exposures and sections; Carboniferous system, Mississippian series, Kinderhook stage, exposures and sections; residual material; Quaternary system, Pleistocene series, Kansan stage, Kansan drift, Buchanan gravels, Iowan stage, Iowan drift, loess, soils.

Economic products, building-stones, limes, brick-clays, sands and gravels, oil, water-powers; water-supplies, importance and general sources, water-horizons, wells, springs, artesian prospects.

Arey, Melvin F. Geology of Davis county. (Iowa Geol. Surv., Vol. XX, pp. 487-524, Des Moines, 1910.) Among the topics considered are:

Introduction, location and area, previous geological work.

Physiography, topography, drainage.

Stratigraphy, general statement, synoptical table; Carboniferous system, Mississippian series, Saint Louis stage, Pella limestone, Pennsylvanian series, Des Moines stage, Cherokee formation, fossils; Quaternary system, Pleistocene series, Nebraskan stage and Aftonian interval, Kansan stage, Kansan drift, loess; residual gravels; Recent series, alluvial soil.

Economic products, coal, building-stones, clays, limes, hydraulic limestone, road-materials, water-supplies, wells, springs, salt springs.

Arey, Melvin F. Geology of Grundy county. (Iowa Geol. Surv., Vol. XX, pp. 61-95, Des Moines, 1900.) The following features are described:

Introduction, location and area, previous geological work.

Physiography, topography, table of elevations, drainage.

Stratigraphy, general relations of strata, table of formations; Devonian system, Middle Devonian series, Cedar Valley limestone, Upper Devonian series, Lime Creek shales; Carboniferous system, Mississippian series, Kinderhook stage, Pennsylvanian series, Des Moines stage;

Mantle rock, residual materials; Quaternary system, Pleistocene series, Kansan stage, Kansan drift, Buchanan gravels, Iowan stage, Iowan drift, modified Iowan drift forms, boulders, Iowan loess, alluvium, soils.

Economic products, building-stones, brick and brick making materials, sands, road-making materials, water-supplies, springs, wells.

Arey, Melvin F. Geology of Wayne county. (Iowa Geol. Surv., Vol. XX, pp. 199-236, Des Moines, 1910.) The various topics discussed include the following:

Introduction, location and area, previous geological work. Physiography, topography, table of elevations, drainage.

Stratigraphy, synoptical table; Carboniferous system, Pennsylvanian series, Des Moines stage, Appanoose formation, Pleasanton shales, Missouri stage; Quaternary system; Pleistocene series, Nebraskan stage, Aftonian interglacial stage, Kansan stage, secondary drift forms, gravels and boulders, gumbo, loess, Recent series, alluvium.

Economic geology, soils, coal, clays, water-supplies, springs.

Arey, Melvin F. History of Geology of Iowa for last Twenty-five Years. (Proc. Iowa Acad. Sci., Vol. XIX, pp. 65-72, Des Moines, 1912.) The progress made during the period is briefly and concisely sketched.

Arey, Melvin E. [Underground Waters of] Buchanan county. (U. S. Geol. Surv., Water Supply Paper No. 293, pp. 281-285, Washington, 1912.)

Arey, Melvin F. [Underground Waters of] Buchanan county. (Iowa Geol. Surv., Vol. XXI, pp. 333-338, Des Moines, 1912.) The features of the water-supply of the county are described in detail.

Aridity, depositional phases of eolation under the stimulus. C. R. Keyes. (Proc. Iowa Acad. Sci., XVIII, 101-103, 1911.)

Arkansan Series.

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Time-values of provincial carboniferous terranes. C. R. Keyes. (Am. Jour. Sci., (4), XII, 305-309, 1901.)

Arkansan series. New terrane of Carboniferous in the Western Interior basin. C. R. Keyes. (Proc. Iowa Acad. Sci., VIII, 123-128, 1901.)

Artesian Waters.

Account of Paleozoic rocks explored by deep-borings at Rock Island and vicinity. J. A. Udden. (Seventeenth Ann. Rept., U. S. G. S., pt. ii, pp. 829-849, 1896.)

Artesian wells in Iowa. R. E. Call. (Science, XIX, 310-311, 1892.)

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Artesian wells of Belle Plaine area. H. R. Mosnat. (Iowa Geol. Surv., IX, 521-562, 1899.)

Artesian wells of Davenport. A. S. Tiffany. (American Geologist, III, 117-118, 1889.)

Artesian wells of Iowa. R. E. Call. (Monthly Rev. Iowa Weather and Crop Service, III, No. 3, 1-15, 1892.)

Artesian wells of Iowa. W. H. Norton. (Iowa Geol. Surv., VI, 113-428, 1897.)

Artesian wells of Keokuk, Ottumwa and Sigourney. C. H. Gordon. (American Geologist, IV, 237-239, 1889.)

Burlington artesian well. F. M. Fultz. (Proc. Iowa Acad. Sci., VI, 70-74, 1899.)

Chemical analyses of waters. R. E. Call. (Monthly Rev. Iowa Weather and Crop Service, II, No. 2, 1-5, 1892.)

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- Chemical composition of underground waters. W. S. Hendrixson. (U. S. Geol. Surv., Water Supply Paper No. 293, 135-183, 1912.)
- General description. C. A. White. (Geology of Iowa, II, 331-333, 1880.)
- Geological section of Y. M. C. A. artesian well at Cedar Rapids. W. H. Norton. (Proc. Iowa Acad. Sci., II, 194-196, 1895.)
- Geology and geological resources of Iowa. S. Calvin. (Proc. International Mining Congress, Fourth Sess., 52-56, 1901.)
- Geology of Boone county. S. W. Beyer. (Iowa Geol. Surv., V, 167-232, 1896.)
- Geology of Bremer county. W. H. Norton. (Iowa Geol. Surv., XVI, 319-405, 1906.)
- Geology of Carroll county. H. F. Bain. (Iowa Geol. Surv., IX, 49-106, 1899.)
- Geology of Cedar county. W. H. Norton. (Iowa Geol. Surv., XI, 279-389, 1901.)
- Geology of Dallas county. A. G. Leonard. (Iowa Geol. Surv., VIII, 51-118, 1898.)
- Geology of Dubuque county. S. Calvin and H. F. Bain. (Iowa Geol. Surv., X, 379-651, 1900.)
- Geology of Lee county. C. R. Keyes. (Iowa Geol. Surv., III, 305-407, 1894.)
- Geology of Louisa county. J. A. Udden. (Iowa Geol. Surv., XI, 53-126, 1901.)
- Geology of Polk county. H. F. Bain. (Iowa Geol. Surv., VII, 263-412, 1897.)
- Geology of Pottawattamie county. J. A. Udden. (Iowa Geol. Surv., XI, 199-277, 1901.)
- Geology of Poweshiek county. S. W. Stookey. (Iowa Geol. Surv., XX, 237-269, 1910.)
- Geology of Scott county. W. H. Norton. (Iowa Geol. Surv., IX, 389-519, 1899.)

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- Artesian well**, Burlington. F. M. Fultz. (Proc. Iowa Acad. Sci., VI, 70-74, 1899.)
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- Artesian wells** of Belle Plaine area. H. R. Mosnat. (Iowa Geol. Surv., IX, 521-562, 1899.)
- Artesian wells** in Iowa. R. E. Call. (Science, XIX, 310-311, 1892.)
- Artesian wells** of Iowa. W. H. Norton. (Iowa Geol. Surv., VI, 113-428, 1897.)
- Artificial** drainage in Iowa, some geological aspects. G. G. Wheat. (Proc. Iowa Acad. Sci., XVII, 151-158, 1910.)
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- Aspects**, some physical, of general geological correlation. C. R. Keyes. (Proc. Iowa Acad. Sci., VI, 131-154, 1899.)
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- Assistant geologist**, report. W. H. Norton. (Iowa Geol. Surv., XI, 33-34, 1901.)

- Geology of Story county. S. W. Beyer. (Iowa Geol. Surv., IX, 155-245, 1899.)
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- Preliminary paper on artesian wells in Iowa. R. E. Call. (Monthly Rev. Iowa Weather and Crop Service, II, 1-6, 1891.)
- Record of Grinnell deep-boring. A. J. Jones. (Proc. Iowa Acad. Sci., II, 31-35, 1895.)
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- Sanitary analyses of some Iowa deep-well waters. J. B. Weems. (Proc. Iowa Acad. Sci., IX, 63-70, 1902.)
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- Thickness of paleozoic strata of northeastern Iowa. W. H. Norton. (Iowa Geol. Surv., III, 176-210, 1895.)
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- Underground water resources of Iowa. W. H. Norton. (Iowa Geol. Surv., XXI, 29-1214, 1912.)
- Underground water resources of Iowa. W. H. Norton. (U. S. Geol. Surv., Water Supply Paper No. 293, 994 pp., 1912.)
- Water-supplies at Waterloo, Iowa. W. H. Norton. (Water-Supply and Irrigation Papers, U. S. Geol. Surv., No. 145, 148-155, 1905.)
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- Assistant geologist, report.** W. H. Norton. (Iowa Geol. Surv., XII, 23-34, 1902.)
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- Assistant state geologist, report.** C. R. Keyes. (Iowa Geol. Surv., III, 29-38, 1894.)
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- Asteroids.**
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Atchison Shales.

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- Carboniferous formations of southwestern Iowa. C. R. Keyes. (American Geologist, XXI, 346-350, 1898.)
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- Formational synonymy of the coal-measures of the Western Interior basin. C. R. Keyes. (Proc. Iowa Acad. Sci., VII, 82-105, 1900.)
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- Geology of Mills and Fremont counties. J. A. Udden. (Iowa Geol. Surv., XIII, 123-183, 1903.)
- Geology of Page county. S. Calvin. (Iowa Geol. Surv., XI, 397-468, 1901.)
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- Names of coals west of the Mississippi river. C. R. Keyes. (Proc. Iowa Acad. Sci., VIII, 128-137, 1901.)
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- Sundry provincial and local phases of general geologic section of Iowa. C. R. Keyes. (Proc. Iowa Acad. Sci., XIX, 147-151, 1912.)

Atkinson Limestone (Fort Atkinson Limestone).

- Geology of Fayette county. T. E. Savage. (Iowa Geol. Surv., XV, 433-546, 1905.)
- Geology of quarry products. S. W. Beyer and I. A. Williams. (Iowa Geol. Surv., XVII, 189-588, 1907.)
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Sundry provincial and local phases of general geologic section of Iowa. C. R. Keyes. (Proc. Iowa Acad. Sci., XIX, 147-151, 1912.)

Audubon County.

Coal deposits of Iowa. C. R. Keyes. (Iowa Geol. Surv., II, 536 pp., 1894.)

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Augusta in geology, use of term. C. R. Keyes. (American Geologist, XXI, 229-235, 1898.)

Augusta Limestone. (*See Burlington Limestone, Kinderhook Limestone.*)

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Geology of Dubuque county. S. Calvin and H. F. Bain. (Iowa Geol. Surv., X, 379-651, 1900.)

Azoic Era.

Administrative report of assistant state geologist. C. R. Keyes. (Iowa Geol. Surv., III, 29-38, 1894.)

Geological Map of Iowa. C. R. Keyes. (Annals of Iowa Historical Quarterly, (3), I, 294-297, 1894.)

Geological formations of Iowa. C. R. Keyes. (Iowa Geol. Surv., I, 11-161, 1893.)

Sketch of the geology of Iowa. C. R. Keyes. (Hand-book of Iowa World's Columbian Exposition at Chicago, 18-28, 1893.)

Sundry provincial and local phases of general geological section of Iowa. C. R. Keyes. (Proc. Iowa Acad. Sci., XIX, 147-151, 1912.)

- Backbone, devil's.** S. Calvin. (Midland Monthly, VI, 20-26, 1896.)
- Bain, H. Foster.** Aftonian and pre-Kansan Deposits in Southwestern Iowa. (American Geologist, Vol. XXI, pp. 255-262, Minneapolis, 1898.) Abstract of another paper of same title.
- Bain, H. Foster.** Aftonian and pre-Kansan Deposits in Southwestern Iowa. (Proc. Iowa Acad. Sci., Vol. V, pp. 86-101, Des Moines, 1898.) The criteria for the discrimination of different drift-sheets are discussed; and the typical Afton and Thayer exposures are described in detail. Evidence is presented to show that there are in Iowa traces of a drift-sheet older than the Kansan and separated from it by an unknown but probably considerable interval.
- Bain, H. Foster.** Bethany Limestone at Bethany, Missouri. (Am. Jour. Sci., (4), Vol. V, pp. 433-439, New Haven, 1898.) The section at the original locality is described in detail, and comparisons are made with the Winter-set limestone of Iowa. A list of fossils accompanies the paper.
- Bain, H. Foster.** Buried Mountains of the Prairies. (Midland Monthly, Vol. VI, pp. 20-26, Des Moines, 1896.)
- Bain, H. Foster.** Central Iowa Section of Mississippian Series. (American Geologist, Vol. XV, pp. 317-325, Minneapolis, 1895.) The lithology of the several members is described and the characteristic fossils of each are noted. The faunal affinities of part of the Kinderhook section to the Devonian are described.
- Bain, H. Foster.** Cretaceous Deposits of Sioux Valley. (Iowa Geol. Surv., Vol. III, pp. 99-114, Des Moines, 1895.) Besides the details of a geologic cross-section along the Big Sioux river the chalk-beds are especially described, and numerous sections are given. The Pierre formation is believed to be represented by 50 feet of black shales, the best exposures being south of Hawarden.

- Bain, H. Foster.** Distribution and Relations of St. Louis Limestone in Mahaska County, Iowa. (Iowa Geol. Surv., Vol. I, pp. 171-179, Des Moines, 1893.) Three narrow bands of the limestones are found crossing the county from northwest to southeast, in the valleys of the principal streams. The coal-measures are thus divided into five distinct fields. A cross-section shows the irregular character of the floor of the coal-measures of the region.
- Bain, H. Foster.** Dubuque Lead and Zinc Mines. (Mines and Minerals, Vol. XX, pp. 10-12, Scranton, 1889.) The occurrence, geology and nature of the ore-bodies are briefly characterized.
- Bain, H. Foster.** Geology of Appanoose County. (Iowa Geol. Surv., Vol. V, pp. 361-438, Des Moines, 1896.) The various topics discussed are:
- Introduction, location and area, previous geological work.
 - Physiography, topography, table of elevations, drainage, origin of present topography.
 - Stratigraphy; geological formations, Carboniferous, Upper Carboniferous series, Des Moines stage, Appanoose beds, Chariton conglomerate, structure, faults, Scandinavian fault, Numa dome, deeper coal-seams; Pleistocene series, Kansan drift-sheet, loess-silt; alluvium.
 - Economic products, coal, coal-lands, character of the Mystic coal, mining methods, mines, clays, building-stones, water-supplies.
 - The Appanoose formation and the character of the Mystic coal seam are the most important features described that are of wide interest.
- Bain, H. Foster.** Geology of Carroll County. (Iowa Geol. Surv., Vol. IX, pp. 49-106, Des Moines, 1899.) In describing the various features the following are noteworthy:
- Introduction, location and area, previous geological work.
 - Physiography, topography, Wisconsin drift-plain, Kansan loess-plain, drainage.
 - Stratigraphy, general relations, Carboniferous, Des Moines; Cretaceous, Dakota; Pleistocene, Kansan drift, loess, Wisconsin drift.

