

Presentation of the Roebling Medal for 2006 of the Mineralogical Society of America to W. Gary Ernst

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President John Valley, members of the society, and guests:

I am really delighted to have this opportunity to introduce Gary Ernst for the Roebling Medal, 25 years after he was our President handing out these awards.

First, I emphasize that it is no surprise to find Gary up here today. The only surprise is that it didn't happen sooner. Anyone brave enough to tackle the experimental synthesis and phase relationships of amphiboles for his Ph.D. thesis in 1959 deserves the Roebling Medal. In fact, it earned him the MSA Award in 1969.

Second, I'll note that Gary took his amphiboles into the field, and the expansive way that he built geology onto his mineralogical base was recognized in 1998 by award of the Geological Society of Japan Medal, and in 2004 by award of the Penrose Medal of the Geological Society of America

Third, what happened in the three decades between these awards for young and old (mature) scientists? Gary's CV presents an extraordinary career of research, administration, and public service, and I've no hope of even outlining all of his contributions.

The Roebling Medal is awarded for "outstanding original research in mineralogy...defined broadly," but a few general remarks are in order before I pass on to this aspect of his incredibly distinguished career. Gary Ernst has always been an acknowledged leader. His early research and "presence" led to his election to the National Academy of Sciences at the tender age of 45. He is known for his insightful work on national committees, and his positions are always presented cogently and fluently. His Presidential Address to the Geological Society of America in 1987 was a thoughtful statement on science policy.

Now, let us return to amphiboles. Gary's early work at the Carnegie Institution Geophysical Laboratory (1950s-60) involved high-pressure experimental studies on amphiboles, very difficult experiments on complex minerals. He cracked a lot of the problems, and worked out details for the alkali amphiboles (and others), publishing results for glaucophane, riebeckite, arfvedsonite, ferrotremolite, and sodic amphiboles. The basic research papers were accompanied by reviews, ranging from "Polymorphism in Alkali Amphiboles" (1963) to "Petrogenesis of Glaucophane Schists" (1963). Gary was always running ahead of the game. When I sent out a circular in the mid-1960s soliciting contributions to a new Springer-Verlag monograph series on minerals and phase diagrams, Gary jumped right in and published in 1968: Vol. 1, *Amphiboles*. This book pulled together for the first time the crystal chemistry, phase relations, and occurrence of a difficult but significant mineral family, and included Gary's own pioneering research on the synthesis and stability of amphiboles.

After an interval when he concentrated on field-based studies, he returned for another attack on amphibole synthesis in the 1980s, with papers published on magnesiohastingsite, edenite, tremolite-tschermakite, and calibration of the Al content of hornblende as a geobarometer. The latter was refined even further in a 1998 paper with Liu on the calibration of Al and Ti contents of calcic amphibole in MORBs for use as a thermobarometer.

The fact that one of his synthesized amphiboles was blue diverted him into the study of blueschists, at a time when plate tectonics was bursting onto the scene. So Gary burst out with a novel interpretation of blueschists as a product of the subduction process. His research on glaucophane schists, applying the results of his experiments, led him through the 1960s and 1970s to detailed field investigations of mineral parageneses in the low-grade metamorphic rocks of the Franciscan mélangé and the Japanese metamorphic terranes, regions to which he has repeatedly returned in person and in print. It took a while for the experts on the Franciscan to be persuaded that these rocks owed their color to genuine high pressures resulting from subduction, but by the time of the 1972 International Geological Congress in Montreal, Gary was already recognized as a world leader in their interpretation. An IUGS Commission sponsored a symposium on *Experimental Petrology and Global Tectonics*, and Gary's invited review led to the 1973 paper "Blueschist Metamorphism and *P-T* Regimes in Active Subduction Zones." This theme has been recurrent in his many refreshing, insightful review papers between 1973 and the new millennium, updated as additional experimental data and extensive field investigations shed more light on this main-line geological process. I understand that his blueschist-subduction interpretation was the primary basis for his election to the National Academy of Sciences in 1976.

Now, what about those in-between decades? Gary has directed his energy to minerals and rocks all over the world. In addition to Japan for blueschists, he went to Italy for eclogites, to Taiwan for ophiolites, to China for amphibolites, and to China and Russia for ultrahigh-pressure metamorphic rocks. The minerals in these rocks led him to more elaborate interpretations of subduction, followed by new ideas about exhumation.

1976 saw his first paper on eclogites in Italy, for him a new rock type on a new continent, both of which occupied his attention for years afterwards. His reviews by the late 1970s expanded into the theme: *Tectonics and P-T Trajectories of High-pressure Rocks*. These interests took him to field areas in Taiwan, where he picked up on the ophiolites that he had encountered also in the Alps and in California. Gary produced many publications presenting detailed field-based studies in these three widely separated regions through the 1980s. By 1988 he had moved on

to China, with a reconnaissance of Precambrian rocks, and this was followed by a series of papers dealing with his old favorites, amphiboles and amphibolites in the cratons of China. In 1991 he joined the frenzy of activity on ultra-high-pressure metamorphic terranes with a paper on the Qinling-Dabie mountain belt of China, and he published papers on this area through the 1990s. He also followed UHP rocks into Russia with several papers starting in 1995.

Throughout the decades when Gary was rambling across other continents, he and his associates still maintained a steady flow of papers dealing with California field-based geology, in the Franciscan where he started his subduction mission, into the Klamath mountains, and for 20 years in the White Mountains where he is now engaged in environmental and remote-sensing applications. He has worked with many coauthors through many years, and he honors the contributions of others in these words: "I stand in awe of my grad students and postdocs...." Those I have known reciprocate with continuing appreciation and friendship.

The last time I met Gary was one evening in the corridor of a hotel somewhere. He was limping along, almost hopping along, looking for a social event, and he told me that he was having problems with his joints. Then he said something like: "Just wait until a couple of months after surgery, and then I'll be back to full speed." He had a hip replacement in 2002, and a knee replacement in 2003. His prediction of resurrection was confirmed by the publication between 2003 and 2005 of 14 papers. He became Emeritus Professor in 2004, but the papers continue to flow

Gary is a data-generator, and a master interpreter of major geological processes, from minerals to mountain ranges. He is also a master communicator in education. Three other basic textbooks followed his first book on Amphiboles: *Earth Materials* in 1969, *Petrologic Phase Equilibria* in 1976, and *The Dynamic Planet* in 1990. In 2000, he organized and edited a huge textbook: *Earth Systems*, which was based on a program and course that he introduced at Stanford. He has also edited more than a dozen research volumes. These books must have been written in spare time between his prodigious research publications. Productivity has remained powerful even during periods when he was an administrator, serving vibrant terms at UCLA and Stanford as Department Chairman, Director, and Dean.

The progression and increased range of his experiments on amphiboles, and his field work and mineralogy on metamorphic terranes on several continents, have culminated in syntheses such as the following publications in 1999: "Overview of UHP metamorphism and tectonics in well-studied collisional orogens," and "Hornblende, the continent maker; evolution of H₂O during circum-Pacific subduction versus continental collision." The latter is a great title, which represents Gary's research quite well. His biography could be titled in parallel fashion: *Gary Ernst, the Amphibole maker*.

His research has ranged from minerals to continents, and he concludes that the "Continent Maker" is "Hornblende." This makes him the 2006 Roebling's Amphibole Emperor. Long live the Emperor, and his charming Empress, Charlotte, sitting over there.