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T. E. Savage. (Proc. Iowa Acad. Sci., XI, 103-109,  
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Surv., XV, 433-546, 1905.)
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Surv., XX, 151-186, 1910.)
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- Geology of Mills and Fremont counties. J. A. Udden. (Iowa Geol. Surv., XIII, 123-183, 1903.)
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  - Geology of Allamakee county. S. Calvin. (Iowa Geol. Surv., IV, 35-111, 1895.)
  - Geology of Clayton county. A. G. Leonard. (Iowa Geol. Surv., XVI, 213-317, 1906.)
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  - Geology of Winneshiek county. S. Calvin. (Iowa Geol. Surv., XVI, 37-146, 1906.)
- Magnesian series of northwestern states. C. W. Hall and F. W. Sardeson. (Bull. Geol. Soc. America, VI, 167-198, 1895.)
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**New species** of crinoids and blastoids. C. Wachsmuth and F. Springer. (Geol. Surv., Illinois, VIII, 157-251, 1890.)

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**New terranes** of carboniferous in western interior basin, Arkansan series. C. R. Keyes. (Proc. Iowa Acad. Sci., VIII, 123-128, 1901.)

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**Niagara limestone.** (*See Goweran Series.*) In nearly all of the reports of the Survey, and other papers, mention of the Niagara limestone refers not to the rocks of the Niagaran series but to those of the Goweran series.

**Niagara** of Iowa, some lime-burning dolomites and dolomitic building-stones. G. L. Houser. (Iowa Geol. Surv., I, 197-207, 1893.)

#### **Niagaran Series.**

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

- Geology of Bremer county. W. H. Norton. (Iowa Geol. Surv., XVI, 319-405, 1906.)
- Geology of Buchanan county. S. Calvin. (Iowa Geol. Surv., VIII, 201-253, 1898.)
- Geology of Clayton county. A. G. Leonard. (Iowa Geol. Surv., XVI, 213-317, 1906.)
- Geology of Clinton county. J. A. Udden. (Iowa Geol. Surv., XV, 369-431, 1905.)
- Geology of Delaware county. S. Calvin. (Iowa Geol. Surv., VIII, 119-199, 1898.)
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Some lime-burning dolomites and dolomitic building-stones from the Niagara of Iowa. G. L. Houser. (Iowa Geol. Surv., I, 197-207, 1893.)

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"**Nickel Ore**" from Iowa. C. R. Keyes. (Eng. and Mining Journal, LIV, 634, 1892.)

**Nickel (Sulphide).**

Annotated catalogue of minerals. C. R. Keyes. (Iowa Geol. Surv., I, 181-198, 1893.)

**Nicollet, J. N.** Cretaceous Formations of Missouri River. (Am. Jour. Sci., (1), Vol. XLV, pp. 153-159, New Haven, 1843.) The rocks of cretaceous origin are described in some detail for the first time in Iowa territory.

**Nicollet, J. N.** Report intended to Illustrate Map of Hydrographic Basin of Upper Mississippi River. (Sen. Doc., 26 Cong., 2d Sess., Vol. V, pt. ii, No. 237, Washington, 1841.) A number of fossils are listed from various parts of Iowa and a few references are made to the rocks of the eastern part of the state.

**Niles, W. H.,** and Charles Wachsmuth. Evidence of Two Distinct Geological Formations in Burlington Limestone. (Am. Jour. Sci., (2), Vol. XLII, pp. 95-99, New Haven, 1866.) A short sketch is given of the **Burlington** beds, with list of the crinoids found in the upper and lower sub-divisions.

**Nineteenth** and twentieth annual reports of state geologist. G. F. Kay. (Iowa Geol. Surv., XXI, ix-xvi, 1912.)

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**Niobrara Limestone.**

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- Geological formations of Iowa. C. R. Keyes. (Iowa Geol. Surv., I, 134, 1893.)
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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.)

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- Geology of Clay and O'Brien counties. T. H. Macbride. (Iowa Geol. Surv., XI, 461-508, 1901.)
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- Geology of Mills county. C. A. White. (Geology of Iowa, I, 368-370, 1870.)
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- Geology of Montgomery county. E. H. Lonsdale. (Iowa Geol. Surv., IV, 381-449, 1895.)
- Geology of Page county. S. Calvin. (Iowa Geol. Surv., XI, 397-460, 1901.)
- Geology of Plymouth county. H. F. Bain. (Iowa Geol. Surv., VIII, 315-366, 1898.)
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Nishnabotna sandstone. C. A. White. (Geology of Iowa, I, 289-291, 1870.)

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#### **Nomenclature.**

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Des Moines river and origin of name. C. R. Keyes. (Annals of Iowa: Historical Quarterly, III, 554-559, 1898.)

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- Geological age of certain gypsum deposits. C. R. Keyes. (American Geologist, XXX, 99-102, 1902.)
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- Remarks on loess. F. W. Sardeson. (Proc. Iowa Acad. Sci., V, 11-12, 1898.)
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- Northeastern Iowa**, evidence of sub-Aftonian till-sheet. S. W. Beyer. (Proc. Iowa Acad. Sci., IV, 58-62, 1897.)
- Northeastern Iowa**, interglacial deposits. S. Calvin. (Proc. Iowa Acad. Sci., V, 64-70, 1898.)
- Northeastern Iowa**, notes on collection of fossils from lower magnesian limestone. S. Calvin. (Bull. Lab. Nat. Hist., State Univ. Iowa. II, 189-193, 1893.)
- Northeastern Iowa**, subdivisions of upper silurian. A. G. Wilson. (Proc. American Assoc. Adv. Sci., XLIV, 137, 1896.)
- Northeastern Iowa**, thickness of paleozoic strata. W. H. Norton. (Iowa Geol. Surv., III, 167-210, 1895.)

- Northeastern Iowa**, occurrence of zinc. A. G. Leonard. (Proc. Iowa Acad. Sci., I, pt. iv, 48-52, 1894.)
- Northeastern Iowa**, upper silurian. A. G. Wilson. (American Geologist, XVI, 275-281, 1895.)
- Northern** and southern Kinderhook faunas. S. Weller. (Journal of Geology, XIII, 617-634, 1905.)
- Northern Iowa** peat-bogs, flora. L. H. Pammel. (Iowa Geol. Surv., XIX, 735-777, 1909.)
- Northward** extension of Lake Valley limestone. C. R. Keyes. (Proc. Iowa Acad. Sci., XII, 169-171, 1905.)
- Northwestern Iowa**, ancient lava-flows. S. W. Beyer. (Iowa Geol. Surv., I, 163-169, 1893.)
- Northwestern Iowa**, notes on drift. H. F. Bain. (American Geologist, XXIII, 168-176, 1899.)
- Northwestern states**, magnesian series. C. W. Hall and F. W. Sardeson. (Bull. Geol. Soc. America, VI, 167-198, 1895.)
- Norton, William H.** Artesian Wells of Iowa. (Iowa Geol. Surv., Vol. VI, pp. 113-428, Des Moines, 1897.) The subjects fully discussed are:

Introduction.

Definition and theory of artesian-wells, definitions, historical résumé, requisite conditions, illustrations of artesian areas.

Iowa field and its artesian conditions, geological structure, area of supply, conditions of supply, reservoir, conditions of transmission, permeable stratum, containing beds, fountain-head.

Records of wells, McGregor-Fairview section, Dubuque-Sioux City section, Clinton-Dunlap section, Davenport-Des Moines section, Washington-Des Moines section, wells of southeastern Iowa, wells of southwestern Iowa, flowing-wells in glacial drift.

Chemistry of artesian waters, interpretation of chemical water analyses, mineral ingredients of artesian waters, dissolved gases, dissolved solids, classification of artesian waters.

Qualities of artesian waters, therapeutics, sanitary, industrial.

Artesian waters as a public supply, adequacy, cost, purity, contract and some minor matters, art of drilling wells.

Bibliography.

The important feature which the results of this investigation emphasizes is the exact stratigraphic location of a great water bearing stratum throughout the state and the exact depths at which it may be reached.

**Norton, William H.** Certain Devonian and Carboniferous Outliers in Eastern Iowa. (Iowa Geol. Surv., Vol. III, pp. 115-133, Des Moines, 1895.) A number of isolated patches of the rocks are noted far beyond the margins of the main body of the strata of their ages. Sections accompany the descriptions. Fossils as determining factors are listed.

**Norton, William H.** Geological Section of Y. M. C. A. Artesian Well at Cedar Rapids. (Proc. Iowa Acad. Sci., Vol. II, pp. 194-196, Des Moines, 1895.) The detailed sequence of rock-layers is given and the various groups are referred to the general geological section of the state.

**Norton, William H.** Geology of Bremer County. (Iowa Geol. Surv., Vol. XVI, pp. 319-405, Des Moines, 1906.) The following subjects are fully considered:

Introduction, location and area, previous geological work. Physiography, relief, table of altitudes, drainage, Cedar River valley, Wapsipinicon River valley.

Stratigraphy, general relations of strata, synoptical table, Ordovician system, Maquoketa stage, Silurian system, Niagara series, sections of the Niagara, Devonian system, Wapsipinicon stage, Lower Davenport sub-stage, Independence sub-stage, sections of the Wapsipinicon, Cedar Valley stage, sections of the Cedar Valley at Waverly, fish remains at Waverly, sections of the Cedar Valley north of Waverly, sections of the Cedar Valley about Frederika, geest, Pleistocene system, pre-Kansan stage, Kansan drift, sections of Kansan drift, topography of the Kansan drift, Denver loess-Kansan area,

Buchanan gravels, Iowan stage, Iowan drift, loess, paha, distribution of the loess, preglacial topography. Economic products, building-stones, crushed stone, lime, clay, soils, water-powers, water supply, section of Waverly well, section of Summer well.

**Norton, William H.** Geology of Cedar County. (Iowa Geol. Surv., Vol. XI, pp. 279-396, Des Moines, 1901.) The features described include:

Introduction, situation and area, previous geological work. Physiography, relief, table of elevations, drainage, Wapsipinicon river, tributaries of the Wapsipinicon, Cedar river, terraces of the Cedar, tributaries of the Cedar, sinks, pre-glacial drainage.

Stratigraphy, general relations, synoptical table, deeper strata; Ordovician system; Silurian system, Niagara, Gower limestone, chemical analyses, sections of the Gower; Devonian system, Coggan, Otis, Independence, Lower Davenport, Upper Davenport, sections of Devonian; Carboniferous; Pleistocene, pre-Kansan and Aftonian, Kansan drift sheet, Kansan ferretto, Kansan topography, advance and retreat of the Kansan, Paha, Buchanan gravels, Iowan drift sheet, loess, remains of mammoth.

Economic geology, building-stone, limes, clays, road materials, sands, water-powers, soils.

The paha and its origin are especially discussed.

**Norton, William H.** Geology of Linn County. (Iowa Geol. Surv., Vol. IV, pp. 121-194, Des Moines, 1895.) The following subjects are considered:

Introduction, situation and area.

Physiography, drainage, topography, table of elevations. Stratigraphy, general relations of strata, classification of formations, geological formations; Silurian *Pentamerus* beds, Coralline beds, Le Claire beds, Mount Vernon beds, Bertram beds, Coggan beds, sections of Coggan, Otis and Kenwood beds, relations of Coggan and Bertram beds; Devonian, Wapsipinicon stage, Otis beds, Kenwood beds, Fayette breccia, Cedar Valley limestone;

Carboniferous; Cretaceous; Pleistocene deposits, residuary clays, Kansan drift-sheet, east Iowan drift-sheet, pre-loess sands, valley drift, loess, preglacial erosion, terraces, distribution of Pleistocene deposits, central drift-plain, paha.

Economic products, building-stones, Mount Vernon beds, Stone City quarries, Waubeck quarries, Mount Vernon quarries, Coggan beds Bertram beds, Otis beds, Kenwood and Fayette beds, Cedar Valley limestone; drift-clays, character and distribution, loess; drift-clay plants in operation, Cedar Rapids, Marion, Lisbon and Mount Vernon, Center Point, Central City, Coggan; limes, Viola, Mount Vernon; sands.

Especially noteworthy features are the differentiation of the Late Silurian section and the Middle Devonian section, the discussion of the formation of the brecciation of the Fayette limestone, the description of certain Carboniferous outliers and the consideration of paha and its origin.

**Norton, William H.** Geology of Scott County. (Iowa Geol. Surv., Vol. IX, pp. 389-519, Des Moines, 1889.) There are described in detail these subjects:

Introduction.

Topography, constructional reliefs, Iowan drift-plains, Paha, Illinoian and Kansan drift-plains, fluvial plains, erosional reliefs, causes and conditions, Illinoian, Kansan, Drainage, Wapsipinicon river, Rock and Walnut creeks, Mud creek, other affluents of the Wapsipinicon, affluents of the Mississippi, Mississippi river, terraces, Rock Island rapids, history of drainage,

Stratigraphy, taxonomic relations; geological formations, Silurian, Gower stage, Le Claire stone, Anamosa stone, relation of Le Claire and Anamosa sections of Gower, Le Claire, Anamosa, intermediate type; Devonian, Wapsipinicon, Otis, Independence, Lower Davenport, brecciation of Lower Davenport, Upper Davenport, fauna of Upper Davenport, sections of the Wapsipinicon, Cedar Valley, general descriptions, sections;

Carboniferous, surface distribution, sections; geest; Pleistocene, taxonomic relations, pre-Kansan, Aftonian, Kansan, Yarmouth, Illinoian, Sangamon, Iowan, Iowan loess, red loam, loess sands, preglacial surface.

Economic products, coal; building-stones, Silurian, Devonian; limes; clays, Carboniferous, loess; road-materials, soils, water-supplies, artesian wells.

Table of wells.

- Norton, William H.** Glaciated Rock-surface near Linn and near Quarry, Iowa; with table of Bearings of Glacial Striæ in Iowa. (Proc. Iowa Acad. Sci., Vol. XVIII, pp. 79-83, Des Moines, 1911.) Finely ice-scored surfaces are described, together with the attendant phenomena.
- Norton, William H.** Notes on Some Strata of Devonian Series in Iowa. (Proc. Iowa Acad. Sci., Vol. I, Pt. iv, pp. 22-24, Des Moines, 1894.) Four stages of the Fayette breccia are noted. Kenwood, Otis and Coggan beds are distinguished.
- Norton, William H.** Occurrence of *Megalomus Canadensis* Hall, in Le Claire Beds at Port Byron, Illinois. (Proc. Iowa Acad. Sci., Vol. II, pp. 42-43, Des Moines, 1895.) Incidental allusion is made to the probable existence of the forms in Iowa.
- Norton, William H.** Report of Assistant Geologist. (Iowa Geol. Surv., Vol. V, pp. 29-30, Des Moines, 1896.) A brief statement is made of the progress in the investigation of the artesian waters.
- Norton, William H.** Report of Assistant Geologist. (Iowa Geol. Surv., Vol. VII, p. 31, Des Moines, 1897.) This is a brief statement of the work accomplished on artesian wells.
- Norton, William H.** Report of Assistant Geologist. (Iowa Geol. Surv., Vol. X, pp. 31-35, Des Moines, 1900.) This is a summary of the continued work on the artesian wells of the state.
- Norton, William H.** Report of Assistant Geologist. (Iowa Geol. Surv., Vol. XI, pp. 33-34, Des Moines, 1901.) The investigations on artesian wells during the year are noted.

- Norton, William H.** Report of Assistant Geologist. (Iowa Geol. Surv., Vol. XII, pp. 23-34, Des Moines, 1902.) Brief statement is made of the artesian work of the year.
- Norton, William H.** Report of Assistant Geologist. (Iowa Geol. Surv., Vol. XIII, pp. 17-19, Des Moines, 1903.) The work on artesian wells is reviewed.
- Norton, William H.** Thickness of Paleozoic Strata of Northeastern Iowa. (Iowa Geol. Surv., Vol. III, pp. 167-210, Des Moines, 1895.) The logs of a number of deep-well drillings are presented to show the relative development of the strata of different geologic periods in various parts of the state. In these wells the artesian water-stratum—the St. Peter sandstone—is sought.
- Norton, William H.** Underground Water Resources of Iowa. (Iowa Geol. Surv., Vol. XXI, pp. 29-1214, Des Moines, 1912.) The topics discussed are as follows:
- Underground water resources of Iowa, introduction, topography and climate, geology, geologic occurrence of underground water, artesian phenomena, chemical composition of underground waters, municipal, domestic and industrial water supplies, mineral waters; underground waters of the Northeast district, Allamakee county, Black Hawk county, Bremer county, Buchanan county, Chickasaw county, Clayton county, Delaware county, Dubuque county, Fayette county, Howard county, Winneshiek county; underground waters of East-central district, Benton county, Cedar county, Clinton county, Iowa county, Jackson county, Johnson county, Jones county, Linn county, Muscatine county, Poweshiek county, Scott county, Tama county; underground waters of the Southeastern district, Davis county, Des Moines county, Henry county, Jefferson county, Keokuk county, Lee county, Louisa county, Mahaska county, Van Buren county, Wapello county, Washington county; underground waters of North-central district, Butler county, Cerro Gordo county, Floyd county, Franklin county, Hancock county, Humboldt



county, Kossuth county, Mitchell county, Winnebago county, Worth county, Wright county; underground waters of Central district, Boone county, Dallas county, Greene county, Grundy county, Guthrie county, Hamilton county, Hardin county, Jasper county, Marshall county, Polk county, Story county, Webster county; underground waters of South-central district, Adair county, Appanoose county, Clarke county, Decatur county, Lucas county, Madison county, Marion county, Monroe county, Ringgold county, Union county, Warren county, Wayne county; underground waters of Northwest district, Buena Vista county, Calhoun county, Carroll county, Cherokee county, Clay county, Crawford county, Dickinson county, Emmet county, Ida county, Lyon county, Monona county, O'Brien county, Osceola county, Palo Alto county, Plymouth county, Pocahontas county, Sac county, Sioux county, Woodbury county; underground waters of Southwest district, Adams county, Audubon county, Cass county, Fremont county, Harrison county, Mills county, Montgomery county, Page county, Pottawattamie county, Shelby county, Taylor county.

- Norton, William H.** Underground Water resources of Iowa. (U. S. Geol. Surv., Water Supply Paper No. 293, 994 pp., Washington, 1912.) The topics discussed are the same as those of the Iowa report of the same title.
- Norton, William H.** Underground Waters of Eastern United States: Iowa. (Water Supply and Irrigation Papers, U. S. Geol. Surv., No. 114, pp. 220-225, Washington, 1905.) There is given a summary of the knowledge on the shallow waters; and the geologic horizons of artesian waters are described.
- Norton, William H.** Variation in Position of Nodes on Axial Segments of Pygidium of a Species of Enerinurus. (Proc. Iowa Acad. Sci., Vol. III, pp. 79-81, Des Moines, 1896.) It is noted that not a single segmental line of more than a score of species is unoccupied by tubercles.

