NATIONAL ACADEMY OF SCIENCES

DONNEL FOSTER HEWETT

1881—1971

A Biographical Memoir by
JAMES GILLULY

Biographical Memoir

D. D. Kennedy

DONNEL FOSTER HEWETT

June 24, 1881–February 5, 1971

BY JAMES GILLULY

DONNEL FOSTER HEWETT lived a long, fruitful, and satisfying life that impinged on many fields of science and many persons. He was alert and productive almost to the day of his death at the age of eighty-nine; in fact, two of his papers were in the press at that time. And he had the satisfaction, granted to few, of participating constructively in the evolution of economic geology as a profession during a period of explosive technologic progress and of being everywhere recognized for his contributions to these developments.

Foster Hewett was born June 24, 1881, at Irwin, Pennsylvania, son of George C. Hewett and Hetty Barclay Foster Hewett. Both his father and his paternal grandfather were highly successful mining engineers; his maternal grandfather had served as a Congressman from Pennsylvania and had once been a candidate for the governorship. Hewett's mother died when he was only three years old, and for more than ten years he was reared in the household of his mother's sister, Mrs. Frank A. Hopper, in Washington, D.C. He attended elementary schools in Washington until 1895 when his father remarried and established a family home in Atlanta, Georgia, where he was then employed by the Southern Railway Company. Young Foster had visited his father in some of the western mining areas during vacations and had become something of an amateur

mineralogist; now rejoined with his engineer father, Foster was taken as a companion on many mine examinations in Alabama and Georgia—experiences that surely influenced his own final choice of a profession.

At fourteen young Hewett entered the Georgia School of Technology where he remained for a year and a half before dropping out to attend a business college. In the fall of 1897, when he was sixteen years old, he was employed as a stenographer and typist for several months. By this time he had decided on an engineering career, so he entered the National Capitol University School in Washington in order to prepare for college.

In the fall of 1898 Hewett enrolled at Lehigh University at Bethlehem, Pennsylvania, as a student of chemistry, metallurgy, and mining. Something of his outgoing personality is revealed by his election to the presidency of his class. He was graduated with high honors in 1902 as Bachelor of Metallurgy. He remained on at Lehigh for a year as an instructor in mineralogy and metallurgy and became one of the most skillful determinative mineralogists of his time. At Lehigh he had come under the influence of Joseph Barrell, one of the ablest geologists of his generation, and acquired the enthusiasm for geology that remained with him through life.

In 1903 Hewett entered the employ of the Pittsburgh Testing Laboratories as a mining engineer. This firm was at that time one of the largest consulting organizations in the mineral industries and the twenty-two-year-old Hewett, fresh from the classroom, was given flattering responsibilities from the beginning—responsibilities he quickly showed he was fully able to meet. Between 1903 and 1909 Hewett examined, mapped, and reported on scores of mines in widely scattered parts of the United States, Mexico, Canada, and Peru. The commodities sought ranged widely over the field of economic geology: arsenic, coal, gold, lead, silver, vanadium, and zinc.

In 1906 Hewett was primarily responsible for the discovery of the largest vanadium deposit in the world, at Mina Ragra, Peru. This was a fantastic ore deposit, from which nearly a dozen minerals new to science have been described. Hewett's skill as a chemist enabled him to recognize that the minerals of the ore body, though previously unknown, were rich in vanadium.* The world supplies of vanadium had previously been insufficient to justify any of the steel manufacturers venturing into the commercial production of vanadium steel, though its superiority for many uses had been recognized. Hewett realized, after mapping the surface ore, that he had before him a probable ore body that might revolutionize the steel industry, as indeed it has. He reported his findings to his principals in Pittsburgh, urging their immediate consideration. They had enough confidence in the judgment of this twenty-five-year-old engineer to act immediately on his recommendations. Their long-term reward was many millions of profits.

