

Geology

Students may complete a major or minor in geology. Within the major, students may complete concentrations in environmental studies, geoarchaeology or geochemistry.

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The department seeks to make students more aware of the physical world around them and of its development through time. The subject includes a study of the materials of which the Earth is made; of the physical processes which have formed the Earth, especially near the surface; of the history of the Earth and its organisms; and of the various techniques necessary to investigate Earth processes and history.

Each introductory course is designed to cover a broad group of topics from a different perspective. Students may elect any of the 100-level courses. Fieldwork is an essential part of geologic training and is part of all introductory courses, most other classes and most independent research projects.

Major Requirements

Thirteen courses are required for the major: Geology 101 and 102 or 103; 202, 203, 204, and 205; Math 101 and 102, or alternates approved by the adviser; a two-semester sequence of Chemistry (101/103-104) or Physics (101-102); Geology 403; and either two advanced geology courses or one advanced geology course and an additional upper-level course in biology, chemistry, mathematics, physics, or computer science.

Additional courses in the allied sciences are strongly recommended and are required by most graduate schools. A student who wishes to follow a career in geology should plan to attend a summer field course, usually following the completion of the 200-level courses.

All geology majors undertake a research project (Geology 403) in the senior year. Most students complete a one-semester project in the fall semester; a two-semester project may be undertaken with approval of the department.

Honors

Honors are awarded to students who have outstanding academic records in geology and allied fields, and whose research is judged by the faculty of the department to be of the highest quality.

Minor Requirements

A minor in geology consists of two of the 100-level Geology courses, and any four of the 200- or 300-level courses offered by the Department.

Concentration in Environmental Studies

The environmental studies concentration allows students to explore the interactions among the geosphere, biosphere, and human societies. The concentration represents interdisciplinary cooperation among the departments of anthropology, biology, economics, english, geology, political science and growth and structure of cities, and is open to students majoring in any of these departments.

The environmental concentration in geology consists of Geology 101 and 103, 202 and two other 200-level geology courses, 302 or 328, 397, another 300-level geology course and 403; Chemistry 101 or 103, and 104; two semesters of math, statistics or computational methods; Biology 220; and three additional environmental courses outside of the Natural Sciences, two of which should address issues of *Planning and Policy*, and one of which should address issues of *Humans in the Environment*. The Environmental Studies website (www.brynmawr.edu/es/core.htm) lists approved courses in these last two categories.

Concentration in Geoarchaeology

The geoarchaeology concentration allows students majoring in Anthropology, Archaeology or Geology to explore the connections among these fields with respect to how our human ancestors interacted with past environments, and how traces of human behavior are preserved in the physical environment. In geology, the geoarchaeology concentration consists of 13 courses: Geology 101 or 102 or 103, 202, 205, 270, 328, another 200- or 300-level Geology course, and 403; Chemistry 101 or 103, and 104; two semesters of math, statistics or computational methods; either Classical and Near Eastern Archeology 101 or Anthropology 101; and one 200- or 300-level elective from among current offerings in Anthropology or Classical and Near Eastern Archaeology.

Concentration in Geochemistry

The geochemistry concentration encourages students majoring either in geology or in chemistry to design a course of study that emphasizes Earth chemistry. In geology this concentration includes at least: Geology 101, 103, 202, 205; one of 301 or 302 or 305; Chemistry 101 or 103, 104 and 231 (Inorganic Chemistry). Additional chemistry courses might include 211 (Organic Chemistry) or 222 (Physical Chemistry). Other courses that complement this concentration are: calculus, linear algebra, computer programming and computer modeling.

GEOL B101 How the Earth Works

An introduction to the study of planet Earth — the materials of which it is made, the forces that shape its surface and interior, the relationship of geological processes to people, and the application of geological knowledge to the search for useful materials. Laboratory and fieldwork focus on learning the tools for geological investigations and applying them to the local area and selected areas around the world. Three lectures and one afternoon of laboratory or fieldwork a week. One required one-day field trip on a weekend. (Weil, Division IIL)

GEOL B102 Earth History

The history of the Earth from its beginning and the evolution of the living forms that have populated it. Three lectures, one afternoon of laboratory a week. A required two-day field trip is taken in the late spring. An extra fee is collected for this trip. (Saunders, Division IIL)

