

Memorial of Charles Milton April 25, 1896–October 4, 1990

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Charles Milton was born in New York City on April 25, 1896, the son of an immigrant woodcarver from the Jewish pale of Czarist Poland. In his infancy the family moved to London, relocating to the United States about ten years later and eventually settling in Chicago. After some years of odd jobs, wandering around the country as a hobo, and brief attendance at various colleges and universities, a correspondence course from the University of Chicago called Elementary Mineralogy that he enrolled in stimulated and excited him on the subject that was to become his lifelong love and vocation.

He enrolled in the University of Illinois, where he worked under Professor W. S. Bayley. Although almost all his formal education in mineralogy and geology was at Illinois, he never fulfilled the university's requirements in other courses for a degree. His Bachelor's degree was obtained from the University of Iowa in 1922, after a summer of field camp in the Black Hills and one semester of residence. During those years he continued his hobo travels (as "blind baggage" on passenger or express trains in preference to freight trains) but at this time more often to classic mineral localities, including Magnet Cove, Arkansas, an area and state that he subsequently devoted much time to studying. In 1926 he abandoned academic life and worked for Sun Oil and Dutch-Shell as an exploration geologist, prospecting for oil in Venezuela. Returning to the United States, he enrolled in Johns Hopkins University, where he received his Ph.D. in 1929. During and after his Ph.D. studies he worked for Sinclair Oil Company in New York City and in Angola. Returning from Angola in time for the Crash of 1929, Charlie worked for Johns Hopkins University and consulted for the Bethlehem Steel Company on open-hearth slag. In 1931 he was offered, and he accepted, the position of junior mineralogist with the U.S. Geological Survey in Washington, DC, where he remained until his mandatory retirement in 1965. He then moved to the Department of Geology at the George Washington University, Washington, DC, as a Research Professor. At the termination of his formal appointment in 1974, he continued his work there as the self-styled Quondam Research Professor until the mid-1980s. After that he maintained an office and laboratory at the U.S. Geological Survey in Reston, Virginia, and frequently came to the Survey to work with colleagues until a fall, in late 1989, left him bedridden.

With the Survey, he was to a large extent an expert



consultant, working on mineralogic and petrographic problems brought in by more field-oriented Survey geologists. Although most of the jobs resulted in internal reports, perhaps to be used for only a few paragraphs in publication, Charles never considered a job finished until a scientifically satisfactory conclusion was reached. Samples submitted by the public exercising their right as taxpayers to seek help and information from the government came to him during most of his career, and although a sight identification and reply sufficed for the great majority, even with these he was not satisfied until an identification was certain. A set of black pebbles from a river bed in British Guiana, vaguely known as merumite and said to be rich in chrome ore, brought in by a man primarily interested in importing tropical fish, started an investigation that culminated, after some 24 years, in a

Survey Professional Paper, which unraveled the complex mineralogy of chromium oxide and hydrated oxides and demonstrated that merumite was a complex mixture of six or more phases, including four new minerals.

His publication record of more than 160 articles, written with more than 65 persons, attests not only to his versatility in mineralogic research but also to his ability to work successfully on research teams. Although he conducted mineralogic research on a diversity of subjects ranging from an innovative petrographic approach to the study of slag fragments from ancient copper smelting sites near Timna, Israel, to the study of the mineralogy of "stones" biologically produced by man and other mammals, his late career was focused in two areas, the Green River Formation in Utah, Wyoming, and Colorado, and the alkalic rocks of Arkansas. The Eocene Green River Formation, lacustrine in origin, is unique in its occurrence of unusual authigenic mineral species. Charles documented many species from this environment, some previously known to form only in igneous or metamorphic settings and some entirely new. With Hans P. Eugster of Johns Hopkins University, he modeled the physical-chemical conditions extant during mineral formation.

Although primarily a laboratory scientist, Charles enjoyed travel and field work, with many trips to such favorite areas as the Green River, Arkansas, and Guyana and with one notable excursion to collect the natrocarbonatite lavas of Oldoinyo Lengai, Tanzania. Partly as relaxation from the pressure of war-related work during World War II, Charles, together with Allan P. Bennison, did some of the first detailed bedrock geologic mapping of quadrangles in northern Virginia, including the future site of the Survey headquarters in Reston. At a time when basement samples signified little more than the failure of an oil company's wildcat well, he realized their geologic importance. He obtained and studied samples of all available basement cores and chips from Florida and the Georgia coastal plain, with his findings published by the respective state Surveys.