During these exciting and broadening experiences, Hewett became more and more convinced of the need for applying detailed geologic studies to the search for ores in a much more intensive way than was usual at the time. He decided, therefore, to undertake graduate studies in geology. In 1909 he enrolled in the Yale Graduate School to study with his old friend and counselor, Joseph Barrell. Although Hewett had originally planned to remain for only one year, a gift from the now prosperous Vanadium Corporation of America in acknowledgment of his work at Mina Ragra enabled him to finance a second year and thus to complete the residence requirements for the doctorate. His thesis and the award of the degree were delayed, however, until 1924.

The appeal of the scientific aspects of economic geology was so great that Hewett was now more attracted to the research

* Of the new minerals found at Mina Ragra, hewettite and metahewettite were named in his honor.

program of the United States Geological Survey than to the more directly economic work he had hitherto carried on. Accordingly in the spring of 1911 he took the three-day examination then required for a Civil Service appointment. He attained a high score and entered on duty as a Junior Geologist in the Geological Survey on June 1, 1911. Except for two brief periods of leave, he was to continue in the Survey until his death, more than fifty-nine years later.

Hewett's first assignment was to the coal fields of the Big Horn Basin of Wyoming, in association with C. T. Lupton. He quickly made significant contributions to the stratigraphy of the region and discovered the Heart Mountain thrust, still one of the most interesting and provocative structural features in the United States. He also discovered, and demonstrated convincingly, that bentonite, so widely distributed in the Cretaceous strata of the West, is an alteration product of volcanic ash. His elucidation of the systematic tilting of the anticlines of the Big Horn Basin was later of considerable value to the petroleum producers of the region. Few two-year field projects have produced so much.

Later assignments were to Oklahoma for studies of petroleum and manganese—the beginning of his lifelong interest in manganese minerals and their origin; to Oregon, where he studied the gold deposits of the Blue Mountains in conjunction with Joseph T. Pardee; to Cuba, for studies of manganese and iron. After nearly ten years of such miscellaneous assignments, Hewett entered upon his most productive mapping program, the study of the geology and ore deposition of the southern Great Basin. Though often interrupted by other duties, this project, under various titles, was to occupy him as long as he could do strenuous fieldwork; his other main scientific interest, the study of the emplacement of manganese, could be pursued even after arduous fieldwork was no longer possible.

Hewett began his Great Basin work in the Goodsprings mining district, in southern Nevada. Goodsprings was not and

never has been a major mining area, but it became famous after Hewett, in 1924, announced the discovery there of the close association of dolomitization with the deposition of lead and zinc ores; an association that, soon recognized, was used the world over as a guide to such ore deposits. Most of the leading petrologists of the early twenties were agreed that magnesium is an element early fixed in magmatic rocks and that it could have little association with the more soluble and readily mobilized elements of ore deposits such as those of lead and zinc. Hewett's careful mapping and detailed observations in Nevada showed this viewpoint to be entirely wrong. In a few weeks in 1926 he showed that some of the classic ore districts of Europe (in Sicily, northern Italy, and Poland) were similarly encased in hydrothermal dolomite like that at Goodsprings. But he likewise showed that this association is by no means universal; the famous mines of Laurium have no such dolomitic mantles. As with most geologic phenomena, a common association is not necessarily an invariable one.

Goodsprings was also the scene of Hewett's recognition of the large thrust faults that characterize the southern Great Basin. He recognized that, while some of the thrusts were of Tertiary age, many were older. When he completed the Goodsprings study he expanded his fieldwork to include the much larger area of the Ivanpah Quadrangle. Here he demonstrated the continuity of a great section of Precambrian rocks in complete conformity with the overlying Paleozoic rocks—one of the few places in the world where the Cambrian–Precambrian boundary does not record a break.

Hewett's other main geological interest was the study of manganese mineralogy and ore deposition, a field in which he came generally to be recognized as the world leader. His interest in this subject began early, but was strengthened almost to the point of total absorption by his assignment during World War I to the evaluation of manganese deposits within the United States. This study was necessitated by the submarine

campaign that threatened to cut off our normal imports from South Africa and Brazil. During the next two decades he personally visited virtually every significant deposit of manganese minerals in the United States.

