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Testimony of the  
**Geological Society of America**  
Dr. Craig M. Schiffries, Director for Geoscience Policy

To the  
**President's Council of Advisors on Science and Technology**

Regarding  
**Geoscience in the National Interest**

6 August 2009  
Washington, DC

### Summary

The geosciences are essential for addressing many of the most important challenges facing society, including climate change, energy resources, water resources, natural hazards, and environmental quality. Despite the critical role of the geosciences in addressing major national challenges, some geoscience programs have had stagnant or declining real budgets for many years. Geosciences agencies have also been omitted from recent initiatives to double the budgets of key federal science programs. For example, the America COMPETES Act and President Bush's American Competitiveness Initiative contain provisions to double the budgets of several science agencies, but neither initiative would double the budgets of the U.S. Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), or NASA's earth science programs. In contrast to the past, it is also important that the National Science Foundation's (NSF) geoscience programs are not left behind as NSF's overall budget is doubled.

When the President's Council of Advisors on Science and Technology (PCAST) evaluates the science and technology priorities of the nation, the Geological Society of America (GSA) urges PCAST to include geoscience research and education programs as components of broader initiatives to increase overall federal investments in science and technology. Substantial increases in federal funding for geoscience research and education are needed to ensure the health, vitality, and security of society and for stewardship of Earth. The need for geoscience research and education has never been greater.

*The Geological Society of America, founded in 1888, is a scientific society with over 22,000 members from academia, government, and industry in all 50 states and more than 90 countries. Through its meetings, publications, and programs, GSA enhances the professional growth of its members and promotes the geosciences in the service of humankind. GSA encourages cooperative research among earth, life, planetary, and social scientists, fosters public dialogue on geoscience issues, and supports all levels of earth science education.*

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SCIENCE n STEWARDSHIP n SERVICE

## **Rationale**

Science and technology are engines of economic prosperity, environmental quality, and national security. Federal investment in research pays substantial dividends. According to a recent report by the National Academies, "...the economic value of investing in science and technology has been thoroughly investigated. Published estimates of return on investment (ROI) for publicly funded R&D range from 20 to 67%" (*Rising Above the Gathering Storm*, 2007).

The geosciences are critical components of the overall science and technology enterprise. Substantial increases in federal funding for geoscience research are needed to ensure the health, vitality, and security of society and for Earth stewardship. Geoscience research provides knowledge and data essential for developing policies, legislation, and regulations regarding land, mineral, and water resources at all levels of government. Growing investments in geoscience research are required to stimulate innovations that fuel the economy, provide security, and enhance the quality of life.

## **Broader Impacts of Geoscience Research**

Federal investments in the geosciences have broad societal impacts in such areas as natural hazards mitigation, energy resources, water resources, and climate change.

- Natural hazards, such as earthquakes, tsunamis, volcanic eruptions, floods, droughts, and hurricanes, remain a major cause of fatalities and economic losses worldwide. An improved scientific understanding of geologic hazards will reduce future losses through better forecasts of their occurrence and magnitude. Recent volcanic activity in Alaska and recent flooding in North Dakota illustrates the value of robust natural hazards monitoring systems and the need for increased federal investments in the geosciences.
- Energy and mineral resources are critical to the functioning of society and to national security and have positive impacts on local, national, and international economies and quality of life. Improved scientific understanding of these resources will allow for their better management and utilization, while at the same time considering economic and environmental issues. This is particularly significant because shifting resource demands often reframe our knowledge as new research-enabling technologies become available.
- The availability and quality of surface water and groundwater are vital to the well being of both society and ecosystems. Greater scientific understanding of these critical resources is necessary to ensure adequate and safe water resources for the future, especially if there are changes in water availability as a result of climate change.
- Forecasting the outcomes of human interactions with Earth's natural systems, including climate change, is limited by an incomplete understanding of geologic and environmental processes. Improved understanding of these processes in Earth's history can increase confidence in the ability to predict future states and enhance the prospects for mitigating or reversing adverse impacts to the planet and its inhabitants.
- Research in earth science is also fundamental to training and educating the next generation of earth science professionals and for improving earth science literacy.

