

School of Arts and Sciences

GEOLOGY

www.geology.pitt.edu/uprogs.html

Geology is not just rocks. Geology is a diverse science that seeks to understand the workings of almost every aspect of the modern and ancient Earth. If you love nature, science, and variety, you should consider geology:

Nature: Geologists are fascinated by the workings of the natural world. Perhaps your curiosity has led you to observe the patterns of flowing water and erosion, or think about what fossils say about their ancient world, or to pick up interesting rocks along a trail. Perhaps you just like the wilderness. Recent geology majors have hiked the Appalachian Trail, gone backpack camping with at-risk youth in the Utah deserts, bicycled across North America, plumbed the depths of unexplored caves, and traveled to Mongolia in pursuit of summer research. All geology majors take a six-week summer field camp that features extensive hiking in the western United States, Italy, New Zealand, or some other place, depending on the field camp they choose.

Science: Although Pennsylvania high schools treat the Earth sciences as a “soft” science suitable for those who don’t like physics or chemistry, geology is in fact a rigorous science that garners hundreds of millions of dollars in National Science Foundation research support each year. To see whether geology is a good major for you, try a geology class (GEOL 0040, 0800, 0820, or 0860) and the Physical Geology Lab (GEOL 0055). Then be sure you are comfortable with the required physics, math, and chemistry (see below)!

Variety: Geology always has deployed an interdisciplinary mix of physics, chemistry, biology, math, and natural science to understand the mysteries of nature. It also has always focused on the solid earth (rocks, minerals, mountain belts, volcanoes, earthquakes, sedimentary basins, oil and gas deposits, etc.) as well as the history of life (paleontology) and its impact on the Earth. In recent decades, geologists have become increasingly concerned with the history of Earth’s climate, how the physical and chemical behavior of the oceans has changed over time, and how drifting continents and evolving life have interacted to control the composition of the atmosphere and oceans and hence to control the global climate. We also examine how human activities have recently impacted our environment, including the quality of air, water, and landscape. Finally, recent NASA missions have revolutionized planetary geology: How do other planets work, is (or was) there life on other planets, and why are they so different from the Earth?

Core requirements of the Geology Major

- **Physical Geology (GEOL 0040)** covers basic geology: plate tectonics; minerals; the recognition and origin of igneous, sedimentary, and metamorphic rocks; volcanic systems; the recognition and origin of geologic structures; earthquakes; the determination of geologic time; and how erosion, rivers, groundwater, beaches, glaciers, and other surface systems operate. Memorize this class and you will go far!
Majors may take **Geology (GEOL 0800)** OR **Natural Hazards (GEOL 0820)** OR **Environmental Geology (GEOL 0860)** instead of GEOL 0040. However, the weekly recitations in 0800 and 0860 cut out one third of the material covered in GEOL 0040. GEOL 0040 is not more difficult; it just better covers the introductory material.
- **Physical Geology Lab (GEOL 0055)** gives you plenty of hands-on experience identifying rocks and minerals and working with maps, aerial photographs, and satellite images. The wide variety of labs (from groundwater to geologic maps to plate tectonics) gives you an excellent sampling of the types of problems that geologists actually work on. This is an excellent companion class to GEOL 0040, GEOL 0800, GEOL 0820, or GEOL 0860.
- **History of the Earth (GEOL 0060)** focuses on the causes and effects of short- and long-term climate change, on the history of the oceans and the continents, and on interpreting the many geochemical and geologic clues that are used to reconstruct the history of the planet. A weekly lab focuses on the practical aspects of inferring local and regional geologic history based on rock samples, fossils, and various types of other data.
- **Mineralogy (GEOL 1001)** covers the recognition of a wide variety of geologically important minerals and the fundamental factors that determine their basic properties. The class covers the symmetry present in 2- and 3-D



objects, the actual 3-D atomic architecture of different minerals, the impact of ionic size and charge on crystal chemistry and mineral properties, and how polarized light allows accurate mineral identification under high-power microscopes. These may sound like obscure topics, but they are actually pretty interesting!

