Memorial to Charles Meyer
1915–1987
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No other individual since Lindgren has done more to accurately describe the Earth’s ore deposits and to advance our understanding of them than did Charles Meyer. During his nearly three decades of tenure at the University of California at Berkeley, he also was probably the best teacher of economic geology in the world. He died unexpectedly, at the peak of his abilities, in Sedona, Arizona, on November 15, 1987. Clearly, we needed much more of his time, but mining and exploration geology and hundreds of students and professional geologists have benefited beyond measure from the time he was with us.

Charles Meyer was the only child of Olinda Hopmann Meyer and Charles F. Meyer. He was born in St. Louis, Missouri, on September 30, 1915. He graduated Phi Beta Kappa from Washington University in St. Louis in 1937. In 1939 he received a master’s degree from Washington University and was elected to Sigma Xi. His master’s thesis was on the geology and iron mineralization of Pilot Knob, Missouri. During these years at Washington University he met a young Latin and classics major by the name of Virginia Borrenpohl. In 1940 she became his wife and lifelong partner.

He earned a fellowship at Harvard University and began graduate studies there in the fall of 1939. His lifelong love affair with the ore deposits of the world was kindled at Harvard by two great teachers: L. C. Graton and Donald McLaughlin. Graton’s “Secondary Enrichment Investigations” had been brought to a close, but the origin of many ores (for example, those in Anaconda’s deep mines at Butte, Montana) remained controversial. Reno Sales, then chief geologist of Anaconda, wanted the facts; he asked McLaughlin to recommend a bright young student to go after them. Meyer had by then completed a second master’s degree and all of the formal course requirements for the Ph.D. except the dissertation. After eight straight years of university studies, he wanted to “get into the mines,” so he left Harvard for Butte. Sales had offered him the opportunity to study the Butte ores with the aid of the mining industry’s first in-house geological field laboratory, which was just then being set up at Butte by another young Anaconda geologist, William H. Swayne. This was the first time that a modern geological laboratory had been brought to the mines. It was equipped with the latest devices for mineral identification, including—even in 1941—x-ray diffraction. It was a revolutionary approach, and Meyer recognized the tremendous advantage it would give him in Butte for accurately describing the mineral assemblages in the ores.

Meyer devoted the next twelve years of his career largely to the study of the Butte District. Papers on wall-rock alteration and vein formation, which he wrote with Sales, as well as his own doctoral dissertation, which earned him a Ph.D. from Harvard in 1950, were the products of Meyer’s work in Butte in these early years. The fundamental importance of Meyer’s early Butte papers is that they are the first careful documentation of the evolutionary and progressive nature of hydrothermal vein and wall-rock alteration reactions. They laid the foundation and provided the methods for the study and interpretation in subsequent years of many other hydrothermal ore deposits throughout the world.

In 1953, Meyer accepted an appointment as a tenured full professor at the University of California at Berkeley, where he remained for 27 years. Vincent Perry, then chief geologist of
Anaconda, offered Meyer a position as consulting geologist, in order that he might continue to stimulate and influence the company's geological programs at Butte and elsewhere. In all, Meyer's association with Anaconda spanned 44 years; it was terminated only by the liquidation of Anaconda itself in 1984-1985. Charles Meyer's loyalty to Anaconda and his willingness to help the company even in its troubled final years was, as his friends and colleagues will instantly affirm, completely characteristic of this highly principled and ethical man.

Meyer continued to study the Butte District after joining the faculty at Berkeley. With several of his own students, and in cooperation with Anaconda's geological staff, he described carefully the early pre-main stage patterns of disseminated mineralization and wall-rock alteration. This work was published by Meyer and others in the Graton-Sales volume of the American Institute of Mining, Metallurgical and Petroleum Engineers (AIME) in 1968, and in several valuable publications by his students.

Meyer's influence was further broadened by his students, who went out from Berkeley to describe a wide variety of other ore deposits both in North America and overseas, including Bingham, Ely, Yerington, Twin Buttes, Grants, Coeur d'Alene, Shasta, Britannia Beach, El Salvador, Chuquicamata, Mantos Blancos, El Teniente, Kambalda, and Kalgoorlie. Meyer's own knowledge of the Earth's ore deposits was further expanded by extensive travel to see for himself the relations in the field. He traveled with his students, as a Guggenheim Fellow (in 1960), and later in connection with invited lectures and short courses that he was asked to deliver all over the world. He was, successively, the McKinstry Memorial Lecturer, Harvard University (1969); the Thayer Lindley Lecturer, Society of Economic Geologists (1972); the Australian-American Foundation Lecturer (1984); and the First International Lecturer, Society of Economic Geologists (1982 and 1983) in Japan, the Republic of South Africa, Australia, Chile, England, France, Belgium, and Germany. He was one of the pioneer contributors of ideas and knowledge that were utilized by many explorers in the 1960s and 1970s with spectacular success. His ideas contributed to the discovery and development of many new porphyry copper-type deposits in Arizona, Chile, the Philippines, and elsewhere in the world, as well as large low-grade orebodies in Butte by Anaconda.

