

## *Foreword*

This is a volume on geological stewardship for the good of humankind. It is a theme particularly well suited to the twenty-first century, where no longer can any gloss be placed on existential threats related to human populations, human communities, human enterprises, nations, and refugee populations living within fragile environments and dealing with the nexus of coupled challenges related to energy resources, mineral resources, natural hazards, water quality and quantity, and climate change. Many of us can recall a time (for me, the 1960s, when I was in college) where education in geology was all about core courses for the major; where applications in the private sector were mainly oil/gas and the minerals industry; and where connecting our science to society was primarily in the hands of geological surveys. Many of us in academics can recall a time (for me, as an assistant professor in the 1970s) where individual contributions in outreach were mainly captured on a short list of assignments that someone outside of the university *asked* us to do. The minimal and passive attention to outreach was in stark contrast to our proactive designs of responsibilities, activities, and objectives in both teaching and research. In some subtle manner, things changed between the 1970s and now. Today much of the research we carry out as academics does indeed include tangible, proactively planned outreach and service to society. This relatively newly forged level of activity had not been forced upon us *per se*. Instead, the shift to be more proactive in framing our professional contributions to include substantive outreach may be a response to awareness that “clinical” investigation and application is an essential ingredient to grasping fundamental knowledge, especially when research involves the messy realities of hazards, risks, water contamination, exploiting hydrocarbons and ore deposits, failed structures in our built environments, and all of the insidious environmental changes in the Critical Zone, i.e., the dynamic interface of bedrock, soil, water, weather, climate, atmosphere, hydrosphere, lithosphere, ecology, and human populations.

But volume editors Jeff Greenberg and Greg Wessel would argue that an important part of expansion of research and teaching to engage in impactful outreach also comes from the heart and from a serious, intelligent, informed grasp of what we as human beings and human enterprises are doing to our home here on earth.

One important objective of this volume is to motivate more geoscientists to become more proactive in applying their research skills to earth environments, communities, and populations of greatest need. The papers within this volume collectively advocate the importance for everyday geoscientists to contribute in both small ways and large to improve and sustain our earth environments, while yet continuously providing to human populations the resources with which to live. Another message issuing from this volume underscores an understanding that effectiveness in outreach requires emotional intelligence, cultural awareness, and the capacity to team with experts from other fields and specialties as well as community leadership on the ground.

The contents and emphases in this volume are consonant with one of the three challenges singled out in the National Science Foundation’s GeoVision Report (2009), namely reducing vulnerability and sustaining life. The GeoVision Report emphasizes, for example, that geohazards may now have reached their greatest historical level, given population growth, settlement patterns, and the expanding infrastructure of the built human environment. Resilience is a major theme, i.e., evaluating whether systems undergoing natural variations can resist extreme or irreversible change. Similarly, the National Research Council’s listing of grand challenges in earth sciences (NRC, 2001) emphasized discovery of natural resources, characterization of

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natural hazards, rendering geoscience support to engineering, and ecosystem management with adaptation to environmental changes. I personally have noted that when grand challenges in earth sciences are identified by committee and panel experts drawn broadly from across disciplines, the challenges are always ones *explicitly linked* to outreach to society, i.e., translation of fundamental science to the good of society. Thus this volume, which urges geosciences onward for the public good, for global development, and toward a sustainable future, is indeed tightly aligned with future directions envisioned in grand challenges.

A flavor of the points of emphasis in this volume can be appreciated through phrases that, to my way of thinking, leap from the titles and abstracts. First we recognize that the volume goes beyond scientific objectives and discoveries to emphasize that sustainable successes as geoscientists in the outreach arena are brought about through thoughtful human approaches and innovative preparation: building good foundation skills for effective engagement; cultural understanding, diplomacy, community mobilization and participation; importance of looking and listening when functioning as an international community development practitioner; ethical, social, and cultural values in geosciences research, practice, and education; geophilanthropy as service rendered through volunteering time and expertise or by materially supporting geology-related projects; sustainable living through restorative impacts; equipping communities for sustainable resource management; spending time participating in local education; improved approaches to military aid; consideration of regional norms, customs, mores, and traditions; benefiting from ethnogeology; educating adaptable, interculturally competent geoscientists; expanding scientific capacity within communities; and even religious faith as motivation in developing a sustainable future.

A second insight derives from points of emphasis on breadth of the research/outreach opportunities, domestically and abroad: improving disaster risk reduction, natural resource management, access to protected water resources, and infrastructure development; finding rare metals; exploiting unconventional deep-ocean resources; securing practical industrial minerals; using byproducts from SO<sub>2</sub> mitigation; mining above ground; discovering optimum locales for exploiting wind energy; effecting water access, sanitation, and security; discovering groundwater resources; dealing with degraded water quality and environmental contamination; addressing mineral hazards and public health, including radon exposure; planning urban development and land use; addressing drought and its consequences; designing structures with resilience in the face of earthquakes; reducing risks stemming from natural disasters, including earthquakes, landslides, flooding; and managing waste, in part through recycling.

Traction will come from our geosciences graduates. Geosciences graduates today enter a world where potential applications of their training are enormously broad. Graduates can cast their eyes on a variety of potential career pathways, e.g., into the metals, minerals, and energy industries; or into teaching in K-13, community colleges, colleges, and universities; or into public service within state or federal surveys; or into consulting firms or government agencies to address mitigation of natural hazards. But are we preparing our graduates for grasping that these career pathways cannot be viewed—as they once were—as being completely separate and isolated from one another? Are we allowing our graduates to see that these paths, taken together, have a linked responsibility to pay attention to the public good, global development, and a sustainable future through overall stewardship of our earth environments and our human communities? Have we in any way revealed to our graduates the enormous opportunities and challenges that lie at the interface of science and public policy? Will our graduates be prepared to help subdue the extreme polarization that American society currently is experiencing at the interface of energy and climate, or at the nexus of natural resources and the environment? Can we emphasize to our graduates what I attempted to emphasize in my GSA Presidential Address?: Find the place where your deepest passions intersect the world's compelling needs! And do it soon.

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## REFERENCES CITED

NRC (National Research Council), 2001, *Basic Research Opportunities in Earth Science*: Washington, D.C., National Academy Press, 168 p. (available at <http://www.nap.edu/catalog/9981/basic-research-opportunities-in-earth-science>).

NSF (National Science Foundation), 2009, *GeoVision Report: Unraveling Earth's Complexities through the Geosciences*: Washington, D.C., National Science Foundation, Advisory Committee for Geosciences (George H. Davis, Chair), 39 p. (available at [http://www.nsf.gov/geo/acgeo/geovision/nsf\\_ac-geo\\_vision\\_10\\_2009.pdf](http://www.nsf.gov/geo/acgeo/geovision/nsf_ac-geo_vision_10_2009.pdf)).