

PRELUDE

And Just What Is Geology?

Learning Objectives

By the end of this prelude, you should be able to . . .

- A. describe the scope and applications of geology.
- B. explain the foundational themes of modern geologic study.
- C. demonstrate how geologists employ the scientific method.
- D. provide a basic definition of the theory of plate tectonics.
- E. explain what geologists mean by the Earth System concept.
- F. name the main layers of the Earth's interior.

Summary from the Text

- Geologists are scientists who study the Earth. They search for the answers to the mysteries of our home planet, from why volcanoes explode to where we can find minerals.
- Geologic study can involve field exploration, laboratory experiments, high-tech measurements, and calculations with computers.
- Geologic research not only provides answers to academic questions such as how the Earth formed, but also addresses practical problems such as how to find groundwater or how to avoid landslides. Many people pursue careers as geologists.
- A set of themes underlies geologic thinking. Key concepts are that the Earth's outer shell consists of moving plates whose interactions produce earthquakes, volcanoes, and mountains; that the Earth is very old; and that interacting realms of material on the planet constitute the Earth System.

Real-World Videos

SCIENCE FOR A CHANGING WORLD

Learning Objectives Covered:

- A. describe the scope and applications of geology.
- C. demonstrate how geologists employ the scientific method.

Length: 8:11

Summary: The U.S. Geological Survey (USGS) is the leading agency providing reliable scientific information for informed decision and policy making. This video outlines a brief history of the USGS, and the significance of USGS's work and mission in today's world. When it was founded in 1879, the primary focus of the survey was mineral resources and mining geology, as well as mapping, paleontology, and stratigraphy. Since its foundation, the USGS has evolved to provide fundamental scientific data relevant to water resources, changing Earth processes, and even the moon landings. Today, USGS scientists throughout the 50 states gather data in six science mission areas critical to the well-being of the nation and world:

- **Ecosystems**—monitors many functions vital to human populations, including soil formation, crop pollination, nutrient cycling, water purification, waste treatment, and atmosphere regulation.
- **Energy, minerals, and environmental health**—assesses the quantity and quality of resources (including environmental impacts of extraction and use).
- **Climate and land use**—uses research, monitoring, remote sensing, modeling, and forecasting to address human impact.
- **Natural hazards**—assesses the threat of natural hazards for public knowledge and policy making.
- **Water**—monitors resources.
- **Core science systems**—translates scientific data into formats that are accessible and understandable.

Classroom Use: This video helps students to understand some of the many ways in which geology solves significant and critical problems faced by human populations today. Before showing the video, ask students to reflect on what geologists do and what types of problems they solve. Additionally, ask them to create a list of what they believe to be some of the greatest risks

facing human populations (regionally or globally). After viewing the video, facilitate a discussion about the relevance of geology to society. What types of problems (e.g., climate change, clean water, land use, agriculture, natural resources) does geology seek to solve?

Adaptations:

- This video could be used together with the “Geology in the News” activity (which would provide specific examples of USGS projects) to form a lesson on the relevance of geologic research to society.

Review and Discussion Questions:

1. What are some of the major areas of geology that the USGS supports?
2. What are some of the greatest challenges that the Earth System faces today?
3. How does the work of the USGS help to address some of the challenges that the Earth System faces today?

Credit: USGS

HYDRAULIC FRACTURING: USING SCIENTIFIC METHODS TO EVALUATE TRADE-OFFS

Learning Objectives Covered:

- A. describe the scope and applications of geology.
- C. demonstrate how geologists employ the scientific method.

Length: 3:07

Summary: This video uses the example of hydraulic fracturing (“fracking”) in Colorado to discuss how scientists gather objective data that can be used to guide environmental regulations. Environmental engineers are investigating the potential impacts of fracking on water and air quality, human health, and energy sustainability, with an emphasis on neutrality. Stakeholders will be able to use the information—such as methane concentration in the atmosphere, and the persistence of fracking fluids in ecosystems—to create a decision framework to improve environmental policy. In the case of fracking, where two opposing points of view are often at odds, science can provide the best source of trusted information.

Classroom Use: