Geochemists

... Use chemical information found in rocks

A wealth of information is buried in the liquids, gases, and mineral deposits of rock. Geochemists must understand this information and use it to make decisions about a range of industrial and scientific research applications. Understanding the chemical composition of rocks tells oil companies where to drill for oil, enables scientists to put together broad-based theories about the way the earth is changing, helps environmental management companies decide how to dispose of toxic or hazardous substances, and steers mining companies toward using natural resources with a minimum environmental impact.

... Provide help for the environment

Consider, for instance, the work of a scientist who specializes in aqueous geochemistry for the U.S. Geological Survey (USGS). Such a geochemist focuses on the chemistry part of geology problems—specifically, the interactions between water and rock that relate to mining activities.

When minerals once buried in mountains are exposed to oxygen and water, they begin to break down more rapidly, making metals more readily available to become part of the water system in the environment. Mining activities exacerbate this process. They also often result in abandoned mine waste piles, which frequently contain sulfides—a key player in creating acid mine drainage. When rain falls or snow melts, acidic, metal-rich water drains off the waste piles. Since mines are in the mountains, their wastewater tends to drain into the headwaters of river systems. These contaminated streams can impact aquatic, animal, and human life because the water is frequently diverted for irrigation and well water in rural areas downstream. As a result, the effect of acid mine drainage on the environment has raised great concern.

The geochemist collects and analyzes samples from abandoned mine land piles and performs leach studies to determine the geology or makeup of the rock and how the elements in the rock affect water. The scientist also tests waters that have come into contact with minerals in these waste piles to determine their acidity and metal content.

With thousands of abandoned mines throughout the United States, land management agencies need geochemists to help them predict the potential environmental impact of the abandoned mine sites and to aid them in prioritizing cleanup efforts.

... Tie together a variety of related disciplines

A broad knowledge base in toxicology, hydrology, math, physics, plant ecology, and soil chemistry (to name only a few topics) helps prepare students to handle today's interdisciplinary scientific work environments. Many projects are cross-disciplinary, combining geochemistry, toxicology, and plant ecology, for example, or geochemistry and hydrology.

Geochemists stress the importance of a firm grounding in a basic chemical science discipline. Analytical chemistry is vital for this kind of work. Training in physical and environmental chemistry is also important. Although a degree in pure chemistry may have been a viable route into the field 10 or 20 years ago, an advanced degree in geochemistry is now more desirable. Unless you plan to work for a consulting firm specializing in geochemical problems, however, a Ph.D. may not provide much advantage. For instance, a Ph.D. may not be necessary for those seeking employment with the U.S. Environmental Protection Agency.

... Enjoy puzzles and like the outdoors

Geochemists describe themselves as people with a propensity for solving puzzles and a natural curiosity about the earth and its composition. They often don't know the composition of their starting material. As a geochemist, you have to accept each given situation, simplify it, and find out what parts can be managed using your expertise. Geochemists also say there is often a significant difference between geochemistry and pure chemistry.

Because many geochemists spend a significant amount of time in the field, this is a career for people who enjoy the outdoors, camping, hiking, and climbing. Even those geochemists who spend most of their time in the lab may do some outdoor work, including collecting and analyzing field samples.

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FACT FILE: Geochemists

WORK DESCRIPTION ► Geochemists study the occurrence and distribution of chemical elements in rocks and minerals. They also study the movement of these elements into soil and water systems. Their work contributes to natural resource use and environmental management policies. For example, analytical work done by geochemists guides oil exploration, helps improve water quality, and is used to develop remediation plans to clean up toxic waste sites.

WORKING CONDITIONS ► Many geochemists spend a lot of time in the field, gathering data and analyzing samples on site. Geochemists underscore the fact that although they spend some time in the lab, theirs is a field for people who like to work outdoors. Travel can be extensive, particularly in environmental areas that extend nationwide or overseas. Government jobs in geochemistry follow a relatively regular schedule, but in industry—and especially in environmental management—hours are long, and some scientists are on call during weekends to respond to emergencies.

PLACES OF EMPLOYMENT ► The government has traditionally employed a large number of geochemists, particularly in the U.S. Department of Energy. Historically, the geochemistry branch of the USGS also has been a major employer, but this has leveled off in recent years. The working atmosphere at the USGS stands somewhere between that of academia and industry. Geochemists at the USGS say they have a lot of latitude in their research and, unlike industry geochemists, are not tied to a customer's requirements or financial constraints. The agency's focus is turning from pure research to applied research—most of it in the environmental arena.

In the 1970s, oil companies were the largest industrial employer of geochemists. Geochemists have careers in a variety of work environments, but employment opportunities in many of these areas are highly competitive. Today, environmental management and consulting firms probably represent the single most promising employer. Geochemists also work in oceanographic institutes, mining companies, the U.S. Bureau of Mines, and colleges and universities. Increasingly, the mining industry is extending itself overseas, offering new employment possibilities for those willing to travel. Some geochemists are finding jobs with private corporations that produce materials.

PERSONAL CHARACTERISTICS ► Geochemists describe themselves as having a natural curiosity about the way the earth works and the way our environment is affected by the earth's processes. Some describe geochemistry as solving a puzzle and say you have to be able to work in a team where each contributes an expertise toward putting together all the pieces. Many emphasize that this field is ideally suited for those who like to work outside.

EDUCATION AND TRAINING ► People come to geochemistry from a range of undergraduate studies, including math, physics, and oceanography, as well as chemistry and geology. Training outside geochemistry is increasingly beneficial because the field has become more interdisciplinary. A solid foundation in analytical chemistry and a breadth of coursework is recommended. Environmentally related areas such as toxicology, hydrology, and sedimentology will prepare you for a job in environmental geochemistry. If you want to go into research, a Ph.D. and postdoctoral work are necessary. However, a career in industry or environmental management often does not require an advanced degree.

JOB OUTLOOK ► The job market for geochemists is highly competitive. However, some positions are opening up in government and academia. Another bright spot is environmental management, which is expected to have work and resources to employ geochemists for many years. Positions in industry may pick up if oil company profits increase and exploration efforts are broadened. Broad training and a flexible outlook prepare students for a wide range of opportunities.

SALARY RANGE ► Geochemists working in the mining, petroleum, or environmental industries command salaries from the mid $40,000s for B.S. chemists to the mid $50,000s for those with master's degrees. Ph.D. geochemists working in industry earn salaries in the mid $90,000s. Government salaries fall slightly lower, but federal, state, and local governments are key employers of geochemists.

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WHAT YOU CAN DO NOW ► Geochemists recommend getting a strong foundation in a basic scientific discipline and stress the importance of analytical, physical, and environmental chemistry. They suggest working as a research assistant for professors to gain confidence about research and help you adapt more quickly on the job. For those interested in the oil industry, mining, or environmental management, geochemists strongly recommend summer internships as a means of gaining early exposure to the work atmosphere. Government labs also offer high-quality internship programs.