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OF

GEORGE PERKINS MERRILL

1854–1929

BY

WALDEMAR LINDGREN

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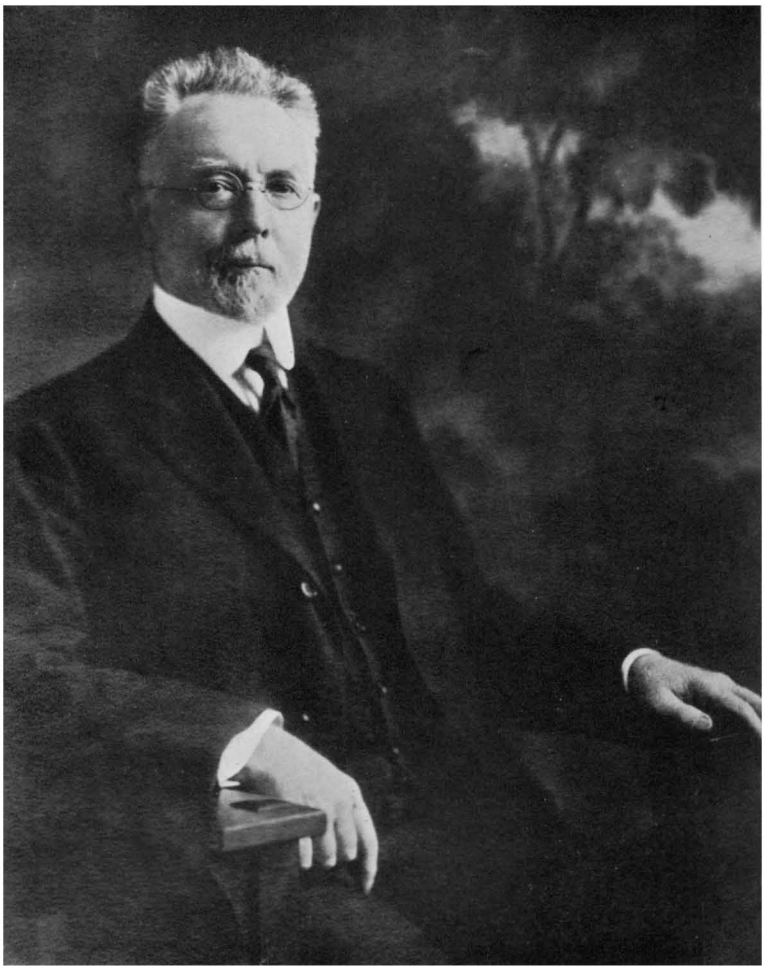

George P. Merrill

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1854–1929

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The sources for the preparation of this memorial are first, an autobiography of Merrill prepared in 1924 and which was submitted to me by the president of the National Academy of Sciences; second, a biography by his friend, Charles Schuchert, published by the Geological Society of America;[1] third, a personal acquaintance with Doctor Merrill dating back to 1890 when I first met him in Washington and continuing at intervals from 1912 to 1929 after my transfer to Boston. To Mrs. Merrill I am greatly indebted for much information obtained in conversation. Miss M. Moodey, who for many years was Doctor Merrill's secretary, has also kindly furnished notes regarding his work.

George Perkins Merrill was born May 31, 1854, at Auburn, Maine. After his undergraduate studies in Maine he was appointed to the geological department of the U. S. National Museum in 1881, and soon became its Curator, remaining an officer of the Museum for nearly 50 years and until his death. He suddenly passed away at Auburn, August 15, 1929, where he had usually spent a short time each summer.

Merrill was married in 1883 to Sarah Farrington of Portland, Maine. In 1892 she fell seriously ill, and died in 1894, leaving four children, one son and three daughters. In 1900 Merrill married Katherine L. Yancey of Virginia, who survives him and by whom he had one daughter.

Merrill was a descendant of an old New England family, one of his ancestors, Nathaniel Merrill, having settled in Old Newberry, Massachusetts, in 1638. It is said that Nathaniel Merrill was originally one of the Huguenots who were driven out of France on St. Bartholomew's day, the name being De Merles, later changed to Merrill. His father, Lucius Merrill, was a carpenter and cabinet maker; his mother Anne (Jones)

[1] Bull. Geol. Soc. America, 42, pp. 95-122, 1931.

Merrill was a daughter of a clergyman long settled in Minot, Maine. The family was large and it became necessary that the young man should do his part toward its support. So it happened that he soon became independent, doing chores for the family and neighbors; later, from the age of eighteen to twenty-one, working in the shoe factories. As he states, his early education was "necessarily scrappy," but with indomitable courage he worked his way, so that in 1876 he entered the University of Maine, at Orono, there supporting himself. In 1879 he obtained the B.S. degree in chemistry. In 1883 he was given the degree of M.S., and in 1889, Ph.D. from the same institution. In 1917 he received the honorary degree of Sc. D. from George Washington University. In 1922 he was elected a member of the National Academy of Sciences, and the same year he was awarded the J. Lawrence Smith gold medal of the Academy for his researches on meteorites. He was a member of many scientific societies, particularly the American Philosophical Society, the Academy of Natural Sciences of Philadelphia, the Washington Academy of Sciences (president 1906-1907), the Geological Society of America (vice-president 1920), the Maryland Academy of Sciences and many other learned organizations.

His earliest work was in chemistry as assistant at the Wesleyan University, Middletown, Connecticut. In the winter of 1880-1881 he was connected with the fisheries census in Washington, and in the following year, through the support of G. Browne Goode, then in charge of the U. S. National Museum, he was appointed aid to George W. Hawes, the petrographer in that institution. These two men undoubtedly influenced his choice to take up the study of mineralogy and geology. He already strongly inclined toward these branches of the natural sciences, evidently in part through the influence of his grandfather at Minot. Under Hawes he took part in the work of the Tenth Census, in which many young geologists gathered their first laurels studying collections of rocks and ores. Under Hawes he also began petrographic studies and learned the preparation of thin sections of rocks. He was thus one of the earliest petrographers of this country, later working with George H.

