**Why geoscience? Why geoscience in the context of societally and culturally relevant questions?**

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**Why geoscience?**

So, what is geoscience, exactly? Although the prefix ***geo*** means *Earth*, not every word that starts with *geo* refers to the geo***sciences***. For example, *geo*s*patial analysis* refers to an approach for analyzing data that have specific locations on the Earth. *Geopolitical* refers to international relations influenced by *geographical* factors such as climate, topography, demography, and natural resources. What distinguishes the geosciences is that they encompass a study of ***Earth* *processes* *and* *products*** through which geoscientists reconstruct the Earth's past using the rock record, understand our present planet with its active (and potentially hazardous) natural processes, and predict the future. Geoscientists focus on the processes and products in the solid Earth, its hydrosphere, and its atmosphere, along with how and why these evolve over time in an enormous and highly complex natural system.

The vast majority of college-educated Americans have never had a geoscience course. Of the over 20 million students enrolled annually in higher education in the US, only about 25,000 are enrolled in a geoscience course. If you do the math, 25,000 is a **very** small percentage (~0.1%) of the total. So “vast majority” is pretty vast – over 99% of college-educated Americans have never taken a college-level geoscience course. And most did not take Earth Science in high school and haven’t had a course that involves any geoscience since middle school.[[1]](#footnote-1)

What’s so important about geoscience?? Geoscience is, in fact, hugely relevant to every person on this planet. The grand challenges that face the human race in this century all have significant geoscience components. The future quality of human life depends on decisions made at personal, community, national, and international levels that require a deep understanding of how the Earth works. Here are some examples:

* **Providing clean, adequate water supplies that are sustainable into the future**: Geoscientists locate groundwater resources, assess both short- and long-term factors affecting groundwater and surface water supply and quality, provide critical expertise to prevent contamination of groundwater and surface water, and develop and carry out strategies for cleaning up water supplies if they become contaminated.
* **Feeding a growing world population**: Geoscience provides critical insights into surface and near-surface processes that affect the quality of soil and that inform sustainable soil management practices that are crucial to our ability to grow enough food in the future.
* **Safely disposing of waste ranging from human to industrial to nuclear**: Geoscientists carry out critical analyses that characterize the bedrock geology, surficial geology, hydrogeology, and active geologic processes at a disposal site and that are critical to the safe and long-term disposal of waste.
* **Developing mineral and energy resources**: Until the human race can transition to entirely renewable/recyclable resources, the world will rely on geoscientists to locate, evaluate, and develop metallic (e.g., iron, copper, zinc, coltan) and non-metallic resources (e.g., sand and gravel, building stone, silica, clay) and fuel sources from the rock record (e.g., coal, oil, natural gas, uranium).
* **Minimizing risk of costly damage from natural hazards:** Active geologic processes come with a long list of accompanying natural hazards – earthquakes, coastal erosion, tsunamis, flooding, volcanic eruptions, landslides, sinkhole collapse, dune migration, glacial surges and glacier bursts, meteorite impact, and so on. Geoscientists investigate the processes leading to these hazards, provide the critical expertise for evaluating the nature of existing hazards and frequency of events in an area, develop hazard and risk maps, and contribute to engineering structures that can withstand events.
* **Predicting the impact of global warming**: The geologic record is the ***only*** record we have about past climate longer ago than a few thousand years, and learning from that record about how the Earth responded in the past is essential to predicting the future impact of climate change.

Using both analysis of the rock record and a deep understanding of modern active geologic processes, geoscientists provide the scientific underpinning for policy decisions that will affect everyone on this planet. Personal, community, national, and international decisions related to these issues should be made by people who are better informed about the geosciences and how the Earth works than is currently the case for the vast majority of citizens and government officials.

**Why teach geoscience in the context of societally and culturally relevant questions?**

Students commonly compartmentalize science and view it as something that scientists do but that has limited relevance either to their lives or to non-science studies. Integrating cultural/societal relevance into geoscience courses, and integrating geoscience into non-geoscience courses can help take science from the realm of factoids to something that really matters to students.

**In geoscience courses.** Few students go to college to major in geoscience, and most students in introductory geo courses are there to satisfy distribution requirements. Integrating societally or culturally relevant questions that have geoscience components is an outstanding way to teach geoscience concepts and thinking *and* give students a personal experience in using geoscience to address real-world problems that have importance for decisions in their own futures. Careful choice of relevant real-world problems (especially place-based ones) can also help attract a diverse group of students to the geosciences.

**In courses outside the geosciences.** In non-science courses, use of case examples that incorporate geoscience can reach students who would not otherwise take a geoscience course. This is not only about teaching students something about geoscience and how the Earth works, but also about the fundamental, but commonly overlooked, underlying influence of geology and geologic processes on humans and human events. Human factors are not the only causative factors for human events, and not taking into account factors in the natural world can result in an incomplete explanation. Here are some examples of underlying geologic influences:

* Influence of the character of paleoplacer gold deposits of the Witwatersrand and evolution of laws and policies leading to apartheid in South Africa.
* Nature of diamonds and diamond deposits and funding for international conflict
* Influence of post-Ice Age sea level rise on the development of agriculture in the major deltas of the world
* Influence of climate change on political legitimacy and the rise and fall of civilizations.

Integrating case examples that illustrate the relevance of geoscience into non-geoscience courses (both science and non-science courses) can also help address the fact that colleges and universities will undoubtedly never have the infrastructure for teaching geoscience courses to a significantly larger percentage of college students than they do at present. And last, future scientists **and** non-scientists need to have personal experience with tackling complex questions where solutions cannot be base solely on one factor such economics, politics, or science.

1. Tewksbury, Barbara J., Manduca, Cathryn A., Mogk, David W., and Macdonald, R. Heather, 2012, Geoscience education for the Anthropocene, *in*, Bickford, M.E., ed., The Impact of the Geological Sciences on Society: Geological Society of America Special Paper 201, p. 189-201. [↑](#footnote-ref-1)