- Norton, William H.** Water-Supplies at Waterloo, Iowa. (Water-supply and Irrigation Papers, U. S. Geol. Surv., No. 145, pp. 148-155, Washington, 1905.) Brief statement is made of the possibilities of artesian water-supplies for the city.
- Norwood, J. G.,** and Henry Pratten. Notice of Producti found in Western States and Territories with Description of Twelve New Species. (Jour. Acad. Nat. Sci. Philadelphia, (2), Vol. III, pp. 5-22, Philadelphia, 1855.) A number of allusions are made to species occurring in Iowa.
- Notable ride,** from driftless area to Iowan drift. S. Calvin. (Proc. Iowa Acad. Sci., VII, 72-77, 1900.)
- Note** on carboniferous fauna of Mississippi valley in Rocky Mountain region. C. R. Keyes. (Proc. Iowa Acad. Sci., XI, 258-259, 1904.)
- Note** on correlation of Clarinda well-section with schematic section of carboniferous. C. R. Keyes. (Iowa Geol. Surv., XI, 461-463, 1901.)
- Note** on difference between *Acervularia profunda*, Hall, and *Acervularia Davidsoni*, Edwards and Haime. S. Calvin. (American Geologist, IX, 365-368, 1892.)
- Note** on difference between *Acervularia profunda*, Hall, and *Acervularia Davidsoni*, Edwards and Haime. S. Calvin. (Proc. Iowa Acad. Sci., I, pt. ii, 30-32, 1892.)
- Note** on distribution of *Helicina occulta*. C. R. Keyes. (American Geologist, III, 18-19, 1889.)
- Note** on Florencia formation. H. A. Pilsbry. (Am. Jour. Sci., (4) V, 232-233, 1898.)
- Note** on geological range of genus *Receptaculites* in American palæozoic strata. J. Hall. (New York State Cab. Nat. Hist., 16th Ann. Rep., App. D. 67-69, 1863.)
- Note** on nature of cone-in-cone. C. R. Keyes. (Proc. Iowa Acad. Sci., III, 75-76, 1896.)
- Note** sur le parallélisme des roches des dépôts paleozoïques de l'Amérique Septentrionale avec ceux de l'Europe, suivie d'un tableau des espèces fossiles communes aux deux Continents, avec l'indication des étages on elles as re-

- contrent, et terminée par un examen critique de chacune de ces espèces. Ed. de Verneuil. (Bull. Soc. géol. de France, (2), t. IV, 646-710, 1847.)
- Notes** explanatory of section from Cleveland, Ohio, to Mississippi river, in southwest direction, with remarks upon the identity of western formations with those of New York. J. Hall. (Trans. Assoc. American Geologists and Naturalists, 267-293, 1842.)
- Notes**, on Aftonian mammals. A. O. Thomas. (Science, N. S., XXXVI, 570, 1912.)
- Notes** on collection of fossils from lower magnesian limestone from northeastern Iowa. S. Calvin. (American Geologist, X, 144-148, 1892.)
- Notes** on collection of fossils from lower magnesian limestone from northeastern Iowa. S. Calvin. (Bull. Lab. Nat. Hist., State Univ. Iowa, II, 189-193, 1893.)
- Notes** on cretaceous flora of western Iowa. P. Bartsch. (Bull. Lab. Nat. Hist., State Univ. Iowa, III, 178-182, 1896.)
- Notes** on "Cone-in-cone." C. A. White. (Am. Jour. Sci., (2), XLV, 400-401, 1868.)
- Notes** on distribution of timber in southwestern Iowa, with inferences concerning origin of prairies. J. E. Todd. (American Naturalist, XII, 91-96, 1878.)
- Notes** on drift of northwestern Iowa. H. F. Bain. (American Geologist, XXIII, 168-176, 1899.)
- Notes** on formations passed through in digging the deep-well at Washington, Iowa. S. Calvin. (American Geologist, I, 28-31, 1888.)
- Notes** on the fossil wood from Keokuk limestone, Keokuk, Iowa. C. H. Gordon. (Proc. Iowa Acad. Sci., I, 97-98, 1890.)
- Notes** on fossils of loess at Iowa City. B. Shimek. (American Geologist, I, 149-152, 1888.)
- Notes** on geological formations of Iowa. S. Calvin. (Pamphlet, printed at World's Exposition at New Orleans, 1-8, 1884.)
- Notes** on geological section of Iowa. S. Calvin. (Iowa Geol. Surv., XVII, 192-200, 1907.)

- Notes** on geology of part of Mississippi valley. W J McGee. (Geological Magazine, (2), VI, 353-362 and 412-420, 1879.)
- Notes** on geology of Johnson county. C. L. Webster. (American Naturalist, XXII, 408-419, 1888.)
- Notes** on geology of southeastern Iowa. C. H. Gordon. (American Geologist, IV, 237-239, 1889.)
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- Notes** on lower strata of devonian series in Iowa. W. H. Norton. (Proc. Iowa Acad. Sci. I, pt. iv, 22-24, 1894.)
- Notes** on Redrock sandstone. C. R. Keyes. (Proc. Iowa Acad. Sci., I, pt. iii, 26-27, 1893.)
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- Notes** on some fossil corals described by David Dale Owen in his report of work in autumn of 1839, with observations on devonian species *Phillipsastrea Gigas* of later authors. S. Calvin. (American Geologist, XII, 108-112, 1893.)
- Notes** on some points in structure and habits of palæozoic crinoides. F. B. Meek and A. H. Worthen. (Proc. Acad. Nat. Sci., Phila., XX, 323-334, 1868.)
- Notes** on synonymy, characters and distribution of *Spirifera parryana*, Hall. S. Calvin. (Bull. Lab. Nat. Hist., State Univ. Iowa, I, 19-28, 1888.)
- Notes** on various glass-sands, mainly undeveloped. F. Burchard. (Bull. U. S. Geol. Surv., No. 315, 377-381, 1907.)
- Notice** of arrow points from loess in city of Muscatine. F. M. Witter. (Proc. Iowa Acad. Sci., I, pt. ii, 66-68, 1892.)
- Notice** of new cœlacanth fish from Iowa kinderhook. C. R. Eastman. (Journal of Geology, XVI, 357-362, 1908.)

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- Notice** of new species of *Platycrinus* and other fossils from Mountain limestone of Illinois and Iowa. A. H. Worthen. (Trans. Acad. Sci., St. Louis, I, 569-571, 1860.)
- Notice** of producti found in western states and territories, with description of twelve new species. J. G. Norwood and H. Pratten. (Jour. Acad. Nat. Sci. Philadelphia, (2), III, 5-22, 1855.)
- Nous avons** lu de grandes richesses houillères. C. R. Keyes. (La Chronique Industrielle, Trente-cinquième Année, No. 102, 1-3, 1912.)
- Number** and distribution of fossil species in paleozoic rocks of Iowa, Wisconsin and Minnesota. D. D. Owen and B. F. Shumard. (Proc. American Assoc. Adv. Sci., V, 235, 1851.)
- Nuttall, Thomas.** Observations on Geological Structure of Valley of Mississippi. (Jour. Acad. Nat. Sci. Philadelphia, Vol. II, pp. 14-52, Philadelphia, 1821.) Some general allusions are made to Iowa geology. By means of fossils early carboniferous and cretaceous rocks are recognized for the first time in Iowa-land and in America.
- O'Brien County.**
- General description. C. A. White. (Geology of Iowa, II, 223-226, 1870.)
- Artesian wells of Iowa. W. H. Norton. (Iowa Geol. Surv., VI, 113-428, 1897.)
- Geology of O'Brien county. T. H. Macbride. (Iowa Geol. Surv., XI, 461-508, 1900.)
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- O'Brien** and Clay counties, geology. T. H. Macbride. (Iowa Geol. Surv., XI, 461-508, 1900.)
- Observations**, additional, on surface deposits in Iowa. B. Shimck. (Proc. Iowa Acad. Sci., IV, 68-72, 1897.)
- Observations** in vicinity of Wall lake. F. A. Wilder. (Proc. Iowa Acad. Sci., VII, 77-82, 1900.)
- Observations** on carboniferous limestones of Mississippi valley. J. Hall. (Am. Jour. Sci., (2), XXIII, 187-203, 1857.)
- Observations** on the classification of Mississippian-series. C. R. Keyes. (American Geologist, XXII, 108-113, 1898.)
- Observations** on drift phenomena of southwestern Iowa. C. A. White. (Am. Jour. Sci., (2), XLIII, 301-305, 1867.)
- Observations** on drift phenomena of southwestern Iowa. C. A. White. (Second Ann. Rep. State Geologist, 143-148, 1868.)
- Observations** on genus Archimedes, or Fenestella, with description of species, etc. J. Hall. (Proc. American Assoc. Adv. Sci., pp. 170-180, 1857.)
- Observations** on geological structure of valley of Mississippi. T. Nuttall. (Jour. Acad. Nat. Sci. Philadelphia, First series, II, 14-52, 1821.)
- Observations** on geology and paleontology of Burlington, Iowa, and its vicinity. C. A. White. (Boston Jour. Nat. Hist., VII, 209-235, 1860.)
- Observations** on Keokuk species of *Agaricocrinus*. C. H. Gordon. (Proc. Iowa Acad. Sci., I, 100-101, 1890.)
- Observations** on Keokuk species of *Agaricocrinus*. C. H. Gordon. (American Geologist, V, 257-261, 1890.)
- Observations** on prairie soil. W. H. Herrick. (Proc. Iowa Acad. Sci., 1875-80, 16, 1880.)
- Observations** on red quartzite boulders of western Iowa; and their original ledges of red quartzite in Iowa, Dakota and Minnesota. C. A. White. (Proc. American Assoc. Adv. Sci., XVII, 340-342, 1869.)
- Observations** on rocks of Mississippi valley which have been referred to Chemung group of New York together with descriptions of new species of fossils from same horizon

at Burlington, Iowa. C. A. White and R. P. Whitfield. (Proc. Boston Soc. Nat. Hist., VIII, 289-316, 1862.)

- Observations** on the summit structure of Pentremites, the structure and arrangement of certain parts of crinoids, and description of new species from carboniferous rocks of Burlington, Iowa. C. A. White. (Boston Jour. Nat. Hist., VII, 481-506, 1863.)
- Occurrence** in Iowa of fossiliferous concretions similar to those of Mazon creek. A. C. Spencer. (Proc. Iowa Acad. Sci., I, pt. iv, 55, 1894.)
- Occurrence** of fish-remains in carboniferous limestone of Illinois. A. H. Worthen. (Proc. American Assoc. Adv. Sci., X, 189-192, 1856.)
- Occurrence** of fossil fishes in devonian of Iowa. C. R. Eastman. (Iowa Geol. Surv., VII, 108-116, 1897.)
- Occurrence** of gold and some other mineral products in Iowa. S. Calvin. (American Geologist, XXVII, 363-372, 1901.)
- Occurrence** of internal convoluted plate within body of certain species of crinoidea. J. Hall. (Proc. Boston Soc. Nat. Hist., X, 33-34, 1866.)
- Occurrence** of *Megalomus canadensis* Hall, in the Le Claire beds at Port Byron, Illinois. W. H. Norton. (Proc. Iowa Acad. Sci., II, 42-43, 1895.)
- Occurrence** of natural gas in Iowa and its probable future. C. R. Keyes. (Mon. Rev. Iowa Weather and Crop Service, III, No. 12, 3-4, 1892.)
- Occurrence** of quenstedtite near Montpelier, Iowa. O. Kuntze. (American Geologist, XXIII, 119-121, 1899.)
- Occurrence** of rhizopods in Pella beds in Iowa. J. A. Udden. (Proc. Iowa Acad. Sci., IX, 120, 1902.)
- Occurrence** of zinc in northeastern Iowa. A. G. Leonard. (Proc. Iowa Acad. Sci., I, pt. iv, 48-52, 1894.)
- Ochre.**  
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**Old channel** of Mississippi in southeastern Iowa. F. Leverett. (Annals of Iowa, Historical Quarterly, (3), V, 38-51, 1901.)

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**On Iowa Kames** and Aasar. W J McGee. (Proc. Iowa Acad. Sci., 1875-80, 19, 1880.)



- On Keokuk** beds and their contained fossils in vicinity of Keokuk, Iowa. C. H. Gordon. (Proc. Iowa Acad. Sci., I, 98-100, 1890.)
- On Loess** and associated deposits of Des Moines. W J McGee and R. E. Call. (Am. Jour. Sci., (3) XXIV, 202-223, 1883.)
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- On Occurrence** of later cretaceous deposits in Iowa. C. A. White. (American Geologist, I, 221-227, 1888.)
- On Parallelism** of palæozoic deposits of North America with those of Europe, etc. [Translated.] J. Hall. (Am. Jour. Sci., (2), V, 176-183 and 359-370, 1848; VII, 45-51, 218-231, 1849.)
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- On Relative** position of forest-beds and associated drift formations in northeastern Iowa. W J McGee. (Am. Jour. Sci., (3), XV, 339-341, 1878.)
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- Geology of Fayette county. T. E. Savage. (Iowa Geol. Surv., XV, 433-546, 1905.)
- Geology of Grundy county. M. F. Arey. (Iowa Geol. Surv., XX, 61-95, 1910.)
- Geology of Hardin county. S. W. Beyer. (Iowa Geol. Surv., X, 243-305, 1900.)
- Geology of Harrison and Monona counties. B. Shimek. (Iowa Geol. Surv., XX, 271-483, 1910.)
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- Geology of Jasper county. I. A. Williams. (Iowa Geol. Surv., XV, 277-367, 1905.)
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- Geology of Keokuk county. H. F. Bain. (Iowa Geol. Surv., IV, 255-311, 1895.)
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- Geology of Madison county. J. L. Tilton and H. F. Bain. (Iowa Geol. Surv., VII, 489-539, 1897.)
- Geology of Mahaska county. H. F. Bain. (Iowa Geol. Surv., IV, 313-380, 1895.)
- Geology of Marshall county. S. W. Beyer. (Iowa Geol. Surv., VII, 197-262, 1897.)

- Geology of Mitchell county. S. Calvin. (Iowa Geol. Surv., XIII, 293-362, 1903.)
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- Geology of Pottawattamie county. J. A. Udden. (Iowa Geol. Surv., XI, 199-277, 1902.)
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- Occurrence in Iowa. C. A. White. (Geology of Iowa, II, 329-330, 1870.)
- Work and scope of the geological survey. C. R. Keyes. (Iowa Geol. Surv., III, 47-98, 1894.)
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- Rockford Shales.** (*See Lime Creek Shales.*)
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Preglacial elevation of Iowa. H. F. Bain. (Proc. Iowa Acad. Sci., II, 23-26, 1895.)

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Upper-silurian in northeastern Iowa. A. G. Wilson. (American Geologist, XVI, 275-281, 1895.)

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Mineral production in Iowa in 1904. S. W. Beyer. (Iowa Geol. Surv., XV, 15-32, 1905.)  
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- Geology of Butler county. M. F. Arey. (Iowa Geol. Surv., XX, 1-59, 1910.)
- Geology of Cedar county. W. H. Norton. (Iowa Geol. Surv., XI, 279-396, 1901.)
- Geology of Clay and O'Brien counties. T. H. Macbride. (Iowa Geol. Surv., XI, 461-508, 1901.)
- Geology of Clinton county. J. A. Udden. (Iowa Geol. Surv., XV, 369-431, 1905.)
- Geology of Des Moines county. C. R. Keyes. (Iowa Geol. Surv., III, 409-492, 1894.)
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- Geology of Story county. S. W. Beyer. (Iowa Geol. Surv., IX, 155-245, 1899.)
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- Occurrences in Iowa. C. A. White. (Geology of Iowa, II, 322-323, 1870.)

**Sangamon Interval.**

Buchanan gravels, an interglacial deposit in Buchanan county, Iowa. S. Calvin. (Proc. Iowa Acad. Sci., III, 58-60, 1896.)

Buchanan gravels; an interglacial deposit in Buchanan county. S. Calvin. (American Geologist, XVII, 76-78, 1896.)

Geology of Cerro Gordo county. S. Calvin. (Iowa Geol. Surv., VII, 117-195, 1897.)

Geology of Louisa county. J. A. Udden. (Iowa Geol. Surv., XI, 53-126, 1901.)

Geology of Muscatine county. J. A. Udden. (Iowa Geol. Surv., IX, 247-380, 1899.)

Geology of Scott county. W. H. Norton. (Iowa Geol. Surv., IX, 389-519, 1899.)

Interglacial deposits of northeastern Iowa. S. Calvin. (Proc. Iowa Acad. Sci., V, 64-70, 1898.)

Mississippi valley between Savanna and Davenport. J. E. Carman. (Bull. Illinois Geol. Surv., No. 13, 96 pp., 1909.)

Present phase of pleistocene problems in Iowa. S. Calvin. (Bull. Geol. Soc. America, XX, 133-152, 1909.)

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

Synopsis of drift deposits of Iowa. S. Calvin. (American Geologist, XIX, 270-272, 1897.)

Weathered zone (Yarmouth) between Illinoian and Kansan till-sheets. Frank Leverett. (Journal of Geology, VI, 238-243, 1898.)

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- Sanitary analyses** of some Iowa deep-well waters. J. B. Weems. (*Proc. Iowa Acad. Sci.*, IX, 63-70, 1902.)
- Sardeson, Frederick W.** Carboniferous Formations of Humboldt, Iowa. (*American Geologist*, Vol. XXX, pp. 300-312, Minneapolis, 1910.) Redescription is made of several fossils occurring in the Kinderhook oolite.
- Sardeson, Frederick W.** Galena Series. (*Bull. Geol. Soc. America*, Vol. XVIII, pp. 179-194, New York, 1907.) This is a review and a discussion of the nomenclature and subdivision of the Ordovician section in Iowa, Minnesota and Wisconsin.
- Sardeson, Frederick W.** Remarks on Loess. (*Proc. Iowa Acad. Sci.*, Vol. V, pp. 11-12, Des Moines, 1898.) Desirability of more exact terminology is pointed out.
- Sardeson, Frederick W.**, and C. W. Hall. Magnesian series of Northwestern States. (*Bull. Geol. Soc. America*, Vol. VI, pp. 167-198, Rochester, 1895.) In describing the lithologic and faunal features of the sequence numerous references are made to Iowa localities.
- Sardeson, Frederick W.**, C. W. Hall and. Paleozoic Formations of Southeastern Minnesota. (*Bull. Geol. Soc. America*, Vol. III, pp. 331-368, 1892.) See C. W. Hall and F. W. Sardeson, 1892.)
- Satin-spar** from Dubuque. A. G. Leonard. (*Proc. Iowa Acad. Sci.*, I, pt. iv, 52-55, 1894.)
- Savage, T. E.** Buried Peat-bed in Dodge Township, Union County, Iowa. (*Proc. Iowa Acad. Sci.*, Vol. XI, pp. 103-109, Des Moines, 1904.) A bed, 6 feet thick, in which many plant remains are identified, is described, and regarded as of Aftonian age.
- Savage, T. E.** Drift Exposures in Tama County. (*Proc. Iowa Acad. Sci.*, Vol. VIII, pp. 275-278, Des Moines, 1901.) Two till-sheets are described.

**Savage, T. E.** Geology of Benton County. (Iowa Geol. Surv., Vol. XV, pp. 125-225, Des Moines, 1905.) The following features are described in detail:

Introduction, location and area, earlier geological work. Physiography, topography, the Iowan-Kansan border, the Kansan area, the Iowan area, altitudes, drainage.

Geological formations, general relations of strata, table of formations; Middle Devonian series, Wapsipinicon stage, Coggan beds, Fayette breccia, Cedar Valley stage, general section of the Cedar Valley; Mississippian series, Kinderhook stage; Pleistocene system, Pre-Kansan stage, Kansan stage, Buchanan gravels, Iowan stage, loess; Post-Glacial deposits, alluvium, cumulose deposits, eolian deposits; soils; unconformities; deformations.

Economic products, building-stones, limes, road materials, sands, clays, copper, water-supplies.

