Careers in the Geosciences

Geoscientists follow paths of exploration and discovery in quest of solutions to some of society's most challenging problems.

- Predicting the behavior of Earth systems and the universe.
- Finding adequate supplies of natural resources, such as ground water, petroleum, and metals.
- Conserving soils and maintaining agricultural productivity.
- Developing natural resources in ways that safeguard the environment.
- Maintaining quality of water supplies.
- Reducing human suffering and property loss from natural hazards, such as volcanic eruptions, earthquakes, floods, landslides, hurricanes, and tsunamis.
- Determining geological controls on natural environments and habitats and predicting the impact of human activities on them.
- Defining the balance between society's demand for natural resources and the need to sustain healthy ecosystems.
- Understanding global climate patterns.

What is a GEOSCIENTIST?

Geoscientists are stewards or caretakers of Earth's resources and environment. They work to understand natural processes on Earth and other planets. Investigating the Earth, its soils, oceans, and atmosphere; forecasting the weather; developing land-use plans; exploring other planets and the solar system; determining environmental impacts; and finding new sources of useful Earth materials are just a few of the ways geoscientists contribute to our understanding of Earth processes and history. Geoscientists provide essential information for solving problems and establishing governmental policies for resource management; environmental protection; and public health, safety, and welfare.

Geoscientists are curious about the Earth and the solar system. Is there life on other planets? How are they changing? What effects will shrinking glaciers have on the oceans and climate? What makes a continent move, a mountain form, a volcano erupt? Why did the dinosaurs become extinct?

Geoscientists are concerned about the Earth. How is the global climate changing? How do Earth systems work? How and where should we dispose of industrial wastes? How can society's growing demands for energy and water be satisfied while conserving natural resources for future generations? As global populations increase, can we grow enough food and fiber to sustain them?

The Earth is an outdoor laboratory filled with opportunities to observe Earth processes in action. By applying their knowledge of forces and factors that shape the Earth, geoscientists seek to reconstruct the past and anticipate the future.

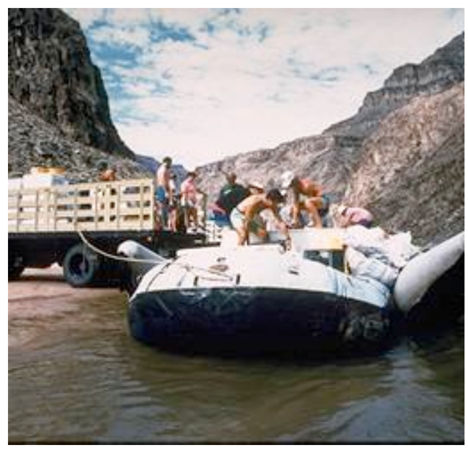
What Do GEOSCIENTISTS Do?

Geoscientists gather and interpret data about the Earth and other planets. They use their knowledge to increase our understanding of Earth processes and to improve the quality of human life. Their work and career paths vary widely because the geosciences are so broad and diverse. The National Science Foundation considers geology, geophysics, hydrology, oceanography, marine science, atmospheric science, planetary science, meteorology, environmental science, and soil science as the major geoscience disciplines. The following list gives a glimpse of what geoscientists do in these disciplines and a variety of subdisciplines.

Atmospheric scientists study weather processes; the global dynamics of climate; solar radiation and its effects; and the role of atmospheric chemistry in ozone depletion, climate change, and pollution.

Economic geologists explore for and develop metallic and nonmetallic resources; they study mineral deposits and find environmentally safe ways to dispose of waste materials from mining activities.

Engineering geologists apply geological data, techniques, and principles to the study of rock and soil surficial materials and ground water; they investigate geologic factors that affect structures such as bridges, buildings, airports, and dams.



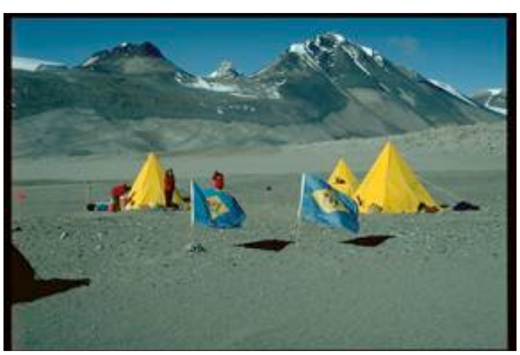
Environmental geologists study the interaction between the geosphere, hydrosphere, atmosphere, biosphere, and human activities. They work to solve problems associated with pollution, waste management, urbanization, and natural hazards, such as flooding and erosion.

