MSA CENTENNIAL REVIEW PAPER

How American Mineralogist and the Mineralogical Society of America influenced a career in mineralogy, petrology, and plate pushing, and thoughts on mineralogy’s future role

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Abstract

My geologic research began at Carleton College. I studied heavy minerals in some midcontinent orthoquartzites, publishing my very first paper in American Mineralogist in 1954. As a master’s candidate at the University of Minnesota, I investigated igneous differentiation in a diabase-granophyre sill of the Duluth Gabbro Complex. Later, in a Ph.D. program at Johns Hopkins University, I became Joe Boyd’s apprentice at the Geophysical Laboratory (GL), and for a time was phase-equilibrium god of the Na-amphiboles. Doctoral research earned me an offer of a UCLA assistant professorship as a mineralogist in 1960. There, I continued pursuing amphibole \(P-T\) stability relations in lab and field. My glaucophane phase equilibrium research would later be found to have instead crystallized Na-magnesiorichterite. However, amphibole research led me to map field occurrences of HP-LT (high \(P\)-low \(T\)) blueschists of the Franciscan Complex. Thus, when plate tectonics emerged in the late 1960s, I was deep in the subduction zone. My recent studies focused on the petrology and geochemistry of oceanic crustal rocks, Californian calc-alkaline arcs, and coesite ± microdiamond-bearing crustal margin rocks in various parts of Eurasia. Other works treated global mineral resources and population, mineralogy and human health, and early Earth petrotectonic evolution. I tried to work on important problems, but mainly studied topics that fired my interest.

For the future, I see the existential challenge facing humanity and the biosphere as the imperative to stop our overdrafting of mineral resources. This will require reaching a dynamic equilibrium between the use and replenishment of near-surface resources (i.e., nutrients) essential for life. Earth scientists are planetary stewards, so we must lead the way forward in life-supporting mineral usage, recycling, substitution, and dematerialization. In any event, sustainable development will soon return to the Earth’s Critical Zone of life because Mother Nature—the ruling terrestrial economist—abhors long-term overdrafting of resources\(^1\).

Keywords: Clinopyroxene stability, subduction-zone metamorphism, ultrahigh-pressure belts, Franciscan Complex, Sanbagawara metamorphic belt, western Alps metamorphism, sustainable development, early Earth plate tectonics

INTRODUCTION

Part of the 2019 centennial celebration of the Mineralogical Society of America took place at the Geological Society of America annual meeting in Phoenix, Arizona. One day’s activities featured invited talks by some of our past presidents. Most speakers described exciting new mineralogic studies in progress, whereas mine was a “walk down memory lane.” That review chronicled 66 yr of my past scientific studies and a few lessons learned from them, as well as concerns regarding the future habitability of the Earth. My research efforts involved an integration of mineralogy, petrology, and geochemistry with regional geology and plate tectonics. American Mineralogist and Mineralogical Society of America publications Reviews in Mineralogy and Elements broadened my horizons. Such cutting-edge research compendia inspired me to bridge across several Earth materials disciplines. What success I have had is partly due to them, but also reflects fortunate timing. In hindsight, I marvel at the importance of mantle overturn attending plate formation and destruction in the production and availability of the resources sustaining life.

At Phoenix, I intended to conclude my presentation by emphasizing what I regard as the existential threat facing humans and life in the Critical Zone. But, typically for me, I ran out of time. This more formal report thus attempts to describe my mineralogic journey. It charts a research life and a concern regarding the future of civilization

FORMATIVE YEARS

At Carleton, I studied a heavy-mineral suite of mechanically, chemically resistant, detrital grains characteristic of some multi-