Economic products, coals, clays, Carroll, Manning; water-supplies, surface waters, artesian wells; soils, drift soil, loess soil.

Bain, H. Foster. Geology of Decatur County. (Iowa Geol. Surv., Vol. VIII, pp. 255-314, Des Moines, 1898.)

There are described the following features:

Introduction, location and area, previous geological work. Physiography, topography, table of elevations, drainage. Stratigraphy, general relations of formations; Carboniferous, Des Moines, Missourian; Pleistocene, Kansan drift, loess and gumbo, alluvium, structure.

Economic products, coal, clays; building-stones, Grand river, De Kalb, Terre Haute, Davis City; limes. Forest trees and shrubs.

Bain, H. Foster. Geology of Guthrie County. (Iowa Geol. Surv., Vol. VII, pp. 413-487, Des Moines, 1897.) The features most fully described are:

Introduction, location and area, previous geological work. Physiography, topography, drainage.

Stratigraphy, general relations of strata; Carboniferous, Des Moines, Missourian; Cretaceous, Dakota; Pleistocene, general relations, Kansan drift, Iowan loess, Wisconsin drift, alluvium.

Economic products, coal, Greenbrier mines; Stapes mine, Keeler, Burgess, Fisher, Dygert, Reese, Emery, White Ash, Harris, Clark, Fansler, Brushy Fork, Wales, Perkins, Burroughs, Anderson, Driscoll, Lonsdale mine; clays, Guthrie Center, Stuart, Panora, Jamaica; building-stones, sands, gravels, natural-gas, water-supplies, soils.

Bain, H. Foster. Geology of Keokuk County. (Iowa Geol. Surv., Vol. IV, pp. 255-311, Des Moines, 1895.) There are described in detail:

Introduction, area and location, previous geological work. Physiography, topography, table of elevations, drainage.

Stratigraphy; general relations of strata; table of geological formations, deeper strata, standard section; Manhattan mill, Nugent and What Cheer typical outcrops; South

Skunk section, North Skunk section, South English section, geological formations, Mississippian, Augusta, Saint Louis, Springvale, Verdi, Pella, Upper Carboniferous, Des Moines, Pleistocene, drift, loess, alluvium; geological structure; cross-sections, North Skunk, South Skunk, Keota to Atwood, South English, North English to Hedrick; deformations, Manhattan anticlinal, Springvale anticlinal, South Skunk anticlinal; unconformities, pre-pleistocene, pre-coal measure.

Economic products; coal, What Cheer district, Delta district, Richland district, Sigourney district; clays, character and distribution, industries; building stones, Des Moines stage, Saint Louis stage, Augusta stage; soils; water-supply; water-power; road-materials; minerals; mineral paint; statistics.

Bain, H. Foster. Geology of Mahaska County. (Iowa Geol. Surv., Vol. IV, pp. 313-380, Des Moines, 1895.) The following topics are treated in detail:

Introduction, area and location, previous geological work. Physiography, topography, table of elevations, drainage.

Stratigraphy, general relations of strata, classification of formations, deeper strata; typical sections, North Skunk river, South Skunk river, Des Moines river; geological formations, Mississippian series, Saint Louis; Upper Carboniferous, Des Moines; Pleistocene, drift, glacial striae, loess, alluvium; geological structure, cross sections, Harvey to Eddyville, Skunk river section, Atwood to North Skunk, North Skunk to Eddyville, Atwood to Harvey; deformations; unconformities, Saint Louis and Des Moines, Raven Cliff, drift and indurated rocks.

Economic products, coal-mines, Black Creek mines, Columbia mines, Rose Hill mines, Spring Creek mines, Oskaloosa mines, Leighton mines, Evans mines, Beacon mines, Muchakinoch mines, Lost Creek mines, Cedar Creek mines, Coal Creek mines, coal lands; clays, character and distribution, industries; limes; building-stones; soils; water-supplies; water-powers; road materials; statistics.

Bain, H. Foster. Geology of Plymouth County. (Iowa Geol. Surv., Vol. VIII, pp. 315-366, Des Moines, 1898.) The various features described include the following:

Introduction, physiography, topography, drainage.

Stratigraphy, general relations of strata, geological formations; Cretaceous, Dakota, Colorado; Pleistocene, general description, summary, age of the bowlder clay, topographic development, alteration, physical character, stratigraphic relationships, résumé.

Economic products, coal, clays, cement, limes, water-supplies, soils.

Bain, H. Foster. Geology of Polk County. (Iowa Geol. Surv., Vol. VII, pp. 263-412, Des Moines, 1897.) Full descriptions include these subjects:

Introduction, location and area, previous geological work.

Physiography, topography, northern area, southern area, drainage, history of drainage, table of elevations.

Stratigraphy, geological formations, general relations of formations; Carboniferous, underlying formations, Greenwood Park well, base of coal measures, general character of coal measures, general cross-sections, section from Capitol hill to mouth of Beaver creek, section from Capitol hill to Walnut creek, detailed stratigraphy, Runnels-Carbondale districts, East Des Moines district, Berwick district, Altoona-Mitchellville district, Saylorville district, Polk City district, Commerce district, North Des Moines district, South Des Moines district, lower coal horizons, fauna of coal measures; Pleistocene, pre-Kansan drift, Kansan drift, loess, list of Pleistocene fossils, Wisconsin drift, alluvium, and terraces.

Economic products, coal, Runnels, Hastie, Manbeck, Carbondale, Northeast Des Moines, East Des Moines, Saylor, Polk City, North Des Moines, South Des Moines, Commerce; clays, Des Moines, Altoona, Polk City, Campbell, Bondurant; soils, gravels, building-stones, water-supplies, natural gas, and oil.

Bain, H. Foster. Geology of Washington County. (Iowa Geol. Surv., Vol. V, pp. 115-173, Des Moines, 1896.) The various topics considered in detail are:

Introduction, location and area, previous geological work. Physiography, topography, table of elevations, drainage, English River, Davis creek, Goose creek, Long creek, Skunk creek, Crooked creek, origin of, drainage system.

Stratigraphy, general relations of strata, classification of formations; standard sections, Maple mill, Eckles quarry, Brighton, Leibs mine, deeper strata; geological formations, Mississippian series, Kinderhook, distribution, Wassonville limestone, English River gritstones, Maple Mill shales, correlations; Augusta limestones, Saint Louis formation, Springvale beds, Verdi beds, Pella beds; Upper Carboniferous series, Des Moines (Lower Coal Measures); Pleistocene, Kansan drift-sheet, striae, loess, alluvium; geological structure; cross-sections; English River, Cotters to Keota, Skunk River, Brighton to Washington; deformations; unconformities, drift and indurated rocks, Des Moines and Saint Louis, Saint Louis and Augusta.

Economic products, coal; clays, character and distribution, clay industries; building-stones, Saint Louis, Augusta, Kinderhook; soils, water-supplies, water-powers, road-materials.

Bain, H. Foster. Geology of Woodbury County. (Iowa Geol. Surv., Vol. V, pp. 241-299, Des Moines, 1896.) Detailed descriptions are given of the following:

Introduction, location and area, previous geological work. Physiography, topography, table of altitudes, drainage, Missouri river, Big Sioux river, Perry creek, Floyd river, Little Sioux river, Maple river.

Stratigraphy, general relations of strata, classification of formations, general sections, pre-Cretaceous strata; standard sections, Sargeant's bluff, North Riverside, Cedar Bluff, Sand-pit; typical exposures, Prospect Hill, Riverside park, Floyd river; geological formations, Cretaceous, Dakota, Colorado; Pleistocene, pre-glacial

deposits, glacial deposits, drift, loess, terraces, post-glacial deposits, alluvium; geological structure, general structure, cross-section.

Economic products, clays, character and distribution, clay industries, cement, building-stones, limes, sands and gravels, coal and lignite, water-supplies, soils.

Bain, H. Foster. Introduction [to Mineral Production for 1897.] (Iowa Geol. Surv., Vol. VIII, pp. 31-33, Des Moines, 1898.) Explanation is made of the initiation of the compilation, and its general use to the public.

Bain, H. Foster. Lead and Zinc Deposits of Upper Mississippi Valley. (Bull. U. S. Geol. Surv., No. 294, pp. 72-75, Washington, 1906.) This is a general discussion of the geology, occurrence, and relations of the ores of the entire region in which there are many references to Iowa. A brief account is given of the mines of the state. There is a map of the Dubuque district.

Bain, H. Foster. Loess Soils of Iowa. (Trans. Iowa Horticultural Soc., Vol. XXXI, pp. 185-191, Des Moines, 1896.) The surface deposits of the state are described in their relations to the soils, special emphasis being placed upon the rich character of the loess loams.

Bain, H. Foster. Machine Coal-mining in Iowa. (Mineral Industry, Vol. IV, pp. 195-200, New York, 1896.) The advantage of mining coal by machinery is discussed in detail, the character of the seams thus able to be operated upon is especially noted, and the machines used are described.

Bain, H. Foster. Mississippian Rocks of Central Iowa. (Proc. Iowa Acad. Sci., Vol. II, p. 174, Des Moines, 1895.) In a brief statement of the subdivisions recognizable in Mahaska, Marion, Keokuk and Washington counties several new formational names are introduced.

- Bain, H. Foster.** Preglacial Elevation of Iowa. (Proc. Iowa Acad. Sci., Vol. II, pp. 23-26, Des Moines, 1895.) The great depth of old river-channels noted in various parts of Iowa seems to indicate that in preglacial times the surface of the region was considerably higher than at present. To this circumstance may be ascribed the initiation of the present drainage-system.
- Bain, H. Foster.** Notes on Drift of Northwestern Iowa. American Geologist, Vol. XXIII, pp. 168-176, Minneapolis, 1899.) Certain moranic deposits are described, that appear to cover Kansan till.
- Bain, H. Foster.** Notes on Iowa Building-stones. (Sixteenth Ann. Rept., U. S. G. S., pt. iv, pp. 500-503, Washington, 1895.) Distribution of the best building-stones is mainly considered.
- Bain, H. Foster.** Origin of Certain Features of Coal-basins. (Journal of Geology, Vol. III, pp. 646-654, Chicago, 1895.) The probability of predicting lower thick seams from the character of basins in the higher seams is discussed and several examples are noted.
- Bain, H. Foster.** Peculiarities of Mystic Coal-seam. (American Geologist, Vol. XIII, pp. 407-411, Minneapolis, 1894.) The relatively great areal extent of basin is commented upon, and comparisons are made with other coal-fields of the state.
- Bain, H. Foster.** Portland-cement Resources of Iowa. (Bull. U. S. G. S., No. 243, pp. 147-165, Washington, 1905.) Suitable materials are reported from nearly every part of the state. The chalk deposits are described; also the principal non-magnesian limestones.
- Bain, H. Foster.** Properties and Tests of Iowa Building-stones. (Iowa Geol. Surv., Vol. VIII, pp. 369-416, Des Moines, 1898.) The discussion leads along the following lines:
- Introduction, use of stone in building.
- Essential properties of building-stones, strength, durability, external factors, mechanical effects, chemical effects, internal factors, color, workability, availability.

Tests of building-stones, test of strength, crushing strength with strawboard bearings, crushing strength with steel bearings, crushing tests of Iowa building-stones, test of durability, freezing tests on Marshalltown stones, absorption and specific gravity tests of Marshalltown stone, absorption tests of various stones, chemical analyses of Marshalltown stone, chemical analyses of various stones, microscopic examinations; general conclusions.

Bain, H. Foster. Relations of Wisconsin and Kansan Drift-Sheets in Central Iowa and Related Phenomena. (Iowa Geol. Surv., Vol. VI, pp. 429-476, Des Moines, 1897.) The features especially described are:

Definition of region.

Definition of term Wisconsin; early study of two drift-sheets in Wisconsin, later correlations, Kansan, recognition of an older drift, Iowan, McGee's studies in Iowa.

Des Moines lobe, early work, topography of lobe, drift, drift-border; kames, valley-trains, forest-beds, relations to loess; McGee and Call; recent work.

Outlying drift, general characteristics, disposition, leaching, ferrugination, topography of outlying drift, development of erosion-curves, river changes, resurrected river, correlation of outlying drift.

Time ratios.

There are especial discussions of erosion-curves, time-ratios, the general periods, and the classification of the Quaternary deposits of the State.

Bain, H. Foster. Report of Assistant State Geologist. (Iowa Geol. Surv., Vol. IV, pp. 29-30, Des Moines, 1895.) There is presented a summary of the field-work accomplished during the year 1894, and a list of the published results.

Bain, H. Foster. Report of Assistant State Geologist. (Iowa Geol. Surv., Vol. V, pp. 27-28, Des Moines, 1896.) Summary is made of the work accomplished during the previous year.

