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CHARLES WHITMAN CROSS

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A Biographical Memoir by

ESPER S., JR. LARSEN

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Whitman Cross

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BY ESPER S. LARSEN, JR.

CHARLES WHITMAN CROSS will be remembered for his detailed, painstaking geologic field work in Colorado, and for his contribution to the classification of igneous rocks in the quantative classification of igneous rocks by C.I.P.W. He was born at Amherst, Massachusetts, on September 1, 1854, the son of the Reverend Moses Kimball Cross and Maria (Mason) Cross. From Amherst College he received the B. S. degree in 1875.

It was the common practice in America seventy years ago for young men preparing to be scientists to attend a German—or at least a European—university. Accordingly, Cross attended Göttingen in 1877, and received his Ph. D. in Leipzig under Zirkel in 1880. He returned to the United States, joined the U. S. Geological Survey as "geologic and microscopical assistant" and for some years was stationed in the Denver office under Dr. S. F. Emmons.

In his early years in Colorado, Cross wrote chiefly papers on mineralogy with Hillebrand and Eakins. Later he presented papers on geologic subjects including the Pikes Peak folio, the Anthracite and Crested Butte folio, the geology of the Rosita Hills, the geology of the Denver Basin, general geology of the Cripple Creek District, and many other papers.

About 1895 he became interested in the San Juan Mountains of southwestern Colorado. He first studied the mining districts of Telluride, La Plata, Rico, Ouray, Silverton, Lake City, and Needle Mountains. He continued his work in southwestern Colorado for

many years, and he and his assistants mapped in some detail an area about a hundred miles square. The study included the mapping and description of a great complex of pre-Cambrian rocks, Paleozoic, Mesozoic, and Tertiary sedimentary rocks, and a complex of Tertiary volcanic rocks. In this study he made great contributions to many geologic problems, including the stratigraphy and structure of the area and most especially to the complex volcanic history. Cross began his work in the western part of the area in which he prepared seven folios of the U. S. Geological Survey. Other papers have been published, and a monograph concerning the whole area has recently appeared.

Cross no doubt selected the San Juan Mountains because of their grandeur and beauty, with fourteen peaks over 14,000 feet in elevation in the central mountains mass, and some of the bordering valleys reaching below 6,000 feet. The region furnishes water to the three great river systems of the Southwest, the Mississippi, the Colorado, and the Rio Grande. Clear swift streams are present in all the valleys, and waterfalls are numerous. Sage brush and other desert brush occupy the lower slopes to about 8,000 feet in elevation. Scattered pine is in the upper part of the sage brush, and spruce, aspen, and some fir are above that to timber line, which is about 11,500 to 12,000 feet. At timber line the spruce is dwarfed and gnarled; above timber line are willows.

Wild flowers are present in great variety, with the alpine types at high altitudes and more familiar types on the lower slopes. Above timber line the alpine flora forms a delicate carpet of great beauty. On the lower slopes, in any place where the timber is not too dense, the profusion of flowers gives the fields and hills solid masses of color. The dainty blue Colorado columbine (Aquilegia Caerolea), state flower of Colorado, is the most attractive, though not the most common. The great fields of larkspur are common on the northwestern slopes below the timber. Paintbrush, monkshood, lupine, and many other flowers grow in the greatest profusion.

While Cross was working in the mountains there were few roads,

The field work by Cross was done with horses or on foot, and camp was moved by pack train, on muleback. The country was wild and difficult to traverse, but Cross believed in living comfortably and his camp unit was one of the best in the west. He had had much experience with such camps and he knew that he must have superior camp men and a comfortable, adequate outfit. He selected camp sites with care and usually had a beautiful view and pleasant surroundings. In the mountains there are thunderstorms nearly every day during July and August. Toward the end of August there might be a snowstorm and from then on no thunderstorms, but delightful cold weather.

Cross was active in organizing the National Research Council. He was a member of the Council from 1918 to 1922, treasurer during 1918 and 1919, and vice-chairman of the Division of Geology and Geography in 1918. He was elected to the National Academy of Sciences in 1908 and was treasurer from 1911 to 1919. He was a member of the Geological Society of America and President of the Society in 1918. He was an honorary member of the Colorado Scientific Society, the Geological Society of Washington (President in 1899), the American Philosophical Society, and the Washington Academy of Sciences. He was a corresponding member of the Academy of Natural Science of Philadelphia and a member of the London Geological Society. He was Associate in Petrology, Smithsonian Institution, from 1920.

He was active in organizing the Petrologists Club and for many years in its early days it met in his study.

Cross was a petrologist and one of the leading field geologists of his generation. Most petrologists of his time were interested chiefly in the description and classification of rocks and groups of rocks, and their field work consisted chiefly of collecting specimens for study in the laboratory and noting local relations of the rock bodies. Cross carried on detailed geological mapping of igneous and metamorphic rocks and of the associated sedimentary rocks. His field was geological, and he studied bodies of igneous rocks as geological units formed by a geological process that was limited both in space and in

time and that was somewhat variable. He was one of the first petrologists to treat successfully the components of great complex piles of volcanic rocks as a group of irregular units that could be more or less successfully mapped in much the same way as sedimentary rocks. The correlation is on the basis of age.