**Savage, T. E.** Geology of Fayette County. (Iowa Geol. Surv., Vol. XV, pp. 433-546, Des Moines, 1905.) The consideration of the following topics is included:

Introduction, location and area, earlier geological work.

Physiography, topography, Iowan-Kansan border, area of Iowan drift, area of Kansan drift, table of altitudes, drainage.

Stratigraphy, general relations of strata, table of formations; Ordovician system, Galena-Trenton stage, Maquoketa stage, typical exposures, lower Maquoketa division, upper Maquoketa division, general section of the Maquoketa shales; Niagara series, Delaware stage; Devonian system, Wapsipinicon stage, Cedar Valley stage; residual materials; Pleistocene system, pre-Kansan stage, Aftonian stage, Kansan stage, Buchanan gravels; Iowan stage, Iowan loess, Iowan gravels; deformations and unconformities; soils.

Economic products, building-stones, limes, clays, sand, road-materials, cement materials; water-supplies; water-powers; lead, copper, gold.

**Savage, T. E.** Geology of Henry County. (Iowa Geol. Surv., Vol. XII, pp. 237-302, Des Moines, 1902.) The following features are described:

Introduction, location and area, earlier geological work.

Physiography, topography, table of elevations, drainage.

Stratigraphy, general relations of strata; Carboniferous system, Mississippian series, Keokuk limestone, Saint Louis limestone, Pennsylvanian series; Pleistocene system, Kansan drift, Buchanan gravels, Illinoian drift, loess, alluvium; deformations; unconformities.

Economic products, soils, coal, building-stones, limes, sands, clays, water-supplies.

**Savage, T. E.** Geology of Jackson county. (Iowa Geol. Surv., Vol. XVI, pp. 563-648, Des Moines, 1906.) The following topics are considered:

Introduction, location and area, earlier geological work.

Physiography, topography, alluvial areas, terraces, altitudes, drainage, Maquoketa river, Goose Lake channel, North Fork of Maquoketa river, South Fork of Maquoketa river, Lytle creek, Farmer creek, Bear creek, Prairie creek, Deep creek, Brush creek, Morts creek, Mill creek, other streams.

Stratigraphy, general relations of strata, table of formations; Ordovician system, Galena stage, typical exposures, Maquoketa stage, distribution, typical exposures, summary; Silurian system, Niagara series, Hopkinton stage, Gower stage; Devonian system; Carboniferous system, Pennsylvanian series, Des Moines stage, residual materials; Pleistocene system, Kansan stage, Kansan drift, Iowan stage, Iowan drift area, loess, distribution, post-glacial deposits, alluvium, eolian deposits; soils, loess soils, sandy soils, alluvial soil, residual soil; deformations; unconformities.

Economic products, soils, building-stones, Galena limestone, Maquoketa beds, Hopkinton stage, Gower stage, Des Moines sandstone, limes, sands, clays, Preston plant, Maquoketa plant, water-supplies.

**Savage, T. E.** Geology of Tama County. (Iowa Geol. Surv., Vol. XIII, pp. 185-253, Des Moines, 1903.) The following topics are considered in detail:

Introduction, location and area, earlier geological work.

Physiography, topography, general description, Iowan drift-plain, Kansan drift areas, flood-plains, elevations, drainage, Iowa river, Wolf creek, Deer creek, Salt creek, Richland creek, history of drainage.

Stratigraphy, general relations of strata; Devonian system, Cedar Valley limestone, Kinderhook stage, typical exposures; Des Moines stage; Pleistocene system; pre-Kansan drift, Kansan drift, Iowan drift, loess, postglacial deposits; unconformities; preglacial surface; soils.

Economic products, building stones, limes, sands, clays, water-supplies.

**Savage, T. E.** Preliminary Report on Peat Resources of Iowa. (Iowa Geol. Surv., Bull. No. 2, pp. 5-21, Des Moines, 1905.)

**Savage, T. E.** Report of Assistant State Geologist. (Iowa Geol. Surv., Vol. XV, pp. 12-14, Des Moines, 1905.) Brief statement is made of the personal work of the year.

**Savage, T. E.** Report of Assistant State Geologist. (Iowa Geol. Surv., Vol. XVI, pp. 13-15, Des Moines, 1906.) Personal work of the year is reviewed.

**Savage, T. E.** Report on Tests of Iowa Coals made at Government coal-testing Plant at Louisiana Purchase Exposition, St. Louis, Mo., 1904. Iowa Geol. Surv., Bull. No. 2, pp. 22-38, Des Moines, 1905.)

**Savage, T. E.** Toledo Lobe of Iowan Drift. (Proc. Iowa. Acad. Sci., Vol. X, pp. 123-129, Des Moines, 1903.) A long local extension of the drift-sheet is described.

#### **Saverton Shales.**

Geology of Des Moines county. C. R. Keyes. (Iowa Geol. Surv., III, 409-492, 1894.)

Geology of Louisa county. J. A. Udden. (Iowa Geol. Surv., XI, 53-126, 1901.)

- Marked unconformity between carboniferous and devonian strata in upper Mississippi valley. C. R. Keyes. (Am. Jour. Sci., (4), XXXVI, 160-164, 1913.)
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- Section** of carboniferous, note on correlation of Clarinda well-section. C. R. Keyes. (Iowa Geol. Surv., XI, 461-463, 1901.)
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- Section** of Iowa, sundry provincial and local phases of the general geological. C. R. Keyes. (Proc. Iowa Acad. Sci., XIX, 147-151, 1912.)
- Section** of southwestern Iowa, carboniferous. G. L. Smith. (Iowa Geol. Surv., XIX, 605-657, 1909.)
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- Accretion of floodplains by means of sand-bars. H. Simpson. (Proc. Iowa Acad. Sci., X, 54-56, 1903.)
  - Degradation of loess. J. E. Todd. (Proc. Iowa Acad. Sci., V, 46-51, 1898.)
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**Selection** of power-plants and equipment for stone-quarries in Iowa. G. W. Bissell. (Iowa Geol. Surv., XVII, 151-183, 1907.)

#### **Selenite.**

Certain minerals of Webster county, Iowa. A. C. Spencer. (Proc. Iowa Acad. Sci., II, 143-145, 1895.)

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

Geology of Muscatine county. J. A. Udden. (Iowa Geol. Surv., IX, 247-380, 1899.)

Geology of Van Buren county. C. H. Gordon. (Iowa Geol. Surv., IV, 197-254, 1895.)

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Lead and zinc deposits of Iowa. A. G. Leonard. (Iowa Geol. Surv., VI, 9-66, 1897.)

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Additional evidence of unconformity between Cedar Valley and Lime Creek stages of devonian of Iowa. (Science, N. S., XXXVI, 569-570, 1912.)

Analyses of lime. J. D. Whitney. (Geology of Iowa, 370-376, 1858.)

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- Description of new species of fossils. F. B. Meek and A. H. Worthen. (Geol. Surv. Illinois, III, 289-565, 1868.)
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- Dipterus in American middle devonian. J. A. Udden. (Journal of Geology, VII, 494-495, 1899.)
- General description. C. A. White. (Geology of Iowa, I, 184-188, 1870.)
- General description of characters. James Hall. (Geology of Iowa, I, 85-88, 1858.)
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- Geology of Linn county. W. H. Norton. (Iowa Geol. Surv., IV, 121-194, 1895.)
- Geology of Mitchell county. S. Calvin. (Iowa Geol. Surv., XIII, 293-352, 1903.)
- Geology of Muscatine county. J. A. Udden. (Iowa Geol. Surv., IX, 247-380, 1899.)
- Geology of Scott county. A. S. Tiffany. (Geology Scott County, etc., 19-26, 1885.)
- Geology of Scott county. W. H. Norton. (Iowa Geol. Surv., IX, 389-519, 1899.)
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- New crinoids from Scott county. F. B. Meek and A. H. Worthen. (Proc. Acad. Nat. Sci. Philadelphia, XVII, 138-143, 1865.)

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Paleontology of New York. James Hall. (Nat. Hist. New York, Paleontology, IV, 422 pp., 1867.) A number of references are made to fossils occurring in Iowa.

Preliminary notice of Newberria. J. Hall. (Tenth Ann. Rep. State Geologist of New York, 91-102, 1891.) Species from Iowa are noted.

Relation of Lime Creek shales to Cedar Valley limestone of Floyd county, Iowa. A. O. Thomas. (Science, N. S., XXXVII, 459, 1913.)

Stereocrinus, Barris. W. H. Barris. (Proc. Davenport Acad. Sci., IV, 102-104, 1885.)

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

Two new species. C. R. Keyes. (Proc. Acad. Nat. Sci. Philadelphia, 247-248, 1888.)

Two unique spirifers from devonian of Iowa. S. Calvin. (Bull. Lab. Nat. Hist., State Univ. Iowa, II, 165-167, 1893.)

### **Sergeant Shales.**

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Description of Elk Point quadrangle. J. E. Todd. (U. S. Geol. Surv., Folio 156, 8 pp., 1908.)

Relation of cretaceous deposits of Iowa to subdivisions of cretaceous by Meek and Hayden. S. Calvin. (Proc. Iowa Acad. Sci., I, pt. iii, 7-12, 1893.)

- Sundry provincial and local phases of general geologic section of Iowa. C. R. Keyes. (Proc. Iowa Acad. Sci., XIX, 147-151, 1912.)
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- Artesian wells of Iowa. W. H. Norton. (Iowa Geol. Surv., VI, 113-428, 1897.)
- Geological formations of Iowa. C. R. Keyes. (Iowa Geol. Surv., I, 23, 1893.)
- Geology of Allamakee county. S. Calvin. (Iowa Geol. Surv., IV, 35-111, 1895.)
- Geology of Clayton county. A. G. Leonard. (Iowa Geol. Surv., XVI, 213-317, 1906.)
- Geology of quarry products. S. W. Beyer and I. A. Williams. (Iowa Geol. Surv., XVII, 189-588, 1907.)
- Geology of Winneshiek county. S. Calvin. (Iowa Geol. Surv., XVI, 37-146, 1906.)
- Magnesian series of northwestern states. C. W. Hall and F. W. Sardeson. (Bull. Geol. Soc. America, VI, 167-198, 1895.)
- Sundry provincial and local phases of general geologic section of Iowa. C. R. Keyes. (Proc. Iowa Acad. Sci., XIX, 147-151, 1912.)
- Shelby County.**
- Coal deposits of Iowa. C. R. Keyes. (Iowa Geol. Surv., II, 536 pp., 1894.)
- General description. O. H. St. John. (Geology of Iowa, II, 171-174, 1870.)
- 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.)

**Sheppard, Charles Upham.** Fall of Meteoric Stones in Iowa. (Am. Jour. Sci., (2), Vol. IV, pp. 288-289, New Haven, 1847.) Description is given of the fragments which fell in Linn county, February 25, 1847.

**Sheppard, Charles Upham.** Report on Meteorites. (Am. Jour. Sci., (2), Vol. VI, pp. 402-417, New Haven, 1848.) Additional notes are given on the Linn county fall, with chemical analyses and observations.

**Shimek, B.** Additional Observations on Surface Deposits in Iowa. Proc. Iowa Acad. Sci., Vol. IV, pp. 68-72, Des Moines, 1897.) The results of shallow borings in the northern part of the state are noted, and the relations of plants to the soils are considered.

**Shimek, B.** Aftonian Sands and Gravels in Western Iowa. (Science, N. S., Vol. XXVIII, p. 923, New York, 1908.) Preliminary announcement of the westward extension of the deposits is made.

**Shimek, B.** Aftonian Sands and Gravels in Western Iowa. (Bull. Geol. Soc. America, Vol. XX, pp. 399-408, New York, 1909.) Announcement of pre-Kansan deposits is made as occurring at numerous localities along the Missouri river.

**Shimek, B.** Distribution of Loess Fossils. (Proc. Iowa Acad. Sci., Vol. VI, pp. 98-113, Des Moines, 1899.) Comparison is made of the molluscan forms of the loess and those occupying the uplands of the region at the present time and the two are thought to be identical.

**Shimek, B.** Distribution of Loess Fossils. (Journal of Geology, Vol. VII, pp. 122-140, Chicago, 1899.) The subject of geographic range is discussed and a list of species collected at Council Bluffs is given.

**Shimek, B.** Eolian Origin of Loess. (Science, N. S., Vol. XXXIII, p. 467, New York, 1911.) Abstract.

**Shimek, B.** Evidence that Fossiliferous Gravels and Sands of Iowa and Nebraska are Aftonian. (Bull. Geol. Soc. America, Vol. XXI, pp. 119-140, New York, 1910.) A number of sections are described in detail and lists of molluscan and mammalian remains found in each are given. The conclusion is that the beds are distinctly of Aftonian age. A mild climate is postulated.

**Shimek, B.** Geology of Harrison and Monona Counties. (Iowa Geol. Surv., Vol. XX, pp. 271-483, Des Moines, 1910.) The following topics are noted:

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

Stratigraphy, synoptical table, Carboniferous system, Pennsylvanian series, Missouri stage, fossils, coal, Quaternary system, Pleistocene series, Nebraskan stage, Aftonian interglacial stage, structure and composition, organic remains, mammalian fauna, Aftonian horses, other ungulates, proboscideans, elephants, mastodon, other proboscideans, edentata, mylodon, megalonyx, correlation, molluscan fauna, significance of Aftonian fauna, fossiliferous sections, sections in which no fossils are found, Snyder's Hollow section, Kansan stage, Loveland loess, bluish loess (post-Kansan), yellow loess, loess fossils, table of fossils and modern mollusca, terrestrial species, fresh-water species, genesis of the loess, recent series, alluvium, the bison in Iowa, sand dunes, mounds.

Economic products, soils and their products, building stones, clays, sand and gravel, road-materials, water-supply, water-powers and drainage ditches.

Meteorological record.

Botanical report: the prairies, types of prairies, the prairie flora, plants of dry prairies, plants of upland woods, plants of alluvial groves, plants of low grounds, marshes, etc., exposure to evaporation, evaporation,

rate of evaporation, contributing causes of prairies, tree-planting, plants in the Whiting grove, weeds, list of weeds and introduced plants.

- Shimek, B.** Genesis of Loess a Problem in Plant Ecology. (Proc. Iowa Acad. Sci., Vol. XV, pp. 57-64, Des Moines, 1908.) Relations of the plants to the formation of the loess are set forth. Incidentally the eolic hypothesis is strengthened.
- Shimek, B.** Is the Loess of Aqueous Origin? (Proc. Iowa Acad. Sci., Vol. V, pp. 32-45, Des Moines, 1898.) The habitat relations of the molluscan forms found in the loess are discussed. It seems evident that the loess materials originated largely or wholly in drift.
- Shimek, B.** Living Plants as Geological Factors. (Proc. Iowa Acad. Sci., Vol. X, pp. 41-48, Des Moines, 1903.) The constructive work of plants is considered, with special reference to the accumulation of the fine soils along the Missouri river. The origin of the loess is ascribed to the wind.
- Shimek, B.** Loess and its Fossils. (Bull. Lab. Nat. Hist., State Univ. Iowa, Vol. I, pp. 200-214, Iowa City, 1890.) An annotated catalogue of the species of mollusks found in the loess of Iowa is presented.
- Shimek, B.** Loess and its Fossils. (Bull. Lab. Nat. Hist., State Univ. Iowa, Vol. II, pp. 89-98, Iowa City, 1890.) Additional notes are given on fossils found in the formation, with a general discussion of the climatic conditions during the deposition of the loess.
- Shimek, B.** Loess of Iowa City and Vicinity. (American Geologist, Vol. XXVIII, pp. 344-358, Minneapolis, 1901.) There is an annotated list of the loess fossils and of the allied forms now living in the locality. The living aquatic species are shown to be of rare occurrence in the loess.
- Shimek, B.** Loess of Iowa City and Vicinity. (Bull. Lab. Nat. Hist., Iowa State Univ., Vol. V, pp. 195-212, Iowa City, 1901.) The living and fossil species of the region are compared.

- Shimek, B.** Loess of Missouri River. (Proc. Iowa Acad. Sci., Vol. XIV, pp. 237-251, Des Moines, 1907.) No obstacle has presented itself more persistently in the way of those who have attempted to explain the formation of loess deposits by aqueous or glacial agencies than the presence of remains of strictly terrestrial mollusks in the deposits. The evidence of the fossils is discussed at some length.
- Shimek, B.** Loess of Paha and River Ridges. (Proc. Iowa Acad. Sci., Vol. XV, pp. 117-124, Des Moines, 1908.) Objections to the eolic hypothesis are answered.
- Shimek, B.** Loesses of Mississippi Valley. (Science, N. S., Vol. XXVII, p. 731, New York, 1908.) Evidence is presented to effect that a loess mantle followed the deposition of each drift-sheet.
- Shimek, B.** Nebraskan Drift. (Science, N. S., Vol. XXXIV, p. 28, New York, 1911.) Abstract.
- Shimek, B.** Notes on Fossils of Loess at Iowa City. (American Geologist, Vol. I, pp. 149-152, Minneapolis, 1888.) Brief notes are given on various species of gasteropods found in the formation.
- Shimek, B.** Pleistocene of Missouri Valley. (Science, N. S., Vol. XXXI, pp. 75-76, New York, 1910.) The glacial deposits near Council Bluffs are differentiated and briefly characterized. Loveland and Nebraskan are new names proposed for certain glacial deposits.
- Shimek, B.** Pleistocene of Vicinity of Omaha, Nebraska, and Council Bluffs, Iowa. (Bull. Geol. Soc. America, Vol. XXII, p. 730, New York, 1911.) Abstract.
- Shimek, B.** Pleistocene in Vicinity of Sioux Falls, South Dakota. (Bull. Geol. Soc. America, Vol. XXII, p. 730, New York, 1911.) Abstract.
- Shimek, B.** Pleistocene of Sioux Falls, South Dakota, and vicinity. (Bull. Geol. Soc. America, Vol. XXIII, pp. 125-154, New York, 1912.)
- Shimek, B.** Pleistocene of Portion of Missouri Valley. (Science, N. S., Vol. XXXIII, p. 467, New York, 1911.) Abstract.

- Shimek, B.** Prairies. (Bull. Iowa State Univ., Lab. Nat. Hist., Vol. VI, pp. 169-240, Iowa City, 1911.)
- Shimek, B.** Significance of Pleistocene Mollusks. (Science, N. S., Vol. XXXVII, pp. 501-509, New York, 1913.) The importance of recognizing the habitats of living species is emphasized in judging the occurrence of the fossil forms.
- Shimek, B.** Theory of the Loess. (Proc. Iowa Acad. Sci., Vol. III, pp. 82-89, Des Moines, 1896.) A modification of the author's formerly expressed views of the aqueous origin of the loess is explained. An eolian genesis of the loess is briefly described in its general features, although no actual data are given.
- Shimek, B.** Variation in Succinidæ of the Loess. (Proc. Iowa Acad. Sci., Vol. I, pt. iv, p. 111, Des Moines, 1894.) The three recognized species are reported as coming from the same stock in glacial time.
- Shumard, B. F.** Catalogue Paleozoic Fossils of North America. (Trans. Acad. Sci., St. Louis, Vol. II, pp. 334-407, St. Louis, 1866.) A large number of echinoderms from Iowa rocks are noted.
- Shumard, B. F.** Description of New Fossil Crinoidæ from Paleozoic Rocks of Western and Southern Portions of United States. (Trans. Acad. Sci., St. Louis, Vol. I, pp. 71-80, St. Louis, 1858.) *Actinocrinus multiradiatus* is described as new, and Iowa is given as one of the localities.
- Shumard, B. F.** Description of New Species of Blastoidea from Paleozoic Rocks of Western States, with some Observations on Structure of Summit of Genus Pentremites. (Trans. Acad. Sci., St. Louis, Vol. I, pp. 238-248, St. Louis, 1858.) In the table of species on pages 245-247 a number of species are noted from Iowa.
- Shumard, B. F.** D. D. Owen and. Description of One New Genus and Twenty-two New Species of Crinoidea from Subcarboniferous Limestone of Iowa. (Rep. Geol. Sur.

