The Citizen-Geologist
GSA Presidential Address, 1992

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I'd like to talk about a matter that calls for our collective attention: What role of the GSA and of geologists should be in the future well-being of our planet.

For over a century, GSA has enjoyed the respect of the geological community, earned by a superb record of promoting and spreading scholarly information on geology. If the self-image of an institution can be measured by the people it chooses to honor, then our Penrose Medalists may gauge our ideal. Searching among the names of only those medalists no longer with us, I find Charles Schuchert, Norman Bowen, Reginald Daly, William Morris Davis, Arthur Holmes, William W. Rube, Preston Cloud, and Harry Hess. Discoverers and innovators all, their thoughts have shaped the way we look at Earth and at science.

With a few notable exceptions, however, these honored men (for they are all men) spoke mainly to other geologists. We have not expected our leading scientists to reach out to the public or to the political leaders. Should GSA be an active role model in public outreach, or should it keep to the traditional focus of propagating scholarly knowledge? These questions deserve serious debate.

Science is too important to be left in the hands of scientists. Geology directly impinges on human welfare and to cannot be an ivory-tower science. Consumer and environmental government agencies, the energy and recovery of Earth's resources, avoidance of natural hazards, disposal of wastes, forecasting of climate change, decisions on land use, equity for the future—these and other issues need geologic knowledge both for technical resolution and for guiding public policy. Public policy needs public support; we ignore the public at our own peril.

That peril is something we geologists dare too well. We feel frustrated that we are underrepresented in science, in education, and in the shaping of government policies. The question is often regarded as a second-class subject in science; when the news media report on natural hazards they often omit geologic information; and that in a budget crunch, departments of the federal government eliminate geologically-based programs are among the first casualties. These situations cry out for us to improve the visibility of geology and to widen its public role. Public outreach is a responsibility from which we may not shrink.

We should also recognize the growing appreciation of geology by building a body of timely useful, and meaningful contributions to their welfare. We can also set an example for interdisciplinary cooperation in matters that affect society. We are well aware that the American people enjoy their political credentials, but there is reason to expect that the demands of the Second World War, symbolized by the Manhattan Project, will not be the last, global, national Project or, using Albert Gore's (1992) more positive language, a globally important technology plan. Such undertakings will involve many disciplines and different kinds of people. It is clearly the GSA's role to have a central role. Will we be ready with wise and specific plans to steer decision-makers toward good choices? Let's prepare ourselves for that happy prospect.

Clearly, better science education is a key to any long-term effort to inform people about our natural world, and GSA is actively promoting earth-science literacy. Scientific literacy is part of a public agenda for a sustainable ballot-box competency. We must relate scientific knowledge to society's sense of value—what is right, what is wrong, what is important—so that people can make scientific knowledge with their own lives. How do we begin?

Let's first consider the public image of a scientist. This is not a frivolous consideration; public perception of a scientist reflects and affects how the public reacts to science. A scientist is often depicted as an eccentric white male, a brilliant weirdo in a white lab coat, deficient in common sense, wearing a lab coat, driven equally by curiosity and by greed. This caricature perfec- mes science fiction, comic strips, TV, and even serious newpapers. I suspect that this image feeds partly on miscon- durings and partly on revulsion against research that people's moral sense. We have not fully faced this issue, and we aggravate the problem every time we answer people's questions about science or scientists.

As a start, we need to show people that scientists are normal people, having the same basic human concerns and impulses. Another element affecting the image of a scientist has to do with scientific ethics. Issues involving ethics are rightly newsworthy, and cases of scientific misconduct do catch public attention. People now realize that sci- entists, being human, are not only fall- but believable, and that research organizations sometimes fail to police themselves.

Ethics does indeed permeate science. Every step we take, from observ- ing to publishing, involves moral decisions. When may I throw out anomalous data? How do I interpret ambiguous information? How do I adapt an error in judgment? Who should be my coauthor? Is my re- search topic independent of natural work? These decisions shape the quality of our science. Because science is a public enterprise and because ethical standards underlie the relation between the tax- payer and the scientist, we need to develop serious dialogue with our fel- low citizens, and cultivate shared val- ues as well as shared interests, based on their common stake in the future.

Environmental ethics is an area where geology has a practical role. I am thinking specifically of our responsibility to protect the long-term ability of Earth to sustain life in its myriad wonders that sustain the human population entailed by the product of resource and environmental. To ask how much life Earth can support acknowledges that we are concerned with Earth as a habitat for all, and not just for human beings. The decision makers have to know that the needs of the other beings, the entire system, require attention. If humankind is to thrive, they need to be considered first, last, and then we wipe out future options; option itself is a nonrenewable resource (Zen, 1983). Perhaps the loss of wetlands can illustrate some of my points. In 1988 George Bush proposed an environmen- tal policy that included "no net loss" of wetlands. Today, an executive redefini- tion of wetlands reduces that protec- tion. This legal juggling might put at the integrity of significant wetland areas at risk (Alpern, 1992; Nicholas, 1992). Is the mere preservation of the total area of wetlands enough to ensure their long-term robustness? Can wetlands be created or are need fast enough to com- pensate for losses, yet steadily enough to fully perform their natural functions (National Research Council, 1992)? How does one create new wetlands, and in whose backyard? Yours or mine? As geologists, we can help broker the nature processes that sustain a wet- land, as well as clarify how human ac- tivities on wetlands are important, why they must be protected, and how their protection goes beyond satisfying legal definitions and filling administrative pigeonholes. A different subject that demands attention is the public appreciation of where earth science fits into the school curriculum for kindergarten through twelfth grade. Does earth science quality as a lab science? This question directly affects the ability of earth sci- ence to attract students. Confusion is rampant part because we geologists are schizophrenic on this matter. Earth science encompasses the lab sciences, meaning they require little more than chemistry, because first, we need these tools to calibrate and project natural relations, and second, we need the constraints of these disciplines to help us distinguish what's plausible from what's fanciful. How earth science fits into the basic curriculum and just applied chemistry and physics, because geology is at its core. Geology is also a historical science that draws inferences from unique events, a pro- cess that gives our science its imper- tant concepts of time, sequence, and correlation. Let me put it another way. Labora- tory studies are usually so designed that the initial and boundary conditions, as well the variables, are controlled, so that one could gain detailed understanding of idealized systems. Earth science is more a matter of discipline, but it also must deal with the real world. This real world is not simple and neat. It is nonlinear, it is contingent, it is time-dependent, and it usually consists of a complex and mess of events. Even when the work to apply earth precise understand- ings gained from simplified systems, we have to extrapolate to situations where we cannot run away from nature's unti- nesses. The two approaches are as woof and warp in weaving: neither can serve
alone. We need to discuss the matter, one on one, with educators at both K through 12 and university levels, so that they will incorporate these understandings into their policies and plans.