## Extraordinary Scientific Opportunities in the Earth Sciences

Extraordinary scientific opportunities in the solid earth sciences have been summarized by the National Academies and other organizations, including the following reports:

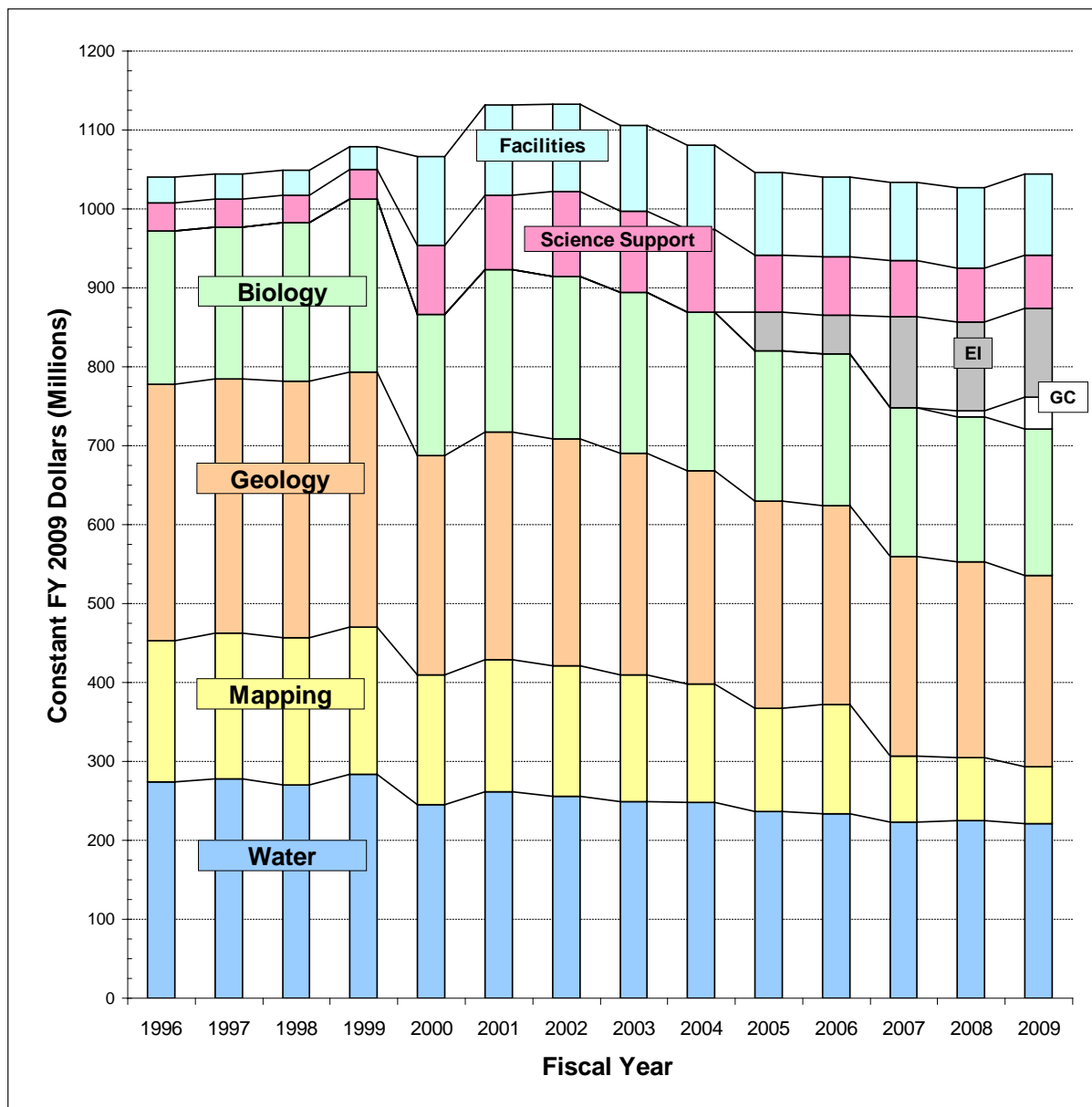
- *Basic Research Opportunities in the Earth Sciences* (National Research Council, 2001)
- *The Geological Record of Biosphere Dynamics* (National Research Council, 2005)
- *Hydrology of a Dynamic Earth* (Consortium of Universities for the Advancement of Hydrologic Science, 2007)
- *Future Research Directions in Paleontology* (Paleontological Society and Society for Vertebrate Paleontology, 2007)
- *Seismological Grand Challenges in Understanding Earth's Dynamic Systems* (Incorporated Research Institutions for Seismology, 2009)