- Bain, H. Foster.** Report of Assistant State Geologist. (Iowa Geol. Surv., Vol. VIII, pp. 25-29, Des Moines, 1898.) The personal inspections and investigations of the year 1897 are summarized.
- Bain, H. Foster.** Report of Assistant State Geologist for 1898. (Iowa Geol. Surv., Vol. IX, pp. 25-27, Des Moines, 1899.) Summary of the investigations of the year is given.
- Bain, H. Foster.** Report of Assistant State Geologist. (Iowa Geol. Surv., Vol. X, pp. 28-30, Des Moines, 1900.) The work of the year 1899 is briefly outlined.
- Bain, H. Foster.** Samuel Calvin. (Journal of Geology, Vol. XIX, pp. 385-391, Chicago, 1911.) A brief sketch of his life is given.
- Bain, H. Foster.** Sigourney Deep-Well. (Proc. Iowa Acad. Sci., Vol. I, pt. iv, pp. 36-38, Des Moines, 1894.) A driller's log is given and the various strata are referred to the general geologic section of the state.
- Bain, H. Foster.** Structure of Mystic Coal-basin. (Proc. Iowa Acad. Sci., Vol. I, pt. iv, pp. 33-36, Des Moines, 1894.) This coal-seam is contrasted with others of the state, and as shown is one of relatively great extent. A notable feature is the associated limestones.
- Bain, H. Foster.** Western Interior Coal-field of America. Trans. North of England Inst. Min. and Mec. Eng., Vol. XLVIII, pp. 55-80, 1898.) Carboniferous stratigraphy of the Mississippi valley and the nature and extent of the coal-bearing rocks are described.
- Bain, H. Foster.** Western Interior Coal-field. (Twenty-second Ann. Rept. U. S. G. S., pt. iii, pp. 333-366, Washington, 1902.) The industrial aspect of the coal resources is chiefly considered.
- Bain, H. Foster, and S. Calvin.** Geology of Dubuque county. (Iowa Geol. Surv., Vol. X, pp. 379-651, Des Moines, 1900.) The following features are especially described: Introduction, location and area, previous geological work. Physiography, topography, drainage.

Stratigraphy, general relations of strata, synoptical table; Ordovocian system, Saint Peter sandstone, Trenton limestone, geological distribution, lithological and faunal characteristics, Galena limestone, Maquoketa shales; Silurian system, Niagara limestone; Superficial materials, residual materials, or geest; Pleistocene system, Kansan drift, Buchanan gravels, Kansan outwash in the driftless area, Iowan drift-loess, Wisconsin terraces; alluvium; summary of pleistocene history; calcareous tufa; deformations; unconformities.

Economic geology, soils; lead and zinc, historical sketch, geology, Saint Peter sandstone, Galena-Trenton, Maquoketa, Niagara, the ore deposits, ores and associated minerals, galena, cerussite, smithsonite, sphalerite, copper, pyrite and marcasite, limonite, wad, calcite and aragonite, gypsum, dolomite, barite, ore-bodies; vertical sheets, flats, pitches, disseminated bodies, cave-deposits, formation of crevices, enlargement of crevices, openings, ore-horizons, description of individual crevices, the timber range, Stewart Park range, Stewart and Bartlett lode, Stewart cave, Levens range, Dubuque cave, Sunflower, Patch diggings, Level, Kilbourne and Karrick, McGowan and Cunningham, Rake pocket, Julien Avenue crevices, Langworthy and Kelley, Rabbit Hollow mines, Center Grove mines, Pike's Peak, other crevices, mines away from Dubuque, origin of the Dubuque ores, ultimate sources of ores, table of analyses, localization of ore-bodies, concentration of ores; practical considerations; mining titles, Bonson rules, methods of work, prospecting, composition and treatment of ores, smelting.

Iron, analyses of Durango ore; limes, Eagle Point lime-works, Key City lime-works; clays, analysis of Maquoketa shales, brick-plants; pigments; road-materials; building-stones; artesian wells; cements; forestry notes.

Bain, H. Foster, E. C. Eckel and. Cement and Cement Materials of Iowa. (Iowa Geol. Surv., Vol. XV, pp. 33-124, Des Moines, 1905.) The following subjects are considered:

Introduction, production of cement in the United States, relation of domestic production and consumption to imports, uses of cement, scope of the report.

Materials and manufacture of Portland cement, the relation of Portland to other cements, classification of cements into simple cements, hydrate cements, carbonate cements, complex cements, pozzuolanic cements, hydraulic limes, natural cements, Portland cements.

Portland cement, its definition, composition and constitution, raw materials for Portland cement, general considerations, combinations of raw materials, origin and general characters of limestone, raw materials actually in use, argillaceous limestone, pure hard-limestone, soft limestone, chalk, fresh-water marls, alkali waste, blast-furnace slag, clays and shales, slate.

Factors determining the value of deposits for cement materials, methods and costs of excavation of the raw materials, cost of raw materials at the mill.

Methods of manufacture, preparation of the mixture for the kilns, drying the raw materials, grinding and mixing, dry methods, slag, limestone mixtures, wet methods, composition of the mixture, burning the mixture, theoretical fuel requirements, losses of heat in practice, actual fuel requirements and output, effect of composition on burning, character of kiln-coal, clinker-grinding, addition of gypsum, constitution of Portland cement.

Cement materials of Iowa, calcareous marls, chalk deposits, limestones, Ordovician limestones, Devonian limestones, Wapsipinicon limestone, Cedar Valley limestone, Lime Creek shales, Carboniferous limestone, Kinderhook limestone, Augusta limestone, St. Louis limestone, Des Moines formation, Missourian formation.

Relation to fuel and markets.

Cement plants in neighboring states.

Bain, H. Foster, and A. G. Leonard. Middle Coal-measures of Western Interior Coal-field. (Journal of Geology, Vol. VI, pp. 577-588, Chicago, 1898.) There are contrasted the conditions under which the sediments of the Des

Moines and Missouri series were deposited. A detailed and general section of the coal-bearing rocks of the central part of the state is given. The classification and correlation of the coal-measures of the state are discussed.

Bain, H. Foster, and A. G. Leonard. Middle Coal-Measures of Western Interior Coal-field. (Bull. Geol. Soc. America, Vol. X, pp. 10-12, Rochester, 1899.) This is an abstract of a paper of similar title.

Bain, H. Foster, and John L. Tilton. Geology of Madison County. (Iowa Geol. Surv., Vol. VII, pp. 489-539, Des Moines, 1897.) Detailed accounts are given of the following features:

Introduction; physiography, topography, table of elevations, drainage.

Stratigraphy, general relations of strata, classification of formations; geological formations; Carboniferous, Des Moines, Hanley section, St. Charles section, Patterson section, Raccoon River section, Missourian formation, Lincoln township section, Backbone section, South River section, Earlham section, Cedar Creek section, Winterset section, Tileville section; Pleistocene, Kansan drift; loess; alluvium.

Economic products; building-stones, Earlham district, Robertson quarry, Earlham Land Co., Nevitt quarry, Eureka quarry, Winterset district, Peru district, St. Charles-Truro district; road-materials, lime, clays, water-supplies, water-powers, coal.

Bain, H. Foster, J. E. Todd and. Interloessial Till near Sioux City, Iowa, (Proc. Iowa Acad. Sci. Vol. II, pp. 20-23, Des Moines, 1895.) This unusual occurrence is fully described and illustrated by photographic prints. The best exposure is in Riverside park.

Bain, H. Foster, C. R. Van Hise and. Lead and Zinc Deposits of Mississippi Valley, U. S. A. (Trans. Inst. Mining Eng., XXIII, 376-434 (London), 1902.)

Balch, E. S. *Glaciers or Freezing Caverns.* (One Volume, pp. 88-89, Philadelphia, 1900.) The general causes of the formation of subterranean ice are discussed. The Decorah ice-cave is especially mentioned.

Ballast Clays.

Betterment of our public highways. C. R. Keyes. (*The Annals of Iowa, Historical Quarterly*, V, 372-379, 1902.)

Burnt clay for roads in west. C. R. Keyes. (*American Monthly Review of Reviews*, XXV, 72-74, 1902.)

Economic aspects of work in pure science. C. R. Keyes. (*The Annals of Iowa, Historical Quarterly*, V, 392-393, 1902.)

Barbour, E. H., Joseph Torrey, Jr., and. Recorded Meteorites of Iowa, with Special Mention of Last, or Winnebago County, Meteorite. (*American Geologist*, Vol. VIII, pp. 65-72, Minneapolis, 1891.) See Joseph Torrey and E. H. Barbour, 1891.

Barbour, Edwin H., Joseph Torrey, Jr., and. Winnebago County (Iowa) Meteorites. (*Science*, Vol. XV, p. 347, 1890.) See Torrey and E. H. Barbour, 1890.

Barris, W. H. Description of Some New Blastoids from Hamilton Group. (*Geol. Surv., Illinois*, Vol. VII, pp. 357-364, Springfield, 1883.) The following species from Iowa are described as new:

Elaeocrinus obovatus.

Elaeocrinus meloniformis.

Barris, W. H. Descriptions of New Crinoids and Blastoids from Hamilton Group. (*Proc. Davenport Acad. Sci.*, Vol. IV, pp. 88-94, 1885.) Revised descriptions are given of the new species *Elaeocrinus obovatus* and *E. meloniformis*.

Barris, W. H. New Fossils from Corniferous Formation at Davenport. (*Proc. Davenport Acad. Nat. Sci.*, Vol. II, pp. 282-288, Davenport, 1878.) The following genera and species are described as new:

Stereocrinus.

Stereocrinus triangulatus.

Stereocrinus triangulatus var. *liratus.*

Megistocrinus nodosus.

Rhynchonella intermedia.
Avicula (Pterinea) cancellata.
Gyroceras pratti.
Proetus davenportensis.

- Barris, W. H.** Notes on Our Local Geology, No. II. (Proc. Davenport Acad. Nat. Sci., Vol. III, pp. 163-168, Davenport, 1882.)
- Barris, W. H.** Our Local Geology. (Proc. Davenport Acad. Nat. Sci., Vol. VII, pp. 14-32, Davenport, 1900.) The lithologic characters and faunal features of the Devonian rocks are described.
- Barris, W. H.** Stereocrinus, Barris. (Proc. Davenport Acad. Nat. Sci., Vol. IV, pp. 102-104, Davenport, 1885.) Description is given of this new genus from the Devonian of Iowa.
- Barris, W. H.** Local Geology of Davenport and Vicinity. (Proc. Davenport Acad. Nat. Sci., Vol. II, pp. 261-269, Davenport, 1877.) A general sketch of the geology of the region is given with special reference to the fossils contained in the rocks.
- Bartsch, Paul.** Notes on Cretaceous Flora of Western Iowa. (Bull. Lab. Nat. Hist., State Univ. Iowa, Vol. III, pp. 178-182, Iowa City, 1896.) A collection of plants found in the Holman cut near Sioux City is identified and the species listed.
- Baryte.**
Annotated catalogue of minerals. C. R. Keyes. (Iowa Geol. Surv., I, 181-196, 1893.)
Decatur, Madison, Marion, Johnson, Bremer and Dubuque counties. C. A. White. (Geology of Iowa, II, 305, 1870.)
Geology of Dubuque county. S. Calvin and H. F. Bain. (Iowa Geol. Surv., X, 379-651, 1900.)
- Basal line of delimitation of carboniferous in northeastern Missouri, present, C. R. Keyes.** (American Geologist, X, 360-384, 1892.)

- Base** of our coal-measures, depositional equivalents of hiatus. C. R. Keyes. (Proc. Iowa Acad. Sci., VIII, 119-123, 1901.)
- Bates, C. O.** Analyses of Certain Clays used for Making Paving-brick for Cedar Rapids. (Proc. Iowa Acad. Sci., Vol. IX, pp. 61-63, Des Moines, 1902.) Results of 30 analyses of clays, from four different pits at Des Moines, are tabulated.
- Beachler, Charles S.** Keokuk Group of Mississippi Valley. (American Geologist, Vol. X, pp. 88-96, Minneapolis, 1892.) A short sketch of the Keokuk rocks is given, with an attempt at a correlation of the different beds in the several states of the upper Mississippi region.
- Beds** of carboniferous drift in bluffs of East Davenport. Tylor McWorther. (Proc. Davenport Acad. Nat. Sci., III, 129-130, 1882.)
- Belle Plaine** area, artesian wells. H. R. Mosnat. (Iowa Geol. Surv., IX, 521-562, 1899.)
- Benton County.**
- Artesian wells of Belle Plaine area. H. R. Mosnat. (Iowa Geol. Surv., IX, 521-562, 1899.)
 - Artesian wells of Iowa. W. H. Norton. (Iowa Geol. Surv., VI, 113-428, 1897.)
 - Geological notes. J. D. Whitney. (Geology of Iowa, I, 260-266, 1858.)
 - Geology of Benton county. T. E. Savage. (Iowa Geol. Surv., XV, 125-225, 1905.)
 - Geology of quarry products. S. W. Beyer and I. A. Williams. (Iowa Geol. Surv., XVII, 189-588, 1907.)
 - Underground water resources of Iowa. W. H. Norton. (Iowa Geol. Surv., XXI, 29-1214, 1912.)
 - Underground water resources of Iowa. W. H. Norton. (U. S. Geol. Surv., Water Supply Paper No. 293, 994 pp., 1912.)
- Benton county, geology.** T. E. Savage. (Iowa Geol. Surv., XV, 125-225, 1905.)
- Benton Formation.**
- Cement and cement materials of Iowa. E. C. Eckel and H. F. Bain. (Iowa Geol. Surv., XV, 33-124, 1905.)

- Composition and origin of Iowa chalk. S. Calvin. (Iowa Geol. Surv., III, 211-236, 1895.)
- Cretaceous deposits of Sioux valley. H. F. Bain. (Iowa Geol. Surv., III, 99-114, 1895.)
- Geology of Plymouth county. H. F. Bain. (Iowa Geol. Surv., VIII, 315-366, 1898.)
- Geology of quarry products [limes]. S. W. Beyer and I. A. Williams. (Iowa Geol. Surv., XVII, 189-588, 1907.)
- Geology of Sac and Ida counties. T. H. Macbride. (Iowa Geol. Surv., XVI, 509-548, 1906.)
- Niobrara chalk. S. Calvin. (Journal of Geology, II, 755-756, 1894.)

Bertram limestone.

- Certain devonian and carboniferous outliers in eastern Iowa. W. H. Norton. (Iowa Geol. Surv., III, 115-133, 1895.)
- Geology of Jones county. S. Calvin. (Iowa Geol. Surv., V, 33-112, 1896.)
- Geology of Linn county. W. H. Norton. (Iowa Geol. Surv., IV, 121-194, 1895.)
- Sundry provincial and local phases of general geological section of Iowa. C. R. Keyes. (Proc. Iowa Acad. Sci., XIX, 147-151, 1912.)

Bethany Limestone.

- Bethany limestone at Bethany, Missouri. H. F. Bain. (Am. Jour. Sci., (4), V, 433-439, 1898.)
- Bethany limestone of western interior coal-field. C. R. Keyes. (Am. Jour. Sci., (4), II, 221-225, 1896.)
- Carboniferous formations of southwestern Iowa. C. R. Keyes. (American Geologist, XXI, 346-350, 1898.)
- Carboniferous section of southwestern Iowa. G. L. Smith. (Iowa Geol. Surv., XIX, 605-657, 1909.)
- Cement and cement materials of Iowa. E. C. Eckel and H. F. Bain. (Iowa Geol. Surv., XV, 33-124, 1905.)
- Formational synonymy of coal-measures of Western Interior basin. C. R. Keyes. (Proc. Iowa Acad. Sci., VII, 82-105, 1900.)
- Geological section along Middle river in central Iowa. J. L. Tilton. (Iowa Geol. Surv., III, 135-146, 1895.)