Cross believed strongly that scientific work, to be efficient, must be adequately supported. He wanted plenty of thin sections, chemical analysis, and a comfortable field outfit. He was not extravagant or wasteful, but knew that some misguided attempts at economy greatly reduced efficiency. He was always a strong advocate of the need to support pure science.

The field parties of Cross were training schools for young geologists, and it was a privilege to be a member of his party. He, a great field geologist, was friendly, sympathetic, generous, and patient with young men, and he was ready to listen patiently to their ideas and to keep them straight in their thinking. He had much influence on the younger men, and was a great and inspiring teacher. Many prominent geologists were his associates, including A. C. Spencer, Ernest Howe, J. D. Irving, R. D. George, G. W. Stone, Albert Johannsen, L. F. Noble, E. S. Larsen, Jr., J. C. Hunter, and C. S. Ross. The young men on the Survey looked up to Cross as a model scientist.

Cross published on the interesting potash-rich rocks of the Leucite Hills, Wyoming. He also visited the Hawaiian rocks. He published other papers on areas not near Colorado, but his main publications were on the Colorado area. He was chief of the Section of Petrology on the U. S. Geological Survey from 1903 to 1907, and secretary of the Survey's committee on petrographic names. This and his own work on rocks made the classification of igneous rocks a matter of major interest to him. Dr. Cross, Joseph P. Iddings, Louis V. Persson, and Henry S. Washington collaborated on devising a system of rock classification and in 1902 in the *Journal of Geology,* they proposed "a quantative chemico-mineralogical classification and nomenclature of igneous rocks," followed a year later by a 268-page volume on the subject. Commonly known as the C.I.P.W. system, it introduced an entirely new method of rock classification which was

widely adopted, and profoundly influenced geologic thought of the world. They calculated from the chemical analysis of a rock a "norm" which was made of simple theoretical minerals such as quartz, orthoclase, albite, anorthite, leucite, melilite, hypersthen, diopside, olivine, etc., and presented a mode which represented the actual minerals of which the rock was made. The latter are mostly solid solutions or mixed crystals, and may differ in a large way from the normative minerals. A comparison of the mode and the norm of a rock is very useful and leads to a clearer understanding of the chemical history of the rock. The normative scheme is still widely used today.

Cross was a member of the group of geologists who urged upon the new Carnegie Institution of Washington the establishment of a laboratory for the study of the behavior of rocks and minerals at high temperatures and pressures. From these proposals came the Geophysical Laboratory of that Institution.

After his retirement in 1925, Dr. Cross devoted his time chiefly to the cultivation of roses, and he devoted the same rigorous, scientific methods to this study that he had earlier devoted to the science of geology. By using systematic methods, he made his garden in Chevy Chase, Maryland, a showplace. He had two thousand rose bushes, and he developed many new varieties. The outstanding new varieties he named, "Chevy Chase," "Hon. Lady Lindsay," and "Mrs. Whitman Cross."

Cross's chief recreation was playing golf. He became an expert in investment and finance, studied investments with great care, and was considered one of the most careful and successful investors in the Washington community.

At the time of his death in 1949, Dr. Cross was the oldest living member of the National Academy of Sciences and the oldest alumnus of Amherst College, from which he had received the honorary degree of Doctor of Science in 1925.

Dr. Cross was survived by Mrs. Cross, (nee Virginia Stevens), a son, Richard Stevens Cross, of Philadelphia, and two grandchildren, Charles Whitman Cross and Helen Virginia Cross.

KEY TO ABBREVIATIONS

Am. G.=American Geologist
Am. J. Sc.=American Journal of Science
Am. Nat.=American Naturalist
Colo. Sci. Soc. Pr.=Colorado Scientific Society Proceedings
G. Soc. Am. Bull.=Geological Society of America Bulletin
G. Soc. London=Geological Society of London
G. Soc. Wash.=Geological Society of Washington
Int. Geol. Con.=International Geological Congress
J. G.=Journal of Geology
Nat. Acad. Sci. Proc.=National Academy of Sciences Proceedings
Nat. Acad. Sci. Bull.=National Academy of Sciences Bulletin
Nat. Acad. Sci. Mem.=National Academy of Sciences, Memoir
Pan-Am. Geol.=Pan-American Geologist
Phil. Soc. Wash. B.=Philosophical Society of Washington Bulletin
U.S.G.S. An. Rp.=United States Geological Survey, Annual Report
U.S.G.S. Geological Atlas=United States Geological Survey, Geological Atlas
U.S.G.S.B.=United States Geological Survey Bulletin
U.S.G.S. Min. Res.=United States Geological Survey Mineral Resources
U.S.G.S.M.=United States Geological Survey Monograph
U.S.G.S., PP.=United States Geological Survey, Professional Paper
U. S. Nat. Mus. Proc.=United States National Museum Proceedings
Wash. Ac. Sc. J.=Washington Academy of Science Journal
Wash. Ac. Sc. Pr.=Proceedings of the Washington Academy of Science

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