The geoscience community’s obligation to its “Last Great Hope”: Do geology graduates understand human transformations of Earth systems?

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“The Last Great Hope.” That is what former GSA President John Geissman called the present generation of geoscience students in his 2011 Presidential Address (Geissman, 2012). He then called for the strengthening and support of the geoscience professoriate as the instructors, mentors, and advisers of tomorrow’s leaders and innovators. To those ends we argue that the geoscience community must ensure that all geology students have an understanding of the global-scale processes that are unsustainably modified or degraded by human transformations, and perhaps more importantly, help develop those students’ ability to communicate that information to the general public. Furthermore, the geoscience professoriate must enable, encourage, and prepare our undergraduate geology students to speak out against misinformation delivered by a small group of individuals in science and the media who present their personal beliefs against the wealth of peer-reviewed and reproducible data that have resulted in the overwhelming scientific majority conclusion of anthropogenically induced climate change.

Students in the senior geology capstone course at the University of Southern Indiana were generally unaware and uninformed of many global-scale human modifications of Earth’s processes (Table 1). Graduating geology students admitted misunderstanding that, without global lifestyle changes, the planet they have studied for the past four years would likely change dramatically during their careers, perhaps becoming Eaarth (McKibben, 2008), essentially a different planet. Textbooks (e.g., Mann and Kump, 2008), lectures, media, and museum and public land exhibits can provide everyone with accurate and timely information about global environmental change. Yet, if these approaches have not adequately informed the general populace on the fundamentals of global change, shouldn’t the geoscience community at least be responsible to inform the next generation of earth scientists about climate change and other anthropogenically aggrated environmental problems?

Ignorance and misunderstandings about environmental transformations amongst geology students are not restricted to senior undergraduates in southern Indiana. Rebich and Gautier (2005) found that upper-division students specifically interested in climate change harbored misconceptions at the beginning of the course that persisted following instruction, including shortwave and longwave radiative processes, changes in temperature, and the greenhouse effect. In the allied field of engineering, Azapagic et al. (2005) found a lack of awareness on a variety of environmental issues, agencies, and sustainability practices. It was also noted that these students believed sustainability to be an issue in the future, rather than of immediate importance. Instruction in geologic thinking, considering differing hypotheses, rates, scales, and variables simultaneously, could do much to enhance understanding of global change (Dodick and Orion, 2003), but simply teaching undergraduates how to think without also introducing them to the spectrum of human transformations will leave them ignorant.

Discussions of human-driven global change, in what many are beginning to refer to as the Anthropocene (Crutzen, 2002), can and should take place in historical geology, mineralogy, petrology, structural geology, sedimentology, stratigraphy, geomorphology, hydrogeology, paleontology, and field courses (Table 1). Although there is no formal accreditation of, or standard for, an undergraduate geology curriculum, there is a generally recognized set of core and elective courses for professional geologists (Williams et al., 2004). And while we have no information about current instances of integrating “humans as geologic agents” across the curriculum, and therefore no assessment of such a curriculum revision, existing core courses can become the vehicle for such integration. Traditional historical geology and paleontology courses, which presumably cover the record of mass extinction events, can include an element investigating the causes and mapping geographical and species distributions of what is now referred to as an anthropogenically induced “sixth extinction” (Barnosky et al., 2011). A traditional sedimentology and stratigraphy course, which presumably covers sedimentation rates and yields, should incorporate an element that quantifies...
humans are now widely recognized as a dominant agent of global change across Earth's geological systems. If we teach an integrated curriculum on geology, the study of Earth, we have no option but to integrate human transformations across that curriculum.

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Geissman, J., 2012, The importance of the global professoriate in the geosciences—The students we are teaching, and learn from, today may represent the last great hope: GSA Today, v. 22, no. 1, p. 12–16.


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