- Geology of Dallas county. A. G. Leonard. (Iowa Geol. Surv., VIII, 51-118, 1898.)
- Geology of Decatur county. H. F. Bain. (Iowa Geol. Surv., VIII, 255-314, 1898.)
- Geology of Guthrie county. H. F. Bain. (Iowa Geol. Surv., VII, 413-487, 1897.)
- Geology of Madison county. J. L. Tilton and H. F. Bain. (Iowa Geol. Surv., VII, 489-539, 1897.)
- Geology of quarry products [limes]. S. W. Beyer and I. A. Williams. (Iowa Geol. Surv., XVII, 189-588, 1907.)
- Geology of Wayne county. M. F. Arey. (Iowa Geol. Surv., XX, 199-236, 1910.)
- Note on correlation of Clarinda well-section with schematic section of Carboniferous. C. R. Keyes. (Iowa Geol. Surv., XI, 461-463, 1901.)
- Report of assistant state geologist. A. G. Leonard. (Iowa Geol. Surv., VII, 29-30, 1897.)
- Sundry provincial and local phases of general geological section of Iowa. C. R. Keyes. (Proc. Iowa Acad. Sci., XIX, 147-151, 1912.)
- Bethany** limestone at Bethany, Missouri. H. F. Bain. (Am. Jour. Sci., (4), V, 433-439, 1898.)
- Bethany** limestone of western interior coal-field. C. R. Keyes. (Am. Jour. Sci., (4), II, 221-225, 1896.)
- Bethany**, Missouri, Bethany limestone. H. F. Bain. (Am. Jour. Sci., (4), V, 433-439, 1898.)
- Betterment** of our public highways. C. R. Keyes. (The Annals of Iowa, Historical Quarterly, V, 372-379, 1902.)
- Beyer, Samuel W.** Ancient Lava Flows in Strata of Northwestern Iowa. (Iowa Geol. Surv., Vol. I, pp. 163-169, Des Moines, 1893.) A petrographical description is given of a quartz-porphry obtained at a depth below 755 feet in the Hull drill-well in Sioux county. Several of these old lava-flows were encountered between 755 and 1220 feet depths.

- Beyer, Samuel W.** Buried Loess in Story County. (Proc. Iowa Acad. Sci., Vol. VI, pp. 117-121, Des Moines, 1899.) Occurrence of a loess-sheet above the Kansan drift is regarded as the loess apron of the Iowan drift-sheet. The formation of appreciable deposits of fine pebble-less deposits by the winds is noted.
- Beyer, Samuel W.** Coal Statistics. (Iowa Geol. Surv., Vol. XIX, pp. 591-597, Des Moines, 1909.) The compilation includes the figures of the annual output since 1840, indicating a growth of from 400 tons in that year to 7,149,517 in 1908.
- Beyer, Samuel W.** Evidence of Sub-Aftonian Till-sheet in Northeastern Iowa. (Proc. Iowa Acad. Sci., Vol. IV, pp. 58-62, Des Moines, 1897.) Sections near Oelwein are described and a distinct drift-sheet is represented as underlying the Kansan drift.
- Beyer, Samuel W.** Geology of Boone county. (Iowa Geol. Surv., Vol. V, pp. 167-232, Des Moines, 1896.) The following features are especially defined:
- Introduction, location and area, previous geological work.
 - Physiography, topography, table of elevations; drainage, Des Moines river system, terraces, age of Des Moines river; Beaver creek, Skunk river system, Squaw creek.
 - Stratigraphy, general relations of strata, table of geological formations, typical sections, Preston branch, the "Ledges," Honey creek, Moingona, Milford, Ogden well section, Boone deep-well section, geological formations, Des Moines stage, general sections, Pleistocene, Pre-Pleistocene, base-level, Lower till or Kansan, Upper till or Wisconsin, terminal moraine, alluvium.
 - Economic products, coal, Des Moines valley mines, Madrid district, Moingona district, Milford district, Boonesboro district, Fraser district, Squaw Creek mines, Angus mines, summary, chemical analyses of coal, coal-lands; building-stones; Pleistocene, clays, Boone clay-works, Boone Paving Co., Griffee pottery-works, Jacob Yegge yard, Slater yard, Everett yard; soil, road-materials, artesian waters, minerals.

Character and distribution of the forest trees and shrubs of Boone county, by L. H. Pammel.

Beyer, Samuel W. Geology of Hardin County. (Iowa Geol. Surv., Vol. X, pp. 243-305, Des Moines, 1900.) The following subjects are considered:

Introduction, location and area, previous geological work, historical résumé.

Physiography, topography, loess-Kansan, Iowan drift-plain, Wisconsin drift-plain, table of elevations; drainage, Iowa river system, Iowa proper, South Fork, other drainage systems.

Stratigraphy, general relations of strata, table of geological formations, Ackley well, geological formations; Carboniferous system, Mississippian series, Kinderhook, Pennsylvanian series, Des Moines; Pleistocene system, glacial series, Kansan, Iowan, loess, Wisconsin, history of drainage lines, terraces.

Economic products, coal, clay industries, Eldora, Gifford, Iowa Falls; building-stones, Kinderhook, Des Moines, Pleistocene; soils; road-materials, post-glacial gravels, indurated rocks; water-supplies, water-powers.

Beyer, Samuel W. Geology of Marshall County. (Iowa Geol. Surv., Vol. VII, pp. 197-262, Des Moines, 1897.) Detailed accounts are given of the following subjects:

Introduction, location and area, previous geological work.

Physiography, topography, table of elevations; drainage, Iowa river system, Iowa river, Timber, Linn, Minerva and Honey creeks, age of Iowa system; Skunk River system. Cleak lake, North Skunk and Snipe creek, terraces.

Stratigraphy, general relations of strata, table of geological formations, pre-Carboniferous strata, Marshalltown deep-well; standard sections, Le Grand, Woodbury mills, Rockton, Timber creek, Marshalltown; Mississippian series, Kinderhook, Le Grand beds, Marshalltown shales, Augusta, Saint Louis, Pennsylvanian series, Des Moines stage; Pleistocene, sub-Aftonian, Aftonian, Kansan, Buchanan, Iowan, loess, Wisconsin, Altamont moraine, post-glacial deposits, alluvium; geological structure.

Economic products; building-stones, mechanical and absorption tests, chemical analyses; clay industries, Marshalltown, Melbourne, Rhodes, Bromley, Gilman; limes, building-sands, moulding-sands, road-materials, coal, soils, water-supplies, water-powers.

Beyer, Samuel W. Geology of Story County. (Iowa Geol. Surv., Vol. IX, pp. 155-245, Des Moines, 1899.) The following subjects are especially considered:

Introduction, location and area, previous geological work.

Physiography, topography, general features, table of elevations, drainage, Skunk River system, Keigley branch, Squaw creek, Walnut creek, Ballard creek, Long Dick and Beaver creeks, Indian creek, Des Moines River system, Big and Four-mile creeks, Iowa River system, Minerva creek.

Stratigraphy, general relations of strata, synoptical table of formations, Nevada well-section, College well-section; geological formations, Carboniferous system, Mississippian series, Saint Louis stage, Pennsylvanian series, Des Moines stage; Pleistocene deposits, Kansan, Buchanan, Iowan, loess, Wisconsin, history of Skunk River system, remains of the mammoth, post-Wisconsin deposits; Skunk river anticlinal.

Economic products, coal; clays, coal measures, Pleistocene; building-stones, Saint Louis; soils, road-materials, building-sands, water-supplies, natural gas.

Beyer, Samuel W. Iowa's Iron Mine. (Eng. and Mining Jour., Vol. LXXIII, pp. 275-276, New York, 1902.) A description of the manner of occurrence, the character, origin and methods of mining of the iron ore in Allamakee county is given.

Beyer, Samuel W. Mineral production of Iowa in 1898. (Iowa Geol. Surv., Vol. IX, pp. 31-48, Des Moines, 1899.) Statistics are given of the output of raw materials for all classes of mineral industry. The figures are by counties.

- Beyer, Samuel W.** Mineral Production of Iowa in 1899. (Iowa Geol. Surv., Vol. X, pp. 41-58, Des Moines, 1900.) Full statistics are given according to the output of counties.
- Beyer, Samuel W.** Mineral Production of Iowa in 1900. (Iowa Geol. Surv., Vol. XI, pp. 37-53, Des Moines, 1901.) Detailed statistics by counties are given.
- Beyer, Samuel W.** Mineral Production of Iowa, in 1901. (Iowa Geol. Surv., Vol. XII, pp. 37-61, Des Moines, 1902.) Full statistics of the output for the year are given. The iron ores are especially considered.
- Beyer, Samuel W.** Mineral Production of Iowa, in 1902. (Iowa Geol. Surv., Vol. XIV, pp. 7-26, Des Moines, 1904.) Detailed statistics of the output for the year are given by counties.
- Beyer, Samuel W.** Mineral Production of Iowa, in 1903. (Iowa Geol. Surv., Vol. XIV, pp. 645-655, Des Moines, 1904.) Statistics are given for the year by counties.
- Beyer, Samuel W.** Mineral Production in Iowa, in 1904. (Iowa Geol. Surv., Vol. XV, pp. 15-32, Des Moines, 1905.) By counties statistics of the output of various minerals are given.
- Beyer, Samuel W.** Mineral Production in Iowa, in 1905. (Iowa Geol. Surv., Vol. XVI, pp. 17-36, Des Moines, 1906.) Statistics by counties of the output of mines are given for the year.
- Beyer, Samuel W.** Mineral Production in Iowa in 1906. (Iowa Geol. Surv., Vol. XVII, pp. 11-25, Des Moines, 1907.) Statistics by counties are given of the mine products of the year.
- Beyer, Samuel W.** Mineral Production in Iowa in 1907. (Iowa Geol. Surv., Vol. XVIII, pp. 11-28, Des Moines, 1908.)
- Beyer, Samuel W.** Mineral Production in Iowa in 1908. (Iowa Geol. Surv., Vol. XIX, pp. 1-20, Des Moines, 1909.) Statistics by counties are given of the mine-output of the year.
- [Beyer, Samuel W.]** Mineral Production in Iowa in 1909 and 1910. (Iowa Geol. Surv., Vol. XXI, pp. 1-28, Des Moines, 1912.) Statistics for each of the two years are given.

- Beyer, Samuel W.** Peat Deposits in Iowa. (Iowa Geol. Surv., Vol. XIX, pp. 689-730, Des Moines, 1909.) The following topics are discussed:

Introduction, peat defined, properties of peat, occurrence, mode of accumulation, peat plants, rate of growth of peat, composition of Iowa peat, heat-value of Iowa peat, methods of preparing peat for market, cut-peat, machine-peat, briquette-peat, uses of peat as a fuel, minor uses of peat, uses for other purposes, table showing location, acreage, depth and drainage of Iowa peat bogs, table showing location and description of samples of Iowa peat, table showing chemical and calorimetric analyses of Iowa peat.

Of special value are the carefully estimated figures on the acreage of peat deposits.

- Beyer, Samuel W.** Physical Tests of Iowa Limes. (Iowa Geol. Surv., Vol. XVII, pp. 91-150, Des Moines, 1907.) The aspects of the subject discussed are:

General considerations, white versus brown limes, white versus argillaceous or siliceous limes, slaking, setting and hardening, lime-mortars, sands.

Test of lime-mortars, high-calcium white limes, lime from Mason City, lime from Springfield, Missouri, magnesian and dolomitic limes, Eagle Point, Iowa, brown lime, Mason City brown lime, Maquoketa white lime (dolomitic), Excelsior white lime (dolomitic), new-process lime, Viola, Iowa, résumé.

- Beyer, Samuel W.** Report of Assistant Geologist for 1898. (Iowa Geol. Surv., Vol. IX, pp. 28-29, Des Moines, 1899.) The work of the year is reviewed.

- Beyer, Samuel W.** Report of Assistant Geologist. (Iowa Geol. Surv., Vol. X, pp. 36-38, Des Moines, 1900.) The work of the year on clays is summarized.

- Beyer, Samuel W.** Report of Assistant Geologist. (Iowa Geol. Surv., XI, p. 35, Des Moines, 1901.) A brief statement is made of the work accomplished during the year on the clay deposits of the state.

Beyer, Samuel W. Sioux Quartzite and Certain Associated Rocks. (Iowa Geol. Surv., Vol. VI, pp. 67-112, Des Moines, 1897.) The phenomena described are chiefly as follows:

Introduction, area, topography.

Special area considered, geological formations, Niobrara chalk, Sioux quartzite, slates, relation of slate to quartzite, thickness of quartzite formation, diabase.

Petrographic description of eruptive rocks; olivine diabase, mineralogical composition, feldspar, alteration products, augite, alteration products, olivine, biotite, hornblende, apatite, magnetite, general alteration of the rock, chemical composition, structure.

Petrographic description of quartzite and slate; quartzite, mineralogical constitution; slates, mineralogical constitution, spotted slates.

Origin of quartzite and slates.

Age of quartzite formation.

Although mainly describing phenomena found just outside of the state, the article is the most important one yet published bearing upon the age, origin and character of the Iowa formation.

Beyer, Samuel W. Supplementary Report on Portland Cement Materials in Iowa. (Iowa Geol. Surv., Bull. No. 3, 36 pp., Des Moines, 1906.) This is a preliminary paper giving brief statement concerning some of the more important cement localities in the state.

Beyer, Samuel W., and I. A. Williams. Directory of Iowa Clay Workers. (Iowa Geol. Surv., Vol. XIV, pp. 621-643, Des Moines, 1904.)