From his initial visit to Arkansas, he developed a life-long interest in its mineralogy and petrology, particularly the Magnet Cove alkalic igneous complex. His initial contribution was his description of the zirconium garnet, kimzeyite, in collaboration with L. V. Blade, and he continued to investigate the mineralogy of Magnet Cove until his death. He initiated the critical compilation of the mineralogy of the entire state, completed by J. M. Howard of the Arkansas Geological Commission and published in 1987 as State Bulletin 23, with a dedication to Charles Milton.

Throughout his career, Charles had a proclivity and an enthusiasm for the study and description of new mineral species, and he collaborated on the description and naming of 21 new minerals. Often the names he used were those of respected and admired friends and associates, such as Robert Garrels, Frank Grimaldi, Vincent McKelvey, William Pecora, Edward Dwornik, John Straczek, Philip Abelson, and others. He not only honored

the illustrious but also the supportive technician. Reedmergnerite, the B analogue of albite, was named for two outstanding thin-section technicians, Frank Reed and John Mergner, who prepared samples at the Geological Survey in Washington for more than 50 years. He also was equally enthusiastic about discrediting mineral species; he discredited ten. Charlie was deeply involved in the investigation of moissanite, SiC, and the question of its legitimacy as a mineral. He published on this subject for more than 50 years. In 1986, when he was 90, at the meeting of the International Mineralogical Association at Stanford, Charlie presented a poster reiterating his contention that moissanite was carborundum contamination. To support his poster in case he was challenged, he lugged six boxes of notebooks filled with documentation and sat there with his poster ready to defend his thesis. His tenaciousness was a clear attribute. Only recently has moissanite (or another polymorph of SiC) been found as a solid inclusion in diamond.

Charles was awarded the Distinguished Service Award, the Department of Interior's highest honor. He was a Life Fellow of the Mineralogical Society of America, a Fellow of the Geological Society of America, and a member of the American Association for the Advancement of Science, the Society of Economic Geologists, the Geological Society of Washington, the Mineralogical Association of Canada, the Philosophical Society of Washington, and the Washington Academy of Sciences. He served on the councils of the Geological Society of Washington and the Mineralogical Society of America.

In 1932 he married Leona Kohn and soon settled in a large house surrounded by a hardwood forest in Forest Glen, Maryland, in what was then the far country suburbs of Washington, DC. There they raised two sons, Daniel and Michael, who became a geologist and a lawyer, respectively. Leona worked as a librarian at Walter Reed Medical Center, and she was also a talented artist; her work hung in their house and his office. Leona died in 1986, but he continued to live on Beechbank Road, going to the Geological Survey once or twice a week. Never too old to try something new, Charlie, at the age of 90, purchased a home computer and proceeded to learn enough of its mysteries to be able to make it work.

SELECTED BIBLIOGRAPHY OF CHARLES MILTON¹

- With J.T. Singewald, Jr. Greisen and associated mineralization at Silver Mine, Mo. *Economic Geology*, 24, 569-591 (1929).
- With R.D. Ohrenschild. The occurrence of moissanite (silicon carbide) in sediments. *Journal of Sedimentary Petrology*, 1, 96-99 (1931).
- With W.D. Johnston, Jr. Sulphate minerals from the Comstock Lode, Nevada. *Economic Geology*, 33, 749-771 (1938).
- With J.M. Axelrod. Fused wood-ash stones: Fairchildite (n. sp.) $K_2CO_3 \cdot CaCO_3$, Buetschliite (n. sp.) $3K_2CO_3 \cdot 2CO_3 \cdot 6H_2O$ and calcite, their essential components. *American Mineralogist*, 32, 607-624 (1947).

¹ A copy of the complete bibliography of Charles Milton may be ordered as Document AM-93-526 from the Business Office, Mineralogical Society of America, 1130 Seventeenth Street NW, Suite 330, Washington, DC 20036, U.S.A. Please remit \$5.00 in advance for the microfiche.