Williams at Johns Hopkins University. Merrill was appointed curator of the geological department in the museum and in 1897 head curator of the department, a position which he held until his death.

One's first impression on meeting Merrill was that of a reserved and austere man, about 5 feet 10 inches in height, and of sturdy, erect build, with sandy hair and short van Dyke beard, and remarkably keen blue eyes. I always thought he changed but little with age. Always occupied, reading and studying, and arranging or planning his great collections in mineralogy and geology, he gave the impression of being interested only in his duties and researches. But underneath this first impression he revealed to his friends a mind rich in knowledge and appreciation of art, literature and music, rich also in humor and in apt quotation.

In his geological work he was primarily an investigator and a research man. He had little inclination to advance and discuss speculative theories, much preferring to stay close to the facts. Looking back on his life's work I have been amazed at its quality and quantity in so many different branches. His life was a busy one indeed, and in spite of ill health during part of his later years, he made an imprint on the history of geology which time will not easily efface.

Though Merrill was not primarily a field geologist, his experience in the field was quite extensive. He assisted Dr. Peale in 1887 and 1889 in the mapping of the classical "Three Forks Folio, Montana." He attended the Geological Congress of 1897 in St. Petersburg, and had opportunity of visiting much of Russia and the Ural Mountains and to examine the great museums of Europe. In 1905 he visited Lower California to investigate certain onyx deposits, and in connection with his studies of building stones and meteorites he visited a large number of localities of exceptional interest in the United States. Merrill's bibliography contains a great number of papers on individual minerals and rocks, aside from his principal fields of investigation. Of particular interest is an article on "Gold in Granite," the specimen from Sonora, Mexico, apparently containing gold of direct magmatic origin (Bibliography, 1896).

In order to appreciate fully the extent of his life's work it should be stated that his bibliography contains some 200 titles, many of his papers being of extensive dimensions. He wrote 47 annual reports of his department, and he was a contributor to at least six dictionaries and encyclopedias. From 1893 to 1915 he held the chair of mineralogy and geology at the (present) George Washington University, lecturing there several hours a week after official office hours.

It is appropriate to consider Merrill's scientific work under the following heads, bearing in mind, as Dr. Schuchert points out, that in three or four of these branches he may be considered a pioneer, at least in this country:

As organizer of the Department of Geology in the U. S. National Museum.

As an investigator of the quality and petrography of building stones.

As a student of the processes of weathering.

As a writer of practically the first book on non-metallic deposits.

As an authority on the petrography of meteorites.

As an historian of North American geology.

ADMINISTRATOR AND COLLECTOR

To have organized, arranged or supervised the arrangement of the collection in geology and mineralogy of the U. S. National Museum might well be considered the work of a lifetime. Anyone conversant with the administrative duties of such a museum will realize this. At the present time this Museum is inferior to none; probably it is among the two or three of the very best in the world.

In 1883 Merrill reports having in charge about 12,500 specimens. Starting thus single-handed in 1880 this section had grown in 1929 to a staff of nineteen curators or associates. It contained 93,044 specimens in the geological collection; 132,279 specimens in the section of mineralogy and petrography; 1,765,600 specimens in the section of stratigraphy or invertebrate paleontology; and 24,497 specimens in the section of vertebrate paleontology; a total of 2,015,420 specimens. The arrangement

of this collection is wonderfully effective, particularly in the mineralogical and economic branches. The successful assembly and arrangement of these enormous collections testify to the great administrative ability of Merrill.

Several publications in the Reports of the Smithsonian Institution and later in the Reports of the U. S. National Museum, illustrate and describe these collections, particularly a book issued separately under the title of "Illustrated Handbook, the Department of Geology of the U. S. National Museum," 1923.

INVESTIGATOR OF BUILDING STONES

The examination of rocks by means of the petrographic microscope began to be developed in the United States about the time Merrill was appointed assistant to Dr. Hawes, who was one of the pioneers in this branch. About the same time Rosenbusch's handbook became generally known, as well as Zirkel's classical investigation of the rocks collected by the Fortieth Parallel Survey. Hawes was appointed special agent of the Tenth Census in charge of building stones, and a very large collection had been brought together from all parts of the United States. After the untimely death of Hawes in 1882 Merrill was appointed in charge of the lithological investigation in this branch, and all this led him directly to the taking up of microscopic petrography. He soon became an expert in this new branch of science. Hawes' plan called not only for an investigation of the industry but also for the petrographic character of the building stones, and the influence of this on the selection of proper material, and on the durability of the stones. One of the first of his duties was the preparation of thin sections of this great collection, and the result of his work was published in Volume 10 of the Tenth Census (1884). In 1889 he brought together the information in a Museum handbook of the building stone collection. It was later (1891) published in revised form as a book of 500 pages entitled: "Stones for Building and Decoration," which passed through three editions. This established his reputation as a pioneer and an authority on building stones of the United States. Thereafter he was frequently consulted in the selection of proper materials

for important buildings and monuments. One of his tasks was the selection of the stone for the Lincoln Memorial.

INVESTIGATOR OF PROCESSES OF WEATHERING

Undoubtedly, the study of building stones led directly to the study of the changes they undergo near the surface. The disintegration of the granitic rocks in the District of Columbia so well exposed near the Zoological Park surely attracted his attention at an early date. Such processes of weathering had been noted and described before, particularly by Roth in Germany, but Merrill began a detailed study to trace the exact chemical and mechanical processes. He collected his specimens and separated and analysed them to ascertain just what amounts of the various minerals had been decomposed, what substances had been leached, and what had been added. By the assumption of constant alumina he succeeded in calculating the almost exact amount of additions and losses.

Merrill made similar careful examinations of the Medford diabase dike (Massachusetts), the gneiss of Virginia, and weathered rocks from many other places, which served as models for later work. In 1896 he published a notable paper in the *Journal of Geology* on the "Principles of Rock Weathering." The next year there appeared his book on "Rocks, Rock Weathering and Soils" (pp. 411). A second edition came out in 1906. This book, which has been most useful and illuminating to hundreds of geologists, firmly established Merrill's reputation as a pioneer and an authority on the processes of weathering.