Wis., Iowa and Minn., App., Art. ii, pp. 587-598, with plates, Philadelphia, 1852.) See D. D. Owen and B. F. Shumard, 1852.

**Shumard, B. F.**, D. D. Owen and. Number and Distribution of Fossil Species in Paleozoic Rocks of Iowa, Wisconsin and Minnesota. (Proc. American Assoc. Adv. Sci., Vol. V, p. 235, 1851.) See D. D. Owen and B. F. Shumard, 1851.

**Siderite.**

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

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- Stone-quarries** in Iowa, selection of power-plants and equipment. G. W. Bissell. (Iowa Geol. Surv., XVII, 151-183, 1907.)
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Stratigraphy, table of formations, Devonian system, Cedar Valley stage; Carboniferous, system, Mississippian series, Kinderhook stage, Osage and St. Louis stages, Pennsylvanian series, Des Moines stage, Quaternary system, Pleistocene series, Nebraskan stage, Aftonian interglacial stage, Kansan stage, Iowan stage; loess; Recent series, alluvium; Preglacial surface.

Economic products, soils, water-supplies, limes, building-stones, clay-products, coal, meteorites.

Flora of Iowa county.

**Stookey, S. W.** Geology of Poweshiek County. (Iowa Geol. Surv., Vol. XX, pp. 237-269, Des Moines, 1910.) The following topics are discussed:

Introduction, location and area, history, previous geological work.

Physiography, topography, table of elevations, drainage.

Stratigraphy, table of formations; Carboniferous system, Mississippian series, Kinderhook stage, Saint Louis stage, Pennsylvanian series, Des Moines stage; Quaternary system, Pleistocene series, Nebraskan stage, Kansan stage, loess, recent series, alluvium.

Soils, drift soils, loess soils, alluvial soils.

Economic products, coal, clay products, water-supplies, analyses, record of strata.

#### **Story County.**

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

Buried loess in Story county. S. W. Beyer. (Proc. Iowa Acad. Sci., VI, 117-121, 1899.)

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Coal deposits of Iowa. H. Hinds. (Iowa Geol. Surv., XIX, 21-396, 1909.)

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Geology of clays. S. W. Beyer and I. A. Williams. (Iowa Geol. Surv., XIV, 377-552, 1904.)

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- Geology of Story county. S. W. Beyer. (Iowa Geol. Surv., IX, 155-245, 1899.)
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- Relations of Wisconsin and Kansan drift-sheets in central Iowa and related phenomena. H. F. Bain. (Iowa Geol. Surv., VI, 429-476, 1897.)
- Sanitary analyses of some Iowa deep-well waters. J. B. Weems. (Proc. Iowa Acad. Sci., IX, 63-70, 1902.)
- Tests of clay products. A. Marston. (Iowa Geol. Surv., XIV, 555-620, 1904.)
- 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.)
- Story county**, buried loess. S. W. Beyer. (Proc. Iowa Acad. Sci., VI, 117-121, 1899.)
- Story county**, geology. S. W. Beyer. (Iowa Geol. Surv., IX, 155-245, 1899.)
- Stratification**, of Postville well, apparent anomalies. S. Calvin. (American Geologist, XVII, 195-203, 1896.)
- Stratigraphic** relations in southeastern Iowa, Salem Limestone. F. M. Van Tuyl. (Proc. Iowa Acad. Sci., XIX, 167-168, 1912.)
- Stratigraphic** relations in southeastern Iowa, Salem limestone. F. M. Van Tuyl. (Science, N. S., XXXVI, 569, 1912.)
- Stratigraphical** location of named trans-Mississippian coals. C. R. Keyes. (Eng. and Mining Jour., LXXII, 198, 1901.)
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- Stratigraphical**, probable, equivalents of coal-measures of Arkansas. C. R. Keyes. (Journal of Geology, VI, 356-365, 1898.)

**Stratigraphy.**

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- Structure of Mystic coal-basin. H. F. Bain. (Proc. Iowa Acad. Sci., I, pt. iv, 33-36, 1894.)
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- Surface** deposits in Iowa, additional observations. B. Shimek. (Proc. Iowa Acad. Sci., IV, 68-72, 1897.)
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- Sweetland Creek** beds. J. A. Udden. (Journal of Geology, VII, 65-78, 1899.)
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- Synopsis** of American paleozoic echinoids. C. R. Keyes. (Proc. Iowa Acad. Sci., II, 178-194, 1895.)
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**Table** of bearings of glacial striæ in Iowa, glaciated rock-surfaces near Linn and near Quarry, Iowa. W. H. Norton. (Proc. Iowa Acad. Sci., XVIII, 70-83, 1911.)

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  - Geology of Lyon and Sioux counties. F. A. Wilder. (Iowa Geol. Surv., X, 85-184, 1900.)
  - Geology of Plymouth county. H. F. Bain. (Iowa Geol. Surv., VIII, 315-366, 1898.)
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- Thomas, A. O.** Fossil Burrowing-sponges from Iowa Devonian. (Bull. Iowa State Univ., Lab. Nat. Hist., Vol. VI, pp. 165-166, Iowa City, 1911.)
- Thomas, A. O.** Relation of Lime Creek Shales to Cedar Valley Limestone of Floyd County, Iowa. (Science, N. S., Vol. XXXVII, p. 459, New York, 1913.) A marked unconformity is shown to exist at the base of the shales.
- Thomas, A. O.** Some Notes on Aftonian Mammals. (Science, N. S., XXXVI, p. 570, New York, 1912.) New finds are recorded.
- Thomas, A. O.** [Underground Waters of] Johnson County. (Iowa Geol. Surv., Vol. XXI, pp. 504-514, Des Moines, 1912.) The features of the water-supply of the area are fully noted.
- Thomas, A. O.** [Underground Waters of Johnson County.] (U. S. Geol. Surv., Water Supply Paper No 293, pp. 419-427, Washington, 1912.)
- Till**, interglacial, near Sioux City, Iowa. J. E. Todd and H. F. Bain. (Proc. Iowa Acad. Sci., II, 20-23, 1895.)
- Tilton, John L.** First Reported Petrified American Lepidostrobus is from Warren County, Iowa. (Proc. Iowa Acad. Sci., Vol. XIX, pp. 163-165, Des Moines, 1912.) The cones are described and the circumstances under which they were found are detailed.

- Tilton, John L.** First Reported *Lepidostrobus* is from Warren county, Iowa. *Science*, N. S., Vol. XXXVI, pp. 569, New York, 1912.) Abstract.
- Tilton, John L.** Geological Section along Middle River in Central Iowa. (*Iowa Geol. Surv.*, Vol. III, pp. 135-146, Des Moines, 1895.) The detailed geological cross section displays almost the complete sequence of the Des Moines series. At short intervals the local successions are noted, together with the thicknesses of the several strata.
- Tilton, John L.** Geology of Warren County. (*Iowa Geol. Surv.*, Vol. V, pp. 301-359, Des Moines, 1896.) The following aspects of the subject are treated in detail:
- Physiography, descriptive physiography, general relations, drainage of region, streams of Warren county, general character of streams, escarpment-makers, escarpments, skyline, dip, explanation of physiography, immensity of erosion, table of elevations.
  - Geological formations, Pleistocene, alluvium, loess, drift; Carboniferous, general description, relations to underlying strata, conditions of deposition, relations to overlying strata, classification of formations, detailed cross-sections, South river, Whitebreast creek, Middle river, North river, southeast to northwest.
  - Economic products, coal, coal-horizons, lower group, upper group, intermediate horizons, statistics of coal production; water-supplies, rainfall, wells, surface wells, deep-wells; oil and gas; minerals; building-stones, clay-deposits, clay-working plants, pottery, brick, tiling, soil.
- In this report the explanation of the present physiography of the whole state is especially discussed.
- Tilton, John L.** Origin of Present Drainage System of Warren County. (*Proc. Iowa Acad. Sci.*, Vol. I, pt. iv, pp. 31-33, Des Moines, 1894.) Present river valleys are larger troughs than present streams require. The valleys are preglacial in origin. The bed-rock surface is very uneven.

- Tilton, John L.** Pleistocene Deposits in Warren County, Iowa. (Pamphlet, 43 pp., University of Chicago Press, Chicago, 1911.)
- Tilton, John L.** Pleistocene Record of Simpson College Well. (Proc. Iowa Acad. Sci., Vol. XVII, pp. 159-164, Des Moines, 1910.) The various formations passed through are discussed in detail.
- Tilton, John L.** Problems in Municipal Water-works for small City. (Proc. Iowa Acad. Sci., Vol. XII, pp. 143-150, Des Moines, 1905.) The various plans are compared and the climatic conditions discussed. Special reference is made to Indianola.
- Tilton, John L.** Results of Recent Geological Work in Madison County. (Proc. Iowa Acad. Sci., Vol. IV, pp. 47-54, Des Moines, 1897.) The geologic features of the district are outlined and some of the salient points described.
- Tilton, J. L.** Strata Between Ford and Winterset. (Proc. Iowa Acad. Sci., Vol. I, pt. iii, pp. 26-27, Des Moines, 1893.) The section along Middle river in Madison and Warren counties is described.
- Tilton, John L.** [Underground Waters of] Warren County. (Iowa Geol. Surv., Vol. XXI, pp. 999-1004, Des Moines, 1912.) The water-supplies of the area are fully described.
- Tilton, John L.** Underground Waters of Warren County. (U. S. Geol. Surv., Water Supply Paper No. 293, pp. 815-818, Washington, 1912.)
- Tilton, John L., and H. F. Bain.** 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, Missouri 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 Springs; Winterset district, Peru district, St. Charles-Truro district; road materials, limes, clays, water-supplies, water-powers, coal.

- Times** of formation of lead and zinc deposits of Mississippi valley. C. R. Keyes. (Trans. American Inst. Mining Eng. XXXI, 603-611, 1901.)
- Time-values** of provincial carboniferous terranes. C. R. Keyes. (Am. Jour. Sci., (4), XII, 305-309, 1901.)
- Todd, J. E.** Description of Elk Point Quadrangle, South Dakota-Nebraska-Iowa. (U. S. Geol. Surv., Folio 156, 8 pp., Washington, 1908.) Incidental reference is made to the strata in the extreme western edge of Plymouth county.
- Todd, J. E.** Annual Deposits of Missouri River During Post-Pliocene. (Proc. American Assoc. Adv. Sci., Vol. XXVI, pp. 287-291, Salem, 1877.)
- Todd, J. E.** Charcoal Streak in Loess. (Proc. Iowa Acad. Sci., 1875-1880, p. 21, Iowa City, 1880.) Abstract is given of a paper read before the Iowa Academy of Sciences, June 24, 1880.
- Todd, J. E.** Evidence that Lake Cheyenne Continued till Ice Age. (Proc. American Assoc. Adv. Sci., Vol. XXXVII, pp. 202-203, Salem, 1889.) Evidence is brought forth to show that western Iowa and eastern Nebraska were occupied by a fresh-water lake before the deposition of the drift. Claw of *Megalonyx* is reported from Mills county.
- Todd, J. E.** Folding of Carboniferous Strata in Southwestern Iowa. (Proc. Iowa Acad. Sci., Vol. I, pt. i, p. 58, Des Moines, 1890.) Abstract is given of a paper read before the Academy, with a general section of the Upper Carboniferous rocks in southwestern Iowa.

- Todd, J. E.** Geology and Soils. (Proc. Iowa Hort. Soc., Vol. XVI, pp. 208-213, Des Moines, 1881.) The dependence of soil on the underlying rocks is described.
- Todd, J. E.** History of Drift Deposits of Iowa. (Proc. Iowa Hort. Soc., Vol. XVIII, pp. 316-327, Des Moines, 1883.) The different kinds of drift-soil are distinguished and their origins described.
- Todd, J. E.** Inequalities in Old Paleozoic Sea-bottom. (American Geologist, Vol. XV, p. 64, Minneapolis, 1895.) The depths at which the crystalline basement is encountered in various parts of Iowa are given.
- Todd, J. E.** Loess and its Soils. (Proc. Iowa Hort. Soc., Vol. XVII, pp. 263-270, Des Moines, 1882.) A popular discussion of the properties of the bluff soil is given.
- Todd, J. E.** More light on Origin of Missouri River Loess. (Proc. Iowa Acad. Sci., Vol. XIII, pp. 187-194, Des Moines, 1906.) The mass of loess is attributed to aqueous deposition; considerable portions will prove to be the work of wind.
- Todd, J. E.** New Light on Drift in South Dakota. (Proc. Iowa Acad. Sci., Vol. VI, pp. 122-130, Des Moines, 1899.) Incidental references are made to the glacial geology of northwestern part of the state.
- Todd, J. E.** Notes on Distribution of Timber in Southwestern Iowa, with Inferences Concerning Origin of Prairies. (American Naturalist, Vol. XII, pp. 91-96, Philadelphia, 1878.) Facts in southwestern Iowa are examined in the light of the different theories concerning the origin of the prairies.
- Todd, J. E.** Recent Alluvial Changes in Southwestern Iowa. (Proc. Iowa Acad. Sci., Vol. XIV, pp. 257-266, Des Moines, 1907.) Details are described of the alluvial fillings in Fremont county.
- Todd, J. E.** Recent Wind-action upon Loess. (Proc. Iowa Acad. Sci., 1875-80, p. 21, Iowa City, 1880.) Abstract of a paper read before the Iowa Academy of Science, June 24, 1880, is given.

- Todd, J. E.** Relation of Loess to Drift in Southwestern Iowa. (Proc. Iowa Acad. Sci., 1875-80, p. 19, Iowa City, 1880.) A general section of the surface deposits of southwestern Iowa is given.
- Todd, J. E.** Richthofen's Theory of Loess in Light of Deposits of the Missouri. (Proc. American Assoc. Adv. Sci., Vol. XXVII, pp. 231-239, Salem, 1878.)
- Todd, J. E.** Roots and Root-marks found in Loess. (Proc. Iowa Acad. Sci., 1875-80, 17, Iowa City, 1880.) Abstract of a paper read before the Academy is given.
- Todd, J. E.** Some variant Conclusions in Iowa Geology. (Proc. Iowa Acad. Sci., Vol. XIII, pp. 183-186, Des Moines, 1906.) Attention is called to the character of the folding of the Carboniferous rocks of Fremont county. The stratigraphic position of the chalk-rock of northwestern Iowa, the nature of the section in the Big Sioux river, the depth of the drift in Clay and O'Brien counties, and the position of the Altamont moraine in the northwest part of the state are discussed.
- Todd, J. E.** Striation of Rocks by River-ice. (American Geologist, Vol. IX, pp. 396-400, Minneapolis, 1892.) It is noted that planation and striation are often accomplished by floating river-ice armed with pebbles, producing phenomena identical with glaciated surfaces.
- Todd, J. E.,** and H. Foster Bain. Interlœssial 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 at Riverside park.
- Toledo lobe** of Iowan drift. T. E. Savage. (Proc. Iowa Acad. Sci., X, 123-129, 1903.)
- Topographic types** of northeastern Iowa. W J McGee. (Proc. American Assoc. Adv. Sci., XXXVII, 248-249, 1890.)
- Topography.**  
Description of Elk Point quadrangle, South Dakota-Nebraska-Iowa. J. E. Todd. (U. S. Geol. Surv., Folio 156, 8 pp., 1908.)



- General topography of Iowa. C. A. White. (Geology of Iowa, I, 29-35, 1870.) Descriptions of the general features, with tables of elevations, and profiles across the state are given.
- Geology of Allamakee county. S. Calvin. (Iowa Geol. Surv., IV, 35-111, 1895.)
- Geology of Appanoose county. H. F. Bain. (Iowa Geol. Surv., V, 361-437, 1896.)
- Geology of Benton county. T. E. Savage. (Iowa Geol. Surv., XV, 125-225, 1905.)
- Geology of Black Hawk county. M. F. Arey. (Iowa Geol. Surv., XVI, 407-453, 1906.)
- 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 Buchanan county. S. Calvin. (Iowa Geol. Surv., VIII, 201-253, 1898.)
- Geology of Butler county. M. F. Arey. (Iowa Geol. Surv., XX, 1-59, 1910.)
- 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, 279-396, 1901.)
- Geology of Cerro Gordo county. S. Calvin. (Iowa Geol. Surv., VII, 117-195, 1897.)
- Geology of Cherokee and Buena Vista counties. T. H. Macbride. (Iowa Geol. Surv., XII, 303-353, 1902.)
- Geology of Chickasaw county. S. Calvin. (Iowa Geol. Surv., XIII, 255-292, 1903.)
- Geology of Clay and O'Brien counties. T. H. Macbride. (Iowa Geol. Surv., XI, 461-508, 1901.)
- Geology of Clayton county. A. G. Leonard. (Iowa Geol. Surv., XVI, 213-317, 1906.)
- Geology of Clinton county. J. A. Udden. (Iowa Geol. Surv., XV, 369-431, 1905.)
- Geology of Dallas county. A. G. Leonard. (Iowa Geol. Surv., VIII, 51-118, 1898.)

- Geology of Davis county. M. F. Arey. (Iowa Geol. Surv., XX, 487-521, 1910.)
- Geology of Decatur county. H. F. Bain. (Iowa Geol. Surv., VIII, 255-314, 1898.)
- Geology of Delaware county. S. Calvin. (Iowa Geol. Surv., VIII, 119-199, 1898.)
- Geology of Dubuque county. S. Calvin and H. F. Bain. (Iowa Geol. Surv., X, 379-651, 1900.)
- Geology of Emmet, Palo Alto and Pocahontas counties. T. H. Macbride. (Iowa Geol. Surv., XV, 227-276, 1905.)
- Geology of Fayette county. T. E. Savage. (Iowa Geol. Surv., XV, 433-546, 1905.)
- Geology of Franklin county. I. A. Williams. (Iowa Geol. Surv., XVI, 453-507, 1906.)
- Geology of Grundy county. M. F. Arey. (Iowa Geol. Surv., XX, 61-95, 1910.)
- Geology of Guthrie county. H. F. Bain. (Iowa Geol. Surv., VII, 413-487, 1897.)
- Geology of Hamilton and Wright counties. T. H. Macbride. (Iowa Geol. Surv., XX, 97-138, 1910.)
- Geology of Hardin county. S. W. Beyer. Iowa Geol. Surv., X, 243-305, 1900.)
- Geology of Harrison and Monona counties. B. Shimek. (Iowa Geol. Surv., XX, 271-483, 1910.)
- Geology of Henry county. T. E. Savage. (Iowa Geol. Surv., XII, 237-302, 1902.)
- Geology of Howard county. S. Calvin. (Iowa Geol. Surv., XIII, 21-79, 1903.)
- Geology of Humboldt county. T. H. Macbride. (Iowa Geol. Surv., IX, 109-154, 1899.)
- Geology of Iowa county. S. W. Stookey. (Iowa Geol. Surv., XX, 151-186, 1910.)
- Geology of Jackson county. T. E. Savage. (Iowa Geol. Surv., XVI, 563-648, 1906.)
- Geology of Jasper county. I. A. Williams. (Iowa Geol. Surv., XV, 277-367, 1905.)
- Geology of Jefferson county. J. A. Udden. (Iowa Geol. Surv., XII, 355-437, 1902.)