Beyer, Samuel W., and I. A. Williams. Geology of Clays. (Iowa Geol. Surv., Vol. XIV, pp. 377-552, Des Moines, 1904.) The topics considered are:

Geological distribution of clays and shales, Saint Croix sandstone, Oneota limestone, Saint Peter sandstone, Galena-Trenton, Allamakee county; Maquoketa shales, Clayton county, Clinton county, Delaware county, Dubuque county, Fayette county, Winneshiek county; Silurian

and Devonian, Cerro Gordo county, Floyd county, Franklin county; Carboniferous, Lower Carboniferous, Kinderhook, Des Moines county, Lee county, Washington county; Augusta, Saint Louis; Upper Carboniferous, Coal Measures, Adair county, Adams county, Appanoose county, Boone county, Dallas county, Decatur county, Des Moines county, Fremont county, Greene county, Guthrie county, Hamilton county, Hardin county, Humboldt county, Jasper county, Jefferson county, Keokuk county, Lee county, Lucas county, Madison county, Mahaska county, Marion county, Monroe county, Montgomery county, Muscatine county, Page county, Polk county, Poweshiek county, Scott county, Story county, Taylor county, Union county, Van Buren county, Wapello county, Warren county, Wayne county, Webster county; Cretaceous, Calhoun county, Montgomery county, Plymouth county, Pottawattamie county, Sac county, Sioux county, Woodbury county; Pleistocene, Pre-Kansan or Albertan, Kansan, Illinoian, Iowan, loess, red-clay.

Beyer, Samuel W., and Ira A. Williams. Geology of Quarry Products. (Iowa Geol. Surv., Vol. XVII, pp. 189-588, Des Moines, 1907.) The subjects treated at length are:

Notes on geological section of Iowa, Sioux quartzite, Cambrian sandstone, Prairie du Chien limestone, St. Peter sandstone, Platteville and Galena limestones, Maquoketa shales, Niagara limestones, Devonian system, Lower Carboniferous, Mississippian, Pennsylvanian series, Permian series, Cretaceous system, Pleistocene deposits.

Geology of Iowa quarry-products, Proterozoic, Sioux quartzite; Cambrian system, Potsdam series, Saint Croix sandstone; Ordovician system, Prairie du Chien limestone, Allamakee county, Clayton county, Dubuque, Fayette, Howard, Jackson, Winneshiek counties; Silurian system, Niagara limestone, Bremer, Buchanan, Cedar, lime, Clayton, Clinton, Delaware, Dubuque, Fayette,

- Jackson, Johnson, Jones counties, Stone City, Anamosa, State Quarry, Linn, Scott, Winneshiek counties.
- Devonian system, Benton, Black Hawk, Bremer, Buchanan, Butler, Cedar, Cerro Gordo counties; Lime Creek shales, Chickasaw, Fayette, Floyd, Franklin, Howard, Johnson, Linn, Mitchell, Muscatine, Scott, Worth counties.
- Carboniferous, Lower Carboniferous, Mississippian, Kinderhook limestone, Des Moines, Franklin, Grundy, Hardin, Humboldt, Marshall counties. Quarry industry, test of Le Grand stone. Tama county, Washington county; Osage limestone, Des Moines, Keokuk, Lee, Louisa, Van Buren, Washington counties; Saint Louis limestone, Des Moines, Hamilton, Henry, Humboldt, Jefferson, Keokuk, Lee, Mahaska, Marion counties; tests of stone, Pocahontas, Story, Van Buren, Wapello, Washington, Webster counties.
- Upper Carboniferous, Pennsylvanian, Des Moines stage, Appanoose, Dallas, Davis, Guthrie, Hardin, Iowa, Jasper, Red-Rock sandstone, Lucas, Marion, Marshall, Muscatine, Polk, Wayne, Webster counties.
- Missouri stage, Adair, Adams, Cass, Clarke, Dallas, Decatur, Fremont, Guthrie, Harrison, Madison counties. Analyses of shale and limestone of Mills, Montgomery, Page, Pottawattamie and Taylor counties; Permian system, Webster county; Cretaceous system, Calhoun, Cass, Guthrie, Pottawattamie, Plymouth, Woodbury and Sac counties. Pleistocene system.
- Analyses of Iowa coals; analyses of limestone and chalks; analyses of clays, shales and marls; tests of Iowa building-stones, directory of Iowa limestone quarries by counties; directory of Iowa sandstone quarries by counties.
- Beyer, Samuel W.**, and I. A. Williams. Materials and Manufacture of Portland Cement. (Iowa Geol. Surv., Vol. XVII, pp. 29-85, Des Moines, 1907.) The following topics are described:
- Introduction.
- Complex cements, classes of silicate cements, pozzuolanic, hydraulic, natural, Portland cements; Portland cement,

definition, composition and constitution, raw materials for Portland cement, general considerations, raw materials actually in use, argillaceous limestone, pure hard-limestone, soft limestone, chalk, fresh-water marls, alkali waste, blast-furnace slag, clays and shales, slate.

Factors determining the value of deposits of cement materials, methods and cost of excavation of the raw materials, quarrying, mining, dredging, cost of raw materials at the mill.

Methods of manufacture, preparation of mixture for kiln, drying raw materials, percentage of water in raw materials, methods and cost of drying, grinding and mixing, dry-methods, wet-methods, composition of mixture, burning the mixture, summary of burning process, theoretical fuel requirements, losses of heat in practice, actual fuel requirements, and output, effect of composition on burning, character of kiln coal, drying coal, pulverizing coal, total cost of coal preparation, clinker grinding, addition of gypsum, constitution of Portland cement, testing of raw materials to determine availability for manufacture of Portland cement, methods of testing, analysis of limestone, process of analysis, treatment of siliceous residue, analysis of clays, interpretation of analysis, determination of hydraulic factor, calculation of cement mixtures.

Beyer, Samuel W., and I. A. Williams. *Technology of Clays.* (Iowa Geol. Surv., Vol. XIV, pp. 29-318, Des Moines, 1904.) The following topics are discussed at length:

Technology of clays, definition, origin, classification, primary residual clays, secondary clays, clays deposited in still water, deposited from running water, deposited by glacial action, deposited by wind.

Composition and chemical properties, kaolinite and pholerite, clay substance, properties of kaolinite, impurities of clays, silica, feldspar and mica, iron, lime, magnesia, alkalis, organic matter, uncommon constituents.

Physical properties of clays, raw clays, structure, color, fuel, slaking, strength, bonding-power, plasticity, shrinkage, porosity, specific gravity, fineness of grain, burnt clays, fusibility, fusibility defined, effect of chemical composition, effect of physical condition, methods of expressing, methods of measuring, table of Seger's cones, methods of preparing clay for fusion-tests, table showing fusion-temperatures for Iowa clays.

Processes in manufacture of clay wares, winning of raw material, surface digging, quarrying, mining, transportation of raw material in works, preparation of raw material, dry way, blake-crusher, rolls, disintegrators, dry-pans, ball-mills, wet method, wet-pan, pug-mill, soaking pit, screens, inclined stationary, inclined vibrating dunlap, formation of clay wares, manufacture of brick, soft mud, stiff mud, cutting-tables, repressing, dry-press, manufacture of drain-tile and building-block, manufacture of sewer-pipe, manufacture of pottery, wedging, jolly, stoneware glazing, salt, slip, bristol.

Properties of clays used in manufacture of foregoing classes of wares, soft-mud brick, stiff-mud brick, drain-tile and hollow-block, sewer-pipe, earthenware, stoneware, drying of clay wares, general consideration, practical consideration in drying clays, types of dryers, outside air-drying, the hot-floor, sewer-pipe or slatted floor, periodic or chamber dryer, continuous tunnel-dryer, direct, fuel for purpose, waste gases from other processes, indirect, radiation from heated brick-work, steam-heated surfaces, summary; burning of clay wares, combustion of fuel, general discussion, practical consideration, changes which occur in burning of clays, water-smoking, stage of oxidation, vitrification, types of kilns, intermittent kilns, updraft, temporary, English clamp, American scove, permanent, direct, rectangular, round, pottery, semi-muffle, muffle, downdraft, direct round, single stack, multiple stack, direct rectangular, single stack, multiple stack, muffle, continuous.

Beyer, Samuel W., and L. E. Young. Geology of Monroe County. (Iowa Geol. Surv., Vol. XIII, pp. 353-433, Des Moines, 1903.) The following subjects are considered: Introduction, location and area, previous geological work. Physiography, topography, general features, table of elevations, drainage, Des Moines river system, Cedar river, Coal creek.

Stratigraphy, general relations of strata, general features, table of formations, geological formations; Mississippian series, St. Louis stage; Pennsylvanian series, Des Moines stage, Monroe beds, Appanoose beds, Chariton conglomerate; Pleistocene deposits, pre-Kansan, Kansan, loess, recent.

Economic geology, coal, historical sketch, importance of the industry, coal-basins, Miller creek district, Smoky hollow, Foster district, Hiteman, Cedar creek mines, Hocking, Hilton, Bluff creek district, mining methods, system, ventilation and drainage, haulage, gaging and arrangement of bottom, pithead machinery, grading and loading, power-plants, transportation and markets, coal-tests, analyses, calorimetry; clays, building-stones, builders' and molders' sand, road-materials, soils, potable waters.

Forest trees and shrubs of Monroe county.

Bibliographic index of North American carboniferous invertebrates. S. Weller. (Bull. U. S. G. S., No. 153, 653 pp., 1898.)

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Bibliography of Iowa peat. J. H. Lees. (Iowa Geol. Surv., XIX, 731-733, 1909.)

- Epoch in history of American science. C. R. Keyes. (*Annals of Iowa, Historical Quarterly*, (3), II, 345-364, 1896.)
- Iowa scientist and his work. C. R. Keyes. (*Annals of Iowa, Historical Quarterly*, IV, 383-392, 1900.)
- Bibliography**, annotated of Iowa Geology and mining. C. R. Keyes. (*Iowa Geol. Surv.*, XXII, 1913.)
- Bibliography** of Iowa coal. J. H. Lees. (*Iowa Geol. Surv.*, XIX, 659-687, 1909.)
- Bibliography** of Iowa geology. C. R. Keyes. (*Iowa Geol. Surv.*, I, 209-464, 1893.)
- Bibliography** of Iowa peat. J. H. Lees. (*Iowa Geol. Surv.*, XIX, 731-733, 1909.)
- Bibliography** of North American paleontology, 1888-1892. C. R. Keyes. (*U. S. Geol. Surv., Bull.* 121, 250 pp., 1894.)
- Bierbauer, Bruno.** Check List of Paleozoic Fossils of Wisconsin, Minnesota, Iowa, Dakota and Nebraska. (*Bull. Minnesota Acad. Nat. Sci.*, Vol. III, pp. 206-247, Minneapolis, 1888.) Many of the species described from Iowa are listed.
- Biographical** sketch of Charles Wachsmuth. C. R. Keyes. (*American Geologist*, XVII, 131-136, 1896.)
- Biography.**
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- Elston Holmes Lonsdale, memorial. C. R. Keyes. (*American Geologist*, XXI, 264-265, 1898.)
- Epoch in history of American science. C. R. Keyes. (*Annals of Iowa, Historical Quarterly*, (3), II, 345-364, 1896.)
- Geological surveys of Iowa. C. R. Keyes. (*Annals of Iowa, Historical Quarterly*, (3), III, 111-121, 1897.)
- Memorial of Charles Wachsmuth. C. R. Keyes. (*Proc. Iowa Acad. Sci.*, IV, 13-16, 1897.)
- Professor W. H. Barris. C. H. Preston. (*American Geologist*, XXVIII, 358-361, 1901.)
- Samuel Calvin. H. Foster Bain. (*Journal of Geology*, XIX, 385-391, 1911.)

Samuel Calvin. George F. Kay. (Science, N. S., XXXIV, 106-107, 1911.)

W. J. McGee; Geologist, Anthropologist, Hydrologist. Charles Keyes. (Annals of Iowa; an historical Quarterly, XI, 1913.)

Bisbee, D. B. Nitrogen Compounds of Soil. (Proc. Iowa Acad. Sci., Vol. II, p. 66, Des Moines, 1895.) Explanation is made of the method of the determination of nitrogen, as developed in connection with the work on soils of the state undertaken by the Iowa geological survey.

Bissell, G. W. Selection, Installation and Care of Power-plants. (Iowa Geol. Surv., Vol. XIV, pp. 349-376, Des Moines, 1904.) The following subjects are explained:

Selection of power-plants, requirements: power-house; machinery, boilers, desirable types, shaking grate.

Specification for horizontal return tubular boiler 72 inches by 18 feet dimensions, material, tubes and braces, riveting construction, openings, castings, fittings, inspection and test.

Alternate specifications for boilers 66 inches by 18 feet, boiler feeding, cold feed-water, feed-water heaters, open, closed, advantages of open heater, construction of open heater, requirements of open heater.

Firing, analyses of Iowa coals, general characteristics of Iowa coals, calorific power of Iowa coals and other fuels, methods of firing.

Engines, proportions to be observed in selection, effective power calculated, foundation for engine.

Minor items, lagging of steam pipes, fitting self-oiling bearings, transmission belts, use of exhaust steam in heating drying room, ventilation.

Bissell, G. W. Selection of Power-Plants and Equipment for Stone Quarries in Iowa. (Iowa Geol. Surv., Vol. XVII, pp. 151-183, Des Moines, 1907.) The following topics are considered:

Introductory, power-house, machinery, boilers, table of dimensions for boilers, specifications for horizontal boilers 72 in. by 18 ft., dimensions, material, riv-

eting, tubes and braces, supports, construction, openings, castings, fittings, inspection and tests, alternate specifications for boilers 66 and 60 in. by 18 feet, table showing capacities in horse-power of chimneys, boiler-feeding, use of cold-feed water, feed-water heaters, open heater, closed heater, advantages of open heater, requirements of open heater, firing, analyses of Iowa coals, general characteristics of Iowa coals, calorific power of Iowa coals and other fuels, cost of fuel and of steam, methods of firing, engines, proportions to be observed in selection, effective power calculated, size of engines, minor items, lagging of steam-pipes, oiling devices, belts, transmission of steam to drills.

Gas-engine power for quarries, tests of fuels, tests of producer gas-engines.

Black Hawk County.

Cretaceous fossils in drift. C. A. White. (Proc. American Association Adv. Sci., XXI, 187-192, 1873.)

Devonian fishes of Iowa. C. R. Eastman. (Iowa Geol. Surv., XVIII, 29-360, 1908.)

Geology of Black Hawk county. M. F. Arey. (Iowa Geol. Surv., XVI, 407-453, 1906.)

Hydraulic cement. C. A. White. (First Ann. Rep. State Geologist, 20-21, 1868.)

Water supplies at Waterloo, Iowa. W. H. Norton. (Water-Supply and Irrigation Papers, U. S. Geol. Surv., 148-155, 1905.)

Species of new genus *Newberria* from devonian noted. J. Hall. (Tenth Ann. Rep. State Geologist of New York, 91-102, 1891.)

Underground water resources of Iowa. W. H. Norton. (Iowa Geol. Surv., XXI, 29-1214, 1912.)

