

Presentation of the Roebling Medal of the Mineralogical Society of America for 1995 to William S. Fyfe

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Mr. President, members, and guests:

My journey all the way from the old Orléans to the New Orleans was, to be honest, for no other reason than to share this moment with my good friend, this year's recipient of the Roebling Medal, William Sefton Fyfe.

Our mutual acquaintance goes back 34 years, when Bill accepted me as a wet-behind-the-ears postdoc coming from Britain to do experimental work on metamorphic equilibria at Berkeley. I had eagerly assimilated the contents of the landmark GSA *Memoir* 73 "Metamorphic Reactions and Metamorphic Facies," of which he was lead author, and as a result I was convinced that Berkeley was the place to broaden my understanding of such things. It was the best decision I ever made in my entire career. I had wanted to work on staurolite, but he steered me into looking at the muscovite breakdown equilibria, and this worked out extremely well. This was one of the myriad pieces of good advice Bill has given his students and postdocs throughout the years. Bill emphasized the important distinction between synthesis and equilibrium experiments in metamorphic phase equilibria, in fact was a vocal critic of the former, and he devised novel methods for determining the conditions of equilibrium in systems with sluggish kinetics.

Although only one member of a distinguished faculty, Bill was unquestionably the inspiration behind much of the petrology and geochemistry research emerging from Berkeley in the 1960s. He supervised students working in field petrology, experimental phase equilibria, crystal chemistry, aqueous geochemistry, and mineral spectroscopy. In doing so, he launched the careers of many now very well-known geoscientists, and some of them are here today. I recall with pleasure Bill's regular invitation to coffee in the morning, because it was invariably a time for more new ideas. Students appreciated not only Bill's ideas, though, but also the informal give-and-take that helped them to grow as scientists, make their own discoveries, and not feel intimidated by their advisor. Bill made a lasting impact on Franciscan geology and metamorphism. Among many other things, he tackled the stability of lawsonite, aragonite, sodic pyroxene, and several other important rock-forming minerals and performed classic work on the kinetics of aragonite in the metamorphic and marine environment.

In 1966 Bill left Berkeley for Manchester, and his interests evolved to include higher temperature metamorphic processes and, logically, the formation and segregation of granitic magmas by dehydration partial melting

in the lower crust, which leaves a dry granulite facies residuum, and the crustal implications of all this. But with his chemistry background Bill's interests in the earth sciences were never merely those of the ordinary petrologist. The role played by fluids in so many of Earth's environments is so all-encompassing that it came to define the theme that has motivated him intellectually over the last decades. Whereas most of us rightly regard fluid-rock interaction as a fundamental issue in the many environments where geosphere and hydrosphere interact, our concerns tend to have boundaries that reflect our degree of comfort with the subject matter. Not so with Bill! He has been into everything. I have difficulty conceiving how one person can simultaneously write frontier papers on sea-floor metamorphism, the formation of massive sulfides, the transport of gold, reaction rates of pyrite, magnesite, anhydrite, and hydrocarbons, kinetics of hydration reactions, the significance of eclogites, migmatites, the generation of batholiths, the Archean crust, subduction and the growth of andesite volcanoes, ophiolites, low-grade metamorphism, fluids in shear zones, and chemical aspects of rock deformation. Ideas generated during this period went into his much cited book *Fluids in the Earth's Crust*. While someone with this breadth of interests might easily be accused of some dilettantism, any of you who have read just a few of his papers in recent years know how far from the truth this would be. Inspired students from his Manchester days, like the earlier ones, have themselves become leaders in science, having learned from Bill the need to break down the walls that unconsciously constrain our thought processes and to ask the right questions.

For a number of years, I ran into Bill in some odd foreign locale. He was no frivolous traveler, however. For him travel has been a formative learning experience, one that has brought to the surface the nature of the really critical problems facing the citizen-scientist, and this consciousness has clearly framed his later career. Privately and publicly, he has long expressed a deep and abiding concern for the management of this planet's finite resources in the face of population growth. He has translated this concern into action in many ways. Not only has he advised scientists in developing countries all across the globe, he has engaged them and their students in research projects that directly address some of their most pressing local problems.

In 1972 Bill crossed the Atlantic again to be professor and chairman of geology and later dean of sciences at the

University of Western Ontario, London, and in the process he has emerged as a leader in Canadian science. He was prominent among the instigators of Canada's Lithoprobe Program, unquestionably the most successful program of its kind in the world. Bill wisely insisted that funding for this megaproject include "trickle-down" money for structural geologists, geochemists, petrologists, geochronologists, and the like, to add some ground truth to the geophysicists. He participated in the pilot Lithoprobe on Vancouver Island, where one of his concerns of course was the fate of fluids from the subduction zone. Even though technically in retirement now, he works with a team of ten graduate students and evidently is as inspirational as ever. His field of environmental geochemistry encompasses virtually every imaginable interaction between surface or near-surface solids and fluids, and naturally much of this research gets published in journals that the majority of us have scarcely heard of. Most of his prodigious energy is directed into projects that address the ever more pressing environmental problems caused by the growth of megacities: water supply, atmospheric pollution, and waste disposal. What is especially impressive is that many of his research projects involve the study of microscale phenomena, with state-of-the-art instrumentation, that provide answers to what are global-scale problems. Bill has an extraordinary ability to connect, bring together, and apply the disciplines of geology and chemistry to the greater complexities of our total global environment. He has admirably shown that research into environmental problems can involve geochemistry and mineralogy that is challenging, satisfying, vital, and of the highest quality. With daring imagination, Bill has found ways to do clay mineralogy in the context of erosion rates; coal mineralogy in the context of remedying atmospheric pollution and finding new uses for coal products; geochemistry of tropical soils to improve agricultural productivity; microbiology to engage the labor of microorganisms to speed reactions and prevent dispersal

of toxic metals; sewage chemistry in the context of soil nutrients and fertilizer; petrology in the context of agricultural productivity and global climate change; phosphate mineralogy and glass stability in the context of nuclear waste; and that is probably not all!

To stave off boredom, Bill recently accepted the task of being President of the International Union of Geological Sciences, the largest organization in the world to focus on promoting international cooperation in the geological sciences, with a particular emphasis on global resources and the environment.

Bill has been honored countless times, and the list is too long to include here. Let me just mention two recent awards that I know he particularly cherishes. In 1989, he was invested as a Companion of the Order of Canada, the nation's highest civilian award, in recognition of his advocacy of science in the service of the world community. In 1992 he received the Canada Gold Medal for Science and Engineering, awarded to people who have contributed to the advancement of science on all levels—public, scientific, and educational. Recently he has been involved in efforts to interest high school students in natural processes, recognizing that students that young can be an enormous source of ideas, unconstrained by conventional dogma or the current paradigm. He rightly emphasizes that education is the key to planetary survival; that responsibility must replace greed and stupidity, before it is too late for this Earth of ours.

With this medal Bill has received two of MSA's three awards, and it must be said that he would be a damn fine candidate for the third, the Distinguished Public Service Award. I am only too aware of how much I have left unsaid in these brief comments. I echo remarks of previous speakers in calling Bill "a citizen of this world and a scientist for all seasons." Mr. President, I present to you this richly deserving candidate for the 1995 Roebling Medal, Bill Fyfe.