Hewett's breadth and tact caused his assignment to many delicate intragovernmental tasks. Perhaps the most interesting was his study, along with Geoffrey Crickmay of the Georgia State Geological Survey, of the hydrology of the Warm Springs of Georgia, famous for their supposedly therapeutic effects in the treatment of poliomyelitis. President Franklin D. Roosevelt, although a self-admitted layman, was thoroughly convinced of the value of the springs and strongly urged a complete study, which he thought would show some peculiarity of the water to account for its supposed helpful qualities. The careful two-year study by Hewett and Crickmay revealed that the springs were not unusual in any way, except for their slightly higher than normal temperature; their volume was precisely what would be expected from deep circulation of the normal rainfall tributary to the watershed; the chemical composion, density, and gaseous content precisely what would be expected of the groundwater of the region. An amusing element in this study was that a German "expert" on therapeutic spas, one Dr. Paul Haertl, Managing Director of Bad-Kissingen, who had been brought over to advise on the development of both Saratoga Hot Springs in New York and Warm Springs, Georgia, insisted that the value of these springs largely depended on the fact that the gas bubbles contained were cubical rather than spherical and thus more stimulating to the skin! With this sort of advice to the authorities of the Warm Springs Foundation, it can be readily understood that Hewett had to walk warily; he did so, and though his report must clearly have been disappointing to the enthusiasts operating the resort, it was never challenged.

Hewett was made Chief of the Section of Metalliferous Geology of the Geological Survey in 1935 and continued in this

position until 1944. Although this administrative position seriously interfered with his scientific work, it was of utmost value to the country during World War II. Hewett was a man of great foresight and was thoroughly familiar with a broad spectrum of mineral affairs. From his experience in World War I he early saw the threat of a wartime cutoff of many mineral products of which this nation has an insufficient supply. There can be little doubt that he was one of the dozen or so men best informed as to the mineral industry who by dint of constant pressure finally persuaded the administration to prepare for the war by building up supplies of "strategic minerals"—minerals whose domestic production is too low to support the needs of industry. He was able to get some support for this program as early as 1938, but full recognition of the crisis and the development of a strong Strategic Minerals Program did not begin until 1940.

Hewett recruited a staff of mostly young geologists until it was large enough to evaluate to some degree nearly every mineral showing of possible value in the country. Before the war ended the nation was producing from many small deposits and a few large ones most of the minerals in short supply. Notable progress was made, for example, in the production of tungsten, mercury, manganese, quartz crystals, mica, and bauxite, though in none of these was the country ever fully self-sufficient. Had it not been for Hewett's success in arousing the administration and the mineral industry to the potential crisis, the country's war effort would have been far more severely handicapped than it was.

After the war Hewett was relieved of his administrative duties and made "Special Scientist," in which position he was free to choose the area of research he would follow. He transferred from Washington, D.C., to Pasadena, California, where the California Institute of Technology offered him laboratory space, and from this base he returned to his studies of the min-

eral deposits and tectonics of the Nevada–California border region.

In 1949 Foster made a second discovery of a unique mineral deposit. He was the first to recognize the great deposit of rare earth elements at Mountain Pass, California. Here he identified and established the abundance of the mineral bastnäsite, a mineral elsewhere rare, but here in sufficient concentration and tonnage to constitute an ore. Hewett's skill in chemistry and mineralogy was dramatically demonstrated for the second time—and at an age approaching that of full retirement for most men.

But in 1951, when Foster reached the statutory retirement age, an unsolicited executive order returned him to active duty without terminal date; Foster was able to continue for many years his productive scientific career. When he was no longer able to do strenuous fieldwork, he continued his laboratory studies of manganese mineralogy, shifting his headquarters to the Menlo Park, California, office of the Geological Survey, where the support of many specialists was available to him. Here he worked until a few weeks before his death, a record of production few men of eighty-nine attain.

Hewett's foresight, already remarked on, extended to private matters. For example, he was one of the few who recognized, during the late twenties, that the paper prosperity of Wall Street was basically unsound. He sold his modest holdings of stocks in late 1928, knowing that prices had not yet peaked, and put the money into government bonds, then selling at very considerable discounts. In 1934, after the collapse of the market, he sold the bonds, then at par, and bought "blue-chip" stocks at the prevailing low prices. Few others were as farseeing.