Geochemists use physical and inorganic chemistry to investigate the nature and distribution of major and trace elements in ground water and Earth materials; they use organic chemistry to study the composition of fossil fuel (coal, oil, and gas) deposits.

Geochronologists use the rates of decay of certain radioactive elements in rocks to determine their age and the time sequence of events in the history of the Earth.

Geologists study the materials, processes, products, physical nature, and history of the Earth.

Geomorphologists study Earth's landforms and landscapes in relation to the geologic and climatic processes and human activities, which form them.



Geophysicists apply the principles of physics to studies of the Earth's interior and investigate Earth's magnetic, electric, and gravitational fields.

Glacial geologists study the physical properties and movement of glaciers and ice sheets.

Hydrogeologists study the occurrence, movement, abundance, distribution, and quality of subsurface waters and related geologic aspects of surface waters.

Hydrologists are concerned with water from the moment of precipitation until it evaporates into the atmosphere or is discharged into the ocean; for example, they study river systems to predict the impacts of flooding.

Marine geologists investigate the ocean-floor and ocean-continent boundaries; they study ocean basins, continental shelves, and the coastal environments on continental borders.

Meteorologists study the atmosphere and atmospheric phenomena, including the weather.

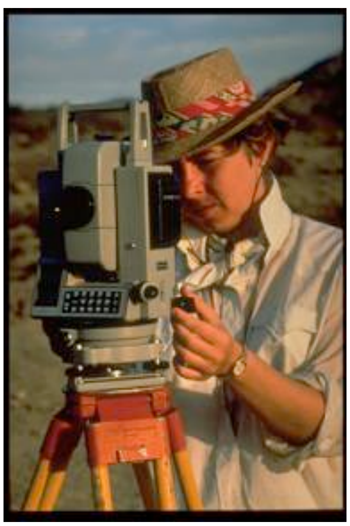
Mineralogists study mineral formation, composition, and properties.

Oceanographers investigate the physical, chemical, biological, and geologic dynamics of oceans.

Paleoecologists study the function and distribution of ancient organisms and their relationships to their environment.

Paleontologists study fossils to understand past life forms and their changes through time and to reconstruct past environments.

Petroleum geologists are involved in exploration for and production of oil and natural gas resources.



Petrologists determine the origin and natural history of rocks by analyzing mineral composition and grain relationships.

Planetary geologists study planets and their moons in order to understand the evolution of the solar system.

Sedimentologists study the nature, origin, distribution, and alteration of sediments, such as sand, silt, and mud. Oil, gas, coal and many mineral deposits occur in such sediments.

Seismologists study earthquakes and analyze the behavior of earthquake waves to interpret the structure of the Earth.

Soil scientists study soils and their properties to determine how to sustain agricultural productivity and to detect and remediate containinated soils.

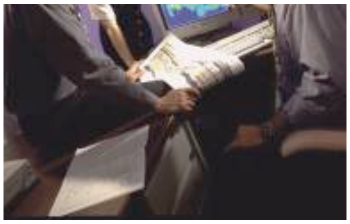
Stratigraphers investigate the time and space relationships of rocks, on a local, regional, and global scale throughout geologic time -- especially the fossil and mineral content of layered rocks.

Structural geologists analyze Earth's forces by studying deformation, fracturing, and folding of the Earth's crust.

Volcanologists investigate volcanoes and volcanic phenomena to understand these natural hazards and predict eruptions.

Where Do GEOSCIENTISTS Work?

Geoscientists may be found sampling the deep ocean floor or examining rock specimens from the Moon or Mars. But the work of most geoscientists is more "down to Earth." They work as explorers for new mineral and hydrocarbon resources, consultants on



engineering and environmental problems, researchers, teachers, writers, editors, and museum curators as well as in many other challenging positions. They often divide their time among work in the field, the laboratory, and the office.

Field work usually consists of making observations, exploring the subsurface by drilling or using geophysical tools, collecting samples, and making measurements that will be analyzed in the laboratory. For example, rock samples may be X-rayed, studied under an electron microscope, and analyzed to determine physical and chemical properties. Geoscientists may also conduct experiments or design computer models to test theories about geologic phenomena and processes.

In the office, they integrate field and laboratory data and prepare reports and presentations that include maps and diagrams that illustrate the results of their studies. Such maps may pinpoint the possible occurrence of ores, coal, oil, natural gas, water resources, or indicate subsurface conditions or hazards that might affect construction sites or land use.

