

Acceptance of the Roebling Medal of the Mineralogical Society of America for 1992

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Thank you, Mr. President, and special thanks to you, Gary, for the generous introduction. Let me extend thanks also to the six members of the Roebling Medal Committee for making the recommendation and the Council for supporting their selection. I am also grateful to the many kind friends who took the time to write letters expressing their pleasure on learning of my selection.

Most of you realize that I receive this medal primarily as a representative of the Geophysical Laboratory. I am somewhat reluctant to show the full measure of my personal pleasure on receiving the medal because of an experience I had some years ago. While at a reception in the Great Hall of the National Academy of Sciences after receiving an award, I was approached by the late Roger Revelle. He said "You are becoming a big man!" As I puffed up with pride, he lowered his eyes and remarked "You are eating too much."

It has been my good fortune to have been surrounded the last 50 years with exceptional professors and colleagues, first with N. L. Bowen at Chicago and J. W. Gruner at Minnesota, then M. J. Buerger and H. W. Fairbairn at M.I.T., F. Birch at Harvard, and then the constant flow of outstanding staff members and over 50 of those remarkable young people we label Fellows, with whom I have worked at the Geophysical Laboratory. With the possible exception of one recipient, I have known, or at least shaken the hand of, all 51 previous recipients of the Roebling Medal, over a third of whom have worked at the Geophysical Laboratory at some time during their career. You may not realize that there are relatively few petrologists on the list. It is easier for mineralogists and crystallographers to appear to walk on water because they are well versed in the principles of polymorphism—they just wait until it inverts to ice!

One cannot underestimate the contribution made by colleagues and students in shaping one's career. Good questions are always more valuable than answers that tend to close off potential thought patterns. I tried teaching on four occasions, only to learn that it is indeed very hard work, and one needed a 48-hour day to accomplish all that was asked of a teacher who kept the door open to his students. I have enjoyed the freedom to work on problems of my own choice with adequate funding provided. As you know, those are the hallmarks of the Geophysical Laboratory. In current politically correct language, that means we are pro-choice on scientific program and for liberal funding on entitlement support. What more



could one ask? My father, a businessman, always thought I should go out and get an honest job making money rather than spending other people's. It is no secret that the Geophysical Laboratory could use much more of other people's money during these times of tight budgets.

It is especially rewarding to receive the Roebling Medal in a city where the Roeblings have one of their notable wire-cable suspension bridges, the longest in the world at the time of its completion in 1867. Its building was delayed because of the Civil War, in which John A. Roebling's son, Col. Washington A. Roebling, played a role at Little Round Top at the battle of Gettysburg. Colonel Roebling assisted in the bridge's construction after the war. It was Colonel Roebling who developed an exceptional mineral collection, consisting of all but 12 of the

minerals then known in the world, which is now in the Smithsonian Institution. He first became interested in minerals at Rensselaer Polytechnic Institute, where he was graduated as a civil engineer. He was a charter member of MSA and served as its vice-president in 1924. We all benefit from his endowment to the Society for the support of the *American Mineralogist*.

There are so many exciting opportunities in petrology today that I find it difficult to limit the number of enticing projects. I would encourage you to consider more fully the thermal aspects of igneous petrology, particularly the heat transfer constraints on magma generation, the coupled problem of simultaneous heat and mass transfer, for which there is no suitable theory, and especially the limitations on convection in partially molten rocks—the porous media problem. In addition, I would like to see an organized effort in the experimental calibration of major- and trace-element partitioning, with due regard for their dependence on bulk composition and volatile constituents. It is a difficult and tedious job that needs to be done.

Perhaps the most critical need is a systematic approach to nonequilibrium, open systems with the guidance of irreversible thermodynamics. The principles are essential to understanding almost all of the current social problems of resource exploration, pollution, stress release on active faults, and explosive volcanism. Fluid dynamics should be a principal part of our petrologic studies on metamorphism, metasomatism, and rock alterations, as well as ore and magma concentration. But

that does not mean we should ignore the multicomponent equilibrium systems, for which we now have the tools to investigate easily. Unfortunately, with a few exceptions around the world, that work appears to have halted. Perhaps it is because we lack a suitable way of thinking rigorously about a ten-component system without the help of our usual geometric models. A master flow sheet for the magmas of all the common rock types is well within reach if people are willing to do the work at critical levels of pressure.

Finally, I appeal to those of you who work on organic minerals to characterize the organic residuum left behind in abandoned oil fields. Generally one-third of the organic material is pumped out as oil, but two-thirds is left in the ground. Imagine what it would do to our oil reserves if that residuum could be mobilized with the appropriate injection fluid after consideration of the organic-inorganic mineral bonding characteristics.

I am indeed honored to receive the Roebling Medal. Admittedly, I am chronologically advantaged, but I would willingly trade myself in on two 35 year olds with the potential of winning the MSA award again. In addition, I have had the support and understanding of a very helpful wife and family. Thank you to Betty and to Karen, our daughter, an entomologist, who are among you. Our son, now in Florida, is not able to join us here.

Thank you all for making this such a pleasurable career. I hope to continue to grow with the field and earn this high honor.