Geological Society of America Response
Request for Information (RFI) on Developing a Roadmap for the Directorate for Technology, Innovation, and Partnerships at the National Science Foundation

June 30, 2023

The Geological Society of America (GSA) appreciates the opportunity to provide input on priority areas for the National Science Foundation (NSF) Directorate for Technology, Innovation, and Partnerships (TIP). GSA (https://www.geosociety.org) is a scientific society that unites a diverse community of geoscientists in a common purpose to study the mysteries of our planet (and beyond) and share scientific findings. Members and friends around the world, from academia, government, and industry, participate in GSA meetings, publications, and programs at all career levels to foster professional excellence. GSA values and supports inclusion through cooperative research, public dialogue on earth issues, science education, and the application of geoscience in the service of humankind.

These comments focus on Question 4. *Addressing societal challenges. Considering the ways each of the key technology focus areas will impact each of the societal, national, and geostrategic challenges, which of the technology areas should receive investment priority and why? This includes investments in use-inspired and translational research, education, training, as well as general literacy on a given topic. On what specific challenge problems related to the societal, national, and geostrategic challenges could TIP focus that would, in turn, drive technological development in the key technology areas?*

Natural and anthropogenic disaster prevention or mitigation.
Growing populations in hazard-prone locations, the interconnection of modern economies, and climate change are increasing the risks associated with natural hazards, including earthquakes, floods, hurricanes, landslides, tsunamis, volcanic eruptions, and wildfires. The impacts of these hazards include the direct costs of repairing damaged infrastructure and housing, economic disruptions, displacement and migration, and negative health effects. Vulnerabilities to hazards and disaster impacts are disproportionately felt by those most marginalized in communities. With population growth and continued development in risky areas, these trends in impact will accelerate as disasters escalate.

GSA strongly endorses the greater integration of geoscience into prevention and mitigation programs, policies, and practices through research to improve understanding and monitoring of natural hazards. To this end, GSA supports efforts to modernize and enhance monitoring networks by improved characterization of the location, magnitude, and frequency of natural hazards.

The current and future contributions of geosciences to society are limited by having one of the lowest diversities among STEM fields. Geoscientists face barriers based on race, gender, gender identity, sexuality, physical ability, neurological difference, citizenship, socioeconomic and other factors, which are exacerbated in field settings. Among the many benefits of increasing diversity

in the geosciences is increasing the relevance of science to marginalized populations and expanding the workforce. With escalating climate and disaster hazards that continue to disproportionately impact the most marginalized populations, these benefits are vital to the ability of the geosciences to address the challenges of the future. Key examples are the emergent role that geoscientists can play in assessing disproportionate community impacts around Earth science issues and environmental injustice, engaging local communities in the research process, and centering Indigenous knowledge in research and decision making.

Advanced energy and industrial efficiency technologies, such as batteries and advanced nuclear technologies, including but not limited to for the purposes of electric generation.

Critical minerals are required for the transition to a low-carbon economy. A thorough understanding of their distribution and abundance, impacts of extraction and processing, and the potential effects of mineral supply disruption is needed.

There is a vital need to understand the abundance and global distribution of continental and oceanic critical mineral resources. To accomplish this goal requires improved fundamental understanding of the geologic processes that form mineral deposits and improved methodologies of exploration for more deeply seated and remote resources. Support for research and development into methodologies for secondary extraction of minerals from mine waste and tailings is also needed.

Beyond critical minerals, research on energy sources and the mineral resources required for low-carbon energy technologies, and the environmental, economic, health, and social impacts and benefits of their development, is vital.

Research is needed for advancing knowledge of the occurrence and formation of energy resources (renewable and non-renewable); evaluating impacts of resource material extraction, use, recycling, disposal, and dispersal; designing advanced technologies to increase the efficiency and reduce the risks of locating and extracting resources, and mitigating environmental impacts of resource extraction and use.