AUTHORITY ON THE NON-METALLIC MINERALS

In the bibliography of Merrill one may find a considerable number of papers on the non-metallic minerals, referring by this name rather to the uses than to the chemical composition. In 1901 one finds "A Guide to the Study of the Collections in the Section of Applied Geology," published in the annual report of the Museum. Many descriptions of the metallic ores had previously been written, but the minerals used for non-metallic

purposes had been greatly neglected. In 1904 Merrill wrote a book (pp. 415) on "The Non-Metallic Minerals, Their Occurrence and Uses," which filled a long felt want of economic geologists. A second enlarged edition was issued in 1910. The writer can gratefully testify to the excellence of this book, in which for the first time the rarer as well as the common minerals were described, with abundant notes on their distribution and uses. Here again we find Merrill a pioneer.

THE FOREMOST AMERICAN AUTHORITY ON METEORITES

Since 1888, when he published his first study of meteorites, Merrill contributed nearly 80 papers on this subject, mostly describing American occurrences, and his interest in this subject continued until his death. His last paper (Bull. 149, U. S. Nat. Museum), issued after his death, was of a comprehensive nature, entitled: "Composition and Structure of Meteorites." He was without doubt the foremost authority on this subject in our country.

Since the days of Berzelius meteorites have, of course, been studied by a large number of authors in Europe, such as Sorby, Haidinger, Tschermak, Cohen, and Brezina. It is worthy of note that C. U. Shepard was the earliest student of meteorites in America; he published 30 papers on meteorites from 1829 to 1886. However, it was not until the methods of microscopical petrography were developed that real progress was made. The National Museum under Merrill's direction, accumulated a collection of these wanderers in space, which is now one of the great collections in the world. Merrill's study was largely directed to the stony meteorites and their peculiar textures, mostly made up of olivine and pyroxene. He discussed not only their composition but also their origin, holding that "the earth today in its course is but passing through and receiving from space a deposit of materials representing one and the same original body, and that body one of an exceeding basic nature, not necessarily resembling in percentage composition the materials which may have reached us during past and earlier

stages of earth history." And in another place: "We are bound, it seems to me, to regard the meteorites as world matter. If so regarded, we are confronted at once with the general basic nature of the original magma from which they were derived."

A new calcium-sodium phosphate, described from an Indian meteorite, has been named Merrillite. Merrill's investigations were supported by aid from the National Academy of Sciences and, as noted above, he received in 1922 the J. Lawrence Smith gold medal for his work on meteorites.

In the summer of 1908 Merrill was detailed by C. D. Walcott to make a study of the so-called Coon Butte, or Canyon Diablo "Meteor Crater" of eastern Arizona. After a careful investigation he concluded that the phenomena of this depression and the meteorites scattered in the vicinity pointed clearly to the impact of a large meteorite that is believed to be buried in the rocks below the bottom of the "crater." Later work has strongly supported Merrill's conclusions, which at first were not universally accepted. At least 20 tons of meteoric fragments have been gathered over several square miles of the ground around the "crater," their individual weights range up to 1800 pounds. A full description by Merrill of this remarkable occurrence was published in the Smithsonian Miscellaneous Collections, Vol. 50, 1908.

HISTORIAN OF NORTH AMERICAN GEOLOGY

One might well think that the various activities briefly reviewed would alone be sufficient to fill a lifetime. But, last but not least, it remains to consider Merrill as an historian of North American geology. In his autobiography Merrill explains that during a couple of years in his early connection with the National Museum, he had some time to spare, and that he became interested in the early history of geology in this country; he accumulated biographical notes, portraits and autographed letters of the early workers. It seems strange, but it is true, that few other geologists had thought of such a useful work. Only the merest outlines had been published. Sketches of nearly 200 American geologists were included in his book,

entitled "Contributions to the History of American Geology" (Ann. Rept. U. S. Nat. Museum, for 1904, pp. 189-733). In 1924 the Yale University Press published the entirely rewritten book under the name of "The First One Hundred Years of American Geology" (pp. 733, pls. 36).

"It is a history of the growth of geology in America in all of its physical aspects. Beginning with 1785 it goes to the closing years of the past century—a review of the gradual development of the science in this country through one hundred years.—It is an impressive volume" (Charles Schuchert, in Biography of Merrill).

It is, I should add, a wonderfully useful volume which every geologist in this country should read. It summarizes historical data many of which but for Merrill would have fallen into oblivion.

Another exceedingly useful book was published by Merrill in 1920. Like the former, it assembles a host of important data. It is entitled "Contributions to a History of American State Geological and Natural History Surveys" (Bull. U. S. National Museum, 109, pp. 549; with 37 portrait plates).

Above is presented in briefest outline, the history of Merrill's life and scientific work. I am proud that I was able to count him as my friend. I cannot but help wondering if I have done him justice. Never advertising himself, never proclaiming his discoveries, simply working along steadily and unostentatiously, even his friends might have failed to realize his true stature during his life. I always thought of him as "the man from Maine." In the highest degree he personified the virtues and the merits of that sturdy New England stock from which he descended: quiet, keen of intelligence, persistent, consistent; originating, not following.

He was not what sometimes is called a "general geologist." Early in life he took up mineralogy and petrography, and these studies led him into new fields, scarcely cultivated before. He originated new branches of great scientific and practical importance, and on this work rests securely his fame as one of the leaders of geological science.

BIBLIOGRAPHY

OF

GEORGE P. MERRILL, 1879-1930

Compiled by Margaret W. Moodey

1879

An examination of Dr. Alfredo Cavazzi's method for the separation of nickel from cobalt. Rep. State Coll. Agr. & Mech. Arts, Orono, Me., pp. 30-31.