Many of the research opportunities described in these reports require funding from the National Science Foundation (NSF), which supports the majority of earth science research at academic institutions. While the NSF's Earth Sciences Division regularly receives a large number of exciting research proposals that are highly rated for both their scientific merit and their broader impacts, only a small percentage of these have been funded in recent years due to budget constraints. Modest additional investments in this research can have significant positive impacts. For example, Interferometric Synthetic Aperture Radar (InSAR) studies may improve our ability to forecast earthquakes and volcanic eruptions.

## Budget Shortfalls

Some geoscience programs have had stagnant or declining real budgets for many years. For example, the USGS budget declined in real dollars for six consecutive years from FY 2003 to FY 2008 (Figure 1). In real terms, funding for the USGS is at its lowest level since FY 1997. From FY 1996 to 2008, funding for the USGS declined by 1 percent, while total federal funding for research and development increased by 54 percent in real dollars. The decline in funding for the USGS during this time period would have been greater if Congress had not repeatedly restored proposed budget cuts. Several consequences of budget shortfalls are described below.

The nation's streamgage network has been in decline because of budgetary pressures. Streamgages provide data that are vital for forecasting floods and droughts, among other purposes. A robust streamgage network is needed to monitor the effects of climate change on water resources. From the combined network of about 7,550 active streamgages nationwide, more than 780 have been discontinued in the last 10 years due to inadequate funding; many of them had over 50 years of continuous record, which gives their loss even greater significance. More than 175 streamgages were discontinued between 2004 and 2005 and another 258 streamgages in 33 states were identified as being at risk or recently discontinued. Many streamgages still need to be "flood hardened" and updated with real-time communications equipment in order to provide reliable flood forecast data.



**Figure 1. USGS funding in constant 2009 dollars, FY 1996 – FY 2009.** EI is Enterprise Information and GC is Global Change. Source: USGS Budget Office.

The United States lacks a robust volcano monitoring system. Recent volcanic activity at Alaska’s Mount Redoubt, 106 miles southwest of Anchorage, illustrates the value of volcano monitoring systems and the need for increased federal investments. Mount Redoubt volcano erupted explosively on March 22, 2009 and multiple explosive events sent volcanic ash more than 50,000 feet into the air. Approximately 20,000 passengers per day travel through the airspace affected by the volcano. The USGS provided advance warning of this explosive volcanism. Interior Secretary Ken Salazar said the USGS was “able to actually forecast this event...to prevent the endangerment of people and places that would otherwise have occurred.” When Redoubt

volcano erupted in 1989, a Boeing 747 passenger plane flew through a cloud of volcanic ash and lost power to all four engines. After plummeting more than 14,000 feet, the crew restarted the engines and safely landed the plane. The volcanic ash caused more than \$80 million in damage to the plane but no lives were lost.

Earthquakes are one of the most costly natural hazards faced by the United States, posing a significant risk to 75 million Americans in 39 states. The nation would benefit from accelerated implementation of the Advanced National Seismic System. This system will eventually be a nationwide network of at least 7000 shaking measurement systems, both on the ground and in buildings that will make it possible to provide emergency response personnel with real-time earthquake information, provide engineers with information about building and site response, and provide scientists with high-quality data to understand earthquake processes and solid earth structure and dynamics.