Granted that science is vital to society, must we aim at literacy for all? The question, whether we can or should, is still open. After all, only a few percent of students can be expected to need science; the rest should get along fairly well without it. Morris Shamso, a past president of the National Science Teachers Association, raised this question by asking, "Is it necessary that the mayor of New York be versed in plate tectonics to run city hall?"

Plate tectonics or not, science does enter into the running of a city hall. That was also Peter Palmer’s point in his article "What should my neighbor know?" (Palmer, 1990). Those who will be making policy choices in 15 or 20 years are today’s students, and one of them may be the next city manager, the next CEO of a major industry, the next environmental activist, the next judge, the next legislator, or the next president or prime minister. Certainly, most citizens will have to respond to technology- and science-based issues at several levels of government: for example, pumping groundwater for irrigation, disposal of nuclear waste, or allocation of public land between private use and public use. Successful resolutions of these technical issues depend on the concurrence of the affected people. My answer to Mr. Shamso’s challenge is that we are obliged to cast our nets widely and to engage as many people as possible in basic knowledge because we don’t know who will need this knowledge.

If we want the world to pay greater attention to geology, and if we want decision makers to allocate more resources for geology, then we need to demonstrate the importance of geology in public affairs, and we must accept our public obligation to be good citizens of geologists. This means that we need to include nonscientists among the immediate beneficiaries of the knowledge we garner and disseminate, and we must make sure that, dealing with them, we use language that’s free of jargon or hidden connotations. Our contribution should not end at publishing a good judgment, clearly labeled, of course, for if we withhold our professional judgment, we would still affect policy formulation, albeit in a negative way. We are geologists by choice, but we are inhabitants of this fragile planet by force. As geologists, we are supposed to know the importance of looking at Earth as a total system, and to know what is going on elsewhere. We should be prepared to speak to our conviction. I, for one, would say this to the world: if we want sustainable global development, then we must learn to be good guests and walk lightly upon Earth.

We must both contain the spread of world population and the explosion of our consumption of resources. Both epidemics destroy our Earth, both consume our future options, and both destroy hopes of sustainable development.

Consider this. In terms of consumption of key energy resources and emission of greenhouse gases, the United States contributes a good deal more than India, China, Indonesia, and Brazil combined, although the total population of those countries is about ten times that of ours (Table 1). In terms of lifetime load on the environment, every additional North American is equal to about 15 additional people in those countries. It seems to me that we cannot continue to enjoy our riches if the rest of the world were present with us. All nations must share the responsibility of ensuring the equity of our future societies because we live under the same blue sky. Indeed, unless we can contain the two epidemics of population and consumption, all other measures of conservation and natural hazard avoidance will be no better than putting Band-aids over mortal wounds, or taking aspirin for cancer.

If geology is to play a major role in the effort to use Earth wisely, then we need to act on that conviction. GSA is already in there. Our SAGE program and our Institute for Environmental Education, as well as our various outreach efforts, are working productively on many important challenges. Our joint sponsorship with the U.S. Geological Survey of the Congressional Science Fellows program has been a success, and our participation in the American Geological Institute’s Government Affairs Program is off to a good start. Nevertheless, we must do more, especially toward building equity for the future. To do so, we need to collaborate with our colleagues in other lands. Perhaps together we can help figure out how to set aside some of our remaining natural endowment for the future world, in ways that meet each nation’s own needs and perceptions. Going beyond that thought, perhaps we should consider whether we need an international geoscience- centered think tank; a group to define and recommend specific long-range actions, rather analogous to Resources for the Future. The Committee for the Wise Use of the Earth, chaired by Bill Hyde, is pondering what GSA and geologists can do to assure sustainable global development. They’d welcome your ideas.

As important in the long haul, we need to work with people as individuals. We need to reach out to students and to their parents; we need to work with teachers. We ought to get involved in public service, and we should convey our views to our elected representatives. Although a single person is unlikely to make a large mark, if we all make an effort, we just might make a difference. This will be a great challenge to us as individuals as well as collectively as members of GSA. This will be a great adventure, where we need to think big and think ahead. Our involvement will demand a high standard of work as well as a high level of sensitivity to public perception. This call cannot wait for someone else, because singly and collectively we are that someone else.

In cloning, I thank Sam Adams, Norman Newell, Pete Palmer, Craig Schneider, Catherine Skinner, Redi Wolman, and especially Alta Walker for commenting on various drafts of this talk. I appreciate having the privilege to take a turn at standing watch for GSA. It has been a challenging and stimulating year. I gratefully acknowledge the wonderful help and support from the entire headquarters staff. I’ve had fun.

REFERENCES CITED