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Black Hawk county, geology. M. F. Arey. (Iowa Geol. Surv., XVI, 407-452, 1906.)

Blastoids.

- Description of new crinoids and blastoids from Hamilton group. W. H. Barris. (Proc. Davenport Acad. Nat. Sci., IV, 88-94, 1885.)
- Description of new species from Hamilton group. W. H. Barris. (Geol. Surv. Illinois, VII, 357-365, 1883.)
- Description of new species from Iowa rocks. F. B. Meek and A. H. Worthen. (Geol. Surv. Illinois, II, 143-411, 1866.)
- Description of new species from lower carboniferous of Iowa. F. B. Meek and A. H. Worthen. (Geol. Surv. Illinois, V, 323-619, 1873.)
- New species from Burlington. F. B. Meek and A. H. Worthen. (Proc. Acad. Nat. Sci., Phila., XXI, 83-91, 1869.)
- New species from Burlington limestone at Burlington. F. B. Meek and A. H. Worthen. (Proc. Acad. Nat. Sci., Phila., XXII, 22-56, 1870.)
- New species from Burlington limestone of Iowa. F. B. Meek and A. H. Worthen. (Proc. Acad. Nat. Sci., Phila., XIII, 128-148, 1861.)
- New species from Kinderhook of Marshall county. C. Wachsmuth and F. Springer. (Geol. Surv. Illinois, VIII, 157-251, 1890.)
- New species of blastoidea from paleozoic rocks of western states. B. F. Shumard. (Trans. Acad. Sci., St. Louis, I, 238-248, 1858.)
- Bogs**, flora of northern Iowa peat. L. H. Pammel. (Iowa Geol. Surv., XIX, 735-777, 1909.)
- Bones** of mammoth in Washington county, Iowa. J. Gass and W. H. Pratt. (Proc. Davenport Acad. Nat. Sci., III, 177-178, 1882.)
- Boone County.**
- Analyses of coal. Rush Emery. (Geology of Iowa, II, 390-391, 1870.)
- Analyses of Iowa coals. J. H. Lees and A. W. Hixson. (Iowa Geol. Surv., XIX, 476-519, 1909.)
- Artesian wells of Iowa. W. H. Norton. (Iowa Geol. Surv., VI, 113-428, 1897.)

- Clay-slide at Boone viaduct, Boone, Iowa. A. W. Merrick. (Journal of Western Soc. Eng., XI, 332-339, 1906.)
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- Coal mines at Boonsboro. C. A. White. (Second Ann. Rep. State Geologist, 142, 1868.)
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- Burchard, E. F.** Portland Cement Materials in District near Dubuque. (Bull. U. S. G. S., No. 522, pp. 174-179, Washington, 1913.)
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- Call, R. Ellsworth.** Artesian Wells in Iowa. (Science, Vol. XIX, pp. 310-311, New York, 1892.) A summary of the knowledge is presented concerning the localities where deep-borings for artesian-waters have been made.

- Call, R. Ellsworth.** Artesian Wells in Iowa. (Proc. Iowa Acad. Sci., Vol. I, pt. ii, 57-63, Des Moines, 1892.) An abstract of other published notes on artesian wells in Iowa, a sketch-map of their location, and several typical sections are given.
- Call, R. Ellsworth.** Sketch of Physical Geography of Iowa. (Annual Report of Iowa Weather and Crop Service, 1890, pp. 12-18, Des Moines, 1891.) A short account of the surface features of Iowa is given, with map of the chief hydrographic basins of the state.
- Call, R. Ellsworth.** Chemistry of Iowa Artesian Waters. (Monthly Rev. Iowa Weather and Crop Service, Vol. II, No. 2, pp. 1-5, Des Moines, 1892.) Results of analyses of the waters, as determined by different chemists, of various wells in the state are tabulated.
- Call, R. Ellsworth.** Fossils of Iowa loess. (American Naturalist, Vol. XV, pp. 585-586, Philadelphia, 1881.) Certain species found in the bluffs of the Missouri river are noted.
- Call, R. Ellsworth.** Iowa Artesian Wells. (Monthly Rev. Iowa Weather and Crop Service, Vol. III, No. 3, pp. 1-15, Des Moines, 1892.) This is a brief sketch of the conditions governing artesian flows, with geological notes of different wells throughout the state. An accompanying sketch-map shows the location of the chief wells.
- Call, R. Ellsworth.** Loess of North America. (American Naturalist, Vol. XVI, pp. 369-381, Philadelphia, 1882.) A number of references are made to the occurrence of loess in Iowa.
- Call, R. Ellsworth.** Natural Gas in Iowa. (Iowa Weather and Crop Service, Vol. III, pp. 6-7, Des Moines, 1892.) Mention is made of the several reported occurrences of natural gas in Iowa.
- Call, R. Ellsworth.** Preliminary Paper on Artesian Wells in Iowa. (Monthly Review of Iowa Weather and Crop Service, Vol. II, No. iv, pp. 1-6, Des Moines, 1891.) Tables of the wells of the state, their location, depth and character of the waters are given.

- Call, R. Ellsworth.** Loess in Central Iowa. (American Naturalist, Vol. XV, pp. 782-784, Philadelphia, 1881.) Announcement is made of its occurrence at Des Moines. Also a list of some fossils found in it is given.
- Call, R. Ellsworth, C. R. Keyes and.** Quaternary Section Eight Miles Southeast of Des Moines, Iowa. (Proc. Iowa Acad. Sci., Vol I, pt. ii, p. 30, Des Moines, 1892.) Description is given of a section near the terminal moraine of the Wisconsin drift, near Des Moines.
- Call, R. Ellsworth, W. J. McGee and.** Loess and Associated Deposits of Des Moines. (Am. Jour. Sci., (3), XXIV, pp. 202-223, New Haven, 1882.)
- Calvin, Samuel.** Additional Notes on the Devonian Rocks of Buchanan County, Iowa. (American Geologist, Vol. VIII, pp. 142-145, Minneapolis, 1891.) A detailed description of the different beds belonging to the Devonian section, as found in Buchanan county, is given.
- Calvin, Samuel.** Aftonian Age of Aftonian Mammalian Fauna. (Proc. Iowa Acad. Sci., Vol. XVII, pp. 177-180, Des Moines, 1910.) The question discussed is why the remains are not older than the Aftonian. The bones are not abraded to the slightest degree.
- Calvin, Samuel.** Aftonian Gravels and their Relations to Drift-sheets in Region about Afton Junction and Thayer. (Proc. Davenport Acad. Sci., Vol. X, pp. 18-30, Davenport, 1907.) The evidence set forth shows two things: "First, in certain localities the Kansan ice rode over the older deposits without causing any break or disturbance, in which case the materials of the older formations occupy their proper stratigraphic relations to the newer Kansan till. Second, under certain conditions the glaciers of the Kansan stage plowed up the Aftonian and sub-Aftonian beds and incorporated masses varying from a few inches to many feet in diameter, in the great sheet of Kansan drift. The evidence probably warrants a third statement to the effect that, when all the facts are taken into account, there is no transition of Aftonian gravels to Kansan clays and nothing that argues contemporaneity of age."

- Calvin, Samuel.** Aftonian Mammalian Fauna. (Bull. Geol. Soc. America, Vol. XX, pp. 341-356, New York, 1909.) The deposits at the original locality are briefly described. Chief consideration is given to the larger relationships of the fossils recently discovered. Horses, elephants, and edentates make up the principal faunal elements.
- Calvin, Samuel.** Aftonian Mammalian Fauna, II. (Bull. Geol. Soc. America, Vol. XXII, pp. 207-216, New York, 1911.)
- Calvin, Samuel.** Apparent Anomalies of Stratification of Postville Well. (American Geologist, Vol. XVII, pp. 195-203, Minneapolis, 1896.) The peculiarities of the so-called Trenton limestone and the Galena dolomite are pointed out and discussed.
- Calvin, Samuel.** Buchanan gravels; an Interglacial Deposit in Buchanan County, Iowa. (American Geologist, Vol. XVII, pp. 76-78, Minneapolis, 1896.) The deposit is shown to be between the Iowan and Kansan till-sheets; and its peculiarities are fully described.
- Calvin, Samuel.** Buchanan Gravels; an Interglacial Deposit in Buchanan County, Iowa. (Proc. Iowa Acad. Sci., Vol. III, pp. 58-60, Des Moines, 1896.) These beds are described in detail. Large railroad gravel-pits are open in them.
- Calvin, Samuel.** Cedar Valley Quarry. (Eng. and Mining Jour., Vol. LXI, p. 544, New York, 1896.) The building-stones of this extensive quarry are described; and its geologic relations considered.
- Calvin, Samuel.** Composition and Origin of Iowa Chalk. (Iowa Geol. Surv., Vol. III, pp. 211-236, Des Moines, 1895.) The microscopic examination of the Iowa chalk shows that it is composed of two chalk-forming organisms in great abundance. The various forms recognized are listed and figured. Conditions under which the chalk was formed are discussed at some length.
- Calvin, Samuel.** Concerning Occurrence of Gold and some Other Mineral Products in Iowa. (American Geologist, Vol. XXVII, pp. 363-372, Minneapolis, 1901.) The author

discusses the close relation existing between certain mineral products and the geologic formations.

- Calvin, Samuel.** Cretaceous Deposits of Woodbury and Plymouth Counties, with Observations on their Economic Uses. (Iowa Geol. Surv., Vol. I, pp. 145-161, Des Moines, 1893.) The general sequence of strata is described in detail and the several subdivisions are correlated with the general Cretaceous column of the Upper Missouri region. The chalk beds are referred to the Niobrara terrane.
- Calvin, Samuel.** Description of a New Species of Spirifera from the Hamilton Group, near Iowa City, Iowa. (Bull. Lab. Nat. Hist., Iowa State Univ., Vol. I, pp. 28-29, Iowa City, 1888.) *Spirifera urbana* is described as new.
- Calvin, Samuel.** Devil's Backbone. (Midland Monthly, Vol. VI, pp. 20-26, Des Moines, 1896.) Description is given of a picturesque bit of scenery in Delaware county.
- Calvin, Samuel.** Eighteenth Annual Report of State Geologist. (Iowa Geol. Surv., XIX, pp. xi-xv, Des Moines, 1909.) Brief statement is made of the work of the year.
- Calvin, Samuel.** Eighth Annual Report of State Geologist. (Iowa Geol. Surv., Vol. X, pp. 11-27, Des Moines, 1900.) A summary of the work of the year 1899 is given.
- Calvin, Samuel.** Eleventh Annual Report of State Geologist. (Iowa Geol. Surv., Vol. XIII, pp. 11-13, Des Moines, 1903.) The work of the year is briefly summarized.
- Calvin, Samuel.** Fifteenth Annual Report of State Geologist. (Iowa Geol. Surv., Vol. XVII, pp. 1-6, Des Moines, 1902.) Brief summary is given of the work of the year.
- Calvin, Samuel.** Fifth Annual Report of State Geologist. (Iowa Geol. Surv., Vol. VII, pp. 11-27, Des Moines, 1897.) Besides the administrative report the complex history of the glacial period is outlined, five glacial stages being recognized and also the same number of interglacial epochs.
- Calvin, Samuel.** First Annual Report of State Geologist for 1892. (Iowa Geol. Surv., Vol. I, pp. 3-5, Des Moines,

1893.) There is summarized the work of the several members of the geological corps during the year.

Calvin, Samuel. Fourth Annual Report of State Geologist. (Iowa Geol. Surv., Vol. V, pp. 12-25, Des Moines, 1896.) In the administrative report the work of the survey is briefly reviewed.

Calvin, Samuel. Geological Reconnaissance in Buchanan County, Iowa. (Bull. Lab. Nat. Hist., State Univ. Iowa, Vol. II, pp. 177-189, Iowa City, 1893.) The numerous exposures of Devonian strata chiefly are noted, and the organic remains characterizing the several layers are named. Certain peculiarities in the distribution of the outcrops are ascribed to uplift at the close of Silurian time.

Calvin, Samuel. Geology and Geologic Resources of Iowa—Formations and their Economic Values. (Mines and Minerals, Vol. XXII, pp. 560-561, Scranton, 1902.) Brief characterizations are given of the mining possibilities of several terranes.

Calvin, Samuel. Geology and Geological Resources of Iowa. (Proc. International Mining Congress, Fourth Sess., pp. 52-56, 1901.) An outline of the stratigraphy is given and the products of economic importance are referred to the different terranes.

Calvin, Samuel. Geology and Revelation. (Pamphlet, 27 pp., 1909.) The address was delivered before the members of the Okoboji Lakeside laboratory on Sunday, the fourth of July, 1909, and printed privately.

Calvin, Samuel. Geology of Allamakee County. (Iowa Geol. Surv., Vol. IV, pp. 35-114, Des Moines, 1895.) The following topics are discussed in detail:

Introduction, situation and area, previous geological work. Physiography, topography; drainage, Oneota river, Village creek, Paint creek, Yellow creek.

Stratigraphy, general relations, geological formations; Cambrian, Saint Croix sandstone, distribution, thickness, lithological character; Ordovician, Oneota limestone, surface distribution, thickness, fauna, taxonomic relations, Saint Peter sandstone, general description,

topographic features, distribution, fauna, Trenton limestone, general description, distribution and relations to drainage, fauna, Galena limestone, superficial deposits, soils, geological structure, deformations.

Economic products, building-stones, Saint Croix, Oneota, Saint Peter, Trenton, Galena, ornamental stones, limes, hydraulic limes and cements, clays, sands, glass sands, building sand, iron, mineral-paint, lead, galena, zinc, water-powers.

Forest trees of Allamakee county.

Of special interest among the subjects considered are the physiographic features of the region, the determination of the Oneota limestone, the character of the residual deposits; the formation of the iron-ores, and the occurrence of lead-ores in the Oneota formation.

Calvin, Samuel. Geology of Buchanan County. (Iowa Geol. Surv., Vol. VIII, pp. 201-253, Des Moines, 1898.) The subdivision of the report is as follows:

Introduction, situation and area, geological work in Buchanan county.

Physiography, topography, drainage.

Geological formations, general relations of strata; Silurian system, Niagara limestone; Devonian system, Independence shales, Fayette breccia, Cedar Valley limestone; Pleistocene, Kansan, Buchanan, Iowan, loess, post-glacial deposits; soils; deformations; unconformities.

Economic products, building-stones, limes, brick-clays, coal, road-materials, water-supplies, water-powers.