- With J.M. Axelrod, F.S. Grimaldi, and K.J. Murata. Uranium minerals from the Hillside Mine, Yavapai Co., Arizona. *American Mineralogist*, 36, 1–22 (1951).
- With J.M. Axelrod. Calculi and other stones found in mammals. *Journal of Mammalogy*, 32, 139–154 (1951).
- With J.M. Axelrod, M.K. Carron, and T.P. Thayer. Phosphate mineralization at Bomi Hills and Bambuta, Liberia, West Africa. *American Mineralogist*, 37, 883–909 (1952).
- With J.M. Axelrod. Beyrichite, a discredited species. *American Mineralogist*, 40, 757–770 (1955).
- With J.M. Axelrod and B. Ingram. Bismutoferrite, chapmanite, and “hypochlorite.” *American Mineralogist*, 43, 656–670 (1958).
- With D.J. Milton. Nickel-gold ore of the Mackinaw Mine, Snohomish County, Washington. *Economic Geology*, 53, 426–447 (1958).
- With L.S. Birks, I. Adler, and E.J. Brooks. Electron probe analysis of minute inclusions of a copper-iron mineral. *American Mineralogist*, 44, 974–978 (1959).
- With H.P. Eugster. Mineral assemblages of the Green River formation. In P.H. Abelson, Ed., *Researches in geochemistry*, p. 118–150. Wiley, New York (1959).
- With E.C.T. Chao, J.M. Axelrod, and F.S. Grimaldi. Reedmergnerite, NaBSi_3O_8 , the boron analogue of albite from the Green River formation, Utah. *American Mineralogist*, 45, 188–189 (1960).
- With J.J. Fahey. Classification and association of the carbonate minerals of the Green River formation. *American Journal of Science*, 258A, 242–246 (1960).
- With H.D. Miser. Quartz, rectorite, and cookeite from the Jeffrey Quarry, near North Little Rock, Pulaski County, Arkansas. *Arkansas Geological Commission Bulletin*, 21, 29 p. (1964).
- With V.J. Hurst. Subsurface “basement” rocks of Georgia. *Geological Survey of Georgia Bulletin* 76, 56 p. (1965).
- With J.W. Smith. Dawsonite in the Green River formation of Colorado. *Economic Geology*, 61, 1029–1042 (1966).
- The “natro-carbonatite” lava of Oldoinyo Lengai, Tanzania (abs.). *Geological Society America Program, Annual Meeting*, 1968, 202 (1968).
- Igneous and metamorphic basement rocks of Florida. *Florida Bureau of Geology. Geological Bulletin No. 55*, 125 p. (1972).
- With E.J. Dwornik, R.B. Finkelman, and P. Toulmin III. Slag from an ancient copper smelter at Timna, Israel. *Journal of the History of Metallurgy Society*, 10, 24–32 (1976).
- With C.G. Stone. Lithium mineralization in Arkansas. *U.S. Geological Survey Professional Paper* 1005, 137–142 (1976).
- With D.E. Appleman, M.H. Appleman, E.C.T. Chao, F. Cuttitta, J.I. Dinnin, E.J. Dwornik, B.L. Ingram, and H.J. Rose, Jr. Merumite: A complex assemblage of chromium minerals from Guyana. *U.S. Geological Survey Professional Paper* 887, 29 p. (1976).
- With E.J. Dwornik, P.A. Estep-Barnes, R.B. Finkelman, A. Pabst, and S. Palmer. Abelsonite, nickel porphyry, a new mineral from the Green River formation, Utah. *American Mineralogist*, 63, 930–937 (1978).
- With H.T. Evans, Jr., G.L. Nord, and J.W. Marinenko. Straczekite, a new calcium barium potassium vanadate mineral from Wilson Springs, Arkansas. *Mineralogical Magazine*, 48, 289–293 (1984).
- With D.B. Vitaliano. The non-existence of moissanite (abs.). *International Geological Congress, 27th Meeting, Moscow, 5, section 10*, 107–108 (1984).
- With D.E. Appleman, H.T. Evans, Jr., G.L. Nord, and E.J. Dwornik. Delindeite and lourenswalsite, two new titanosilicates from the Magnet Cove Region, Arkansas. *Mineralogical Magazine*, 51, 417–425 (1987).