- **Igneous and Metamorphic Petrology (GEOL 1003)** focuses on using the compositional and textural clues in igneous and metamorphic rocks to understand their origin and, by extension, the history of a given region. This class takes you deep into the mysteries of mineral crystallization in liquids of complex compositions and how these processes affect everything from rock and mineral textures to volcanic eruption styles. This class is an important prerequisite for the upper-level course in volcanology.
- **Sedimentology and Stratigraphy (GEOL 1020)** has three main components. The first looks at fluid dynamics and sediment transport in the context of modern depositional systems (alluvial fans, sand dunes, lakes, rivers, deltas, beaches, continental shelves, reefs, and the deep ocean). The second combines careful rock observations with your knowledge of depositional systems to determine how given sedimentary sequences were deposited. The final part, stratigraphy, covers the surprisingly subtle science of applying a time scale to the rock record.
- **Structural Geology (GEOL 1100)** provides an array of analytical techniques that are used to unravel the complex and highly varied processes of deformation that characterize the world's mountain belts and fault zones. A theoretical understanding of how rocks are deformed under a variety of temperature, pressure, and stress conditions is combined with observations made on rocks, outcrops, and geologic maps in order to unravel the complex history of deformed regions.
- **Summer Field Camp (GEOL 1960)** is the capstone experience for the geology major. Most of the above classes include lab experiences, and many include field trips in order to give you the practical skills you need to do geology. However, the whole undergraduate experience is comprehensively integrated in summer field camp. Summer field camps vary, but all involve setting students loose in the wilderness to identify the rock units in a given area, map their distribution, understand their significance, and thereby infer the Earth's history within the map area. People come back from summer field camp saying, "Now I feel like a real geologist!"

Electives (9 credits)

Students must earn at least nine credits of upper-division or graduate-level geology courses from the following:

- **Groundwater Geology (GEOL 1051)** The basic physical and chemical properties of groundwater will be tested in a geologic context with emphasis on geologic process during this course. The importance of groundwater as a resource and as a geochemical agent will be explored in detail.
- **Environmental Science, Ethics, and Public Policy (GEOL 1055)** This course examines the interrelationships between environmental science, ethics, and policy.
- **Geomorphology (GEOL 1060)** This course is a survey of the major landform features found on the Earth's surface. Each landform type is first described qualitatively and then examined in the terms of the processes that created it.
- **Field Methods (GEOL 1079)** This course provides hands-on practical experience in using a variety of geological mapping tools. This course is designed as a prelude for students going on to field camp.
- **Geoarchaeology (GEOL 1080)** This course is an examination of geological methods applied to the study of archaeology. The first part of the course examines location of sites by familiarization with the physical environment, maps, and photos. The second examines characteristics of site sediments and artifacts with emphasis on stratigraphic principles. Specific sites are discussed.
- **Paleontology (GEOL 1200)** All invertebrate phyla with significant fossil record are surveyed during this course.
- **Introduction to Solid-Earth Geophysics (GEOL 1400)** This course is an introduction to solid-Earth geophysics. Topics covered include meteorites, seismology, determination of the composition of the Earth's interior, heat flow within the Earth, geomagnetism, and plate tectonics.
- **Exploration Geophysics (GEOL 1410)** This course is an introduction to the theory, methods, and instrumentation used in exploration geophysics. Topics include gravity, magnetics, electromagnetics, and seismics.
- **Well Logging (GEOL 1413)** This course is an introduction to the interpretation of open-hole logs and their use in estimating rock parameters useful to both the geologist and the petroleum engineer.
- **GIS, GPS, and Computer Methods (GEOL 1445)** The goal of this course is to gain expertise in Arc/Info GIS and UNIX-based workstations.
- **Remote Sensing of the Earth (GEOL 1460)** This course is an introduction to the theory and techniques of remote sensing of the surfaces of the Earth and other planets using electromagnetic radiation and its application to the solution of geological problems.
- **Chemistry of Earth and Its Environment (GEOL 1500)** This course is an examination of the uses of chemistry in geology.
- **Environmental Geochemistry (GEOL 1515)** This course will explore the complex interactions of Earth's rock, water, air, and life systems that determine the chemical characteristics of the surface environment.
- **Mineral and Energy Resources (GEOL 1602)** This course deals with the geology of the fossil fuels, the more important industrial rocks and minerals and building stone. Emphasis is on the processes that form the commercial accumulations of these materials and the geological setting in which they occur.

- **Geologic and Environmental Hazards (GEOL 1640)** Students will be introduced to different types of geological processes and environmental conditions that can produce hazardous conditions in the modern world.
- **Geology of the Planets (GEOL 1701)** This course is an introduction to the geological processes and resulting landforms occurring on the surfaces of the planets of our solar system.
- **Internship (GEOL 1900)**
- **Undergraduate Research (GEOL 1903)** This course provides the opportunity for undergraduates to obtain hands-on experience in geology by actively interacting with faculty members on research projects.
- **Topics in Environmental Geology (GEOL 3963)** This is a course designed to permit the teaching of new and significant developments in the field of economic geology and environment. It permits maximum flexibility, enabling presentation of subject matter not normally treated in formal geology courses.

