

Acceptance of the Roebling Medal of the Mineralogical Society of America for 1988

JULIAN R. GOLDSMITH

University of Chicago, 5734 South Ellis Avenue, Chicago, Illinois 60637, U.S.A.

The most important part of an award ceremony is the selection of the citator. Ask either a *very* good friend who will ignore your peccadillos and stupidities or a stupid acquaintance who is unaware of or does not recognize them. I have not selected Bob for stupidity, and he is aware of the blunders I have perpetrated, at least since the 1960s. He could have amused you with a brief summary of them in place of the praise, but its length would get boring. To further the process of unboring you, I have engaged Paul Ribbe to ghostwrite this acceptance. He was selected because I really enjoyed his last year's Presidential Address. Of course, I ghostwrote *it* for *him*. Don't blame *me* if anything that follows displeases you.

It is a measure of my age that I have known all but one or two of the 47 Roebling Medalists (who go back to 1937, when I was an undergraduate) and can call myself a friend of—or at least on a first name basis with—25 of them. Four were particularly influential in my career: N. L. Bowen, Tom Barth, Martin Buerger, and Fritz Laves. I am privileged to have such friends and associates, but I am also proud of and blessed by my friendship with so many more who have not been formally honored by this or other societies; some have died and others will do so without kudos. Some of the audience may know my feeling about awards and prizes, and what I call “the embarrassment of honors,” only a part of that embarrassment coming from being categorized along with those whose abilities and accomplishments are orders of magnitude greater than mine. Perhaps Groucho's statement that he would not join any club that would admit him should be extended to one that says that if awards are to be given, the standards should be so high that *nobody* qualifies and nobody gets hurt. But it would be less than honest of me to say that I am immune to the pleasure that this award brings and that the enjoyment of doing my research is sufficient unto itself. If this attitude be my ideal, my scientific zeal tests out inadequately; my spirit is not strong enough. Of course I am pleased and honored.

Returning to my associates: they have provided me with the rich, stimulating culture that I feel is so important for fostering research. One of course “learns” from associates, but perhaps even more important is the inspiration and encouragement a good environment produces. For this I am everlastingly grateful to the University of Chicago, where these factors plus just the pride of being there have meant so much to me. I truly feel it is a special place. I suspect that moderate brainpower embedded in stimulating surroundings is more productive than genius in isolation. One of the first people from whom I learned by inspiration as well as instruction was my father. I was very touched by the MSA Award accep-



tance last year by Don DePaolo, and his warm account of his roots and blue-collar background. I will follow his lead. My father left a wild-west scene and his bad-man and Indian associates at age 17 in 1908 while proto-Oklahoma was still Indian Territory, where Chickasaw dialect, along with English, was his first language, and where his education under a teacher he revered named Dick Vatter was in a one-room schoolhouse, with only the big sky beyond the eighth grade. He came to Chicago, went to Metropolitan Business College, and took a job as office boy with the Armstrong Paint and Varnish Works at \$7 per week. He almost lost the job because he disliked shoes and had problems with the telephone, but became president of the company before he was 30, and died before I was 30. The spoon that was found in my mouth at birth may not have been silver, but it *was* a spoon, and always well-filled. When the great depression arrived I did not personally feel it; the paint business was good, for when people lost their jobs they had nothing to do and so painted their houses. With some justification, I thought my dad to be the greatest man in the world. Let me share an early learning experience with you. At ca. age ten I had been badgering him, a cigar smoker, to let me “take a puff.” He tired of this, and to cure me once and for all, sat me down, stuck a cigar in my mouth, lit a match, and sat back to watch me get sick. I puffed and puffed—in

seventh heaven. After about five minutes and perhaps an inch or more of cigar, not only wasn't I sick, but happy as a clam, and my father could no longer restrain himself. He snatched it out of my mouth, and yelled, "Let THAT be a lesson to you!"

The first geologist I knew was J Harlen Bretz, who I thought was the greatest geologist in the world. My thesis supervisor was Norman L. Bowen, who I *knew* to be the greatest, but by then I had married the greatest woman in the world BAR NONE, and it is not possible to increase my assurance as to judgment beyond this point. At the Corning Glass Works, Fred Bickford was as great a boss and compatriot as I can imagine. I could go on through a list of friends and associates, but I don't care to compete with Jerry Gibbs, who in last year's address acknowledged and thanked 46 people plus the U.S. Congress. I do, however, continue to be blessed with great associates and colleagues, give or take one or two. I include the guy who introduced me and who took me back into the laboratory after my long bout with administration (during which I had almost convinced myself I was a big shot) and completely re-educated me in the art of being an honest scientist. I'll even excuse him for, apropos of my earlier comment, comparing me with the likes of Michael Faraday.