GEOL B103 Earth Systems and the Environment

This integrated approach to studying the Earth focuses on interactions among geology, oceanography and biology. Also discussed are the consequences of population growth, industrial development and human land use. Two lectures, one afternoon of laboratory a week. Includes a mandatory two-day field trip for which an extra fee may be collected. (Barber, Division IIL; cross-listed as Growth and Structure of Cities 103)

GEOL B201 Crystallography and Optical Mineralogy

Crystallography involves the study of the external forms and symmetry of crystalline solids, as well as an introduction to the study of crystals using x-ray diffraction. Optical mineralogy introduces the effects of the interaction of light with crystalline substances, and use of the polarizing microscope for mineral identification. Lecture three hours, laboratory at least three hours a week. Prerequisites: Geology 101 or Chemistry 101 or 103, and 104. (staff, Division IIL) *Not offered in 2005-06.*

GEOL B202 Mineralogy and Crystal Chemistry

The crystal chemistry of representative minerals. Descriptive and determinative mineralogy, as well as the relation between the physical properties of minerals and their structures and chemical compositions. The occurrence and petrography of typical mineral associations and rocks is also covered. Lecture three hours, laboratory at least three hours a week. Prerequisite: introductory course in geology or chemistry (both recommended). (staff, Division IIL)

GEOL B203 Invertebrate Paleobiology

Biology, evolution, ecology and morphology of the major marine invertebrate fossil groups. Three lectures and one three-hour laboratory a week. A semester-long research project introducing computer-aided morphometric analysis will be based on material collected on a three-day trip to the Tertiary deposits of the Chesapeake Bay. (Saunders, Division IIL)

GEOL B204 Structural Geology

Three lectures and three hours of laboratory a week, plus weekend field trips. Recognition and description of deformed rocks, map reading and an introduction to the

mechanics and patterns of deformation. Prerequisites: Geology 101 and Mathematics 101. (Weil, Division III)

GEOL B205 Sedimentary Materials and Environments

An introduction to the principles of sedimentology, depositional processes, facies analysis and stratigraphy, including interpretation of sedimentary sequences and techniques for reconstructing past environmental conditions. Three lectures and one lab a week, with at least one day-long field trip. Prerequisite: Geology 101, 102 or 103 or instructor permission. Recommended: Geology 202 and 203. (Barber, Division III)

GEOL B206 Energy Resources and Public Policy

An examination of issues concerning the supply of energy and raw materials required by humanity. This includes an investigation of requirements and supply of energy and of essential resources, of the geological framework that determines resource availability, and of the social, economic and political considerations related to energy production and resource development. Two 90-minute lectures a week. Prerequisite: one year of college science. (staff, Division II) *Not offered in 2005-06.*

GEOL B209 Natural Hazards

Discussion of Earth processes that occur on human time scales and their impact on humanity both past and present. We quantitatively consider the past, current and future hazards presented by geologic processes, including earthquakes, volcanoes, landslides, floods and hurricanes. The course includes discussion of the social, economic and policy contexts in which geologic processes become geologic hazards. Case studies are drawn from contemporary and ancient societies. Lecture three hours a week, with one day-long field trip. Prerequisite: one semester of college science or permission of instructor. (Weil, Division II or Quantitative Skills; cross-listed as Growth and Structure of Cities 209)

GEOL B236 Evolution

A lecture/discussion course on the development of evolutionary thought, generally regarded as the most profound scientific event of the 19th century; its foundations in biology and geology; and the extent of its implications to many disciplines. Emphasis is placed on the nature of evolution in terms of process, product, patterns, historical development of the theory, and its applications to interpretations of organic history. Lecture three hours a week. Prerequisite: a 100-level science course or permission of instructors. (Davis, Gardiner, Saunders, Division II; cross-listed as Anthropology 236 and Biology 236)

GEOL B250 Computational Models in the Sciences

Introductory survey of theoretical methods in the sciences. Design, implementation, interpretation, and evaluation of models. Conceptual, analytical, and computational models; simulations; evolutionary algorithms; optimality models; and role of theory in science. Case studies from a variety of natural and social sciences. Laboratory three hours a week, group research project. Prerequisite: sophomore or higher standing, two courses at any level in any single natural or social science. (staff, Division II or Quantitative Skills; cross-listed as Biology 250 and Computer Science 250)