1882

Microscopic examination and determination of the building stones of Maine. Rep. State Coll. Agr. and Mech. Arts, Orono, Me., pp. 89-100.

Bibliography of writings of Dr. George W. Hawes. Rep. Asst. Director U. S. Nat. Mus., pp. 42-48.

1883

Note on a Potsdam sandstone, or conglomerate, from Berks County, Pa. Proc. U. S. Nat. Mus., vol. 5, pp. 660-661.

On the collection of Maine building stones in the United States National Museum. Proc. U. S. Nat. Mus., vol. 6, pp. 165-183.

Preliminary note on the crystalline schists of the District of Columbia. Proc. U. S. Nat. Mus., vol. 6, pp. 159-161.

Fluidal cavities in quartz grains of sandstones [Fort Ann, New York.] Science, vol. 1, p. 221.

On the black nodules or so-called inclusions in the Maine granites. Proc. U. S. Nat. Mus., vol. 6, pp. 137-141.

1884

Hornblende andesite from the new Bogosloff volcano. Science, vol. 4, p. 524.

[Building stones]. Tenth Census U. S. Report on the building stones of the United States and statistics of the quarry industry for 1880, p. 357, bound as part of vol. 10, but with separate pagination. Washington.

On prochlorite from the District of Columbia. Proc. U. S. Nat. Mus., vol. 7, p. 67.

Preliminary plan for a collection of the building and ornamental stones and rocks of the United States, to be exhibited at the World's Industrial and Cotton Centennial Exposition of 1884-85 at New Orleans. Proc. U. S. Nat. Mus., vol. 7, pp. 573-574. (Also published as Museum Circular No. 25.)

Microscopic structure. Tenth Census U.S. Report on the building stones of the United States and statistics of the quarry industry for 1880, pp. 15-20, plates, bound as part of vol. 10, but with separate pagination. Washington.

1885

Building and ornamental stones of the United States. Pop. Sci. Monthly, vol. 28, pp. 520-532.

On supposed crude jade from Alaska. Science, Mar. 13, p. 209.

On hornblende andesites from the new volcano on Bogosloff Island in Bering Sea. Proc. U. S. Nat. Mus., vol 8, pp. 31-33.

Notes on the mineralogy and lithology of the District of Columbia. Proc. U. S. Nat. Mus., vol. 8, pp. 351-353.

Volcanic dust from southwestern Nebraska. Science, vol. 5, p. 335.

On deposits of volcanic dust and sand in southwestern Nebraska. Proc. U. S. Nat. Mus., vol. 8, pp. 99-100.

1886

On fulgurites. Proc. U. S. Nat. Mus., vol. 9, pp. 83-90.

Notes on the composition of certain "Pliocene sandstones" from Montana and Idaho. Am. Journ. Sci., 3d ser., vol. 32, pp. 199-204.

1887

Fulgurites, or lightning holes. Pop. Sci. Monthly, pp. 529-539, 4 figs.

Common salt; its geology and manufacture. The Chautauquan, vol. 8, no. 2, pp. 82-85.

1888

The literature of geyserite. Am. Geol., vol. 2, pp. 436-437.

What makes it rain? St. Nicholas, vol. 15, no. 6, pp. 403-405, 2 illustrations.

On the selection of building stone. Stone, Dec., pp. 196-197.

Note on the secondary enlargement of augites in a peridotite from Little Deer Isle, Me. Am. Journ. Sci., 3d ser., vol. 35, pp. 488-490.

The salt industry in the United States. Nature, vol. 37, no. 963, Apr. 12, p. 558.

On a new meteorite from the San Emigdio Range, San Bernardino County, California. Am. Journ. Sci., 3d ser., vol. 35, pp. 490-491.

On nephrite and jadeite. Proc. U. S. Nat. Mus., vol. 11, pp. 115-130. (With F. W. Clarke.)

The Fayette County, Texas, meteorite. Am. Journ. Sci., vol. 36, pp. 113-119, 3 figs. (With J. E. Whitfield.)

On the San Emigdio meteorite. Proc. U. S. Nat. Mus., vol. 11, pp. 161-167, pl. 35.

On a peridotite from Little Deer Isle, in Penobscot Bay, Maine. Proc. U. S. Nat. Mus., vol. 11, pp. 191-195, pl. 34.

On the serpentine of Montville, N. J. Proc. U. S. Nat. Mus., vol. 11, pp. 105-111, pls. 31, 32.

Concerning the Montville serpentine. Science, vol. 11, p. 302.

1889

On the ophiolite of Thurman, Warren County, New York, with remarks on the Eozoon canadense. Am. Journ. Sci., 3d ser., vol. 37, pp. 189-191.

[Preliminary notes on eruptive rocks collected about Fort Ellis and in Gallatin Valley, Montana.] Eighth Rep. U. S. Geol. Surv., J. W. Powell, Director, pp. 147-148.

The collection of building and ornamental stones in the United States National Museum, a handbook and catalogue. Rep. Smithsonian Inst., 1886, pt. 2, pp. 277-648, pls. 1-9.

Among the Pennsylvania slate quarries. Sci. Am. Suppl., vol. 27, no. 681, pp. 10874-10875.

1890

An account of the progress in petrography for the years 1887 and 1888. Rep. Smithsonian Inst., 1888, pt. 1, pp. 327-354.

Notes on the serpentinous rocks of Essex County, N. Y., from aqueduct shaft 26, New York City, and from near Easton, Pennsylvania. Proc. U. S. Nat. Mus., vol 12, pp. 595-600.

1891

Preliminary handbook of the department of geology in the U. S. National Museum. Rep. U. S. Nat. Mus. for 1888-89, Appendix E, pp. 1-50.

Stones for building and decoration. 453 pp. Wiley and Sons, New York. (Second edition, 506 pp., 1897.) (3d edition, 551 pp., 1903.)

A marble quarry. St. Nicholas Magazine, Aug., 2 pp., 2 illustrations.

1892

On some basic eruptive rocks in the vicinity of Lewistown and Auburn, Androscoggin County, Maine. Am. Geol., vol. 10, pp. 49-55.