- Geology of Johnson county. S. Calvin. (Iowa Geol. Surv., VII, 33-116, 1897.)
- 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.)
- Geology of Louisa county. J. A. Udden. (Iowa Geol. Surv., XI, 53-126, 1901.)
- Geology of Lyon and Sioux counties. F. A. Wilder. (Iowa Geol. Surv., X, 85-184, 1900.)
- Geology of Madison county. J. L. Tilton and H. F. Bain. (Iowa Geol. Surv., VII, 489-539, 1897.)
- Geology of Mahaska county. H. F. Bain. (Iowa Geol. Surv., IV, 313-380, 1895.)
- Geology of Marion county. B. L. Miller. (Iowa Geol. Surv., XI, 127-197, 1901.)
- Geology of Marshall county. S. W. Beyer. (Iowa Geol. Surv., VII, 197-262, 1897.)
- Geology of Mills and Fremont counties. J. A. Udden. (Iowa Geol. Surv., XIII, 123-183, 1903.)
- Geology of Mitchell county. S. Calvin. (Iowa Geol. Surv., XIII, 293-352, 1903.)
- Geology of Monroe county. S. W. Beyer and L. E. Young. (Iowa Geol. Surv., XIII, 353-433, 1903.)
- Geology of Montgomery county. E. H. Lonsdale. (Iowa Geol. Surv., IV, 381-449, 1895.)
- Geology of Muscatine county. J. A. Udden. (Iowa Geol. Surv., IX, 247-380, 1899.)
- Geology of northeastern Iowa. W. J. McGee. (Eleventh Ann. Rep. U. S. Geol. Surv., 180-377, 1892.)
- Geology of Osceola and Dickinson counties. T. H. Macbride. (Iowa Geol. Surv., X, 185-239, 1900.)
- Geology of Page county. S. Calvin. (Iowa Geol. Surv., XI, 397-460, 1901.)
- Geology of Plymouth county. H. F. Bain. (Iowa Geol. Surv., VIII, 315-355, 1898.)
- 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 Sac and Ida counties. T. H. Macbride. (Iowa Geol. Surv., XVI, 509-548, 1906.)
- Geology of Scott county. W. H. Norton. (Iowa Geol. Surv., IX, 389-519, 1899.)
- Geology of Story county. S. W. Beyer. (Iowa Geol. Surv., IX, 155-245, 1899.)
- Geology of Tama county. T. E. Savage. (Iowa Geol. Surv., XIII, 185-253, 1903.)
- Geology of Van Buren county. C. H. Gordon. (Iowa Geol. Surv., IV, 197-254, 1895.)
- Geology of Wapello county. A. G. Leonard. (Iowa Geol. Surv., XII, 439-499, 1902.)
- Geology of Washington county. H. F. Bain. (Iowa Geol. Surv., V, 115-173, 1896.)
- Geology of Wayne county. M. F. Arey. (Iowa Geol. Surv., XX, 199-236, 1910.)
- Geology of Webster county. F. A. Wilder. (Iowa Geol. Surv., XII, 63-235, 1902.)
- Geology of Winneshiek county. S. Calvin. (Iowa Geol. Surv., XVI, 37-146, 1906.)
- Geology of Woodbury county. H. F. Bain. (Iowa Geol. Surv., V, 241-299, 1896.)
- Geology of Worth county. I. A. Williams. (Iowa Geol. Surv., X, 315-377, 1900.)
- Mississippi valley between Savanna and Davenport. J. E. Carman. (Bull. Illinois Geol. Surv., No. 13, 96 pp., 1909.)
- Physical geography of Iowa. J. D. Whitney. (Geology of Iowa, I, 1-8, 1858.)
- Physiography of Iowa. S. Calvin. (Iowa Weather and Crop Service, Ann. Rept. for 1902, 3-11, 1903.)
- Prairies. B. Shimek. (Bull. Iowa State Univ., Lab. Nat. Hist., VI, 169-240, 1911.)

- Preglacial elevation of Iowa. H. F. Bain. (Proc. Iowa Acad. Sci., II, 23-26, 1895.)
- Tables of altitudes. H. Gannett. (Bull. U. S. Geol. Surv., No. 5, Iowa, 105-112, 1884. Bull. 160, Iowa, 197-221, 1899. Bull. 274, Iowa, 300-332, 1906.)
- Topographic types of northeastern Iowa. W J McGee. (Proc. American Assoc. Adv. Sci., XXXVII, 248-249, 1890.)
- Topography and climate of Iowa. H. E. Simpson. (Iowa Geol. Surv. XXI, 48-66, 1912.)
- Topography and climate of Iowa. H. E. Simpson. (U. S. Geol. Surv., Water Supply Paper No. 293, 45-59, 1912.)
- 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.)
- Topography** and climate of Iowa. H. E. Simpson. (Iowa Geol. Surv., XXI, 48-66, 1912.)
- Topography** and climate of Iowa. H. E. Simpson. (U. S. Geol. Surv., Water Supply Paper No. 293, 45-59, 1912.)
- Torrey, Joseph, Jr.**, and E. H. Barbour. Recorded Meteorites of Iowa, with Special Mention of Last, or Winnebago County, Meteorite. (American Geologist, Vol. VIII, pp. 65-72, Minneapolis, 1891.)
- Torrey, Joseph, Jr.**, and E. H. Barbour. Winnebago County (Iowa) Meteorites. (Science, Vol. XV, p. 347, New York, 1890.) Reference is made to a fragment supposed to be a piece of meteorite. The authors claim it was not, and base their claims on the grounds of: Too low specific gravity, absence of metals and external crust, and chemical analysis.
- Transition** forms in crinoids and description of five new species. Charles Wachsmuth and Frank Springer. (Proc. Acad. Nat. Sci. Philadelphia, 224-226, 1878.)
- Transitional drift.** Clement L. Webster. (American Naturalist, XXIV, 1182-1185, 1890.)

- Trans-Mississippian** coals, geological position. C. R. Keyes. (Eng. and Mining Jour., LXIX, 528-529, 1900.)
- Trans-Mississippian** coals, horizons of Arkansas and Indian Territory coals compared. C. R. Keyes. (Eng. and Mining Jour., LXXI, 692-693, 1901.)
- Trans-Mississippian** coals, stratigraphical location. C. R. Keyes. (Eng. and Mining Jour., LXXII, 198, 1901.)
- Trans-Mississippian** field, structure of coal deposits. C. R. Keyes. (Eng. and Mining Jour., LXV, 253-254, and 281, 1898.)
- Trilobites.**  
Description of new species. D. D. Owen. (Rept. Geol. Surv. Wisconsin, Iowa and Minnesota, App., Art. i, 573-577, 1852.)
- Turkey River** valley in Fayette county, Iowa, terrace formation. G. E. Finch. (Proc. Iowa Acad. Sci., VIII, 204-206, 1901.)
- Twelfth annual** report of state geologist. S. Calvin. (Iowa Geol. Surv., XIX, 3-6, 1904.)
- Twentieth** and nineteenth annual reports of state geologist. G. F. Kay. (Iowa Geol. Surv., XXI, ix-xvi, 1912.)
- Two** remarkable cephalopods from upper paleozoic. C. R. Keyes. (Proc. Iowa Acad. Sci., III, 76-78, 1896.)
- Two** unique spirifers from devonian strata of Iowa. S. Calvin. (Bull. Lab. Nat. Hist., State Univ. Iowa, II, 165-167, 1893.)
- Types** and figured specimens in Paleontological collections of geological department, American museum of natural history; lower carboniferous to pleistocene, inclusive. R. P. Whitfield and E. O. Hovey. (Bull. American Mus. Nat. Hist., XI, pt. 4, 357-500, 1901.)
- Udden, Johan A.** Account of Paleozoic Rocks Explored by Deep-borings at Rock Island and Vicinity. (Seventeenth Ann. Rept. U. S. G. S., pt. ii, pp. 829-849, Washington, 1896.) The strata passed through in wells at Davenport are noted.

- Udden, Johan, A.** Diatomaceous Earth in Muscatine County. (Proc. Iowa Acad. Sci., Vol. VI, p. 53, Des Moines, 1899.) A deposit is reported associated with ancient peat under the loess. Fragments of the peculiar deposit are also found in Scott county.
- Udden, Johan A.** Dipterus in American Middle Devonian. (Journal of Geology, Vol. VII, pp. 494-495, Chicago, 1899.) The occurrence of the form in the rocks of Iowa is especially noted.
- Udden, Johan A.** Foraminiferal Ooze in Coal Measures of Iowa. (Journal of Geology, Vol. XI, pp. 283-284, Chicago, 1903.) A number of genera of Rhizopods are reported and vast numbers of individuals are said to extend throughout the Missouri section.
- Udden, Johan A.** Geology of Jefferson County. (Iowa Geol. Surv., Vol. XII, pp. 355-437, Des Moines, 1902.) There are described:

Introduction, area and location, earlier investigations.

Physiography, topography, flat uplands, upland slopes, terraces, bottom lands, table of elevations, drainage.

Stratigraphy, general relations of strata, underlying formations; Saint Louis, distribution and local sections, sections on Burr Oak and other creeks, on Walnut creek, Rocky branch, Turkey creek and adjacent ravines, Brush creek and Wolf creek, Cedar creek basin, Des Moines river basin, Springvale beds, Lower Verdi beds, Upper Verdi beds, Pella beds, geographical conditions, correlations; Des Moines, distribution and local sections, Walnut township, Lockridge township, Round Prairie township, Penn, Buchanan, Cedar, Black Hawk, Fairfield, Liberty, Polk, Locust Grove, Des Moines, thickness of the Des Moines, general character, correlations; table of fossils; erosion intervals; well-records; Pleistocene, associated gravels, bowlder clays, loess, alluvial deposits, Pleistocene fossils, geological structure, joints, glacial-scorings.

Economic products, building-stones, clay industries, coal, water-resources, soils.

**Udden, Johan A.** Geology of Louisa County. (Iowa Geol. Surv., Vol. XI, pp. 53-126, Des Moines, 1901.) The subjects discussed are as follows:

Introduction, location and area, earlier investigations.

Physiography, topography, Mississippi bottoms, Iowa river lowlands, east drift plain, table of altitudes, drainage.

Stratigraphy, general relations of strata, underlying formations; Mississippian series, typical sections, sections in bluffs and creeks north and east of Morning Sun, sections in Otter Creek basin, sections in Long Creek basin, sections on Clifton Creek and Iowa river, general section of subcarboniferous rocks, Maple Hill shale, English River gritstone (Chonopectus sandstone), "lithographic" limestone, Upper gritstone, Wassonville limestone, Lower Burlington limestone, main lower chert, Upper Burlington limestone, Montrose chert, upper shaly limestone, correlation, geographic conditions, Saint Louis limestone; Des Moines; subsequent history; Ozarkian and geest, table of well records; Pleistocene, Albertan, Aftonian, Kansan, Buchanan gravel and Yarmouth soil, Illinoian, Sangamon, loess, terraces and alluvium.

Economic products, Geological structure; joints; minerals; building-stones and macadam, clay products, natural-gas, gravels and sands, soils, water-supplies.

**Udden, Johan A.** Geology of Mills and Fremont Counties. (Iowa Geol. Surv., Vol. XIII, pp. 123-183, Des Moines, 1903.) The following subjects are discussed in detail:

Introduction, location and area, earlier investigations.

Physiography, topography, upland flats, upland slopes, lowlands and terraces, drainage, table of elevations.

Stratigraphy, general statement, deep explorations; Carboniferous, Missourian, exposures in and near bluffs of the Missouri in Mills county, exposures in and near the bluffs of the Missouri river in Fremont county, sections in the uplands east of Hamburg, scattered exposures, correlations, geographical conditions, fauna and flora, list of fossils; Cretaceous, erosion interval;



Pleistocene, ante-glacial silt, boulder clay, gumbo, loess, fossil snails of the loess, alluvium, calcareous tufa, geological structure, ice-scorings.

Economic products, building-stones, coal, clay industries, water-supplies, sands and gravels, soils.

**Udden, Johan A.** Geology of Muscatine County. (Iowa Geol. Surv., Vol. IX, pp. 247-380, Des Moines, 1899.) The following subjects are dealt with in detail:

Introduction, location and area, earlier investigations.

Physiography, topography, Mississippi bottoms, West Liberty plain, Illinoian drift-plain, Kansan drift-plain, table of elevations, drainage.

Stratigraphy, general relations of strata, underlying formations, Silurian system; Devonian system, Fayette breccia and Cedar Valley limestone, Sweetland creek beds; Carboniferous system, Des Moines stage, Pine Creek conglomerate; preglacial erosion; Pleistocene, ante-glacial silt, glacial deposits, pre-Kansan till, Kansan till, Buchanan gravel and Yarmouth soil, Illinoian till, Sangamon soil and leached horizon, Lake Calvin, loess, terraces and alluvium; deformations; joints, earth temperatures; minerals.

Economic products, coal, building-stones, gravels, sands, clay industries, Fairport potteries, brick and tile, water supplies, natural gas, soils.

**Udden, Johan A.** Geology of Pottawattamie County. (Iowa Geol. Surv., Vol. XI, pp. 199-277, Des Moines, 1901.) The following topics are considered in detail:

Introduction, location and area, previous investigations.

Physiography, topography, flood-plains, uplands, table of elevations, history of drainage.

Stratigraphy, general statement, deep-explorations; Carboniferous, Missourian; Cretaceous; Tertiary erosion, well-records; Pleistocene, ante-glacial silt and sand, boulder-clay, pre-Kansan, valley-drift gravel, gumbo, loess, terrace and alluvium, deformations, joints, ice-scorings.

Economic products, building stones, clay industries, water supplies, coal, road-ballast, soils.

- Udden, Johan A.** Occurrence of Rhizopods in Pella Beds in Iowa. (Proc. Iowa Acad. Sci., Vol. IX, p. 120, Des Moines, 1902.) Several species are identified in material from the St. Louis limestone of Jefferson county.
- Udden, Johan A.** Pine Creek Conglomerate. (Proc. Iowa Acad. Sci., Vol. VI, pp. 54-56, Des Moines, 1899.) Lithologically the bed resembles the Rockville conglomerate, and a rock of Cretaceous age found in Guthrie county. The suggestion is made that the Muscatine deposit may be also of the same age.
- Udden, Johan A.** Pleuroptyx in Iowa Coal measures. (Proc. Iowa Acad. Sci., Vol. IX, p. 121, Des Moines, 1902.) Remains of a batrachian are noted from the rocks of Jefferson county.
- Udden, Johan A.** Some Cretaceous Drift Pebbles in Northern Iowa. (American Geologist, Vol. XXIV, pp. 389-390, Minneapolis, 1899.) The original locality of the pebbles is thought to be to the north and not to the northwest where Cretaceous rocks are now exposed.
- Udden, Johan A.** Some Pre-Glacial Soils. (Proc. Iowa Acad. Sci., Vol. V, pp. 102-104, Des Moines, 1908.) South of the driftless area and beneath the Kansan till old soils are exposed in numerous localities. Between two of them is a fossiliferous loesslike bed. They attain a thickness of 16 feet in places.
- Udden, Johan A.** Some Preglacial soils. (American Geologist, Vol. XXI, pp. 262-264, Minneapolis, 1898.) A number of fossils were collected in Iowa.
- Udden, Jon Andreas.** Geology of Clinton County. (Iowa Geol. Surv., Vol. XV, pp. 369-451, Des Moines, 1905.) The following subjects are considered in detail:
- Introduction, area and location, previous investigations.  
 Physiography, topography, Mississippi lowlands, Wapsipinicon lowlands, Iowan drift-plain, older drift-plain, Goose Lake channel, drainage, table of altitudes.  
 Stratigraphy, general relations of strata, underlying for-

mations, data, older Clinton wells, the latest waterworks well, Pitch well, description of section; basal sandstones and shales; Saint Lawrence, Jordan and Oneota; Saint Peter, Galena and Trenton, Maquoketa shale; Niagara limestone, summary of the section.

Ordovician system, Maquoketa shale, exposures, thickness and geographical distribution.

Silurian system, Niagara limestone, areal extent, description by townships, Berlin, Bloomfield, Brookfield, Camanche, Centre, Deep Creek, Dewitt, Elden, Elk River, Hampshire, Liberty, Lincoln, Olive, Orange, Sharon, Spring Rock, Spring Valley, Washington, Waterford, Welton, divisions of Niagara, thickness of Niagara.

Carboniferous system, Des Moines stage.

Erosion intervals; geest.

Table of well-records.

Pleistocene system, pre-Kansas stage, Illinoian drift, Iowan drift, gravels of uncertain age, loess, alluvium.

Geological structure.

Minerals.

Economic products, clay industries, sands and gravels, building-stones; water-supplies; soils; quicklime; coal, lead and copper.

**Ueber** das Carbon des Mississippithales. C. R. Keyes. (Neues Jahrbuch für Mineralogie, Geologie und Palaeontologie, Jahrg. 1896, I, 96-110, 1896.)

**Ulrich, E. O.** Paleozoic bryozoa. (Geol. Surv., Illinois, Vol. VIII, pp. 283-688, Springfield, 1890.) A number of species from Iowa are described as new.

**Ulrich, E. O.** Sponges of Devonian and Carboniferous Systems. (Geol. Surv. Illinois, Vol. VIII, pp. 243-251, Springfield, 1890.) Two species from Iowa are described as new.

#### **Unconformity.**

Arkansan series: new terrane of Carboniferous in the western interior basin. C. R. Keyes. (Proc. Iowa Acad. Sci., VIII, 123-128, 1901.)

- Character of unconformability of Iowa coal-measures upon older rocks. C. A. White. (Am. Jour. Sci., (2), XLV, 331-334, 1868.)
- Depositional equivalent of hiatus at base of our coal-measures. C. R. Keyes. (Proc. Iowa Acad. Sci., VIII, 119-123, 1901.)
- Depositional measure of unconformity. C. R. Keyes. (Bull. Geol. Soc. America, XII, 173-196, 1901.)
- Devonian fishes of Iowa. C. R. Eastman. (Iowa Geol. Surv., XVIII, 29-360, 1908.)
- Devonian hiatus in continental interior; its character and depositional equivalents. C. R. Keyes. (Proc. Iowa Acad. Sci., IX, 105-112, 1902.)
- Distribution and relations of St. Louis limestone in Mahaska county, Iowa. H. F. Bain. (Iowa Geol. Surv., I, 171-179, 1893.)
- Geological formations of Iowa. C. R. Keyes. (Iowa Geol. Surv., I, 11-161, 1893.)
- Geological reconnaissance in Buchanan county, Iowa. S. Calvin. (Bull. Lab. Nat. Hist., State Univ. Iowa, II, 177-189, 1893.)
- Geological structure and relations of coal-bearing strata of central Iowa. C. R. Keyes. (Proc. Iowa Acad. Sci., I, pt. ii, 27-28, 1892.)
- Geology of Benton county. T. E. Savage. (Iowa Geol. Surv., XV, 125-225, 1905.)
- Geology of Black Hawk county. M. F. Arey. (Iowa Geol. Surv., XVI, 407-452, 1906.)
- Geology of Buchanan county. S. Calvin. (Iowa Geol. Surv., VIII, 201-253, 1898.)
- Geology of Cerro Gordo county. S. Calvin. (Iowa Geol. Surv., VII, 117-195, 1897.)
- Geology of Henry county. T. E. Savage. (Iowa Geol. Surv., XII, 237-302, 1902.)
- Geology of Howard county. S. Calvin. (Iowa Geol. Surv., XIII, 21-79, 1903.)
- Geology of Jackson county. T. E. Savage. (Iowa Geol. Surv., XVI, 563-649, 1906.)