His foresight was not so evident when he was behind the wheel of an automobile. Here he would become so interested in the passing scene or in some topic of conversation that he would often have narrow misses. Some of his passengers would, as one remarked, start a trip as bare acquaintances and after an hour's drive find themselves in each other's arms! While he

never had a severe accident, Foster's passengers had many a thrill they would rather have gone without.

Foster was a man of medium height, broad-shouldered and appearing squat. His energy, so well displayed in his work, was evident in his every move. He walked with springy stride until he was past eighty, and his conversation was both quick and thoughtful. An interesting and stimulating companion, he had almost complete recall of events many years in the past and a fund of current information that was truly astounding.

Hewett was married in January 1909 to Mary Amelia Hamilton, of New Castle, Pennsylvania, his companion in the field and at home for more than sixty-two years, who survived him by less than a year. Mary Hewett was a delightful reader; one of the most pleasant occasions for their friends was to be included in a small group in the Hewett home for an evening of reading and discussion. Mary would read—usually political or philosophical works—and all were free at any time to interrupt either to agree or to disagree with the author. Sometimes the reading would stop for an hour as one listener after another had his or her comments to make. Foster's were always among the most thoughtful.

Although the Hewetts were childless, they became literally "foster" parents to a host of junior associates—secretaries, clerks, aspiring young geologists and their wives—whoever was privileged to work in close association with Foster. Later they took much satisfaction in aiding needy students in half a dozen colleges and universities; no one knows how many.

In any company Foster Hewett was a leader. His impress on the work of the Geological Survey was surely greater than that of any of his contemporaries; the present prestige of the organization is in large part due to his foresight in the matter of strategic minerals and the sound basis he then established for a wide spectrum of work. Few men have made so great a contribution to a scientific or governmental enterprise.

HONORS AND DISTINCTIONS

PROFESSIONAL SOCIETIES AND OTHER MEMBERSHIPS

Fellow, Geological Society of America (Councillor, 1931–1933; Vice President, 1935, 1945)
Fellow, Mineralogical Society of America
Society of Economic Geologists (Vice President, 1931; President, 1936)
American Chemical Society
National Academy of Sciences, elected 1937
American Academy of Arts and Sciences
American Institute of Mining, Metallurgical and Petroleum Engineers
American Association for the Advancement of Science
Tau Beta Pi
Sigma Xi
Phi Beta Kappa

AWARDS AND MEDALS

Distinguished Service Medal, United States Department of the Interior, 1952
Award, American Academy of Achievement, 1965
Honorary Doctor of Science, Lehigh University, 1942
Penrose Gold Medal, Society of Economic Geologists, 1956
Penrose Medal, Geological Society of America, 1964
Research Associate, California Institute of Technology, 1947–1954
Research Associate, Stanford University, 1957–1971

BIBLIOGRAPHY

KEY TO ABBREVIATIONS

Am. J. Sci. = American Journal of Science
Am. Mineralogist = American Mineralogist
Calif. Dept. Nat. Res. Div. Mines Bull. = California Department of Natural Resources, Division of Mines Bulletin
Econ. Geol. = Economic Geology
Eng. Mining J. Press = Engineering and Mining Journal Press
J. Wash. Acad. Sci. = Journal of the Washington Academy of Sciences
U.S. Geol. Surv. Bull. = United States Department of the Interior, Geological Survey, Bulletin
U.S. Geol. Surv. Mineral Res. of the U.S. = United States Department of the Interior, Geological Survey, Mineral Resources of the United States
U.S. Geol. Surv. Profess. Pap. = United States Department of the Interior, Geological Survey, Professional Papers

1912

A graphic method for dips on geologic sections. Econ. Geol., 7: 190–91.

1913

Sulphur deposits of the Sunlight Basin, Wyoming. U.S. Geol. Surv. Bull., No. 530, pp. 350–62.

Manganese and manganiferous ores. U.S. Geol. Surv. Mineral Res. of the U.S., 1912, Part 1, pp. 203–21.

1914

The ore deposits of Kirwin, Wyoming. U.S. Geol. Surv. Bull., No. 540, pp. 121–32.