The wind as a factor in geology. Eng. Mag., vol. 2, pp. 596-597.

Handbook for the department of geology in the U. S. National Museum. Pt. 1, Geognosy.—The materials of the earth's crust. Rep. U. S. Nat. Mus. for 1890, pp. 503-591, pls. 118-129.

Discussion of the strength and weathering qualities of roofing slate. Trans. Am. Soc. Civil Eng., vol. 27, pp. 685-687.

On an azure-blue pyroxenic rock from the Middle Gila, New Mexico. Am. Journ. Sci., 3d ser., vol. 43, pp. 279-280. (With R. L. Packard.)

The building stone industry of the United States. Stone, July, pp. 131-139; Aug., pp. 263-268, 2 pls., 1 fig. in text; Sept., pp. 369-374, 3 pls., 2 figs. in text.

A cheap form of box for microscopic slides. Science, Nov. 25, p. 298.

The marble region of Knoxville, Tennessee. Stone, Nov., pp. 591-599, 1 map and 5 figs. in text.

1893

Notes on the petrography of the Paleozoic section in the vicinity of Three Forks, Montana. Bull. U. S. Geol. Surv., no. 110, pp. 47-54.

The newer eruptive rocks [of Nantasket area]. Boston Soc. Nat. Hist., Occ. Papers, IV, vol. 1, pt. 1, pp. 31-44.

The architect and his materials. The Am. Architect and Building News, Mar. 4, p. 134.

Report upon rocks collected from the Galapagos Islands. Bull. Mus. Comp. Zool., vol. 16, no. 13, pp. 235-237.

1894

[Beaver Creek meteorite]. Am. Journ. Sci., 3d ser., vol. 47, p. 435.

On the formation of stalactites and gypsum incrustations in caves. Proc. U. S. Nat. Mus., vol. 17, pp. 77-81, pls. 2-5.

Geological sketch of Lower California. Bull. Geol. Soc. America, vol. 4. pp. 489-514, pl. 19. (With S. F. Emmons.)

1895

The onyx marbles: Their origin, composition, and uses, both ancient and modern. Rep. U. S. Nat. Mus. for 1893, pp. 539-585, pls. 1-18.

Directions for collecting rocks and for the preparation of thin sections. Bull. U. S. Nat. Mus., no. 39, pt. 1, pp. 1-15, 17 figs.

The formation of sandstone concretions. Proc. U. S. Nat. Mus., vol. 17, pp. 87-88, pl. 6.

Notes on some eruptive rocks from Gallatin, Jefferson and Madison Counties, Montana. Proc. U. S. Nat. Mus., vol. 17, pp. 637-673.

Disintegration of the granitic rocks of the District of Columbia. Bull. Geol. Soc. America, vol. 6, pp. 321-332, pl. 16.

1896

Disintegration and decomposition of diabase at Medford, Massachusetts. Bull. Geol. Soc. America, vol. 7, pp. 349-362, pl. 16.

An occurrence of free gold in granite. Am. Journ. Sci., 4th ser., vol. 1, pp. 309-311.

The principles of rock weathering. Journ. Geol., vol. 4, pp. 704-724, 850-871.

Notes on asbestos and asbestiform minerals. Proc. U. S. Nat. Mus., vol. 18, pp. 281-299.

On the composition and structure of the Hamblen County, Tennessee, meteorite. Am. Journ. Sci., 4th ser., vol. 2, pp. 149-155, figs. 1, 2.

The onyx marbles: Their origin, composition, and uses, both ancient and modern. Stone, vol. 12, pp. 116-121, 228-236, 326-330, 425-429, 559-564; vol. 13, pp. 9-12, 116-120, pls. 5-18.

1897

Notes on the geology and natural history of the peninsula of Lower California. Rep. U. S. Nat. Mus. for 1895, pp. 969-994, pls. 1-10.

A treatise on rocks, rock weathering, and soils. 8 vo. xx and 411 pp., 25 pls., 42 figs. The Macmillan Co., New York.

Weathering of micaceous gneiss in Albemarle County, Virginia. Bull. Geol. Soc. America, vol. 8, pp. 157-168.

1898

A trip across Lower California. The Osprey, vol. 3, pp. 20-25, pls. 3-5.

The physical, chemical, and economic properties of building stones. Maryland Geol. Surv., vol. 2, pp. 47-123.

1899

A discussion on the use of the terms rock weathering, serpentinization, and hydrometamorphism. Geol. Mag., dec. IV, vol. 6, pp. 354-358; Am. Geol., vol. 24, pp. 244-250.

Preliminary note on new meteorites from Allegan, Michigan, and Mart, Texas. Science, new ser., vol. 10, pp. 770-771.

A consideration of some little known American ornamental stones. Stone, vol. 19, pp. 225-230.

1900

Sandstone disintegration through the formation of interstitial gypsum. Science, new ser., vol. 11, p. 850.

Nepheline-melilite basalt from Oahu, Hawaiian Islands. Am. Geol., vol. 25, pp. 312-313.

A new stony meteorite from Allegan, Michigan, and a new iron meteorite from Mart, Texas. Proc. Wash. Acad. Sci., vol. 2, pp. 41-68, 6 pls. (With H. N. Stokes.)

The Marsh collection of vertebrate fossils. Am. Geol., vol. 25, pp. 171-173.

1901

The department of geology in the National Museum. Am. Geol., vol. 28, pp. 107-123, 5 pls.

On a stony meteorite which fell near Felix, Perry County, Alabama, May 15, 1901. Proc. U. S. Nat. Mus., vol. 24, pp. 193-198, 2 pls.

Guide to the study of the collections in the section of applied geology—the non-metallic minerals [U. S. National Museum]. Ann. Rep. U. S. Nat. Mus. for 1899, pp. 156-483, 30 pls., 13 figs.

1902

A newly found meteorite from Admire, Lyon County, Kansas. Proc. U. S. Nat. Mus., vol. 24, pp. 907-913, 7 pls.