- Geology of Jefferson county. J. A. Udden. (Iowa Geol. Surv., XII, 355-437, 1902.)
- Geology of Johnson county. S. Calvin. (Iowa Geol. Surv., VII, 33-116, 1897.)
- Geology of Jones county. S. Calvin. (Iowa Geol. Surv., V, 33-112, 1896.)
- Geology of Keokuk county. H. F. Bain. (Iowa Geol. Surv., IV, 255-311, 1895.)
- Geology of Lee county. C. R. Keyes. (Iowa Geol. Surv., III, 305-407, 1894.)
- Geology of Mahaska county. H. F. Bain. (Iowa Geol. Surv., IV, 313-380, 1895.)
- Geology of Marion county. B. L. Miller. (Iowa Geol. Surv., XI, 127-197, 1901.)
- Geology of Muscatine county. J. A. Udden. (Iowa Geol. Surv., IX, 247-380, 1899.)
- Geology of Page county. S. Calvin. (Iowa Geol. Surv., XI, 397-460, 1901.)
- Geology of Story county. S. W. Beyer. (Iowa Geol. Surv., IX, 155-245, 1899.)
- Geology of Van Buren county. C. H. Gordon. (Iowa Geol. Surv., IV, 197-254, 1895.)
- Geology of Wapello county. A. G. Leonard. (Iowa Geol. Surv., XII, 439-499, 1902.)
- Geology of Washington county. H. F. Bain. (Iowa Geol. Surv., V, 115-173, 1896.)
- Geology of Webster county. F. A. Wilder. (Iowa Geol. Surv., XII, 63-235, 1902.)
- Geology of Winneshiek county. S. Calvin. (Iowa Geol. Surv., XVI, 37-146, 1906.)
- Gypsum deposits of Iowa. C. R. Keyes. (Iowa Geol. Surv., III, 257-299, 1895.)
- Horizons of Arkansas and Indian Territory coals compared with those of other trans-Mississippian coals. C. R. Keyes. (Eng. and Mining Jour., LXXI, 692-693, 1901.)
- Inequalities in old paleozoic sea-bottom. J. E. Todd. (American Geologist, XV, p. 64, 1895.)

- Marked unconformity between carboniferous and devonian strata in upper Mississippi valley. C. R. Keyes. (Am. Jour. Sci., (4), XXXVI, 160-164, 1913.)
- Nether delimitation of our carbonic rocks. C. R. Keyes. (Proc. Iowa Acad. Sci., XIX, 153-156, 1912.)
- Notes on Redrock sandstone. C. R. Keyes. (Proc. Iowa Acad. Sci., I, pt. ii, 26-27, 1892.)
- Orotaxial correlation of geological terranes and diastrophism. C. R. Keyes. (Proc. Iowa Acad. Sci., XVI, 153-157, 1909.)
- Redrock sandstone of Marion county, Iowa. C. R. Keyes. (Am. Jour. Sci., (3), XLI, 273-276, 1891.)
- Relation of Lime Creek shales to Cedar Valley limestone of Floyd county, Iowa. A. O. Thomas. (Science, N. S., XXXVII, 459, 1913.)
- Some physical aspects of general geological correlation. C. R. Keyes. (Proc. Iowa Acad. Sci., VI, 131-154, 1899.)
- Stratigraphy of carboniferous in central Iowa. C. R. Keyes. (Bull. Geol. Soc. America, II, 277-292, 1891.)
- Stratigraphy of St. Louis and Warsaw formations in southeastern Iowa. C. H. Gordon. (Journal of Geology, III, 289-311, 1895.)
- Sundry provincial and local phases of general geologic section of Iowa. C. R. Keyes. (Proc. Iowa Acad. Sci., XIX, 147-151, 1912.)
- Unconformable on underlying strata. J. Hall. (Proc. American Assoc. Adv. Sci., X, 51-69, 1857.)
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- Weems, J. B.** Report of Chemist. (Iowa Geol. Surv., Vol. X, pp. 39-40, Des Moines, 1900.) The work of the laboratory during the year 1899 is summarized.
- Weems, J. B.** Report of Chemist. (Iowa Geol. Surv., Vol. XI, p. 36, Des Moines, 1901.) A brief statement is given of the analytical work done during the year.
- Weems, J. B.** Report of Chemist. (Iowa Geol. Surv., Vol. XII, p. 35, Des Moines, 1902.) A general summary of the analyses made during the year is given.
- Weems, J. B.** Report of Chemist. (Iowa Geol. Surv., Vol. XIII, p. 20, Des Moines, 1903.) Brief statement is made of the chemical work of the year.
- Weems, J. B.** Sanitary Analyses of Some Iowa Deep-well Waters. (Proc. Iowa Acad. Sci., Vol. IX, pp. 63-70, Des Moines, 1902.) Results of 22 analyses are tabulated.
- Weidman, Samuel.** Pleistocene Succession in Wisconsin. (Science, N. S., Vol. XXXVII, p. 456, New York, 1913.) The drift sheets are correlated with those of Iowa.
- Well**, Simpson college, pleistocene record. J. L. Tilton. (Proc. Iowa Acad. Sci., XVII, 159-164, 1910.)

- Weller, Stuart.** Bibliographic Index of North American Carboniferous Invertebrates. (Bull. U. S. G. S., No. 153, 653 pp., Washington, 1898.) Numerous references are made to the literature on fossils from Iowa localities.
- Weller, Stewart.** Circum-insular Paleozoic fauna. (Journal of Geology, Vol. III, pp. 903-917, Chicago, 1895.) General reference is made to Iowa. It is stated that while the Chouteau (Kinderhook) fauna is not the Chemung fauna, the two lived contemporaneously. In their nature and origin the differences between them are geographic rather than climatological.
- Weller, Stuart.** Classification of Mississippian Series. (Journal of Geology, Vol. VI, pp. 303-314, Chicago, 1898.) The three faunal subdivisions proposed by Williams are advocated.
- Weller, Stuart.** Correlation of Devonian Faunas in Southern Illinois. (Journal of Geology, Vol. V, pp. 625-635, Chicago, 1897.) Incidental reference is made to the correlation with Iowa rocks.
- Weller, Stuart.** Kinderhook Faunal Studies: II, Fauna of Chonopectus Sandstone at Burlington, Iowa. (Trans. St. Louis Acad. Sci., Vol. X, pp. 57-129, St. Louis, 1900.) The literature on the formation at Burlington is summarized.
- Weller, Stuart.** Kinderhook Faunal Studies; III, Faunas of Beds Nos. 3 to 7 at Burlington, Iowa. (Trans. Acad. Sci., St. Louis, Vol. XI, pp. 147-214, St. Louis, 1901.) This is a detailed discussion of the affinities of the faunas immediately underlying the Burlington limestones. The Louisiana limestone is regarded as represented by beds much nearer the Burlington limestone than indicated in Missouri.
- Weller, Stuart.** Northern and Southern Kinderhook Faunas. (Journal of Geology, Vol. XIII, pp. 617-634, Chicago, 1905.) Incidental references are made to the correlation of the Iowa rocks.

- Weller, Stuart.** Osage vs. Augusta. (*American Geologist*, Vol. XXII, pp. 12-16, Minneapolis, 1898.) It is argued that the two terms are synonymous.
- Weller, Stuart.** Succession of Fossil Faunas in Kinderhook at Burlington, Iowa. (*Iowa Geol. Surv.*, Vol. X, pp. 59-79, Des Moines, 1900.) The paper embraces the results of a detailed faunal and stratigraphic investigation of one of the classic sections of Lower Carboniferous rocks in this country.
- Weller, Stuart,** and A. D. Davidson. *Petalocrinus Mirabilis*, N. Sp., and a New American Fauna. (*Journal of Geology*, Vol. IV, pp. 166-173, Chicago, 1896.) The form represents a European fauna.
- Wells, artesian, of Iowa.** W. H. Norton. (*Iowa Geol. Surv.*, VI, 113-428, 1897.)
- Wells, in Iowa, artesian.** R. E. Call. (*Science*, XIX, 310-311, 1892.)
- Well-section, Clarinda, correlation with, schematic section of Carboniferous.** C. R. Keyes. (*Iowa Geol. Surv.*, XI, 461-463, 1901.)
- West, burnt clay for roads.** C. R. Keyes. (*American Monthly Review of Reviews*, XXV, 72-74, 1902.)
- West of Mississippi river, names of coals.** C. R. Keyes. (*Proc. Iowa Acad. Sci.*, VII, 128-137, 1901.)
- West boundary of driftless area, exposures of Iowan and Kansan drift.** E. Orr. (*Proc. Iowa Acad. Sci.*, XIV, 231-236, 1907.)
- Western interior basin, Arkansan series: a new terrane of the carboniferous.** C. R. Keyes. (*Proc. Iowa Acad. Sci.*, VIII, 123-128, 1901.)
- Western interior basin, formational synonymy of coal measures.** C. R. Keyes. (*Proc. Iowa Acad. Sci.*, VII, 82-105, 1900.)
- Western interior coal-field.** H. F. Bain. (*Twenty-second Ann. Rept. U. S. G. S.*, pt. iii, 333-366, 1902.)
- Western interior coal-field, Bethany limestone.** C. R. Keyes. (*Am. Jour. Sci.*, (4), II, 221-225, 1896.)

- Western interior** coal-field, middle coal-measures. H. F. Bain and A. G. Leonard. (Journal of Geology, VI, 577-588, 1898.)
- Western interior** coal-field, middle coal-measures. H. F. Bain and A. G. Leonard. (Bull. Geol. Soc. America, X, 10-12, 1899.)
- Western interior** coal-field of America. H. F. Bain. (Trans. North of England Inst. Min. and Mec. Eng., XLVIII, 55-80, 1898.)
- Western Iowa**, Aftonian sands and gravels. B. Shimek. (Science, N. S., XXVIII, 923, 1908.)
- Western Iowa**, notes on cretaceous flora. P. Bartsch. (Bull. Lab. Nat. Hist., State Univ. Iowa, III, 178-182, 1896.)
- Westerville Limestone** (Bethany).  
Geology of Decatur county. H. F. Bain. (Iowa Geol. Surv., VIII, 255-314, 1898.)
- Weston Shales** (Lawrence).  
Carboniferous section of southwestern Iowa. G. L. Smith. (Iowa Geol. Surv., XIX, 605-657, 1909.)
- What** Iowa geological survey has been doing. C. R. Keyes. (Mon. Rev. Iowa Weather Serv., V, No. 1, 4-7, 1894.)
- Wheat, G. G.** Some Geological Aspects of Artificial Drainage in Iowa. (Proc. Iowa Acad. Sci., Vol. XVII, pp. 151-158, Des Moines, 1910.) The most destructive effect of the many drainage ditches is to cause local floods, when before the water was held back by swamps and ponds.
- White, Charles A.** Announcement of Existence of Cretaceous Rocks in Guthrie County, Iowa. (Proc. American Assoc. Adv. Sci., Vol. XVII, pp. 326-327, Cambridge, 1869.)
- White, Charles A.** Character of Unconformability of Iowa Coal Measures upon Older Rocks. (Am. Jour. Sci., (2), Vol. XLV, pp. 331-334, New Haven, 1868.) A brief announcement is made of the unconformity of the coal-measures on the lower carboniferous rocks.

- White, Charles A.** Contributions to Invertebrate Paleontology, No. 8: Fossils from Carboniferous Rocks in Interior States. (U. S. Geol. and Geog. Sur. Terr., Twelfth Ann. Rep., 1878, pp. 155-171, Washington, 1883.) Descriptions of new species of fossils from Iowa are included.
- White, Charles A.** Description of New Species of Fossils from Devonian and Carboniferous Rocks of Mississippi Valley. (Proc. Boston Soc. Nat. Hist., Vol. IX, pp. 8-33, Boston, 1865.) A number of species of fossils are described as new.
- White, Charles A.** Description of New Species of Fossils from Paleozoic Rocks of Iowa. (Proc. Acad. Nat. Sci., Phila., Vol. XXVIII, pp. 27-34, Philadelphia, 1877.) Numerous species are described as new.
- White, Charles A.** Drift Phenomena of Southwestern Iowa. (Am. Jour. Sci., (2), Vol. XLIV, p. 119, New Haven, 1867.) An additional note to an article of the same title is given.
- White, Charles A.** Eastern Limit of Cretaceous Deposits in Iowa. (Proc. American Assoc. Adv. Sci., Vol. XXI, pp. 187-192, Cambridge, 1873.) Cretaceous fossils are reported from the drift of Howard, Black Hawk and Johnson counties.
- White, Charles A.** Exogenous Leaves in Cretaceous Rocks of Iowa. (Am. Jour. Sci., (2), Vol. XLIV, p. 119, New Haven, 1867.) The note announces the discovery of exogenous leaves, and shows that the "Nishnabotna sandstone" is identical with the Dakota group.
- White, Charles A.** First Annual Report of Progress of State Geologist. (Pamphlet, pp. 1-4, Des Moines, 1867.) A statement of the work done during the year previous is given.
- White, Charles A.** First Annual Report of State Geologist. (First and Second Annual Report by the State Geologist, on Geological Survey of State of Iowa, pp. 5-8, Des Moines, 1868.) A short report is given of the work

carried on during the preceding two years, with a reprint of popular letters appearing in the various newspapers of the state.

- White, Charles A.** Geological Map Model of Iowa. (Geology of Iowa, Vol. I, p. 32, Des Moines, 1870.)
- White, Charles A.** Geological Map of State of Iowa. (Geology of Iowa, Vol. II, Des Moines, 1870.)
- White, Charles A.** Iowa Drift. (American Naturalist, Vol. II, pp. 615-616, Salem, 1869.) The derivation of the drift-material from the underlying rocks, by their disintegration and comminution, is shown.
- White, Charles A.** Lakes of Iowa; Past and Present. (American Naturalist, Vol. II, pp. 143-155, Salem, 1868.) The drift lakes, including the so-called "walled" lakes, are described, and the origin of the "walls" is explained. Also the bluff deposit of the Missouri river valley is shown to be the deposit of an ancient lake.
- White, Charles A.** Lakes of Iowa; Past and Present. (Second Ann. Rep. State Geologist, pp. 151-163, Des Moines, 1868.) A popular description of some of the lakes in Iowa is given.
- White, Charles A.** Note on "Cone-in-cone." (Am. Jour. Sci. (2), Vol. XIV, pp. 400-401, New Haven, 1868.) The mineral mentioned is from the lower coal measures of Iowa.
- White, Charles A.** Observations on Red Quartzite Boulders of Western Iowa; and their Original Ledges of Red Quartzite in Iowa, Dakota and Minnesota. (Proc. American Assoc. Adv. Sci., Vol. XVII, pp. 340-342, Cambridge, 1869.)
- White, Charles A.** Observations on Summit Structure of Pentremites, the Structure and Arrangement of Certain Parts of Crinoids, and Description of New Species from Carboniferous Rocks of Burlington, Iowa. (Boston Jour. Nat. Hist., Vol. VII, pp. 481-506, Boston, 1863.)
- White, Charles A.** Observations upon Geology and Paleontology of Burlington, Iowa, and its Vicinity. (Boston Jour. Nat. Hist., Vol. VII, pp. 209-235, Boston, 1860.) A de-

tailed description is given of the rock-section at Burlington, Iowa, with table showing vertical range of the more important fossils. All below the oölite is referred to the Chemung (Devonian). Several species are described as new.

- White, Charles A.** Observations upon Drift Phenomena of Southwestern Iowa. (Second Ann. Rep. State Geologist, pp. 143-148, Des Moines, 1868.) A short account of the glacial scratches and drift materials is given.
- White, Charles A.** Observations upon Drift Phenomena of Southwestern Iowa. (Am. Jour. Sci., (2), Vol. XLIII, pp. 301-305, New Haven, 1867.) Special attention is directed to the glacial striæ upon rocks *in situ*.
- White, Charles A.** Occurrence of Later Cretaceous Deposits in Iowa. (American Geologist, Vol. I, pp. 221-227, Minneapolis, 1888.) Notes on certain fossils found in the drift in Hardin county are presented.
- White, Charles A.** Report of Geological Survey of State of Iowa. (Vol. I, pp. i-viii and 1-391, Des Moines, 1870.)  
Introduction: Historical statement, popular explanations, and general classification of the Iowa rocks.

PART FIRST (PHYSICAL GEOGRAPHY AND SURFACE GEOLOGY).

Chapter I is a general account of the surface features of the state: Boundaries, general topography, drainage, springs, etc.

Chapter II forms a general description of the surface deposits of the state, with detailed accounts of the composition, distribution and origin of the drift, altered drift, alluvium and bluff-deposits (loess).

Chapter III treats of the soils of the drift, loess (bluff) and alluvium; and of the adaptability of the Iowa soils for the growth of the forest trees. Also, an explanation of origin of prairies.

Chapter IV is on the climate of Iowa. (See T. S. Parvin, 1870.)



## PART SECOND (GENERAL GEOLOGY).

Chapter I describes the area, general characters, economic value and the fossils of the Archæan, Lower Silurian and Upper Silurian and their general subdivisions.

Chapter II gives an account of the Subcarboniferous; the general characters, economic value and fossils of the Kinderhook, Burlington, Keokuk and St. Louis limestones, together with sections and their minor subdivisions. Notes are also given on the unconformability of the coal measures upon older rocks and of the St. Louis limestone upon older formations of the Subcarboniferous group.

Chapter III: The lower, middle and upper coal measures are recognized by their general characters; and their economic value and fossil features are described. Also general observations are made on the Carboniferous rocks of Iowa, with some practical conclusions.

Chapter IV treats of the middle coal measures. (See O. H. St. John, 1870).

Chapter V. Earlier Cretaceous, Nishnabotna sandstone, Woodbury shales and Inoceramus beds are described; and their areas, lithological character, economic value and fossils noted.

## PART THIRD (COUNTY GEOLOGY).

Chapter I is a general account of the geology of southwestern Iowa, with special descriptions of the geological features of seventeen counties.

**White, Charles A.** Report of Geological Survey of State of Iowa. (Vol. II, pp. i-viii and 1-435, Des Moines, 1870.)

## PART FIRST (COUNTY GEOLOGY).

Chapter I deals of the geology of the middle region of western Iowa. (See O. H. St. John, 1870.) The physical features and general geology are described, with special reference to the post-tertiary, cretaceous and coal-measures. The general features of the following coun-

ties are briefly described, with numerous sections: Woodbury county, Monona, Harrison, Shelby, Crawford, Audubon, Sac, Ida, Calhoun, Carroll, Greene, Guthrie, Dallas, Polk, Boone, Webster.

Chapter II treats chiefly of northwestern Iowa. The general characteristics of the geology and material resources, and the geological features of the following counties are briefly described:

Pocahontas county, Palo Alto, Emmet, Dickinson, Clay, Buena Vista, Cherokee, O'Brien, Osceola, Lyon, Sioux, Plymouth.

Chapter III describes the middle region of northern Iowa, including the geology of the following counties:

Franklin county, Wright, Cerro Gordo, Hancock, Worth, Winnebago, Kossuth, Humboldt.

