

## Acceptance of the Roebling Medal of the Mineralogical Society of America for 1981

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*Mr. President, Fellows, Members and Guests:*

First I want to thank Hal for his excellent introduction. In our many years of association, first as teacher and student at Harvard, afterwards as colleagues at Northwestern, he learned all too much about my faults and my virtues. It pleases me to see that his memory is as marvelously asymmetric as a good friend's should be.

I accept the Roebling Medal with simultaneous humility and pride. It is a great honor I never expected to receive, but clearly little is beyond the range of one who stands on the shoulders of giants. Over the past ten years so much of my work involved problems of sedimentation, mass balances, erosion rates and variations in isotope ratios that my long and deep associations with mineralogy and mineralogists had faded a little until I was delightfully jolted by the news of the Roebling Medal. Now, thinking back through my career, I am a little surprised not only at the degree of my involvement in mineralogic problems, but with the direct influence of Roebling Medalists on my career. To show you the luck I had in being exposed to these outstanding mineralogists, I cannot resist a brief historical account.

Roebling medalists influenced me 12 years before I was born. In 1904 my father took mineralogy at the University of Michigan from Professor Edward Kraus (Roebling, 1945), whose laboratory assistant was a youngster, Walter Hunt (1957), from whom I too took mineralogy in 1936.

As a graduate student at Northwestern University in 1937, I was caught playing poker with my petrology professor, Elburt F. Osborn (1972). In the summer of 1939, I was scolded severely by Arthur Buddington (1956) for having spent several weeks in the field without making a map. There followed a short respite, but in 1952 I joined the Geochemistry and Petrology Branch of the U.S. Geological Survey.



Next door to me at the Survey was Waldemar Schaller (1938), two rooms away Mike Fleischer (1975), three rooms away C. S. Ross (1946), and a couple of miles away—but in the same group—Esper S. Larsen, Jr. (1941). A unique collection of talent! One day I rushed in to Waldemar to tell him that I had just predicted what would happen when I put pyrite on zinc amalgam. Waldemar almost wept. I asked why. Waldemar said, “With luck, each of us has one prediction come true. Too bad you are so young, with no future.”

During my years with the U.S. Survey in the early '50's, I spent many days in Grand Junction, Colorado, with John Gruner (1962) discussing the origins of uranium deposits. Then I went to Harvard to be a colleague of Cliff Frondel (1964) and Jim Thompson (1978).

How could a young man, exposed to such an array of talent, fail to become educated a little bit? I must say that compilation of this list has made me nostalgic; I long for the old days of earth science, when everyone knew everyone, the neophyte consorted with the stars, the literature could be consumed with a little time left over, and one couldn't help being a pioneer because almost anything one did was new.

It was now 40 years since I received my Doctor's Degree at Northwestern University. To recount here the history of all the important influences on my career, both personal and scientific, is manifestly impossible. But I would like to recognize the importance to me of three groups of people. The first I want to recognize is the small but brilliant geology faculty at Northwestern University from 1946 to 1952: Ed Dapples, Art Howland, Bill Krumbein, Howard Slack, Larry Sloss, Jack Stark. Those years, when we lunched together every day in Bill Krumbein's office, expanded my horizons immensely. No part of earth science escaped those noon hour discussions.

If the years at Northwestern could be termed broadening, the following three years at the Geochemistry and Petrology Branch of the U.S. Geological Survey might be called intensifying. They showed me how all the skills of chemists, physicists, spectrographers, X-ray scientists, mineralogists and geologists could be focused and coordinated toward a simple end—in this case the genesis of the sandstone-type uranium deposits. The efforts

of the X-ray group, headed by Charles Christ, were particularly spectacular in revealing the importance of crystal structures in mineral genesis.

Now I would like to pay tribute to the third group—my students. Through the years, my students have been my friends, my burdens, and my inspirations. Many major concepts have been given to me by them. To name only a few: Julian Hemley explained sulfide complexes to me every week or two as he did his thesis; Alden Carpenter first pointed out that many of my diagrams that I had drawn in three dimensions required only two (I guess he understood the phase rule); Marco Einaudi showed me how my activity diagrams could be derived from composition diagrams, thus permitting me to understand Jim Thompson a little better.

Finally, I want to pay tribute to an individual, Charles L. Christ, my co-author, colleague, teacher and close friend, from 1952 until his untimely death last year. My contributions are so intertwined with his, and the direction of my research so influenced by him, that I cannot but feel that I accept this medal for him and for me. Thank you.