Have you ever had the feeling that your speech is like one of those dull parties you can't really leave because you're the one giving it? I read this in an airline magazine, but I digress, and will shift gears.

At the Corning Glass Works I got involved in the surface chemistry of silicates, especially 96.5% SiO₂ glass (Vycor), for we were using it in a ceramic process to make insulators and other parts for Oak Ridge (which I later learned were used for isotopic separation of uranium in the calutron). This glass, when finely ground by ball-milling in distilled water, would produce a suspension ("slip," used for casting) that produced an acid reaction with a pH meter and when electro-dialyzed, got down to pH 3.2. In the early 1940s I ascribed this to the grabbing of the OH in water by the Si left dangling by the fracturing of the SiO₂-rich glass, to satisfy the broken Si-O bonds. The remaining proton, perhaps in a diffuse colloidal double layer, could be detected by the glass electrode of the pH meter. This was my first experience with a behavior that led me into the role of water in some of my current work, which might be called mechanistic mineralogy.

The accelerating effect of pressures of at least 10 kbar on certain reactions has been known and made use of for some time by Bob Newton and me, even if little understood, and still seems not to be widely recognized. Recent work on the rate of Al-Si order and disorder in NaAlSi₃O₈ and KAlSi₃O₈ in the absence of water as a function of pressure has shown the profoundly enhanced diffusion to be dependent on a source of protons and might be termed PAD, proton-activated diffusion. Although molecular water plays no role as such, the chief source of protons appears to be the dissociation of water (in the surrounding high-pressure media external to the capsule), and to date the relative importance of pressure per se on the

reaction versus that induced by the known several-orders-of-magnitude-increased dissociation of water at these pressures is not clear. The role of structural defects acting as charge-balancing electron donors or receptors is also unevaluated. I have suggested a mechanism involving proton-activated, transient coordination increase in which Si-O and Al-O bonds are broken. I suspect that this phenomenon is responsible for the "hydrolytic weakening" effect in quartz and other silicates and that perhaps the role of "water" in some "hydrothermal" reactions should be re-examined.

The effect of high pressures on rates of oxygen-isotope exchange between a number of minerals and anhydrous CaCO₃ and CO₂ gas as well as water is also striking, and our high-pressure laboratory in collaboration with Bob Clayton's isotopic analysis laboratory is examining equilibrium isotopic fractionation in anhydrous systems and examining the mechanisms of the exchange process. This technique avoids the problem of hydration and breakdown of some phases as well as the uncertainties related to exchange behavior with supercritical water.

Getting back to my associates—I suppose that knowing great people is pure luck, and I am truly a lucky man. I've had a good ride, all of which I have enjoyed. I seem to have usually been in the right place, at the right time, to be aided by the right person. And, at three score and ten, I find my luck continuing, for I have a hand steady enough to be able to keep hacking away in the lab. I am here reminded of Harold Urey's 70th birthday party. He had come to Chicago for it, having left at 65 for San Diego, where he remained active indeed. The then Dean of the Biological Sciences introduced him at a dinner, he had never met Urey before, but was selected to avoid the problem of choosing one from so many friends. Dr. B was an American born in Japan, and respect for age was ingrained in him. In a lengthy eulogy, he treated Harold as a grand old man of science, a white-haired patriarch, etc., etc. Harold Urey was youthful in spirit, even if possessing at best a vestigial sense of humor, and I watched him getting red-faced, angrier and angrier, grasping the edge of the table with whitened knuckles. When he stood up, he didn't even acknowledge the introduction, but barked out pretty much the following: "At 70, I don't feel any different than I did at 60!! At 60, I didn't feel any different than I did at 50!! At 50 (long pause, and in a small voice), I felt different than I did at 40."

I will end with the Matthew Effect (reference for what follows supplied on request): "For unto everyone that hath shall be given, and he shall have abundance; but from him that hath not shall be taken away even that which he hath." Peers and colleagues regard each scientific accomplishment as a prelude to greater ones and produce a social pressure that does not allow the achiever to remain content. There thus seems little chance for repose at the top in science, and I know Harold Urey felt that way. And it was Einstein who said, "The only way to escape the personal corruption of praise is to go on working."

Thank you for everything, including listening.