Sulphur deposits in Park County, Wyoming. U.S. Geol. Surv. Bull., No. 540, pp. 477–80.

The Shoshone River section, Wyoming. U.S. Geol. Surv. Bull., No. 541, pp. 89–113.

With J. T. Pardee. Geology and mineral resources of the Sumpter Quadrangle, Oregon. Mineral Resources of Oregon, 1(6):3–128.

1916

Some manganese mines in Virginia and Maryland. U.S. Geol. Surv. Bull., No. 640, pp. 37–71.

1917

With C. T. Lupton. Anticlines in the Big Horn Basin, Wyoming. U.S. Geol. Surv. Bull., No. 656, 192 pp.

The origin of bentonite and the geologic range of related materials in the Big Horn Basin, Wyoming. J. Wash. Acad. Sci., 7:196–98.

Manganese. American Institute of Mining Engineers Bulletin, No. 129, pp. v–xiii.

1918

With others. Possibilities for manganese ore on certain undeveloped tracts in Shenandoah Valley, Virginia. U.S. Geol. Surv. Bull., No. 660, pp. 271–96.

1919

Manganese and manganiferous ores in 1917. U.S. Geol. Surv. Mineral Res. of the U.S., 1917, Part 1, pp. 665–96.

1920

The Heart Mountain overthrust, Wyoming. Journal of Geology, 28:536–57.

Manganese and manganiferous ores in 1918. U.S. Geol. Surv. Mineral Res. of the U.S., 1918, Part 1, pp. 607–56.

Measurements of folded beds. Econ. Geol., 15:367–85.

1921

With E. V. Shannon. Orientite, a new hydrous silicate of manganese and calcium from Cuba. Am. J. Sci., 1:491–506.

Manganese deposits near Bromide, Oklahoma. U.S. Geol. Surv. Bull., No. 725, pp. 311–29.

1923

Carnotite in southern Nevada. Eng. Mining J. Press, 115:232–35.

1924

Deposits of magnesia alum near Fallon, Nevada. U.S. Geol. Surv. Bull., No. 750, pp. 79–86.

1925

With W. T. Schaller. Hisingerite from Blaine County, Idaho. Am. J. Sci., 10:29–38.

Carnotite discovered near Aguila, Arizona. Eng. Mining J. Press, 120:19.

1926

Geology and oil and coal resources of the Oregon Basin, Meeteetse, and Grass Creek Basin quadrangles, Wyoming. U.S. Geol. Surv. Profess. Pap., No. 145, 111 pp.

1927

Late Tertiary thrust faults in the Mojave Desert, California. Proceedings of the National Academy of Sciences, 14:7–12.

1928

A manganese deposit of Pleistocene age in Bannock County, Idaho. U.S. Geol. Surv. Bull., No. 795, pp. 211–18.

Two Tertiary epochs of thrust faulting in the Mojave Desert, California. Bulletin of the Geological Society of America, 39:178–79.

With E. V. Shannon and F. A. Gonyer. Zeolites from Ritter Hot Spring, Grant County, Oregon. Proceedings of the U.S. National Museum, Vol. 73, Article 16, 18 pp.

Dolomitization and ore deposition. Econ. Geol., 23:821–63.

1929

Cycles in metal production. American Institute of Mining and Metallurgical Engineers Technical Publication, No. 183, 31 pp.

1930

With O. N. Rove. Occurrence and relations of alabandite. Econ. Geol., 25:35–56.

Genesis of iron–manganese carbonate concretions in central South Dakota. J. Wash. Acad. Sci., 20:243.

1931

Geology and ore deposits of the Goodsprings Quadrangle, Nevada. U.S. Geol. Surv. Profess. Pap., No. 162, 172 pp.

Zonal relations of the lodes of the Sumpter Quadrangle, eastern Oregon. American Institute of Mining and Metallurgical Engineers Transactions for 1931, pp. 305–46.

With B. N. Webber. Bedded deposits of manganese oxides near Las Vegas, Nevada. Nevada University Bulletin, Vol. 25, No. 6, 17 pp.

