



Stealth Disasters and Geoethics

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Natural processes of the earth unleash energy in ways that are sometimes harmful or, at best, inconvenient, for humans: earthquakes, volcanic eruptions, hurricanes, landslides, floods. Ignoring the biological component of the geosphere, we have historically called such events “natural disasters.” They are typically characterized by a sudden onset and relatively immediate consequences. There are many historical examples and our human societies have evolved various ways of coping with them logistically, economically, and psychologically. Preparation, co-existence, recovery, and remediation are possible, at least to some extent, even in the largest of events. Geoethical questions exist in each stage, but the limited local extent of these disasters allows the possibility of discussion and resolution.

There are other disasters that involve the natural systems that support us. Rather than being driven primarily by natural non-biological processes, these are driven by human behavior. Examples are climate change, desertification, acidification of the oceans, and compaction and erosion of fertile soils. They typically have more gradual onsets than natural disasters and, because of this, I refer to these as “stealth disasters.” Although they are unfolding unnoticed or ignored by many, they are having near-term consequences. At a global scale they are new to human experience. Our efforts at preparation, co-existence, recovery, and remediation lag far behind those that we have in place for natural disasters. Furthermore, these four stages in stealth disaster situations involve many ethical questions that typically must be solved in the context of much larger cultural and social differences than encountered in natural disaster settings.

Four core ethical principles may provide guidelines—autonomy, non-maleficence, beneficence, and justice (e.g., *Jamais Cascio*). Geoscientists can contribute to the solutions in many ways. We can work to ensure that as people take responsibility for their own lives (autonomy), they have relevant information in useable form. To minimize harm to others and the environment (non-maleficence), we can design and implement sustainable ways to extract resources and dispose of waste. To advance the welfare of humankind (beneficence), we can work with engineers on innovative uses for commodities that are easily-obtained, and on replacements for rare ones. And, we can strive toward social justice by recognizing that social, ethical, legal and political issues regarding resource use may be far more difficult than the geotechnical ones, and work within the (sometimes frustrating) framework for resolution of those issues. Referring back to the four stages of co-existence with natural disasters (preparation, co-existence, recovery, and remediation), the global scope of stealth disasters raises far more geoethical issues than we have encountered with natural disasters. Just as we have learned (e.g., Hurricanes Katrina and Sandy in the U.S.) that inter-agency response is crucial to successful management of natural disasters, we can expect that global cooperation in management and governance will be essential to the management of stealth disasters. It is imperative that research and education of current and future geoscientists in universities recognize the newly developing role of the geosciences in stealth disasters and that we train our students for a future within this context.