Chapter IV deals with the geology of the coal measures. A few preliminary notes and a rather full account of the geological features of the following counties are given: Webster county, Hamilton, Hardin, Boone, Story, Marshall, Polk, Jasper, Warren, Marion, Mahaska, Keokuk, Monroe, Wapello, Appanoose, Davis, Van Buren, Jefferson.

#### PART SECOND (ECONOMIC GEOLOGY).

Chapter I describes at length the peat formation of the state; also brief reference is made to the petroleum.

Chapter II describes in detail the gypsum deposits and related materials.

Chapter III gives an account of the building materials, especially the clays found in the eastern part of the state; also more or less brief mention of the limestone, fire-clay, road materials, etc., with brief allusion to the artesian wells and mineral springs.

Chapter IV is chiefly a report of chemical work done by the Survey. (See Rush Emery, 1870.) This includes minerals, rocks, lead, clays, coals, waters, and peats.

Appendix A is a list of railroad elevations by chief engineers of the different railways.

Appendix B is a catalogue of Iowa Birds. (By J. A. Allen.)  
Appendix C is an explanation of land surveys. (By C. W. Irish.)

- White, Charles A.** Report upon Invertebrate Fossils Collected in Portions of Nevada, Utah, Colorado, New Mexico and Arizona by Parties of Expeditions of 1871, 1872, 1873 and 1874. (Rept. Geol. and Geog. Expl. and Surv. W. 100 Mer., Vol. IV, pp. 1-219, Washington, 1875.) A number of species from Iowa are described as new.
- White, Charles A.** Second Annual Report of State Geologist on Geological Survey of State of Iowa. (Pamphlet, pp. 81-284, Des Moines, 1868.) A short sketch is given of the work done, with reprint of popular letters appearing in the various newspapers of the state.
- White, Charles A.** Sketch-Map of State of Iowa. (Geological Magazine, (1), Vol. VIII, p. 222, London, 1871.)
- White, Charles A.** Sketch of Geology of Southwestern Iowa. (Am. Jour. Sci., (2), Vol. XLIV, pp. 23-31, New Haven, 1867.) It is shown that the limestones of the region discussed belong to the upper and not to the lower carboniferous series, as has been supposed by some previous authors.
- White, Charles A.** Soils of Iowa and Their Origin. (Rep. Sec. Iowa State Agric. Soc., 1865, pp. 245-267, 1865.) A popular lecture was delivered before the society, September 29, 1865.
- White, Charles A.** Spontaneous Fission? in Zaphrentis. (Am. Jour. Sci., (3), Vol. V, p. 72, New Haven, 1873.) Special reference is made to specimens from the St. Louis limestone of Marion county.
- White, Charles A.** Trip to Great Red Pipestone Quarry. (American Naturalist, Vol. II, pp. 644-653, Salem, 1869.)
- White, Charles A., and O. H. St. John.** Descriptions of New Subcarboniferous and Coal Measure Fossils, collected upon Geological Survey of Iowa, together with notice of new Generic Characters observed in two Species of

- Brachiopods. (Trans. Chicago Acad. Sci., Vol. I, pp. 115-127, Chicago, 1867.) Fourteen species of fossils are described as new from Iowa rocks.
- White, Charles A.**, and O. H. St. John. Preliminary Notice of New Genera and Species of Fossils, by C. A. White and O. H. St. John. (Pamphlet, pp. 1-3, Iowa City, 1867.)
- White, Charles A.**, and R. P. Whitfield. Observations upon Rocks of Mississippi Valley which have been Referred to Chemung Group of New York, together with Descriptions of new Species of Fossils from same Horizon at Burlington, Iowa. (Proc. Boston Soc. Nat. Hist., Vol. VIII, pp. 289-316, Boston, 1862.) Several species are described as new from Iowa.
- Whitfield, R. P.** Description of New Species of Crinoid from Burlington Limestone, at Burlington, Iowa. (Bull. American Mus. Nat. Hist., Vol. I, pp. 7-9, New York, 1881.) *Poteriocrinus jesupi* is described and figured as new from Iowa.
- Whitfield, R. P.** Discovery of Second Example of Macrouran Decapod Crustacean, Palæo-palæomon Newberryi. (American Geologist, Vol. IX, pp. 237-238, Minneapolis, 1892.) The form is described, and a detailed comparison is made with the type.
- Whitfield, R. P.** Fauna of Lower Carboniferous Limestones of Spergen Hill, Ind., with Revision of Descriptions of its Fossils hitherto Published, and Illustrations of Species from Original Type Series. (Bull. American Mus. Nat. Hist., Vol. I, pp. 39-97, New York, 1882.) A number of the species reported from Iowa localities are described.
- Whitfield, R. P.** Notice of New Genus and Species of Lower Carboniferous Bryozoan. (Bull. American Mus. Nat. Hist., Vol. XX, p. 469, New York, 1904.) *Dictyoretmon burlingtonensis* is described as new from Burlington.
- Whitfield, R. P.** Paleontology of Wisconsin. (Geol. Surv., Wisconsin, Vol. IV, pp. 163-349, Madison, 1882.) A number of species of fossils from Iowa localities are noted.

- Whitfield, R. P.** Recapitulation of Descriptions of Lower Carboniferous Crinoidea from the Hall Collection now in American Museum of Natural History, with Illustrations of Original Type Specimens not heretofore figured. (Mem. American Mus. Nat. Hist., Vol. I, pt. i, pp. 1-37, New York, 1893.) The original descriptions are reprinted with notes.
- Whitfield, R. P., and J. Hall.** Description of New Species of Fossils from Devonian Rocks of Iowa. (New York State Cab. Nat. Hist., 23d Ann. Rept., pp. 223-239, Albany, 1873.)
- Whitfield, R. P., and E. O. Hovey.** Catalogue of Types and Figured Specimens in Paleontological Collections of Geological Department, American Museum of Natural History; Lower Carboniferous to Pleistocene, inclusive. (Bull. American Mus. Nat. Hist., Vol. XI, pt. 4, pp. 357-500, New York, 1901.) Many of the forms are from Iowa.
- Whitney, J. D.** Chemistry and Economical Geology. (Geology of Iowa, I, 324-472, Albany, 1858.) The chemical composition and lithological characters of the various geological formations are noted with chemical analyses; also notes on the mode of occurrence of lead-ore in northeastern Iowa are given.
- Whitney, J. D.** County Geology. (Geology of Iowa, I, 259-323, Albany, 1858.) Detailed notices of the geology of the central and northern counties in the eastern part of Iowa are given.
- Whitney, J. D.** Geological Map of Lead Region in States of Wisconsin, Illinois and Iowa. (Geol. Surv. Wisconsin, Vol. I, Albany, 1862.)
- Whitney, J. D.** Geology of Lead Region. (Geol. Surv. Illinois, Vol. I, pp. 153-207, Springfield, 1866.) Numerous references to the occurrence of lead in northeastern Iowa are given.
- Whitney, J. D.** Physical Geography of Iowa. (Geology of Iowa, Vol. I, pp. 1-34, 1858.) A descriptive account of the surface features, soil and climate of Iowa is presented.

**Wilcox, O. W.** Certain Aspects of Loess of Southwestern Iowa. (Journal of Geology, Vol. XII, pp. 716-721, Chicago, 1904.) At Red Oak three loess-sheets are distinctly seen; the yellow, white, and red, overlying the Kansan drift sheet.

**Wilcox, O. W.** So-called Alkali Spots of Younger Drift-sheets. (Journal of Geology, Vol. XIII, pp. 254-263, Chicago, 1905.) These areas are found in small undrained basins. The effervescence is mainly compound of magnesian sulphates; and the soils are therefore not true alkali soils.

**Wilder, Frank A.** Age and Origin of Gypsum of Central Iowa. (Journal of Geology, Vol. XI, pp. 723-748, Chicago, 1903.) The manner of probable formation is discussed and the conclusion is reached that the age is Permian.

**Wilder, Frank A.** Geology of Lyon and Sioux counties. (Iowa Geol. Surv., Vol. X, pp. 85-184, Des Moines, 1901.) The principal topics discussed or described are the following:

Introduction, location and area, previous geological work.

Physiography, topography, table of elevations, drainage.

Stratigraphy, general relations of strata, table of geological formations; quartzite, quartz-porphry; Cretaceous strata, Dakota sandstone, Benton shales; Pleistocene, loess, loess-covered drift, Buchanan gravels, Altamont moraine, eastern Lyon county, western Lyon county, Wisconsin, gravel-terraces, pre-Wisconsin course of Big Sioux, origin of the loess.

Economic products, Sioux quartzite, clays, cement, gravels, road materials, wells, coal, gas, soils, water-powers.

Flora of Lyon county.

**Wilder, Frank A.** Geology of Webster County. (Iowa Geol. Surv., Vol. XII, pp. 63-235, Des Moines, 1902.) The following subjects are discussed in detail:

Introduction, location and area, previous geological work.

Physiography, topography, drainage.

Stratigraphy, general relations of strata, table of geological formations; Carboniferous system, Mississippian series, relation of Saint Louis limestone to Coal Measures and

gypsum, Pennsylvanian series, Des Moines stage, coal seams, Permian series, gypsum and associated deposits, well-data, records of prospect-holes, nature of gypsum beds, age of gypsum and associated deposits, origin of gypsum; Pleistocene system, Aftonian gravels, Wisconsin drift, old soils and gravels, Coon Mound Esker, Morainic belts, Pre-Wisconsin valley of the Des Moines; terraces.

Economic products, gypsum, composition and characteristics of gypsum, nature of Webster county gypsum, extent and availability, permanence of supply, distribution of gypsum in United States and markets, history of the gypsum-plaster industry in Webster county, nature of gypsum-plaster, nature of retarder, products of American gypsum-mills, gypsum as a fertilizer, gypsum as a basis for Portland cement, methods of hardening gypsum to imitate marble, chalcedony, hardening of cement plaster, gypsum as a basis for paint, mechanical processes in making hard-wall plaster, plaster of Paris, possible improvements in the manufacture of plaster; coal, analyses of Webster county coal, clays, building-stones, Portland cement, limes, road-materials, water-powers, water supplies, mineral paints, mineral springs, miscellaneous minerals, soils.

Gypsum industry of Germany, kinds of gypsum plaster used, stuck gypsum, estrick gypsum, porcelain gypsum, dunge gypsum (Land Plaster), processes of manufacturing the various kinds of gypsum plaster.

Preliminary tests of stucco and plaster.

The industrial aspects of the gypsum products are considered at length. There is also given a short review of the gypsum industry of Germany.

**Wilder, Frank A.** Gypsum Deposits of Iowa. (Bull. U. S. G. S., No. 223, pp. 49-52, Washington, 1904.) A brief summary is given of the geology of the gypsum area, with several sections. It is regarded as Permian in age.

- Wilder, Frank A.** Fourteenth Annual Report of State Geologist. (Iowa Geol. Surv., Vol. XVI, pp. 1-12, Des Moines, 1906.) The work of the year is reviewed. The peat deposits are especially noted.
- Wilder, Frank A.** Fuel Values of Iowa Coals. (Iowa Geol. Surv., Vol. XIX, pp. 399-475, Des Moines, 1909.) Samples from the five leading coal-producing counties are considered. The subjects of chemical analyses, boiler tests, gas-producing, coking, briquetting, and washing are especially described.
- Wilder, Frank A.** Observations in Vicinity of Wall Lake. (Proc. Iowa Acad. Sci., Vol. VII, pp. 77-82, Des Moines, 1900.) This is a body of water lying within the Altamont moraine and therefore has a special genetic significance.
- Wilder, Frank A.** Thirteenth Annual Report of State Geologist. (Iowa Geol. Surv., Vol. XV, pp. 3-11, Des Moines, 1905.) Brief summary of the work of the year is given.
- Williams, H. S.** Correlation Papers: Devonian and Carboniferous. (Bull. U. S. Geol. Surv., No. 80, pp. 1-279, Washington, 1891.) The rocks of Iowa are discussed in a general way, and their correlation with other formations in the Mississippi valley noted.
- Williams, H. S.** Equivalency of Lime Creek Beds. (Am. Jour. Sci., (3), Vol. XXV, p. 311, New Haven, 1883.) A short note in which statements made in a former publication are corrected.
- Williams, H. S.** Relation of Devonian Faunas of Iowa. (American Geologist, Vol. III, pp. 230-233, Minneapolis, 1888.) Observations on the Devonian rocks of Iowa are recorded.
- Williams, H. S.** Remarkable Fauna at Base of Chemung in New York. (Am. Jour. Sci., (3), Vol. XXV, pp. 97-104, New Haven, 1883.) Comparisons of fossils of the Lime Creek beds of Iowa are made with those of New York.
- Williams, Ira A.** Geology of Franklin County. (Iowa Geol. Surv., Vol. XVI, pp. 453-507, Des Moines, 1906.) The following features are fully described:



Introduction, location and area, earlier geological work.

Physiography, topography, Iowan drift area, Wisconsin drift area, moraines, Wisconsin drift plain, table of elevations, drainage, West Fork of Cedar river, Hartgrave creek, Otter creek, Spring creek, Mayne creek, Beaver creek, Iowa river.

Stratigraphy, general relations, table of geological formations; Devonian system, Lime Creek shales, Hackberry shales, Owen beds; Carboniferous system, Kinderhook, typical sections, Bailey creek, Otter creek, Mayne creek; Pleistocene system, Kansan drift, Buchanan gravels, Iowan drift, Wisconsin drift, gravel-trains and terraces, post-glacial deposits; soils.

Economic products, building-stones, Kinderhook limestone, Owen limestone, clay industry, Dows, Sheffield, sands, gravels, peat, water-supplies, water-powers.

**Williams, Ira A.** Geology of Jasper County. (Iowa Geol. Surv., Vol. XV, pp. 277-367, Des Moines, 1905.) The subjects discussed in detail include the following:

Introduction, location and area, history and previous geological work.

Physiography, topography, general features, Kansan drift area, Iowan drift area, Wisconsin drift area, elevations.

Drainage, meteorology, Skunk river system, Skunk river, Indian creek, Clear creek, Mud creek, Wolf creek, Prairie creek, Cherry creek, Squaw creek, Elk creek, North Skunk river, Snipe creek, Rock creek, Sugar creek, Des Moines River system, Camp creek, Walnut creek, Calhoun creek, Brush creek.

Stratigraphy, general relations of strata, table of formations, deep-well sections; geological formations, Mississippian series, Kinderhook and Saint Louis stages, Pennsylvanian series, Des Moines stage, coal measures, representative exposures, Red-rock sandstone; Pleistocene system, pre-Kansan deposits, Kansan stage, Iowan stage, loess, Wisconsin stage, postglacial sands and illuvium, soils.

Economic products, coal, Lynnville, Monroe, Newton, Prairie City, Vandalia, Colfax, Oswalt; clays, Lynnville, Monroe, Kellogg, Newton, Baxter, Colfax; building-stones, Lynnville, Rock creek, Kellogg, Murphy, Reasnor; sands, road-materials, ocher, ores of the metals, water-supplies, mineral waters, water-powers.

**Williams, Ira A.** Geology of Worth County. (Iowa Geol. Surv., Vol. X, pp. 315-377, Des Moines, 1900.) The following features are fully described.

Introduction, situation and area, previous geological work. Physiography, topography, Wisconsin drift-area, Iowan drift-plain, drainage, Lime creek, Beaver creek, Winan creek, Willow creek, Shell Rock river, Elk creek, Goose creek, Deer creek.

Geological formations, general descriptions; Devonian system, Cedar Valley limestone, typical sections, Shell Rock river, Manly well, Lime creek, Lime Creek shales; Pleistocene system, Kansan drift, Buchanan gravels, Iowan drift, Wisconsin drift, alluvium.

Economic products, soils, building-stones, peat, water-supplies, water-powers.

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

Geology, distribution of clay 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, Winneshek county.

Silurian.

Devonian—Cerro Gordo county, Floyd county, Franklin county.

Carboniferous—Lower Carboniferous, Kinderhook, Des Moines county, Lee county, Washington county; Augusta; St. Louis.

Upper Carboniferous—the 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, Poweshiek county, Polk 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, Delaware county, the loess, the red clay, the gumbo, burnt-clay ballast, Iowan loess.

Wisconsin—Buena Vista county, Clay county, Pocahontas county, post-Wisconsin.

**Williams, Ira A.,** S. W. Beyer and. *Geology of Quarry Products.* (Iowa Geol. Surv., Vol. XVII, pp. 187-588, Des Moines, 1907.) The subjects treated at length are:

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

Geology of quarry products, Proterozoic group, Sioux quartzite, Cambrian system, Potsdam series, Saint Croix sandstones, Ordovician system, Prairie du Chien limestone, Saint Peter sandstone, Platteville limestone, Galena limestone, Maquoketa shales, Allamakee county, Clayton, Dubuque, Fayette, Howard, Jackson, Winneshek counties.

Silurian system, Niagara limestone, Bremer, Buchanan, Cedar, Linn, 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 county, 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 counties, Red Rock sandstone, Lucas, Marion, Marshall, Muscatine, Polk, Wayne, Webster counties.

Missouri stage, Adair county, Adams, Cass, Clarke, Dallas, Decatur, Fremont, Guthrie, Harrison, Madison counties. Analyses of shale and limestone, Mills, Montgomery, Page, Pottawattamie, Taylor counties.

Permian system, Webster county.

Cretaceous system, Calhoun, Cass, Guthrie, Pottawattamie, Plymouth and Woodbury, Sac counties. Pleistocene system.

Analyses of Iowa coals, analyses of limestones and chalks, analyses of clays, shales and marls, test of Iowa building stones.

Directory of Iowa limestone quarries by counties.

Directory of Iowa sandstone quarries by counties.

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

**Williams, Ira A.,** S. W. Beyer and. 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, Ladd's, Buckley's, Orton's; primary or residual clays, secondary clays, clays deposited in still water, clays deposited from running water, clays deposited by glacial action, clays deposited by wind.

Composition and chemical properties, kaolinite and pholerite, clay substances, 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, feel, slaking, strength, bonding-power, plasticity, shrinkage, porosity, specific gravity, fineness of grain, burnt clay, 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 the clay for fusion tests, table showing fusion temperatures for Iowa clays.

Processes in the manufacture of clay-wares, winning of the raw material, surface digging, quarrying, mining, transportation of raw material to works, preparation of raw material; dry way, blake-crusher, rolls, disintegrators, dry-press, 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 considerations, practical considerations in drying clays, types of dryers, outside air-drying, the hot-floor, sewer-pipe or slatted floor, periodic or chamber dryer, the continuous tunnel-dryer, direct, by fuel burned for the purpose, by waste gases from other processes, indirect, radiation from heated brick-work, radiation from steam heated surfaces, summary; burning of clay-wares, combustion of fuel, general discussion, practical considerations, 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 triangular, single stack, multiple stack, muffle, continuous.

**Wilson, Andrew Gordon.** Frozen Streams of Iowan Drift-Border. (*American Geologist*, Vol. XVII, pp. 364-371, Minneapolis, 1896.) Small streams freezing solid frequently over-flow in spring until several feet of ice are accumulated. The bearing of the phenomena on glacial work is discussed.

**Wilson, Andrew Gordon.** Subdivisions of Upper Silurian in Northeastern Iowa. (*Proc. Assoc. Adv. Sci.*, Vol. XLIV, p. 137, 1896.) Five distinct terranes are recognized.

**Wilson, Andrew Gordon.** Upper Silurian in Northeastern Iowa. (*American Geologist*, Vol. XVI, pp. 275-281, Minneapolis, 1895.) Subdivision of the Silurian section of Iowa is discussed and five numbers are characterized lithologically and faunally. Four of these are essentially the subdivisions at present recognized.

