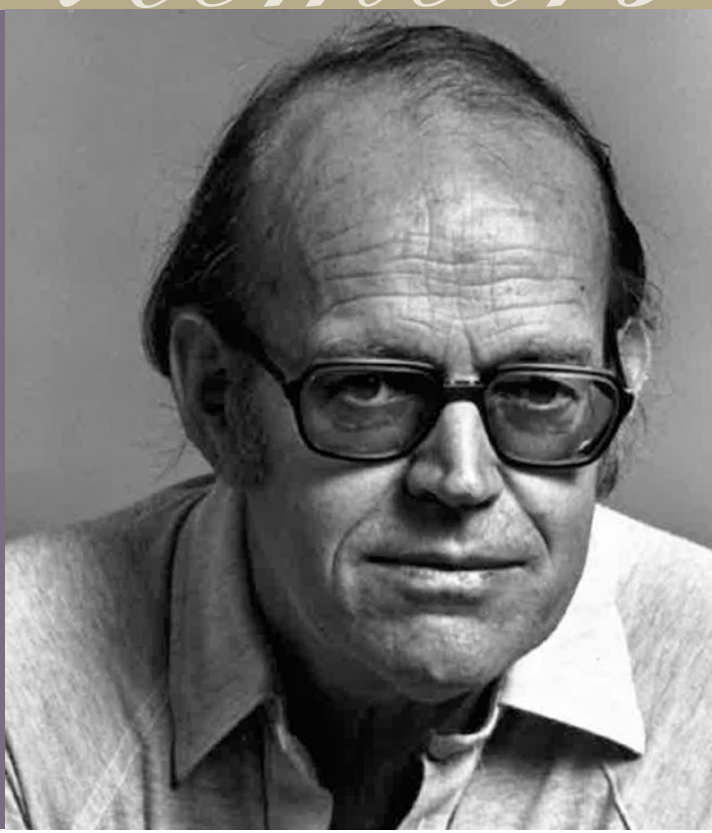
Hans P. Eugster

1925–1987

BIOGRAPHICAL *Memoirs*



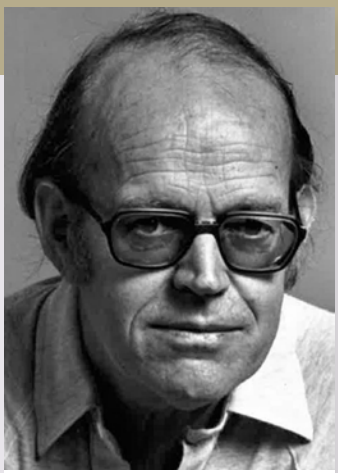
A Biographical Memoir by
W. G. Ernst

NATIONAL ACADEMY OF SCIENCES

HANS PETER **EUGSTER**

November 19, 1925–December 17, 1987

Elected to the NAS, 1972



By W. G. Ernst

Hans Peter Eugster was an internationally recognized geochemist who will be remembered as one of the most broadly accomplished petrologists of our time. He was equally proficient in thermodynamic theory, laboratory experiment, and geologic field occurrence. His research showed, for instance, that low-temperature, chemically precipitated sediments followed the same principles as high-temperature igneous and metamorphic rocks. A professor of geology at The Johns Hopkins University, he modernized his department, upgrading the curriculum and building a bridge from chemistry to geology by improving students' geochemical skills. His diverse and innovative contributions to mineralogy were breathtaking, covering the broad geological range of temperature, pressure, state of crystallinity and composition.

Early Life and studies

Born in Landquart, Switzerland on November 19, 1925, the third of five children, Hans conducted advanced petrologic studies of metamorphism in the Central Alps under the direction of Professor Paul Niggli at the Swiss Federal Institute of Technology in Zürich (ETHZ). Hans received his MSc in 1948 and the DSc at that institution in 1951.

For his doctoral dissertation, Hans studied metamorphic recrystallization in the eastern part of the Aar massif in the Swiss Alps. This continental complex is one of the main external blocks of pre-Mesozoic basement gneisses and granites caught up in the Alpine mountain-building event, involving convergent-plate tectonism and subsolidus recrystallization. During this formative Swiss period, he was also engaged as a crystallographer at the Davos Institute for Snow and Avalanche Control.