What constitutes a clay? Am. Geol., vol. 30, pp. 318-322.

Rutile mining in Virginia. Eng. and Min. Journ., vol. 73, p. 351; Science, new ser., vol. 15, p. 389 (Abstract of paper read before the Geological Society of Washington).

1903

A newly found meteorite from Mount Vernon, Christian County, Kentucky. Am. Geol., vol. 31, pp. 156-158.

John Wesley Powell. Am. Geol., vol. 31, pp. 327-333, 1 pl. (port.).

The quantitative classification of igneous rocks. A review. Am. Geol., vol. 32, pp. 48-54.

On the glacial pothole in the National Museum. Smithsonian Misc. Coll., vol. 45, pp. 100-103, 1 pl.; Sci. Am. Suppl., vol. 58, p. 23844, 1 fig., 1904.

Stones for building and decoration. Third edition. xi and 551 pp., 33 pls., 24 figs. Wiley and Sons, New York.

The diamond mines of South Africa. A review. Am. Geol., vol. 31, pp. 51-53.

1904

The non-metallic minerals, their occurrence and uses. 414 pp., 32 pls., 28 figs. Wiley and Sons, New York.

1905

Catalogue of the type and figured specimens of fossils, minerals, rocks, and ores in the department of geology, United States National Museum. Part 1.—Fossil invertebrates. Bull. U. S. Nat. Mus., no. 53, pt. 1, 704 pp.

On the origin of veins of asbestiform serpentine. Bull. Geol. Soc. America, vol. 16, pp. 131-136, 2 pls., 2 figs.

Gold and its associations. Eng. and Min. Journ., vol. 79, pp. 902-903.

The division of applied geology, United States National Museum. Am. Inst. Min. Eng., Bi-mo. Bull. no. 4, pp. 929-937.

1906

A treatise on rocks, rock weathering and soils. New edition. 400 pp., 31 pls., 42 figs. The Macmillan Company, New York.

A new meteorite from Scott County, Kansas. Science, new ser., vol. 23, pp. 391-392.

The development of the glacial hypothesis in America. Pop. Sci. Monthly, vol. 68, no. 4, pp. 300-322.

On a new stony meteorite from Modoc, Scott County, Kansas. Am. Journ. Sci., 4th ser., vol. 21, pp. 356-360.

Contributions to the history of American geology. Ann. Rep. U. S. Nat. Mus. for 1904, pp. 189-733, 37 pls., 141 figs.

The building and ornamental stones of North Carolina. Bull. North Carolina Geol. Surv., no. 2, pp. 1-283. Collaborator with F. B. Laney and Thomas L. Watson.

University training of engineers in economic geology. Econ. Geol., vol. 1, no. 4, pp. 387-391.

1907

Catalogue of the type and figured specimens of fossils, minerals, rocks, and ores in the department of geology, United States National Museum. Part II.—Fossil vertebrates; fossil plants; minerals, rocks, and ores. Bull. U. S. Nat. Mus., no. 53, pt. 2, 370 pp.

On a newly found meteorite from Selma, Dallas County, Alabama. Proc. U. S. Nat. Mus., vol. 32, pp. 59-61, 2 pls.

Notes on the composition and structure of the Hendersonville, North Carolina, meteorite. With chemical analyses by Wirt Tassin. Proc. U. S. Nat. Mus., vol. 32, pp. 79-82, 2 pls., 1 fig.

On the meteorite from Rich Mountain, Jackson County, North Carolina. Proc. U. S. Nat. Mus., vol. 32, pp. 241-244, 1 pl.

On a peculiar form of metamorphism in siliceous sandstone. Proc. U. S. Nat. Mus., vol. 32, pp. 547-550, 1 pl.

Contributions to the study of the Canyon Diablo meteorites. Smithsonian Misc. Coll., vol. 50 (Quart. Issue, vol. 4, pt. 2), pp. 203-215, pls. 18-21, text figs. 48, 49. (With Wirt Tassin.)

1908

The meteor crater of Canyon Diablo, Arizona; its history, origin, and associated meteoric irons. Smithsonian Misc. Coll., vol. 50 (Quart. Issue, vol. 4, pt. 4), pp. 461-498, 15 pls., 6 figs.

Carl Ludwig Rominger. Smithsonian Misc. Coll., vol. 52 (Quart. Issue, vol. 5, pt. 1), pp. 79-82, 1 fig. (port.)

Edward Travers Cox. Smithsonian Misc. Coll., vol. 52 (Quart. Issue, vol. 5, pt. 1), pp. 83-84, 1 fig. (port.).

1909

A heretofore undescribed stony meteorite from Thomson, McDuffie County, Georgia. Smithsonian Misc. Coll., vol. 52 (Quart. Issue, vol. 5, pt. 4), pp. 473-476, 2 pls.

The composition of stony meteorites compared with that of terrestrial igneous rocks, and considered with reference to their efficacy in world making. Am. Journ. Sci., 4th ser., vol. 27, pp. 469-474.

Coon Butte or Meteor Crater. Abstract. Science, new ser., vol. 29, pp. 239-240.

The Meteor Crater of Arizona. Australasian Assoc. Adv. Sci., Rep. Twelfth meeting, Brisbane, pp. 320-323, 4 figs.

1910

Memoir of W[illiam] S[mith] Yeates. Bull. Geol. Soc. America, vol. 20, pp. 618-619, 1 pl. (port.).

The non-metallic minerals, their occurrence and uses. Second edition, revised. 432 pp., 38 pls., 55 figs. Wiley and Sons, New York.

1911

On the supposed origin of the moldavites and like sporadic glasses from various sources. Proc. U. S. Nat. Mus., vol. 40, pp. 481-486, 2 pls. Abstract. Bull. Geol. Soc. America, vol. 22, no. 4, p. 736.

The fossil forests of Arizona. 23 pp., 7 figs. Washington.