**Winchell, Alexander.** Description of Fossils from Yellow Sandstone lying below Burlington Limestone at Burlington, Iowa. (*Proc. Acad. Nat. Sci. Philadelphia*, XV, pp. 2-25, Philadelphia, 1863.) A number of species and genera are described as new.

**Winchell, Alexander.** Description of New Species of Fossils from Marshall Group of Michigan and its Supposed Equivalent in Other States: with Notes on Some Fossils of Same Age Previously Described. (Proc. Acad. Nat. Sci. Philadelphia, Vol. XVII, pp. 109-133, Philadelphia, 1865.) Several species of fossils are noted from Burlington.

**Winchell, Alexander.** Marshall Group: A Memoir on its Geological Position, Characters and Equivalencies in United States. (Proc. American Philosophical Soc., Vol. XI, pp. 57-83, Philadelphia, 1869.) References to the correlation of the Kinderhook rocks of Iowa are made.

**Winchell N. H.** Description of Deep-well at Emmetsburg, Iowa. (Bull. Minnesota Acad. Sci., Vol. I, pp. 387-390, Minneapolis, 1880.)

**Winchell, N. H.** Geology of Minnesota. (Geol. and Nat. Hist. Surv., Minnesota, Final Rep., Vol. I, 697 pp., Minneapolis, 1884.) A number of incidental references are given concerning the geology of Iowa.

#### **Winnebago County.**

Analysis of a meteorite. J. Torrey and E. H. Barbour. (American Geologist, VIII, 67-72, 1891.)

Analyses of peat. Rush Emery. (Geology of Iowa, II, 398, 1870.)

General description. C. A. White. (Geology of Iowa, II, 247-249, 1870.) Brief general description of the surface characters is given.

Geology of Kossuth, Hancock and Winnebago counties. T. H. Macbride. (Iowa Geol. Surv., XIII, 81-122, 1903.)

Meteorites. Joseph Torrey, Jr., and E. H. Barbour. (Science, Vol. XV, 347, 1890.)

Peat deposits in Iowa. S. W. Beyer. (Iowa Geol. Surv., XIX, 699-730, 1909.)

Preliminary report on peat resources of Iowa. T. E. Savage. (Iowa Geol. Surv., Bull. No. 2, 5-21, 1905.)

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.)
- Winnebago meteorite. E. N. Eaton. (American Geologist, VIII, 385-387, 1891.)
- Winnebago county**, geology. T. H. Macbride. (Iowa Geol. Surv., XIII, 81-122, 1903.)
- Winneshiek County.**
- Artesian wells of Iowa. W. H. Norton. (Iowa Geol. Surv., VI, 113-428, 1897.)
- Decorah ice cave and its explanation. A. F. Kovarik. (Scientific American Supplement, MCXC, p. 19158, 1898.)
- Geology of clays. S. W. Beyer and I. A. Williams. (Iowa Geol. Surv., XIV, 377-552, 1904.)
- Geology of quarry products. S. W. Beyer and I. A. Williams. (Iowa Geol. Surv., XVII, 189-588, 1907.)
- Geology of Winneshiek county. S. Calvin. (Iowa Geol. Surv., XVI, 37-146, 1906.)
- Glacierés, or freezing caverns. E. S. Balch. (One volume, 88-89, 1900.)
- Ice caves and frozen wells. W J McGee. (National Geog. Mag., XII, 433, 1901.)
- Notice of geology. J. D. Whitney. (Geology of Iowa, I, 312-317, 1858.)
- 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.)
- Winneshiek county**, geology. S. Calvin. (Iowa Geol. Surv., XVI, 37-146, 1906.)
- Winterset Limestone** (Bethany).
- Geology of Decatur county. H. F. Bain. (Iowa Geol. Surv., VIII, 255-314, 1898.)
- Geology of Madison county. J. L. Tilton and H. F. Bain. (Iowa Geol. Surv., VII, 489-539, 1897.)



**Wisconsin and Kansan drift sheets in central Iowa and related phenomena, relations.** H. F. Bain. (Iowa Geol. Surv., VI, 429-476, 1897.)

**Wisconsin Till.**

Complexity of glacial period and Iowa's role in its establishment. C. Keyes. (Annals of Iowa; an Historical Quarterly, XI, 1913.)

Geology of Boone county. S. W. Beyer. (Iowa Geol. Surv., V, 167-232, 1896.)

Geology of Carroll county. H. F. Bain. (Iowa Geol. Surv., IX, 49-106, 1899.)

Geology of Cerro Gordo county. S. Calvin. (Iowa Geol. Surv., VII, 117-195, 1897.)

Geology of Cherokee and Buena Vista counties. T. H. Macbride. (Iowa Geol. Surv., XII, 303-353, 1902.)

Geology of Clay and O'Brien counties. T. H. Macbride. (Iowa Geol. Surv., XI, 461-508, 1901.)

Geology of clays. S. W. Beyer and I. A. Williams. (Iowa Geol. Surv., XIV, 377-552, 1904.)

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 Emmet, Palo Alto and Pocahontas counties. T. H. Macbride. (Iowa Geol. Surv., XV, 227-276, 1905.)

Geology of Franklin county. I. A. Williams. (Iowa Geol. Surv., XVI, 453-507, 1906.)

Geology of Guthrie county. H. F. Bain. (Iowa Geol. Surv., VII, 413-487, 1897.)

Geology of Hamilton and Wright counties. T. H. Macbride. (Iowa Geol. Surv., XX, 97-138, 1910.)

Geology of Hardin county. S. W. Beyer. (Iowa Geol. Surv., X, 243-305, 1900.)

Geology of Humboldt county. T. H. Macbride. (Iowa Geol. Surv., IX, 109-154, 1899.)

Geology of Jasper county. I. A. Williams. (Iowa Geol. Surv., XV, 277-367, 1905.)

- Geology of Kossuth, Hancock and Winnebago counties. T. H. Macbride. (Iowa Geol. Surv., XIII, 81-122, 1903.)
- Geology of Lyon and Sioux counties. F. A. Wilder. (Iowa Geol. Surv., X, 85-184, 1900.)
- Geology of Marshall county. S. W. Beyer. (Iowa Geol. Surv., VII, 197-262, 1897.)
- Geology of Plymouth county. H. F. Bain. (Iowa Geol. Surv., VIII, 315-366, 1898.)
- Geology of Osceola and Dickinson counties. T. H. Macbride. (Iowa Geol. Surv., X, 185-239, 1900.)
- Geology of Polk county. H. F. Bain. (Iowa Geol. Surv., VII, 263-412, 1897.)
- Geology of Sac and Ida counties. T. H. Macbride. (Iowa Geol. Surv., XVI, 509-548, 1906.)
- Geology of Story county. S. W. Beyer. (Iowa Geol. Surv., IX, 155-245, 1899.)
- Geology of Webster county. F. A. Wilder. (Iowa Geol. Surv., XII, 63-235, 1902.)
- Geology of Worth county. I. A. Williams. (Iowa Geol. Surv., X, 315-377, 1900.)
- Mississippi valley between Savanna and Davenport. J. E. Carman. (Bull. Illinois Geol. Surv., No. 13, 96 pp., 1909.)
- Observations in vicinity of Wall Lake. F. A. Wilder. (Proc. Iowa Acad. Sci., VII, 77-78, 1900.)
- Present phase of pleistocene problems in Iowa. S. Calvin. (Bull. Geol. Soc. America, XX, 133-152, 1909.)
- Principal soil areas of Iowa. W. H. Stevenson. (Bull. Iowa State College, Exper. Station, No. 82, 373-388, 1911.)
- Relation of Wisconsin and Kansan drift sheets in central Iowa and related phenomena. H. F. Bain. (Iowa Geol. Surv., VI, 439-476, 1897.)
- Some features of channel of Mississippi river between Lansing and Dubuque, and their probable history. S. Calvin. (Proc. Iowa Acad. Sci., XIV, 213-220, 1907.)
- Some variant conclusions in Iowa geology. J. E. Todd. (Proc. Iowa Acad. Sci., XIII, 183-186, 1906.)

- Sundry provincial and local phases of general geologic section of Iowa. C. R. Keyes. (Proc. Iowa Acad. Sci., XIX, 147-151, 1912.)
- Synopsis of drift deposits of Iowa. S. Calvin. (American Geologist, XIX, 270-272, 1897.)
- Topography and climate of Iowa. H. E. Simpson. (Iowa Geol. Surv., XXI, 48-66, 1912.)
- Topography and climate of Iowa. H. E. Simpson. (U. S. Geol. Surv., Water Supply Paper No. 293, 45-59, 1912.)
- Witter, F. M.** Additional Observations on Loess in and about Muscatine. (Proc. Iowa Acad. Sci., Vol. I, pt. i, p. 45, Des Moines, 1890.) Abstract of paper read before the Academy is given.
- Witter, F. M.** Geological Features near Muscatine. (Proc. Iowa Acad. Sci., 1875-1880, p. 16, Iowa City. 1880.) Brief notice of the loess and its fossils at Muscatine is made.
- Witter, F. M.** Gas wells near Letts, Iowa. (American Geologist, Vol. IX, pp. 319-321, Minneapolis, 1892.) Notes on natural gas-wells recently opened in Louisa county are presented.
- Witter, F. M.** Gas Wells near Letts, Iowa. (Proc. Iowa Acad. Sci., I, pt. ii, pp. 68-70, Des Moines, 1892.) Gas is reported as being found in a number of places near Letts, in Louisa county, and as furnishing supplies for a number of families.
- Witter, F. M.** Notice of Arrow-points from Loess in City of Muscatine. (Proc. Iowa Acad. Sci., I, pt. ii, pp. 66-68, Des Moines, 1892.) Announcement is made of arrow-heads found in brick-pits in the loess.
- Woodbury county.**
- Artesian wells of Iowa. W. H. Norton. (Iowa Geol. Surv., VI, 113-428, 1897.)
- Cretaceous deposits at mouth of Big Sioux. F. B. Meek. (U. S. Geol. Surv., Terr., IX, p. xxv, 1876.)
- Cretaceous rocks near Sioux City. J. Marcou. (Bull. Soc. géol. de France, (2), XXIV, 56, 1866.)
- Cretaceous deposits of Sioux valley. H. F. Bain. (Iowa Geol. Surv., III, 99-114, 1895.)

- Cretaceous deposits of Woodbury and Plymouth counties, with observations on their economic uses. S. Calvin. (Iowa Geol. Surv., I, 145-161, 1893.)
- Cretaceous formations of Missouri river. J. N. Nicollet. (American Jour. Sci., (1), XLV, 153-159, 1843.)
- Description of geology. O. H. St. John. (Geology of Iowa, II, 186-200, 1870.)
- Evidence that fossiliferous gravels and sands of Iowa and Nebraska are Aftonian. B. Shimek. (Bull. Geol. Soc. America, XXI, 119-140, 1910.)
- Geology of clays. S. W. Beyer and I. A. Williams. (Iowa Geol. Surv., XIV, 377-552, 1904.)
- Geology of quarry products. S. W. Beyer and I. A. Williams. (Iowa Geol. Surv., XVII, 189-588, 1907.)
- Geology of Woodbury county. H. F. Bain. (Iowa Geol. Surv., V, 241-299, 1896.)
- Interclassial till near Sioux City, Iowa. J. E. Todd and H. F. Bain. (Proc. Iowa Acad. Sci., II, 20-23, 1895.)
- Niobrara chalk. S. Calvin. (American Geologist, XIV, 140-161, 1894.)
- Notes on cretaceous flora of western Iowa. P. Bartsch. (Bull. Lab. Nat. Hist., State Univ. Iowa, III, 178-182, 1896.)
- Notes on various glass-sands, mainly undeveloped. E. F. Burchard. (Bull. U. S. Geol. Surv., No. 315, 377-379, 1907.)
- Observations on geological structure of valley of Mississippi. T. Nuttall. (Jour. Acad. Nat. Sci. Philadelphia, First series, II, 14-52, 1821.)
- Preglacial elevation of Iowa. H. F. Bain. (Proc. Iowa Acad. Sci., II, 23-25, 1895.)
- Relation of cretaceous deposits of Iowa to subdivisions of cretaceous proposed by Meek and Hayden. S. Calvin. (Proc. Iowa Acad. Sci., I, pt. iii, pp. 7-12, 1893.)
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Sanitary analyses of some Iowa deep-well waters. J. B. Weems. (Proc. Iowa Acad. Sci., IX, 63-70, 1902.)

Sioux City water supply. A. N. Cook and C. F. Eberly. (Proc. Iowa Acad. Sci., IX, 90-101, 1902.)

Sioux City water supply, II. A. N. Cook and W. J. Morgan. (Proc. Iowa Acad. Sci., X, 122-123, 1903.)

Smoking bluffs of Missouri river region. H. C. Powers. (Sioux City Acad. Sci. and Letters, I, 57-60, 1904.)

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

Underground waters resources of Iowa. W. H. Norton. (U. S. Geol. Surv., Water Supply Paper No. 293, 994 pp. 1912.)

**Woodbury** and Plymouth counties, Cretaceous deposits, with observations on their economic uses. S. Calvin. (Iowa Geol. Surv., I, 145-161, 1893.)

**Woodbury county**, geology. H. F. Bain. (Iowa Geol. Surv., V, 241-299, 1896.)

#### **Woodbury Shales.**

Cretaceous deposits of Sioux valley. H. F. Bain. (Iowa Geol. Surv. III, 99-114, 1895.)

Cretaceous formations of Iowa. C. R. Keyes. (Proc. Iowa Acad. Sci., I, iv, 25-26, 1894.)

Cretaceous formations of Missouri river. J. N. Nicollet. (American Jour. Sci., (1), XLV, 153-159, 1843.)

Geological formations of Iowa. C. R. Keyes. (Iowa Geol. Surv., I, 137-138, 1893.)

Geology of clays. S. W. Beyer and I. A. Williams. (Iowa Geol. Surv., XIV, 377-552, 1904.)

Geology of Plymouth county. H. F. Bain. (Iowa Geol. Surv., VIII, 315-366, 1898.)

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- Smoking bluffs of Missouri river region. H. C. Powers. (Sioux City Acad. Sci. and Letters, I, 57-60, 1904.)
- Sundry provincial and local phases of general geologic section of Iowa. C. R. Keyes. (Proc. Iowa Acad. Sci., XIX, 147-151, 1912.)
- Woodbury sandstones and shales. C. A. White. (Geology of Iowa, I, 291-293, 1870.)

### **Worms.**

- Kinderhook faunal studies; II, fauna of Chonopectus sandstone at Burlington, Iowa. S. Weller. (Trans. St. Louis Acad. Sci., X, 57-129, 1900.)
- New species from devonian near Iowa City. S. Calvin. (American Geologist, I, 24-28, 1888.)
- New species from Paleozoic rocks of Iowa. C. A. White. (Proc. Acad. Nat. Sci. Philadelphia, XXVIII, 27-34, 1877.)

**Work** and scope of the geological survey. C. R. Keyes. (Iowa Geol. Surv., III, 47-98, 1894.)

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

**Work** of chemical laboratory. N. W. Lord. (Prof. Paper No. 48, U. S. G. S., 221-225, 1906.)

**Work** of Iowa geological survey. S. Calvin. (Proc. Iowa Acad. Sci., XVI, 11-18, 1909.)

### **Worth County.**

Analyses of peat. Rush Emery. (Geology of Iowa, II, 398, 1870.)

Distribution of Rockford shales. C. L. Webster. (Proc. Davenport Acad. Nat. Sci., V, 100-109, 1887.)

General description. C. A. White. (Geology of Iowa, II, 249-251, 1870.)

Geology of quarry products. S. W. Beyer and I. A. Williams. (Iowa Geol. Surv., XVII, 189-588, 1907.)

Geology of Worth county. I. A. Williams. (Iowa Geol. Surv., X, 315-377, 1900.)

- Peat deposits in Iowa. S. W. Beyer. (Iowa Geol. Surv., XIX, 699-730, 1909.)
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- Underground water resources of Iowa. W. H. Norton. (U. S. Geol. Surv., Water Supply Paper No. 293, 994 pp., 1912.)
- Worth county, geology.** I. A. Williams. (Iowa Geol. Surv., X, 315-377, 1900.)
- Worthen, A. H.** Description of Fossil Invertebrates. (Geol. Surv. Illinois, Vol. VII, pp. 264-322, Springfield, 1883.)  
A number of species are redescribed and figured from Iowa.
- Worthen, A. H.** Description of Fossil Invertebrates. (Geol. Surv. Illinois, Vol. VIII, pp. 69-154, Springfield, 1890.)  
A number of species are described as new from Iowa.
- Worthen, A. H.** Description of New Species of Crinoids. (Illinois State Mus. Nat. Hist., Bull. No. 1, pp. 1-39, Springfield, 1882.) Several species from Iowa are described as new.
- Worthen, A. H.** General Geology of Illinois. (Geol. Surv. Illinois, Vol. I, pp. 1-153, Springfield, 1866.) Numerous references are made to the geology of eastern Iowa.
- Worthen, A. H.** Geology of Certain Counties. (Geology of Iowa, Vol. I, pp. 132-258, Albany, 1858.) Detailed accounts of the geology of the following counties are given:
- Lee county, Des Moines, Henry, Van Buren, Jefferson, Washington and Wapello.
- Worthen, A. H.** Geology of Des Moines Valley. (Geology of Iowa, I, pp. 147-182, Albany, 1856.) A detailed geological account is given of a trip made up the Des Moines river during the year 1856, from Keokuk to Ft. Dodge, with numerous sections.

- Worthen, A. H.** Notice of New Species of *Platycrinus* and Other Fossils from Mountain Limestone of Illinois and Iowa. (Trans. Acad. Sci. St. Louis, Vol. I, pp. 569-571, St. Louis, 1860.) *Platycrinus pratteni* is described from Burlington, Iowa.
- Worthen, A. H.** Occurrence of Fish Remains in Carboniferous Limestone of Illinois. (Proc. American Assoc. Adv. Sci., Vol. X, pp. 189-192, 1856.) Beds containing fish remains are recognized, the lower of which is near the top of the Burlington crinoidal limestone and has been recognized at Augusta, Iowa.
- Worthen, A. H., F. B. Meek and.** Contribution to Paleontology of Illinois and other Western States. (Proc. Acad. Nat. Sci. Philadelphia, Vol. XIX, pp. 251-275, Philadelphia, 1868.) See F. B. Meek and A. H. Worthen, 1868.
- Worthen, A. H., F. B. Meek and.** Description of New Carboniferous Fossils from Illinois and Other Western States. (Proc. Acad. Nat. Sci. Philadelphia, Vol. XII, pp. 447-472, Philadelphia, 1860.) See F. B. Meek and A. H. Worthen, 1860.
- Worthen, A. H., F. B. Meek and.** Description of New Crinoidea and Echinoidea from Carboniferous Rocks of Western States; with note on Genus *Onychaster*. (Proc. Acad. Nat. Sci. Philadelphia, XXI, pp. 67-83, Philadelphia, 1869.) See F. B. Meek and A. H. Worthen, 1869.
- Worthen, A. H., F. B. Meek and.** Description of New Paleozoic Fossils from Illinois and Iowa. (Proc. Acad. Nat. Sci. Philadelphia, Vol. XIII, pp. 128-148, Philadelphia, 1861.) See F. B. Meek and A. H. Worthen, 1861.
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