Calvin, Samuel. Geology of Cerro Gordo County. (Iowa Geol. Surv., Vol. VII, pp. 117-195, Des Moines, 1897.) Descriptions include the following features:

Introduction, situation and area, previous geological work. Physiography, topography, Iowan drift-area, Altamont moraine, table of elevations; drainage, Lime creek, Shell Rock river, Willow creek, Calamus creek, Cold water creek, drainage of morainic area, sources of supply of Clear lake, drainage during Wisconsin time.

Geological formations, general description; Devonian system, Cedar Valley limestone, stratigraphical equivalents, typical exposures, Kuppinger quarry, Parker mill section, Lein quarry, Belding quarry, Mason City quarries, Portland section, exposure on Lime creek below Portland, sections at Nora Springs and Rockford, sections along Shell Rock river, sections along Lime creek above Mason City, section along interglacial channel, general section of Cedar Valley limestone, Lime Creek shales, Hackberry Grove section, Owen Creek exposures, general section of Lime Creek shales, Fauna of Lime Creek shales; Carboniferous system, Kinderhook; Pleistocene system, Kansan drift, Buchanan gravels, Iowan drift, Wisconsin drift, eskers and valley-trains, post-glacial deposits; soils; deformations; unconformities.

Economic products; building-stones, Kuppinger quarry, Belding quarry, Mason City stone quarry, Mason City quarry, other quarries in Cedar Valley limestone; quarries in Owen beds; value of quarry products, future of stone industry; limes, clays, Mason City Brick and Tile Co., Nelson brickyard, future of clay industry; peat, water-supplies, Mason City deep-well, water-powers.

Calvin, Samuel. Geology of Chickasaw County. (Iowa Geol. Surv., Vol. XIII, pp. 255-292, Des Moines, 1903.) The descriptions take up the following topics:

Introduction, geologic and geographic relations, area, previous geological work.

Physiography, topography, Iowan plain, rolling Iowan, pre-Iowan topography, shallow stream valleys, drainage, altitudes.

Stratigraphy, synopsis, synoptical table; Devonian system, general discussion, typical exposures, Gypidula Comis beds, Atrypa Occidentalis beds, Acervularia Profunda beds, Spirifer Parryanus beds, Idiostroma beds, lithographic beds, intermediate beds, upper yellow magnesian beds, general Devonian section; Pleistocene system, Kansan stage, Kansan drift, Buchanan gravels,

Iowan stage, Iowan drift, Iowan boulders, boulders not superglacial, depth of Pleistocene deposits.

Soils.

Economic products, building-stones, limestones, granites, limes, brick-clays, road-materials, peat, limonite, water-supplies, water-powers.

Calvin, Samuel. Geology of Delaware County. (Iowa Geol. Surv., Vol. VIII, pp. 119-199, Des Moines, 1898.) Subjects discussed are:

Introduction. Physiography, topography, drainage.

Stratigraphy; Ordovician, Maquoketa shales; Silurian, Delaware stage, cliff-forming beds, non-dolomitic beds, fossils, chert-beds; Devonian, Wapsipinicon; Cretaceous, Rockville conglomerate; residual materials; Pleistocene, sub-Aftonian, Kansan, Buchanan gravels, Iowan drift, loess, alluvium, terraces; soils; deformations.

Economic products, building-stones, limes, clays, cement-rocks, iron-ores, road-materials, railway ballast, water-supplies, water-powers.

Calvin, Samuel. Geology of Howard County. (Iowa Geol. Surv., Vol. XIII, pp. 21-79, Des Moines, 1903.) The features chiefly described are:

Introduction, location and area, previous geological work.

Physiography, topography, general discussion, topography of loess-Kansan area, area occupied by Kansan drift, preglacial valley of Upper Iowa or Oneota river, mixed types of topography, topography of Iowan area, relative size of area, relative age of topographic forms, genesis of Iowan topographic forms, typical characteristics of Iowan plain, stream valleys in Iowan area, preglacial topography in Iowan area, other unusual types, drainage, drainage courses mostly preglacial, Upper Iowa or Oneota river, Turkey river, streams in southwestern part of county.

Stratigraphy, general description; Devonian overlap, synoptical table; Ordovician system; Galena-Trenton, distribution, characteristics, typical sections and exposures, cliffs in Albion township, section at Florence-

ville, section at Granger, Minnesota; Maquoketa or Hudson River shales, general characteristics, fossils, distribution, typical exposures, correlation and thickness; Devonian system, general description, relation to Maquoketa, horizon of lowest Devonian in Howard county, typical exposures, *Productella* beds, *Acervularia* beds, Stromatoporoid horizon, non-dolomitic beds preserving anomalous fauna, quarry-stone beds, dip of Devonian, general Devonian section; Pleistocene system, Kansan stage, Kansan till, Buchanan gravels, Iowan stage, Iowan till, Iowan loess, alluvium, thickness of Pleistocene deposits.

Soils, loess soils, alluvial soils, sandy and gravelly soils, soils developed on Iowan drift.

Unconformities.

Economic products, quarry-stones, clays, limes, road-materials, water-supplies, water-powers.

Summary.

Calvin, Samuel. Geology of Johnson County. (Iowa Geol. Surv., Vol. VII, pp. 33-116, Des Moines, 1897.) The following subjects are treated in detail:

Introduction, situation and area, geological work in Johnson county.

Physiography, topography, Iowan drift-plains, Kansan drift-plains, topography of loess, river flood plains, lake-basins; table of elevations; drainage, Iowa river, Clear creek, Buffalo creek, Old Man creek, Pardieu creek, Rapid creek, Sander creek.

Stratigraphy, general relations of strata, synoptical table; geological formations, Silurian system, La Claire limestone, Anamosa limestone, Bertram and Coggan beds; Devonian system, Wapsipinicon stage, Otis and Independence beds, Fayette breccia, Cedar Valley stage, typical localities and exposures, general section, State Quarry limestone, State Quarry fish-beds, distribution, taxonomic relations; Carboniferous system, Kinderhook stage, Des Moines stage, Iowa City outlier, Anamosa outlier, fossils; Pleistocene system, Kansan drift, Gla-

cial scorings, Iowan drift, loess, genesis of loess, fossils; alluvium, depth of Pleistocene deposits, pre-glacial surface; soils, drift-soils, alluvial soils, loess soils; deformations; unconformities.

Economic products, building-stones, Anamosa stage, Wapsipinicon stage, Cedar Valley stage, State Quarry stage, Des Moines stage, railway ballast and road materials, ornamental stone, flagging-stone; limes, sands; clays, River Junction, Oxford, Tiffin, Iowa City; minerals, water-supplies, water-powers.

Forest trees of Johnson county.

Occurrence of fossil fishes in the Devonian of Iowa.

The glacial deposits and the State Quarry formations are especially described.

Calvin, Samuel. Geology of Jones County. (Iowa Geol. Surv., Vol. V, pp. 33-112, Des Moines, 1896.) The following is a table of the contents of the report:

Introduction, situation and area, previous geological work. Physiography, topography, drift-plains, loess hills, alluvial plains and river valleys, drainage.

Stratigraphy, general relations of strata; geological formations, Niagara series, Delaware stage, Le Claire stage, Anamosa stage, Bertram stage; Carboniferous series, Des Moines stage; geest; Pleistocene deposits, typical exposures, Castle Grove township, Monticello township, Richland township, Washington township, Cass township, Wayne township, Scotch Grove township, Clay township, Fairview township, Jackson township, Madison township, Wyoming township, Greenfield township, Rome township, Hale township, Oxford township; unconformities; deformations.

Economic products, soils; building-stones, Gold Hill quarry, Champion quarry, Stone City quarry, Anamosa quarry, Gem quarry, State quarry, Johnellen quarry, other quarries of Stone City basin, Andrew Rummel quarry, Shope quarries, Dolby quarry, Carter quarry, Hale quarry, Clay quarry, Ballou quarry, other quarries in

Anamosa limestone; limes, clays, clay-works; building-sands, moulding-sands, road-materials, lead, water-supplies, water-powers.

Calvin, Samuel. Geology of Mitchell County. (Iowa Geol. Surv., Vol. XIII, pp. 293-352, Des Moines, 1903.) The features described in detail are:

Introduction, geological relations, topographical relations, causes of certain topographic phenomena, geographical relations, area; previous geological work.

Physiography, topography, drainage, altitudes.

Stratigraphy, general discussion, synoptical table; Devonian system, typical sections and exposures, Lewis lime-quarry, Chandler cliff section, rock exposures near Orchard, exposures near Mitchell, St. Ansgar exposures, Otranto exposures, exposures west of Cedar river, exposures on the Little Cedar, exposures near McIntire; Pleistocene system, Kansan stage, Kansan drift, Buchanan gravels, Iowan stage, Iowan drift, Iowan loess, supra-Iowan loess, Iowan terraces.

Deformations and unconformities.

Soils.

Economic products, building-stones, limes, lithographic stone, road-materials, clays, iron-ore, coal.

Water-supplies.

Water-powers.

Summary.

Calvin, Samuel. Geology of Page County. (Iowa Geol. Surv., Vol. XI, pp. 397-468, Des Moines, 1901.) The subjects considered in this connection are here enumerated:

Introduction, location and area, previous geological work.

Physiography, topography, drainage.

Stratigraphy, general relations of strata, synoptical table of geological formations; Carboniferous system, Missourian stage, general discussion, Keyes' divisions of the Missourian, correlations, typical sections, Hawleyville, Braddyville, Shambaugh mill, general dip of strata, Burlington Junction section, sections of limestones of Tarkio valley, relations of Tarkio limestones

to Nodaway limestones, Linquist coal-horizon, deep drill-holes, Clarinda, Larrabee well, Grant township wells, Falk prospect-hole; Cretaceous system, Dakota stage; Pleistocene system, Kansan drift, relation to topography, materials forming drift, indications of age, residual gravel, loess, two beds of loess, flooded-valley deposits, characteristics, distribution, probable age, alluvium.

Deformations and unconformities.

Soils.

Economic products, coal, Ingraham mine, mines near Shambaugh, Linquist coal; building-stones, brick and tile, water-supplies, wells, springs, Dunbar mineral springs, water-powers.

Summary.

Calvin, Samuel. Geology of Winneshiek County. (Iowa Geol. Surv., Vol. XVI, pp. 37-146, Des Moines, 1906.) The various topics treated of are as follows:

Introduction, geographic and geologic relations, area, boundaries, relations to topographic areas, relations to distribution of geological formations, previous geological work.

Physiography, topography, preglacial topography, topographic effects of the several rock-formations, topography controlled by Pleistocene deposits, area of Kansan drift, Iowan-Kansan drift, Iowan-Kansan border, area of Iowan drift, topography due to recent shifting of mantle rocks, larger topographic features, Cresco-Calmar ridge, drainage basin of the Oneota, or Upper Iowa river, drainage basin of Yellow river, drainage basin of Turkey river, elevations, drainage, Oneota, or Upper Iowa river, Canoe creek, Bear creek, Ten-mile creek, Trout creek, Root river system, Turkey river, drainage of the Iowan plain.

Stratigraphy, general relations of the strata, synoptical table, new names used in synoptical table, Cambrian system, Oneota limestone, New Richmond sandstone, Shakopee limestone, Saint Peter sandstone, Trenton

series, Platteville limestone, Decorah shale, Galena limestone, Maquoketa beds, Elgin beds, Clermont shales, Fort Atkinson limestone, Brainard shale, Silurian system, Niagara series, Hopkinton limestone, Devonian system, Middle Devonian series, Wapsipinicon and Cedar Valley limestones.

Mantle rocks, residual materials, Pleistocene system, glacial series, Kansan stage, Kansan drift, Buchanan gravels, deposits of uncertain age—possibly Kansan, Post-Kansan loess, Iowan stage, Iowan drift, Iowan sand terraces, Iowan loess, alluvium.

Soils, stony residual soils, loess-Kansan soils, Iowan drift soils, alluvial soils.

Unconformities, the great unconformity between Ordovician and Devonian, other unconformities.

Economic products, building-stone, Oneota, Platteville, Galena, Maquoketa, Isotelus zone, Fort Atkinson limestone, Niagara lime, clays, road-materials, water-supplies, water-powers, gold.

Caves, Glenwood cave, Decorah ice-cave.

Calvin, Samuel. Interglacial Deposits of Northeastern Iowa. (Proc. Iowa Acad. Sci., Vol. V, pp. 64-70, Des Moines, 1898.) With the recognition of several drift-sheets comes complexity of interglacial considerations. Buchanan gravels are described, but represent two interglacial intervals instead of one.

Calvin, Samuel. Iowan drift. (Bull. Geol. Soc. America, Vol. X, pp. 107-120, Rochester, 1899.) This till-sheet is compared with the other tills of the state. Its boundaries and features are described.

Calvin, Samuel. Iowan Drift. (Bull. Geol. Soc. America, Vol. XXII, pp. 729-730, New York, 1911.) Abstract.

Calvin, Samuel. Iowan drift. (Journal of Geology, Vol. XIX, pp. 577-602, Chicago, 1911.) The evidence is set forth showing that the till-sheet to which the name is applied is quite distinct from all others in the region. The nomenclature of all the glacial deposits of the state is fully discussed.

- Calvin, Samuel.** Le Claire limestone. (Bull. Lab. Nat. Hist., State Univ. Iowa, Vol. III, pp. 183-189, Iowa City, 1896.) The remarkable oblique bedding of this formation is described and its origin considered.
- Calvin, Samuel.** Le Claire Limestone. (Proc. Iowa Acad. Sci., Vol. III, pp. 52-58, Des Moines, 1896.) This is a detailed characterization of the formation as it occurs in Iowa.
- [**Calvin, Samuel.**] Later Cretaceous in Iowa. (American Geologist, Vol. I, p. 337, Minneapolis, 1888.) A short note is made on the Cretaceous fossils found in the drift near Mt. Vernon, in Linn county.
- Calvin, Samuel.** Maquoketa Shales in Delaware County. (Proc. Iowa Acad. Sci., Vol. II, pp. 40-42, Des Moines, 1895.) Announcement is made of the fact that owing to a low fold trending northwest and southeast across the county some of the streams have cut through the Silurian strata exposing Ordovician shales.
- Calvin, Samuel.** New Horizons and Some New Localities for Friable Sandstone in which the Grains are enlarged by Secondary Deposition of Silica in Optical Continuity with the original Nucleus. (American Geologist, Vol. XIII, pp. 225-227, Minneapolis, 1894.) Many localities in northeastern Iowa are noted where the phenomenon is observable. The geologic horizon of the sandstone is the New Richmond formation of the Canadian series.
- Calvin, Samuel.** New Species and New Genus of Tubicolar Annelida. (American Geologist, Vol. I, pp. 24-28, Minneapolis, 1888.) This is an account and description of a worm found infesting the Devonian corals near Iowa City. The following genus and species are described as new:
- Streptindytes.*
Streptindytes acervulariae.
- Calvin, Samuel.** Ninth Annual Report of State Geologist. (Iowa Geol. Surv., Vol. XI, pp. 11-30, Des Moines, 1901.) The work of the previous year is summarized.