An earthquake that generated a tsunami in the Indian Ocean on 26 December 2004 caused approximately 230,000 fatalities. This and other tragic events have inspired a greater awareness and appreciation of the need to improve environmental monitoring, forecasting, and warning systems that can prevent natural hazards from becoming natural disasters.

## **Conclusion**

Despite the critical role of the geosciences in addressing major national challenges, some geoscience programs have had stagnant or declining real budgets for many years. Geosciences agencies have also been omitted from recent initiatives to double the budgets of key federal science agencies and programs. For example, the America COMPETES Act and President Bush's American Competitiveness Initiative contain provisions to double the budgets of several science agencies, but neither initiative would double the budgets of the U.S. Geological Survey, NOAA, or NASA's earth science programs. In contrast to the past, it is also important that the National Science Foundation's (NSF) geoscience programs are not left behind as NSF's overall budget is doubled.

When the President's Council of Advisors on Science and Technology (PCAST) evaluates the science and technology priorities of the nation, the Geological Society of America urges PCAST to include geoscience research and education programs as components of broader initiatives to increase overall federal investments in science and technology. Substantial increases in federal funding for geoscience research and education are needed to ensure the health, vitality, and security of society and for stewardship of Earth. The need for geoscience research and education has never been greater.

The Geological Society of America is grateful to the President's Council of Advisors on Science and Technology for providing an opportunity to discuss geosciences in the national interest. Thank you for your thoughtful consideration of our request. For additional information or to learn more about the Geological Society of America, please visit [www.geosociety.org](http://www.geosociety.org) or contact Dr. Craig Schiffries at [cschiffries@geosociety.org](mailto:cschiffries@geosociety.org).

## Biographical Sketch

**Dr. Craig M. Schiffries** is Director for Geoscience Policy at the Geological Society of America, a scientific society with over 22,000 members from academia, government, and industry in more than 90 countries. He also serves as Co-Chair of the U.S. Geological Survey Coalition, an alliance of more than 70 scientific organizations united by a commitment to the continued vitality of the U.S. Geological Survey.

Dr. Schiffries formerly served as Director of Science Policy at the National Council for Science and the Environment. He was Chairman of the 5<sup>th</sup> National Conference on Science, Policy and the Environment: *Forecasting Environmental Changes*. He was also Chairman of the 4<sup>th</sup> National Conference on Science, Policy and the Environment: *Water for a Sustainable and Secure Future*.

Dr. Schiffries previously served as Director of the Board on Earth Sciences and Resources of the U.S. National Academy of Sciences/National Research Council. His group published 17 books, including *Hardrock Mining on Federal Lands*, *Satellite Gravity and the Geosphere*, *Research Required to Support Comprehensive Nuclear Test Ban Treaty Monitoring*, and *Rediscovering Geography*. He also served as a visiting faculty member at Yale University; Director of Government Affairs at the American Geological Institute; a consultant with Monitor Company; and a Congressional Science Fellow on the staff of the United States Senate Judiciary Committee.

In addition to his technical publications in petrology, geochemistry, and economic geology, Dr. Schiffries has written on science policy and testified before Congress, the President's Council of Advisors on Science and Technology, the EPA Science Advisory Board, and other advisory bodies.

Dr. Schiffries simultaneously earned his B.S. and M.S. degrees from Yale University, where he was elected to *Phi Beta Kappa*, graduated *summa cum laude*, and double-majored in Geology and Geophysics and in Economics and Political Science. He was a Marshall Scholar at Oxford University, where he earned an honors B.A. in Philosophy, Politics, and Economics. He received a Ph.D. in Geology from Harvard University, where he held a fellowship from the Hertz Foundation. Dr. Schiffries is Chairman of the Marshall Scholarship selection committee in Washington, D.C.