Arriving at the Massachusetts Institute of Technology (MIT) on a postdoctoral fellowship to study optical spectroscopy, Hans undoubtedly was strongly influenced by the renais-

sance in petrology taking place just up the road at Harvard University under the leadership of Professor James B. Thompson, Jr. A metamorphic petrologist, Jim Thompson and his graduate students—including several disciples at MIT—were applying the concepts of classical thermodynamics and phase equilibrium to the study of the naturally occurring mineral assemblages that characterize metamorphic rocks.

After his short postdoctoral research appointment at MIT, Hans was recruited as a staff member at the Geophysical Laboratory of the Carnegie Institution in Washington, D. C. After Hans moved to Washington, one of this MIT group, Dave Wones, obtained a fellowship there and became Hans' first research advisee.

Geophysical Laboratory

At the Geophysical Laboratory, Hans worked with Hatten Yoder, Jr. on high temperatures and aqueous fluid pressures. There, Hans initiated some of the earliest experimental studies of hydroxyl layer-silicate minerals such as phlogopite and muscovite. In an innovative attempt to extend his studies to a diverse group of chemically more complex natural minerals, Hans devised a buffer technique that allowed laboratory mineralogists for the first time to control oxygen fugacity in the redox investigations of phases containing elements of variable valence. This technical advance opened up a broad range of Fe-bearing phases to quantitative studies, previously unavailable due to lack of compositional control. The first to be investigated in collaboration with Dave Wones was the important biotite group (iron-bearing hydroxyl layer-silicates).

Scientific staff and research associates of the Geophysical Laboratory, 1952. Hans Eugster stands on the extreme right, sporting a moustache he soon abandoned. Photo courtesy Geophysical Laboratory Archives.

Introduced to the plethora of saline minerals of the Green River Formation by U. S. Geological Survey associate Charles Milton, Hans applied the principles of phase equilibrium and classical thermodynamics to these minerals in order to elucidate how the mineral assemblages of these remarkable non-marine evaporite deposits were formed.

The detailed study of such mineral associations had been pioneered by the Nobel prize-winning chemist Jacobus van 't Hoff in a classic study of the evaporation of seawater.

Hans was now able to demonstrate that these assemblages obeyed the laws of physical chemistry in their close approach to phase equilibrium. In addition, Hans applied these universal concepts to the laboratory synthesis of rock-forming silicate minerals under controlled conditions of temperature, pressure, and composition, thereby demonstrating the achievement of chemical stability—or in some cases, the lack thereof.

The Johns Hopkins University

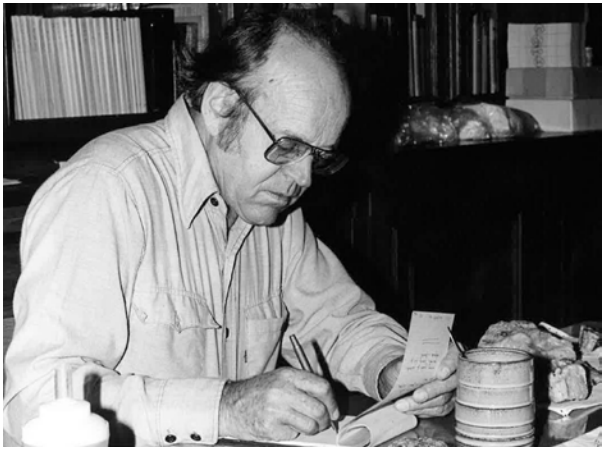
Asked to teach a geochemistry course at The Johns Hopkins University, Hans' illuminating and insightful presentations led to speedy recruitment. He became an associate professor of experimental petrology in 1958. He was promoted to the rank of professor in 1960. From this educational base, the collaboration with Charles Milton provided entry to a broad range of studies with numerous lacustrine geologists and mineralogists, among them Hopkins colleague Lawrence Hardie, and Blair Jones of the U. S. Geological Survey.