Science Co-requisites

- Three calculus classes: MATH 0220, 0230, 0240
- Two chemistry classes: CHEM 0110, 0120
- Two physics classes: PHYS 0174, 0175

Sample Geology Electives: Geology majors need nine credits from at least three classes numbered 1000 or above. Here is a partial list:

- Groundwater Geology (GEOL 1051)
- Environmental Science, Ethics, and Public Policy
- Paleoclimates (GEOL 1052)
- Geomorphology (landform study; GEOL 1060)
- Exploration Geophysics (GEOL 1410)
- Environmental Geochemistry (GEOL 1515)
- Geology of the Planets (GEOL 1701)

GIS Certificate: The Certificate in Geographic Information Systems (GIS) is a great opportunity to earn electives while acquiring a range of software and image analysis skills (aerial photos, maps, and satellite images) that are highly sought after by both public and private employers. Check out our Web site for classes and more information.

Opportunities available with a geology degree

If you love nature and science, a geology degree should give you the skills you need for the sort of job you'd enjoy, whether or not it is as a geologist. For example, your scientific and mapping skills are great training for jobs in parks and forestry management, museum work, science education, urban and suburban planning, and many other jobs that involve nature and/or resource issues. Geology majors are also highly competitive when it comes to on-campus job fairs. Like business people, geologists analyze a lot of factual information and make rational decisions (hypotheses) based on incomplete information. Like business people, geologists are comfortable analyzing numerical data and with explaining the results and significance of their data. Within the field of geology, there are environmental and geotechnical jobs for people with BS degrees. A master's degree opens up better jobs in these fields, plus oil and gas exploration jobs (which can be enormously rewarding, both financially and intellectually). With a PhD and a lot of hard work, a job at a university or government lab may be yours. If you are worried about getting a job when you graduate, pursue as many internships as possible! This allows you to meet potential employers, learn about real-world opportunities, and sample different types of work.

Related Area

Geology majors automatically fulfill the School of Arts and Sciences-required related area by taking courses in mathematics, physics and chemistry.

Departmental Honors

To graduate with departmental honors, a student must complete one of three options (course, research, or internship). Please see the department for details on these options for students majoring in geology.

For more information about the geology major, contact:

University of Pittsburgh
 Department of Geology and Planetary Science
 Charles E. Jones
 503 Space Research Coordination Center
 Pittsburgh, PA 15260
 412-624-6347
 E-mail: cejones@pitt.edu

For more information about other majors, contact:

University of Pittsburgh
 Office of Admissions and Financial Aid
 Alumni Hall, 4227 Fifth Avenue
 Pittsburgh, PA 15260-6601
 412-624-PITT
 E-mail: oafa@pitt.edu
 www.oafa.pitt.edu

Special Programs and Opportunities

Geological Society of the University of Pittsburgh (Geoclub)

This student group is aimed at anyone who has an interest in the Earth sciences or the environment, who calls himself or herself “rockhound” or “mineral hound,” or who wants to share a love of all things outdoor. Activities include a regular weekly seminar and mineral collecting trips to places like New York and Laurel Caverns.

Sigma Gamma Epsilon

This student organization is the geology honorary society. Its activities include a geoprom and field trips like fossil collecting in Footedale, Pa.; mineral collecting in Bancroft, Ontario; and mineral and fossil collecting in the Pittsburgh region.

University Honors College (UHC)

The UHC offers many resources for talented, active students—unique courses, special degrees, opportunities to perform independent research or teach, supplemental advising, and a social and academic community of similarly motivated students. UHC courses offer a more in-depth treatment of the material covered in a nonhonors course. Students work more problems, write more, read more, and discuss topics in greater depth. Although the UHC does not have a formal membership and does invite all students to participate in honors courses, there are certain qualifications that must be met to be eligible to take UHC courses. Entering freshmen are automatically considered for UHC participation on the basis of their admissions applications. A minimum quality point average of 3.25 is required for current Pitt students.

Internships

Having an internship can be one of the most enlightening and productive aspects of your undergraduate education. It not only gives you a closer look at working in a particular field but can help you gain a competitive edge, make contacts in the marketplace, and earn credits toward your degree. Pittsburgh is an exciting place for internship opportunities: internationally known as a renowned center for health care and groundbreaking medical research; home to many corporate headquarters, including H.J. Heinz, Fisher Scientific, PPG Industries, Westinghouse Electric, and Mellon Financial Corp.; and a city with a wealth of cultural and entertainment activities, including three professional sports teams and the Carnegie system of museums. Internships are not limited to Pittsburgh, however. Every year, students complete internships in cities such as Philadelphia, Pa.; Washington, D.C.; New York, N.Y.; and their own home towns. Some students even complete an internship as part of their study abroad experience.