Charles Meyer also recognized that theoretical and experimental geochemistry, based on knowledge of the mineral phases actually involved in chemical reactions that form ores and alter wall rocks, would improve our understanding and interpretations of field relations. Therefore, while at Berkeley, he initiated an experimental geochemistry program. J. J. Hemley, one of his early students, used the reactions written in the ores and associated alteration haloes of the Butte veins (as described by Meyer) to model and control his early experiments on hydrolysis reactions, which have proved to be of such fundamental importance. The collaboration of Meyer and Hemley through the years resulted in papers on wall-rock alteration and the geochemistry of ore formation. These joint papers reflect a familiarity with real ore deposits and the subtle interactions of complex hydrothermal systems, in which wall-rock reactions with the mineralizing fluids have profoundly influenced metal solubilities and mechanisms of ore deposition in hydrothermal systems.

During his later years, Meyer's research focused on putting the major ore deposits of the world into context with the evolution through geologic time of the Earth's crust, hydrosphere, and biosphere. This work is unfinished, but he provided progress reports with his presidential address to the Society of Economic Geologists in 1972, with his paper in the 75th anniversary volume of Economic Geology in 1980, and, most recently, in a fascinating paper for the Annual Review of Earth and Planetary Sciences, to be published posthumously in 1988. This last paper, "Ore deposits as guides to geologic history of the Earth," is in fact the outline of a major book, a book that, unfortunately, now will not be written. Charles Meyer has, however, shown us some striking worldwide patterns of ore formation and rock associations that vary sharply with geologic time. These regional and temporal patterns will stimulate future researchers in many disciplines—including biochemistry, climatology, astronomy, and petrology—to consider the evidence contained in ore deposits in their efforts to understand the
evolution of the Earth's crust and the history of the planet. His work will also stimulate and guide future explorers in, for example, prospecting the deeply covered Proterozoic regions of the mid-continent of the United States.

Charles Meyer went to Berkeley not only to continue his own research but also to teach. He was then 37 years old, and the youthful-appearing professor was often difficult to distinguish from his own graduate students. His contributions as a teacher are extraordinary. He gave his time to his students without limits, both at the university and on numerous field trips that he led, often to the detriment of his own personal work schedule. He was a dedicated teacher, and he was there to communicate with his students. He encouraged questions and informal discussion, and inspired students with his vital and enthusiastic love of the subject itself. He was "Chuck" to most of his students, and to be his student was fun, hard work, and incredibly stimulating. The essence of what he taught was really how to think for oneself, to map first the field relations and then apply all available laboratory tools and data, and to clearly separate facts and observations from interpretations. He taught his students to think critically. "What do we really know? The 'experts' may be wrong," he often said. "Be cautious with interpretations," he would warn. The field or laboratory evidence for the conclusion may be true "at that point," but what are the overall or broader relations? Develop the facts "brick by brick," and don't leap to the easy answer or be swept away by the latest scientific "break-through." These were the Meyer methods.

Chuck's students streamed out of Berkeley into industry, government agencies, and to universities all over the world, magnifying his influence immensely. Those who passed through Berkeley were not his only students. Through his numerous lectures and visits to mines, he passed on his approach and philosophy to probably hundreds of professional geologists all over the world. He was always a welcome visitor—either with his students, or with his wife and partner Virginia—because his motives were always scientific, not personal, and because everyone always learned something from Charles Meyer wherever he went.

He was honored not only by his students and professional colleagues during his lifetime, but also by the professional societies in which he was active. He was a Fellow of the Geological Society of America, the Mineralogical Society of America, and the Geochemical Society. He was a senior member of the American Institute of Mining Engineers. The Society of Economic Geologists elected him their president in 1971 and awarded him their highest honor, the Penrose Medal, in 1982.

In his acceptance of the Penrose Medal, Chuck acknowledged that his greatest debt was to his "wife and best friend, Jinny Meyer." No memorial to Charles Meyer would be complete without emphasizing how important their nearly 50-year partnership was to his contributions as a teacher and student of ore deposits. She was his traveling companion, secretary, editor, and sounding board for many of his ideas.

Charles Meyer was one of the finest men and greatest economic geologists of our time. History will record that he was among the giants of his profession.

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