Researches on Green River saline mineral paragenesis soon led Hans and his associates to a vast range of studies of analogous deposits around the world, including Saline Valley and Searles Lake in California, Great Salt Lake, Utah, central Sicily, Lake Magadi in the Kenyan East African Rift Valley, Lake Chad in the southern Sahara, several of the salt lakes festooning the Bolivian Altiplano, and the Qaidam Basin of western China. Beginning in 1970, Hans also served as an adjunct professor at the University of Wyoming, where he taught advanced geochemistry and conducted laboratory and field research until his untimely death from a ruptured aorta on December 17, 1987 at the age of 62.

Reflecting Hans' seminal contributions to the investigation of saline lake deposits, Lideke Vergouwen named a newly recognized mineral, eugsterite, $Na_4Ca(SO_4)_3 \bullet 2H_2O$, in his honor in 1981. This salt mineral was reported from surface efflorescence on soils near Lake Victoria, Kenya. Hans continued important, substantially higher temperature hydrothermal investigations as well, most consistently with I-Ming Chou of the U. S. Geological Survey, on the geochemistry of supercritical saline solutions—providing a scientific introduction to the geologic formation of ore deposits.

Hans' appointment to The Johns Hopkins faculty had a most profound effect on the Geology Department because his research goals and instructional thrusts ushered in the geochemical revolution that was sweeping through the earth sciences in the late 1960s. Hans was deeply involved in upgrading the curriculum, and thus student proficiencies

in geochemistry, and thereby the course of experimental and theoretical petrology. As he himself stated, he devoted his career to "building a bridge from chemistry to geology." Hans came to teach a course, but over three decades his leadership led to a world-class, geochemically famous department—an organization that by the 1980s had evolved into the Department of Earth and Planetary Sciences. He also served as chair of this department from 1983-1987.



Hans Eugster in mineralogic research mode, photo taken about 1985. Courtesy Johns Hopkins Department of Earth and Planetary Sciences Archives.

Through the years at Hopkins, Hans and his students extended the high-temperature high-pressure buffer technique to a wide range of chemical systems and continued to study lacustrine evaporite petrology and sedimentology, marine evaporite petrogenesis, mineral solubilities, and the origin of hydrothermal ore deposits. A central theme in all his many research efforts was the concept of the co-dependent interaction of minerals with aqueous fluids. Hans gained insight for experimental studies through field observations and measurements, and used the results of his laboratory investigations to better constrain processes attending the formation and evolution of natural rocks. His research demonstrated that the underlying principles of experimental petrology and classical thermodynamics could be applied to low-temperature, chemically precipitated sediments as well as to high-temperature igneous and metamorphic rocks.

Awards and Honors

Hans was awarded the Arthur L. Day Medal of the Geological Society of America in 1971, the Goldschmidt Award of the Geochemical Society (its highest honor) in 1976, and the Roebling Medal of the Mineralogical Society of America (its highest honor) in 1983. He served as president of the Mineralogical Society of America in 1985. In 1972 he was elected as a member of the National Academy of Sciences, and a fellow of the American Academy of Arts and Sciences. Hans was also advanced to fellowship in

the American Geophysical Union, the American Association for the Advancement of Science, the Mineralogical Society of America, and the Geological Society of America.

Outside Interests

Hans enjoyed a rich and diversified life outside the walls of academia. He was a talented violinist, an accomplished painter, an innovative potter, and an avid theater and concertgoer. In all of these—as in his science—he sought the avant-garde realms, the new, the novel, and the cutting edge of each area of interest. He loved to ski, possibly a legacy from his study of snow and ice in the Alps. He enjoyed country living with his family in an old farm in rural Maryland. Scientist, artist, a renaissance man enthused about his varied interests, Hans was an indefatigable worker and an insistent lover of life.

Hans personally first and foremost had a generosity of the spirit; he offered his ideas and insights without reservation. His basic good cheer was infectious, pervasive and contagious, even when he was going through serious health problems. As a painter, potter, and accomplished musician, he was fond of saying that he was an artist who worked in geology to make a living. He broadened all our horizons, extended our understanding of unifying chemical principles far beyond normal expectations, and profoundly influenced the sciences of mineralogy, petrology and geochemistry. He was a remarkable intellectual leader and a warm personal friend to all who were privileged to know him.

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