1932

Manganese sediments. In: *Treatise on Sedimentation,* by W. H. Twenhofel and others, pp. 562–81. Baltimore, Williams & Wilkins Company.

1933

Sedimentary manganese deposits. In: *Ore Deposits of the Western States* (Lindgren Volume), pp. 488–91. New York, American Institute of Mining & Metallurgical Engineers.

With J. T. Pardee. Manganese in western hydrothermal ore deposits. In: *Ore Deposits of the Western States* (Lindgren Volume), pp. 671–82. New York, American Institute of Mining & Metallurgical Engineers.

1936

With others. Mineral resources of the region around Boulder Dam. U.S. Geol. Surv. Bull., No. 871, 197 pp.

1937

With G. W. Crickmay. The Warm Springs of Georgia, their geologic relations and origin. United States Geological Survey Water-Supply Paper, No. 819, 40 pp.

With W. T. Schaller. Braunite from Mason County, Texas. Am. Mineralogist, 22:785–89.

Helvite from the Butte district, Montana. Am. Mineralogist, 22: 803–4.

1938

With H. D. Miser. The unweathered manganese deposits of the Batesville district, Arkansas. Econ. Geol., 32:1069.

1948

Iron deposits of the Kingston Range, San Bernardino County, California. Calif. Dept. Nat. Res. Div. Mines Bull., No. 129: Iron Resources of California, Part M, pp. 195–206.

1953

With J. J. Glass. Two uranium-bearing pegmatite bodies in San Bernardino County, California. Am. Mineralogist, 38:1040–50.

1954

General geology of the Mojave Desert region, California. Calif. Dept. Nat. Res. Div. Mines Bull., No. 170: Geology of Southern California, ed. by R. H. Jahns, Chapter 2, pp. 5–20.

A fault map of the Mojave Desert region, California. Calif. Dept. Nat. Res. Div. Mines Bull., No. 170: Geology of Southern California, ed. by R. H. Jahns, Chapter 4, pp. 15–18.

1955

Structural features of the Mojave Desert region, California. In: *Crust of the Earth,* ed. by A. Poldervaart, pp. 377–90. Geological Society of America Special Paper No. 62. (Symposium)

1956

Geology and mineral resources of the Ivanpah Quadrangle, California and Nevada. U.S. Geol. Surv. Profess. Pap., No. 275, 172 pp.

With others. Manganese deposits of the United States. In: *Symposium sobre yacimientos de manganeso,* ed. by J. Enaro González Reyna, Tome 3, pp. 169–75. 20th International Geological Congress, Mexico.

1960

With M. Fleischer. Deposits of the manganese oxides. Econ. Geol., 55:1–55.

1961

With others. Tephroite in California manganese deposits. Econ. Geol., 56:39–58.

1963

Manganese is a clue to deep base and precious metals. Mining World, 25:26–28.

With others. Deposits of the manganese oxides—supplement. Econ. Geol., 58:1–51.

1964

Veins of hypogene manganese oxide minerals in the southwestern United States. Econ. Geol., 59:1429–72.

1965

With others. Black calcite—a source of silver? Mining Congress Journal, 51:78.

1966

Stratified deposits of the oxides and carbonates of manganese. Econ. Geol., 61:431–61.

1967

With A. S. Radke. Silver-bearing black calcite in western mining districts. Econ. Geol., 62:1–21.

With others. Aurorite, argentian todorokite, and hydrous silver-bearing lead manganese oxide. Econ. Geol., 62:186–206.

1968

Silver in veins of hypogene manganese oxides. United States Geological Survey Circular, No. 553, 9 pp.

1969

With others. Hypogene veins of gibbsite, pyrolusite, and lithiophorite in Nye County, Nevada. Econ. Geol., 63:360–71.

With others. The ages of three uranium minerals, Mojave Desert, California. U.S. Geol. Surv. Profess. Pap., No. 650-B, pp. B84–B88.

1971

Coronadite—modes of occurrence and origin. Econ. Geol., 66:164–77.

1972

Manganite, housmannite, braunite: features, modes of origin. Econ. Geol., 67:103–110.