Job and Salary OUTLOOK

The employment outlook in the geosciences -- as in any profession -- varies with the economic climate of the country. The long-range outlook is good at this time. Dwindling energy, mineral, and water resources along with increasing concerns about the environment and natural hazards present new challenges to geoscientists.

According to the National Science Foundation, about 125,000 geoscientists work in the United States. Most geoscientists are employed by industries related to oil and gas, mining and minerals and water resources.

Many geoscientists are self-employed as geological consultants or work with consulting firms. Most consulting geologists have had extensive professional experience in industry, teaching, or research.

Also, many geoscientists work for the federal government or a state government agency. The U.S. Geological Survey (Department of the Interior), Department of Energy, Department of Agriculture, Forest Service, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, U.S. Army Corps of Engineers, state geological surveys, and state departments of environment and resources all employ geoscientists.

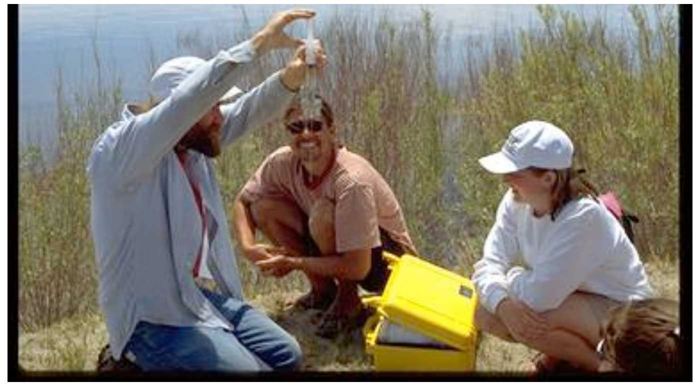
Salary scales vary from employer to employer depending on the career path, location, qualifications of the geoscientist, and, of course, the economy.

According to the Bureau of Labor Statistics (BLS), jobs in the geosciences are expected to grow by 22 percent between 2006 and 2016. This is a much faster increase in employment tha the average for all occupations. Geoscientists with Master's degrees are expected to have the most employment opportunites of all degreed geoscientists.

Salary estimates released by BLS for 2008 indicated that the mean annual salary for geoscientists was $89,300. Geoscientists in the petroleum and mining industries earned the highest salaries ($95,200 - $130,620) and those in state government earned the least ($59,830). Geoscientist faculty earned a mean annual salary of $74,770 in 2008. Additionally, according to the National Association of Colleges and Employers, average starting salaries for college graduates with geoscience bachelor's degrees were $40,786 in 2007.

INTERESTED?

A strong interest in science and a good education are the most important elements in becoming a geoscientist. The geosciences draw on biology, chemistry, mathematics, physics, and engineering. High school courses related to these subjects plus a geology or earth-science course, or an integrated science curriculum, will help prepare you for college. Also, get a solid grounding in English, because geoscientists need to be able to write and speak clearly.



In choosing a college or university, look at the course listings for departments of geology, geoscience, earth-systems science, or environmental science to identify the geoscience programs that best match your interests. As in any profession, the applicants with the best qualifications get the best jobs. Most professional positions in the geosciences require a master's degree. A Ph.D. is needed for advancement in college teaching and in most high-level research positions.

FOR MORE INFORMATION...

"Professional Career Pathways in the Geosciences" includes the American Geological Institute's "Careers" site on the World Wide Web, an interactive CD-ROM, and a videotape. AGI developed these materials in cooperation with its member societies and other geoscience organizations through a grant from the Alfred P. Sloan Foundation.

The Directory of Geoscience Departments lists more than 800 degree-granting geoscience departments in North America; the Guide to Geoscience Departments gives in-depth profiles of selected geoscience departments. Both books are available from AGI.

Contact the organizations listed here, as well as other geoscientific societies and government agencies that employ geoscientists.

- **American Geological Institute,**4220 King Street, Alexandria, Virginia 22302-1502
  Phone: 703/379-2480, FAX: 703/379-7563 - workforce@agiweb.org - http://www.agiweb.org/
- **American Association of Petroleum Geologists,**P.O. Box 979, Tulsa, Oklahoma 74101-0979
  Phone: 918/584-2555, FAX: 918/560-2636 - postmaster@aapg.org - http://www.aapg.org/
- **Geological Society of America,** 3300 Penrose Place, P.O. Box 9140, Boulder, Colorado 80301
  Phone: 303/447-2020 - FAX: 303/447-1133, educate@geosociety.org - http://www.geosociety.org

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