- Calvin, Samuel.** Niobrara Chalk. (American Geologist, Vol. XIV, pp. 140-161, Minneapolis, 1894.) The physical characters of the rock are noted and comparison is made with the English chalk. The areal extent in the state is estimated. This description refers to the Crill chalk or lime-stone and not to the Niobrara chalk proper.
- Calvin, Samuel.** Niobrara Chalk. (Journal of Geology, Vol. II, pp. 755-756, Chicago, 1894.) The character of the chalk is briefly noted.
- Calvin, Samuel.** Niobrara Chalk. (Proc. American Assoc. Adv. Sci., Vol. XLIII, pp. 192-217, 1895.) The stratigraphy of the formation is discussed and the foraminiferal origin of the chalk explained.
- Calvin, Samuel.** Notable Ride; From Driftless Area to Iowan Drift. (Proc. Iowa Acad. Sci., Vol. VII, pp. 72-77, Des Moines, 1900.) Along the Illinois Central railroad from Dubuque to Dyersville, a distance of 30 miles, is one of the most instructive trips for observing Pleistocene phenomena known, and one that should become famous.
- Calvin, Samuel.** Note on Difference between *Acervularia Profunda*, Hall, and *Acervularia Davidsoni*, Edwards and Haime. (Proc. Iowa Acad. Sci., Vol. I, pt. ii, pp. 30-32, Des Moines, 1892.) Characters of the two species at Independence, Iowa, and elsewhere, are given.
- Calvin, Samuel.** Note on Difference between *Acervularia Profunda*, Hall, and *Acervularia Davidsoni*, Edwards and Haime. (American Geologist, Vol. IX, pp. 355-358, Minneapolis, 1892.) A short statement is made of the difference between the two species.
- Calvin, Samuel.** Notes on Collection of Fossils from Lower Magnesian Limestone, from Northeastern Iowa. (American Geologist, Vol. X, pp. 144-148, Minneapolis, 1892.) Short characterizations of various fossils are given, and the following species, without figures, are described as new:
- Straparollus claytonensis.*
Straparollus pristiniiformis.
Raphistoma multivolvatum.

Raphistoma paucivolvatum.

Cyrtoceras luthei.

- Calvin, Samuel.** Notes on Collection of Fossils from Lower Magnesian Limestone from Northeastern Iowa. (Bull. Lab. Nat. Hist., State Univ. Iowa, Vol. II, pp. 189-193, Iowa City, 1893.) There are described a number of new species and several others are identified.
- Calvin, Samuel.** Notes on Formations Passed Through in Boring Deep Well at Washington, Iowa. (American Geologist, Vol. I, pp. 28-31, Minneapolis, 1888.) Comments on the formations passed through in sinking a well at Washington are made.
- Calvin, Samuel.** Notes on Geological Formations of Iowa. (Pamphlet, World's Exposition at New Orleans, pp. 1-8, 1884.) This is a brief resumé of what is known of the geological formations of the State.
- Calvin, Samuel.** Notes on Geological Section of Iowa. (Iowa Geol. Surv., Vol. XVII, pp. 192-200, Des Moines, 1907.) The principal formations and subdivisions are briefly characterized.
- Calvin, Samuel.** Notes on Some Fossil Corals described by David Owen, in his Report of work done in Autumn of 1839, with Observations on Devonian Species *Phillipsastrea Gigas* of later authors. (American Geologist, Vol. XII, pp. 108-112, Minneapolis, 1893.) The nomenclature is discussed and the identifications considered.
- Calvin, Samuel.** Notes on Synonymy, Characters and Distribution of Spirifera Parryana, Hall. (Bull. Lab. Nat. Hist. State Univ. Iowa, Vol. I, pp. 19-28, Iowa City, 1888.) All the related species of *Spirifera parryana* described from the Iowa formations are considered to be synonyms of this species.
- Calvin, Samuel.** On Chert of Upper Coal Measures in Montgomery County, Iowa. (American Geologist, Vol. I, pp. 116-117, Minneapolis, 1888.) A brief comparison of the Iowa cherts with those of Ireland is made.

Calvin, Samuel. On Some Dark Shale Recently Discovered below Devonian Limestones, at Independence, Iowa; with a Notice of its Fossils and Description of New species. (Bull. U. S. Geol. and Geog. Sur. Terr., Vol. IV, pp. 725-730, Washington, 1878.) A short description of the rocks of the locality, with remarks on some of the fossils, is given. The following species are regarded as new:

Strophodonta variabilis.

Strophodonta quadrata.

Orthis infera.

Rhynchonella ambigua.

Gypidula munda.

Calvin, Samuel. On Fauna Found at Lime Creek, Iowa, and its Relation to Other Geological Faunas. (Am. Jour. Sci., (3), Vol. XXV, pp. 434-436, New Haven, 1883.) This is a criticism on H. S. Williams' paper on the same subject, with additional notes and a description of *Spirifera macbridei*, regarded as new.

Calvin, Samuel. Physiography of Iowa. (Iowa Weather and Crop Service, Ann. Rept. for 1902, Appendix, pp. 3-11, Des Moines, 1903.) The surface relief and drainage features are described, and the distribution of the drift sheets is outlined.

Calvin, Samuel. Present Phase of Pleistocene Problems in Iowa. (Bull. Geol. Soc. America, Vol. XX, pp. 133-152, New York, 1909.) Five and probably six distinct drift-sheets are clearly differentiated in Iowa. So far as the age of ice is concerned the problems of this area are the problems of this continent. The relationships of the several drift-sheets are discussed.

Calvin, Samuel. President's Address: Work of Iowa Geological Survey. (Proc. Iowa Acad. Sci., Vol. XVI, pp. 11-18, Des Moines, 1909.) A summary of the chief results accomplished by the organization is given.

- Calvin, Samuel.** Relation of Cretaceous Deposits of Iowa to Subdivisions of Cretaceous proposed by Meek and Hayden. (Proc. Iowa Acad. Sci., Vol. I, pt. iii, pp. 7-12, Des Moines, 1893.) The Cretaceous deposits in the vicinity of Sioux City are described in detail.
- Calvin, Samuel.** Relation of Cretaceous Deposits of Iowa to Subdivisions of Cretaceous proposed by Meek and Hayden. (American Geologist, Vol. XI, pp. 300-307, Minneapolis, 1893.) The section on the Big Sioux River is described and the diastrophic movements during Cretaceous times are discussed.
- Calvin, Samuel.** Second Annual Report of State Geologist, for 1893. (Iowa Geol. Surv., Vol. III, pp. 19-27, Des Moines, 1895.) The summary of the work accomplished during the year includes also an outline of the results obtained by each of the assistants.
- Calvin, Samuel.** Seventeenth Annual Report of State Geologist. (Iowa Geol. Surv., XIX, pp. xiii-xiv, Des Moines, 1909.) Brief statement is made of the work of the year.
- Calvin, Samuel.** Seventh Annual Report of State Geologist. (Iowa Geol. Surv., Vol. IX, pp. 11-24, Des Moines, 1899.) Progress of the work during the previous year is reviewed.
- Calvin, Samuel.** Sixteenth Annual Report of State Geologist. (Iowa Geol. Surv., Vol. XVIII, pp. 1-5, Des Moines, 1908.) The work of the year is briefly noted.
- Calvin, Samuel.** Sixth Annual Report of State Geologist. (Iowa Geol. Surv., Vol. VIII, pp. 11-23, Des Moines, 1898.) The work of the Geological Survey for the year 1897 is reviewed.
- Calvin, Samuel.** Some Features of Channel of Mississippi River between Lansing and Dubuque, and their Probable History. (Proc. Iowa Acad. Sci., Vol. XIV, pp. 213-220, Des Moines, 1907.) The development of the Mississippi river valley is followed. Towards the close of Tertiary times the region is regarded as being more elevated, causing energetic erosion. At this time the Mississippi gorge was over 800 feet deep; this gorge was later partially filled by glacial debris.

- Calvin, Samuel.** Some Geological Problems in Muscatine County, Iowa. (Bull. Lab. Nat. Hist., State Univ. Iowa, Vol. I, pp. 7-18, Iowa City, 1888.) A description of certain rocks about Muscatine showing that they are Devonian instead of early Carboniferous in age. Numerous references to fossils are given.
- Calvin, Samuel.** Some Geological Problems in Muscatine County, Iowa, with Special Reference to Rectification of Supposed Kinderhook near Mouth of Pine Creek. (American Geologist, Vol. III, pp. 25-36, Minneapolis, 1889.) Special account is given of certain yellow sandstones in Muscatine county, formerly referred to the Chemung or Kinderhook, and they are now shown to be Devonian in age.
- Calvin, Samuel.** Some New Species of Paleozoic Fossils. (Bull. Lab. Nat. Hist., State Univ. Iowa, Vol. I, pp. 173-181, Iowa City, 1890.) The following species are described as new:
- Terebratula iowensis.*
 - Schizodus symmetricus.*
 - Holopea grandis.*
 - Straparollus lativolvis.*
 - Straparollus bicarinatus.*
 - Straparollus tricarinatus.*
- Calvin, Samuel.** State Quarry Limestone. (Proc. Iowa Acad. Sci., Vol. IV, pp. 16-21, Des Moines, 1897.) The deposit seems to rest in marked unconformity upon the Middle Devonian formations.
- Calvin, Samuel.** Structure and Probable Affinities of Cerionites Dactylioides, Owen. (Proc. Iowa Acad. Sci., Vol. I, pt. iii, pp. 13-15, Des Moines, 1893.) The structure of the fossils is described in detail and an ideal restoration is made.
- Calvin, Samuel.** Structure and Probable Affinities of Cerionites Dactylioides, Owen. (American Geologist, Vol. XII, pp. 53-57, Minneapolis, 1893.) The nomenclature and zoological relations are discussed.

- Calvin, Samuel.** Summary of Discussion (on Oelwein Drift Section.) (Proc. Iowa Acad. Sci., Vol. IV, pp. 66-68, Des Moines, 1897.) The recognition of five distinct ice invasions, and of four interglacial intervals is emphasized. "Iowa is now classic ground for the study of Pleistocene deposits, and geologists the world over, if they would study these deposits to best advantage, must come to Iowa to do it."
- Calvin, Samuel.** Switzerland of Iowa. (Midland Monthly, Vol. III, pp. 403-414, Des Moines, 1895.) The scenery of the extreme northeastern corner of the state is described and illustrated.
- Calvin, Samuel.** Synopsis of Drift Deposits of Iowa. (American Geologist, Vol. XIX, pp. 270-272, Minneapolis, 1897.) The several till-sheets recently differentiated in the state are briefly characterized, and their boundaries indicated.
- Calvin, Samuel.** Tenth Annual Report of State Geologist. (Iowa Geol. Surv., Vol. XII, pp. 11-27, Des Moines, 1902.) The work of the year is summarized. Recent advancements in knowledge of the glacial deposits are noted.
- Calvin, Samuel.** Third Annual Report of State Geologist, for 1894. (Iowa Geol. Surv., Vol. IV, pp. 19-26, Des Moines, 1895.) This is a summary of the results obtained during the year by the different members of the geological corps.
- Calvin, Samuel.** Twelfth Annual Report of State Geologist. (Iowa Geol. Surv., Vol. XIV, pp. 3-6, Des Moines, 1904.) Brief summary is given of the work of the year.
- Calvin, Samuel.** Two Unique Spirifers from Devonian of Iowa. (Bull. Lab. Nat. Hist., State Univ. Iowa, Vol. II, pp. 165-167, Iowa City, 1893.)
- Calvin, Samuel, and H. F. Bain.** Geology of Dubuque County. (Iowa Geol. Surv., Vol. X, pp. 379-651, Des Moines, 1900.) The following features are described:
Introduction, location and area, previous geological work.
Physiography, topography, drainage.

Stratigraphy, general relations of strata, synoptical table; Ordovician system, Saint Peter sandstone, Trenton limestone, geographical distribution, lithological and faunal characteristics, Galena limestone, Maquoketa shales; Silurian system, Niagara limestone; superficial materials, residual materials or geest; Pleistocene system, Kansan drift, Buchanan gravels, Kansan outwash in driftless area, Iowan drift, loess, Wisconsin terraces, alluvium, summary of Pleistocene history, calcareous tufa; deformations; unconformities.

Economic geology, soils; lead and zinc, historical sketch, geology, Saint Peter sandstone, Galena-Trenton, Maquoketa, Niagara, ore deposits, ores and associated minerals, galena, cerussite, smithsonite, sphalerite, copper, pyrite and marcasite, limonite, wad, calcite and aragonite, gypsum, barite, ore-bodies, vertical sheets, flats, pitches, disseminated bodies, cave-deposits, formation of crevices, enlargement of crevices, openings, horizons, description of individual crevices, Timber range, Stewart Park ridge, Stewart and Bartlett lode, Stewart cave, Levens range, Dubuque cave, Sunflower, Patch Diggings, Level, Kilbourne and Karrick, McGowen and Cunningham, Rake pocket, Julien Avenue crevices, Langworthy and Kelly, Rabbit Hollow mines, Center Grove mines, Pikes peak, other crevices, mines away from Dubuque, origin of Dubuque ore, ultimate source of ores, table of analyses, localization of bodies, concentration of ores, practical considerations, mining titles, Bonson rules, methods of work, prospecting, composition and treatment of ores, smelting.

Iron, analyses of Durango ore; lime, Eagle Point lime-works, Key City lime-works; clays, analysis Maquoketa shale, brick-plants; pigments; road materials; building-stones; artesian wells; cements.

Forestry notes.

The origin and character of the lead and zinc deposits are especially discussed. The dolomitization of the Galena limestone is described.

- Calvin, Samuel.** G. F. Kay. (Science, N. S., XXXIV, 106-107, 1911.)
- Calvin, Samuel.** H. F. Bain. (Journal of Geology, XIX, 385-391, 1911.)
- Cambrian Period.**
- Artesian wells of Iowa. W. H. Norton. (Iowa Geol. Surv., VI, 113-428, 1897.)
- Bibliography of North American paleontology, 1888-1892. C. R. Keyes. (U. S. Geol. Surv., Bull. 121, 250 pp., 1894.)
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