1912

A second meteoric find from Scott County, Kansas. Proc. U. S. Nat. Mus., vol. 42, pp. 295-296, 1 pl.

A recent meteorite fall near Holbrook, Navajo County, Arizona. Smithsonian Misc. Coll., vol. 60, no. 9, 4 pp.

A newly found meteoric iron from Perryville, Perry County, Missouri. Proc. U. S. Nat. Mus., vol. 43, pp. 595-597, 2 pls.

1913

Dana, the geologist. Bull. Geol. Soc. America, vol. 24, no. 1, pp. 64-68.

A newly found meteorite from near Cullison, Pratt County, Kansas. Proc. U. S. Nat. Mus., vol. 44, pp. 325-330, 2 pls.

On the minor constituents of meteorites. Am. Journ. Sci., 4th ser., vol. 35, pp. 509-525.

The "fossil forests" of Arizona. Am. Mus. Journ., vol. 13, no. 7, pp. 311-316, 8 figs.

1915

The Fisher, Polk County, Minnesota, meteorite. Proc. U. S. Nat. Mus., vol. 48, pp. 503-506, 1 pl.

Report on some carbonic acid tests on the weathering of marbles and limestones. Proc. U. S. Nat. Mus., vol. 49, pp. 347-349.

On the monticellite-like mineral in meteorites, and oldhamite as a meteoric constituent. Proc. Nat. Acad. Sci., vol. 1, no. 5, pp. 302-308, 5 figs.

Researches on the chemical and mineralogical composition of meteorites. Proc. Nat. Acad. Sci., vol. 1, no 7, pp. 429-431.

Notes on the composition and structure of the Indarch, Russia, meteoric stone. Proc. U. S. Nat. Mus., vol. 49, pp. 109-112, pl. 37.

1916

Handbook and descriptive catalogue of the meteorite collections in the United States National Museum. Bull. U. S. Nat. Mus., no. 94, 207 pp., 41 pls.

Report on researches on the chemical and mineralogical composition of meteorites, with especial reference to their minor constituents. Mem. Nat. Acad Sci., vol. 14, mem. 1, 29 pp.

Chemical and mineralogical composition of meteorites. (Abstracts with discussion by O. C. Farrington.) Bull. Geol. Soc. America, vol. 27, no. 1, p. 50.

Review of *Meteorites, their structure, composition, and terrestrial relations,* by O. C. Farrington. Science, vol. 44, pp. 314-315.

A recently found iron meteorite from Cookeville, Putnam County, Tennessee. Proc. U. S. Nat. Mus., vol. 51, pp. 325-326, 1 pl.

Notes on the Whitfield County, Georgia, meteoric irons, with new analyses. Proc. U. S. Nat. Mus., vol. 51, pp. 447-449, 1 pl.

A newly found meteoric stone from Lake Okechobee, Florida. Proc. U. S. Nat. Mus., vol. 51, pp. 525-526.

1917

A new find of meteoric stones near Plainview, Hale County, Texas. Proc. U. S. Nat. Mus., vol. 52, pp. 419-422, 2 pls.

On the calcium phosphate in meteoric stones. Am. Journ. Sci., 4th ser., vol. 43, pp. 322-324, 1 fig.

1918

A second meteorite find in Florida [Eustis, Lake Co.]. Am. Journ. Sci., 4th ser., vol. 45, pp. 64-65.

A peculiar fibrous form of opal. Am. Mineralogist, vol. 3, no. 2, pp. 11-12.

Further notes on the Plainview, Texas, meteorite. Proc. U. S. Nat. Mus., vol. 54, pp. 503-505, 2 pls.

On the Fayette County, Texas, meteorite finds of 1878 and 1900, and the probability of their representing two distinct falls. Proc. U. S. Nat. Mus., vol. 54, pp. 557-561, 2 pls., 2 figs.

Tests for fluorine and tin in meteorites with notes on maskelynite and the effect of dry heat on meteoric stones. Proc. Nat. Acad. Sci., vol. 4, no. 6, pp. 176-180, 1 pl.

Lazulite in an unusual form. Am. Mineralogist, vol. 3, no. 11, p. 192.

1919

The composition and structure of meteorites compared with that of terrestrial rocks. Ann. Rep. Smithsonian Inst. for 1917, pp. 175-188, 9 pls., 4 figs.

The percentage number of meteorite falls and finds considered with reference to their varying basicity. Proc. Nat. Acad. Sci., vol. 5, no. 2, pp. 37-39.

A heretofore undescribed meteoric stone from Kansas City, Missouri. Proc. U. S. Nat. Mus., vol. 55, pp. 95-96, 2 pls.

Second report on researches on the chemical and mineralogical composition of meteorites. Mem. Nat. Acad. Sci., vol. 14, mem. 4, 15 pp., 5 pls., 4 figs.

The Cumberland Falls meteorite. Science, new ser., vol. 50, p. 90.

1920

Contributions to a history of American state geological and natural history surveys. Bull. U. S. Nat. Mus., no. 109, 549 pp., 37 pls. (portraits).

The Cumberland Falls, Whitley County, Kentucky, meteorite. Proc. U. S. Nat. Mus., vol. 57, pp. 97-105, 5 pls., 1 fig.

Notes on the meteorite of Estherville, Iowa, with special reference to its included "peckhamite" and probable metamorphic nature. Proc. U. S. Nat. Mus., vol. 58, pp. 363-370, 3 pls.

On chondrules and chrondritic structure in meteorites. Proc. Nat. Acad. Sci., vol. 6, no. 8, pp. 449-472, 1 pl., 17 figs.

Obituary, Joseph Paxson Iddings. Am. Journ. Sci., 4th ser., vol. 50, p. 316.

A retrospective view of the origin of Meteor Crater, Arizona. Pub. Astr. Soc. Pacific, no. 189, pp. 1-6, pl. 7, text fig. 1.

1921

On the mineral composition and structure of the Troup meteorite. Proc. U. S. Nat. Mus., vol. 59, pp. 477-478, pl. 102.

