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Presentation of the Roebling Medal for 2007 of the Mineralogical Society of America to Gordon E. Brown Jr.

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President Barb Dutrow, Officers, Past Roebling Medalists, Members of the Mineralogical Society of America and Guests:

Gordon Brown's Early Years (by G.V. Gibbs)

It gives me great pleasure to say a few words about Gordon Brown, the 2007 Roebling Medalist, a mineralogist who, in his own words, claims to have gone astray. I have always defined mineralogy as what mineralogists do and what Gordon has done, at least in my mind, is to have broadened the field of mineralogy during his career into other exciting areas such as biology, chemistry, and physics.

The great rewards of being a professor are the brilliant students who grace your life. Gordon was one such student. I first met him at Penn State University in 1965 where I was Assistant Professor of Mineralogy. Shortly after making a commitment to work with me, I was made an offer that I could not refuse. Virginia Tech made an offer to Don Bloss, Paul Ribbe, and our students, hiring us as a small team to establish a Center of Mineralogical Research at Virginia Tech. Much to my delight, Gordon agreed to join the team. His decision had to have been a bit scary to leave the well-established internationally known Mineralogy-Geochemistry Department at Penn State University and to go a virtually unknown sleepy school in Southwest Virginia with little or no reputation in mineralogy. I remember talking about my decision with one of my colleagues at Penn State. His comment was "Jerry, you're going where? To Virginia Tech, we will never hear from you again!"

Gordon hit the ground at Tech running. He wrote a Master's thesis that was published in its entirety and then he undertook a comprehensive study of the crystal chemistry of the olivines that was published in the Reviews in Mineralogy. I know that several of you have read the account of his olivine study as more than 5000 copies of the volume have been sold. In addition to fulfilling his Master's and Ph.D.'s requirements in four short years, he wrote three highly cited papers on the bond interactions in silicates in terms of their bond length and angle variations, electronegativity considerations and Durward Cruickshank's $(d–p)\pi$ Si-O bond model. During that time, the Vietnam War was in full bloom, and grades were of utmost importance. I was teaching a course on Crystal Chemistry of the Rock Forming Minerals. At the second meeting, a couple of the students approached me with the proposal that I not give an exam but with the assurance that they would keep up and learn the material. In short, they would learn the material without the stimulus of an examination. I agreed. At the last meeting of the course, I decided to give an examination with the understanding that they would all receive an A no matter how poorly they performed. The exams showed that I had made a blunder! All of the students failed except for Gordon, who wrote a nearly perfect paper. It was clear that Gordon was highly motivated to learn and understand the material. The assorted directions that his career took in molecular-level studies in environmental science, X-ray studies of the structure, bonded interactions and properties of silicate glasses, and the applications of synchrotron radiation in the elucidation of the structure and properties of Earth materials were clear evidence of his desire to understand and expand his horizons were foremost for him, ever broadening the scope of his research interests and knowledge. I might add that although Gordon was a student during our early days at Tech, I attribute much of our early success in establishing our reputation in mineralogy at Virginia Tech to Gordon. In addition to his publications, he gave several well-attended and excellent talks at AGU and GSA where he caught the attention of both Charlie Prewitt and Bill Luth.

Upon graduation, I encouraged Gordon to go to Stony Brook as a post-doc, to work with my good friend and now colleague Charlie Prewitt, where Gordon undertook research on lunar samples and high-temperature crystal chemistry. Shortly thereafter he took a position at Princeton. Several years later, I received a call from Bill Luth asking about Gordon for whom I had nothing but high praise, a scholar with a very bright future. Gordon was then confronted with the onerous task of either remaining at Princeton or going to Stanford. A great choice for a young mineralogist destined to go astray, not only enriching our science but broadening it into other fields. He elected to go to Stanford where he is has had an exciting career, a story that is continued below.

Gordon Brown's Stanford Years (by M.F. Hochella Jr.)

Gordon never missed a beat in moving to Stanford, and in fact, to this day, his career continues to accelerate. During the Stanford years, he has been deeply involved in the study of the structure of glass, surface science, molecular environmental science, and geomicrobiology.

At Stanford, he is currently the Dorrell William Kirby Professor of Mineralogy and Geochemistry, and Professor of Photon Science, and well as the Director of the Stanford Molecular Science Institute. And when you combine that with his scientific brilliance and international influence, you get someone who not only has won the most prestigious mineralogy prize in the world (the Roebling Medal, of course), but also in the same year, the

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Patterson Medal of the Geochemical Society, that society's top environmental prize. And now, along with what Jerry so eloquently said, give me just an additional few moments to explain how this came about.

I would like to concentrate on just one item of, in my opinion, seminal, if not timeless importance. It all stems from a 1987 paper in Science, with Gordon "hidden" as the third author. The reference is: K.F. Hayes, A.L. Roe, G.E. Brown, Jr., K.O. Hodgson, J.O. Leckie, and G.A. Parks (1987) In-situ X-ray absorption study of surface complexes at oxide/water interfaces: selenium oxyanions on α-FeOOH. Science, 238, 783–786.

So, picture this. The time was the mid-1980s, and Gordon was very interested in high levels of dissolved selenium that had been discovered in surface water and shallow groundwater in the western sections of the Central Valley of California. At the time, it was starting to become apparent that excessive irrigation was leaching selenium out of the predominantly marine rocks, and soil derived from these rocks, that underlie that area. Birth defects had been observed in waterfowl that frequented these surface waters. How mobile was selenium in the subsurface? And, as important, what controlled its mobility? Gordon insisted that, to begin to understand this from a scientific point-of-view, one would have to determine the sorptive structure of weakly interacting oxyanions like aqueous selenium in-situ, that is, directly at the mineral-water interface. And now comes the best part...Gordon was the first in the world to correctly surmise that one could look at realistically low levels of any sorbent, in this case selenium, directly at the mineral-water interface using X-ray absorption spectroscopy performed at a synchrotron. This turned out to be the key move, and eventually resulted in the Science article just noted. Even though Gordon is third author, the study would not have existed without him.

So what is the aftermath, in fact legacy, of Hayes et al. (1987)? First, the paper is easily in the top 1% of the most referenced research papers in the geosciences literature for papers that have been out since the late-1980s. But much, much more important than this statistic is the realization that this paper started an avalanche of productivity in the field of environmental mineralogy that continues to this day, 20 years later. I would estimate that at least one thousand, if not a few thousand publications have resulted from this first study, and there are presently no signs of this slowing down. This work has made a difference, from fundamental science, to funding patterns, to environmental engineering systems, to policy decisions.

Let me conclude by saying that I consider Gordon's contributions, all of them, to be one of the greatest achievements in the mineral sciences in the last half century. His work and vision did as much as anyone in taking mineral sciences from the 20th to the 21st century, much as 1967 Roebling medalist Linus Pauling's fundamental work in crystal chemistry did to bring us from the first to the second half of the 20th century. And Gordon has been as big a player as anyone in the world at bringing environmental mineralogy to the fore. As we face the future alongside our stressed planet, I don't know of anything that could be more important in our field of science than this.

President Dutrow, MSA officers, Roebling committee chair Bob Downs, past Roebling medalists, members of the Mineralogical Society of America and Guests, it is a lifetime honor and privilege for Jerry Gibbs and me to present to you the 2007 Roebling Medalist, Gordon E. Brown Jr.