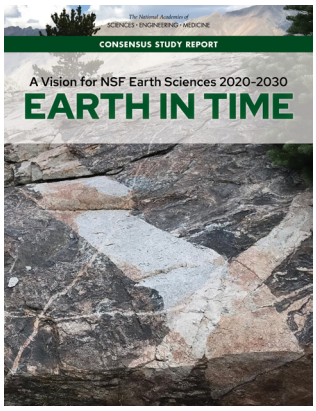

A VISION FOR NSF EARTH SCIENCES 2020-2030: EARTH IN TIME

The NSF's Division of Earth Science (EAR) is the primary federal research program funding Earth science. A Vision for NSF Earth Sciences 2020-2030: Earth in Time identifies 12 priority science questions to help guide EAR research through 2030.

1. How is Earth's internal magnetic field generated?

Understanding what has powered the geodynamo through time and what controls its rate of change is crucial for understanding interactions from Earth's interior to the atmosphere.

2. When, why, and how did plate tectonics start?

There remains a lack of fundamental understanding of when plate tectonics developed on Earth, why on Earth and not elsewhere, and how plate tectonics has developed through time.

3. How are critical elements distributed and cycled in the Earth?

Fundamental questions remain about how critical elements essential for geologic processes are transported within the Earth, across a range of spatial and temporal scales.

4. What is an earthquake?

Deformation of the Earth occurs over a spectrum of rates and in a variety of styles, leading Earth scientists to reconsider the nature of earthquakes.

5. What drives volcanism?

The effects of volcanic eruptions create an urgent need for research on how magma forms, rises, and erupts around the world and how these systems have operated throughout geologic time.

6. What are the causes and consequences of topographic change?

New technology for measuring topography over geologic to human timescales makes it possible to address questions linking the deep and surface Earth as well as societal challenges.

7. How does the critical zone influence climate?

The reactive skin of the terrestrial Earth influences many exchanges between the land and atmosphere, and its influence on climate is a vital component of understanding the Earth system.

8. What does Earth's past reveal about the dynamics of the climate system?

Both long-term and rapid environmental change in Earth's history helps to elucidate Earth system dynamics and plays a critical role in predicting future change.

9. How is Earth's water cycle changing?

Understanding current and future changes to the water cycle requires knowledge of the hydro-terrestrial system and how the water cycle interacts with other processes.

10. How do biogeochemical cycles evolve?

A deeper understanding of biogeochemical cycles is needed to quantify the role of biology through time in rock and mineral formation and weathering and carbon cycling.

11. How do geological processes influence biodiversity?

Understanding how and why the diversity of life on Earth has varied over time, environment, and geography, including major events like extinctions is needed.

12. How can Earth science research reduce the risk and toll of geohazards?

A predictive and quantitative understanding of geohazards is essential to reduce risk and impacts and to save lives and infrastructure.

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