On metamorphism in meteorites. Bull. Geol. Soc. America, vol. 32, pp. 395-416, pls. 2-6.

1922

On meteoric irons from Alpine, Brewster County, Texas, and Signal Mountain, Lower California, and a pallasite from Cold Bay, Alaska. Proc. U. S. Nat. Mus., vol. 61, art. 4, pp. 1-4, pls. 1, 2.

Meteoric iron from Odessa, Ector County, Texas. Am. Journ. Sci., vol. 3, pp. 335-337, 1 fig.

Handbook and descriptive catalogue of the collection of gems and precious stones in the United States National Museum. Bull. U. S. Nat. Mus., no. 118, pp. 1-225, pls. 1-14, text figs. 1-26. (Assisted by Margaret W. Moodey and Edgar T. Wherry.)

A meteoric iron from Owens Valley, California. Mem. Nat. Acad. Sci., vol. 19, mem. 4, pp. 1-7, pls. 1, 2.

Observations of falling meteorites. Science, n. s., vol. 55, pp. 675, 676.

1923

On a recently found meteoric iron from Glasgow, Barren County, Kentucky. Am. Journ. Sci., vol. 5, pp. 63, 64.

A newly found iron meteorite from Somerset County, Pennsylvania. Am. Journ. Sci., vol. 5, pp. 175, 176.

A meteoric metabolite from Dungannon, Virginia. Proc. U. S. Nat. Mus., vol. 62, art. 18, pp. 1, 2, pls. 1, 2.

The department of geology of the United States National Museum. Rep. Smithsonian Inst. for 1921, pp. 261-302, pls. 1-20. Also issued separately and sold under the title *Illustrated handbook, the department of geology of the United States National Museum.*

The New Baltimore, Somerset County, Pennsylvania, meteoric iron. Supplemental note. Am. Journ. Sci., vol. 6, pp. 262-264.

Report on cooperative educational and research work carried on by the Smithsonian Institution and its branches. Smithsonian Misc. Coll., vol. 76, no. 4, 30 pp.

Recently found meteoric irons from Mesa Verde Park, Colorado, and Savannah, Tennessee. Proc. U. S. Nat. Mus., vol. 63, art. 18, pp. 1-4.

1924

The first one hundred years of American geology. Pp. i-xxi, 1-773, 36 pls., 130 figs. in text. Yale University Press.

On a stony meteorite from Anthony, Harper County, Kansas, and a recently found meteoric iron from Mejillones, Chile. Proc. Nat. Acad. Sci,. vol. 10, no. 7, pp. 306-312, pls. 1-3.

On a meteoric iron from Four Corners, San Juan County, New Mexico. Proc. Nat. Acad. Sci., vol. 10, no. 7, pp. 312-318, pls. 1-3.

Quartz in meteorites. Amer. Mineralogist, vol. 9, pp. 112, 113, fig. 1.

1925

A new meteoric stone from Baldwyn, Mississippi. Proc. U. S. Nat. Mus., vol. 67, art. 6, pp. 1, 2, pl. 1.

Notes on the meteoric stone of Colby, Wisconsin. Proc. U. S. Nat. Mus., vol. 67, art. 2, pp. 1-3, pl. 1.

Radio talks on science. Meteors. Sci. Monthly, vol. 21, pp. 456-461.

Supplemental notes. In E. O. Hovey, A new meteoric stone from Johnstown, Weld County, Colorado. Amer. Mus. Novitates, no. 203, pp. 7-13, figs. 5, 6.

1926

The present condition of knowledge on the composition of meteorites. Proc. Amer. Philos. Soc., vol. 65, no. 2, pp. 119-130.

1927

A stony meteorite from Forksville, Mecklenberg County, Virginia. Proc. U. S. Nat. Mus., vol. 70, art. 21, pp. 1-4, pls. 1-3.

A recently found iron meteorite from Oakley, Idaho. Proc. U. S. Nat. Mus., vol. 71, art. 21, pp. 1-3, pls. 1, 2.

Heretofore undescribed meteoric irons from [1] Bolivia, South America, [2] western Arkansas, and [3] Seneca Township, Michigan. Proc. U. S. Nat. Mus., vol. 72, art. 4, pp. 1-4, pls. 1, 2.

Two noted mineral collections. Sci. Monthly, Oct., pp. 314-320, figs. 1-7.

On newly discovered meteoric irons from the Wallapai (Hualapai) Indian Reservation, Arizona. Proc. U. S. Nat. Mus., vol. 72, art. 22, pp. 1-4, pls. 1-3.

Biographical Memoir George Ferdinand Becker, 1847-1919. Nat. Acad. Sci., vol. 21, 2d memoir, pp. 1-19, portrait.

Visits to the serpentine district of southern England and the gem cutting town of Oberstein, Germany. Smithsonian Misc. Coll., vol. 78, no. 7, pp. 21-23, figs. 27-34.

1928

Concerning the origin of metal in meteorites. Proc. U. S. Nat. Mus., vol. 73, art. 21, pp. 1-7, pls. 1-3.

1929

A newly found meteoric stone reported by W. B. Lang from Peck's Spring, Midland County, Texas. Proc. U. S. Nat. Mus., vol. 75, art. 16, pp. 1, 2, pl. 1.

The story of meteorites. Minerals from earth and sky. Smithsonian Scientific Series, vol. 3, pt. 1, pp. 1-163, frontispiece, pls. 1-42, figs. 1-7.

A visit to the mineral producing regions of New England. Expl. and Field-work of the Smithsonian Inst., pp. 5, 6, fig. 3.

1930

Composition and structure of meteorites. Bull. 149, U. S. Nat. Mus., pp. i-vi, 1-62, frontispiece, pls. 1-32.

In addition to the titles given above, Doctor Merrill was a contributor to the Standard Dictionary; Johnson's Universal Cyclopedia; Sturgis's Dictionary of Architecture; Nelson's Encyclopedia; Bailey's Cyclopedia of American Agriculture; and Dictionary of American Biography.