GEOL B255 Problem Solving in the Environmental Sciences

Provides basic quantitative and numerical modeling skills that can be applied to any of the natural sciences, including geology and environmental studies. Students will learn fundamental quantitative concepts while exploring issues such as global warming, sudden catastrophes, and the effects of steady flow of wind and water on Earth's surface. Lecture/discussion three hours a week. (Riihimaki, Division II or Quantitative Skills)

GEOL B270 Geoarchaeology

Societies of the past depended on our human ancestors' ability to interact with their environment. Geoarchaeology analyzes these interactions by combining archaeological and geological techniques to document human behavior while also reconstructing the past environment. Course meets twice weekly for lecture, discussion of readings, and hands-on exercises. Prerequisite: an introductory course in anthropology, archaeology or geology, or consent of instructor. (Barber, Magee, Division II, cross-listed as Anthropology 270 and Classical and Near Eastern Archeology 270)

GEOL B301 Geochemistry of Crystalline Rocks

Principles and theory of various aspects of geochemistry including elementary thermodynamics and phase diagrams, an introduction to isotopes, and the applications of chemistry to the study of igneous and metamorphic rocks. Three lectures per week augmented by occasional fieldwork. Prerequisites: Geology 202, Chemistry 101 or 103 and 104 or consent of the instructor. (staff) *Not offered in 2005-06.*

GEOL B302 Low-Temperature Geochemistry

The geochemistry of Earth surface processes. Emphasis is on the chemistry of surface waters, atmosphere-water environmental chemistry, chemical evolution of natural waters and pollution issues. Fundamental principles are applied to natural systems with particular focus on environmental chemistry. Two hours of lecture a week and problem sessions. Prerequisites: Chemistry 103, 104 and Geology 202 or two 200-level chemistry courses, or permission of instructor. (Hoyle)

GEOL B303 Advanced Paleontology

Principles, theory and application of various aspects of paleobiology such as evolution. Seminar-based, with a semester-long research project. Three lectures, three hours of

laboratory a week (with occasional fieldwork). Prerequisite: Geology 203 or permission of instructor. (Saunders)

GEOL B304 Tectonics

Three hours of lecture and a problem session a week. Plate tectonics and continental orogeny are reviewed in light of the geologic record in selected mountain ranges and certain geophysical data. Prerequisite: Geology 204. (Weil)

GEOL B305 Igneous and Metamorphic Petrology

The origin, mode of occurrence and distribution of igneous and metamorphic rocks. The focus is on the experimental and field evidence for interpreting rock associations and the interplay between igneous and metamorphic rock genesis and tectonics. Three lectures and three hours of laboratory or equivalent field work a week. Occasional weekend field trips. Prerequisites: Geology 202 and Chemistry 101 or 103, and 104. (staff)

GEOL B310 Introduction to Geophysics

An overview covering how geophysical observations of the Earth's magnetic field, gravity field, heat flow, radioactivity and seismic waves provide a means to study plate tectonics. Also covered are the geophysical techniques used in mineral and energy resources exploration, and in the monitoring of groundwater, earthquakes and volcanoes. Three class hours a week. Prerequisites: Geology 101 and Physics 101, 102. (Weil) *Not offered in 2005-06.*

GEOL B312 Quaternary Geology

The Quaternary Period comprises the last 1.5 million years of Earth history, an interval dominated by climate fluctuations and the waxing and waning of large northern hemisphere ice sheets. This course covers the many types of geological evidence, from glacial geomorphology to deep-sea geochemistry, used to reconstruct ocean and atmospheric conditions emphasizing Quaternary climate variability. Three class hours a week, including hands-on data analysis. Prerequisite: Geology 101, 102 or 103. (Barber)

GEOL B314 Marine Geology

An introduction to the structure and tectonics of ocean basins, their sedimentary record and the place of marine systems in the geologic record. Includes an overview of physical and chemical oceanography, and a review of how paleoceanographic research has shaped our knowledge of Earth's climate history. Meets twice weekly for a combination of lecture, discussion and hands-on exercises, including one day-long field trip. Prerequisite: Geology 101, 102 or 103. (Barber) *Not offered in 2005-06.*

GEOL B328 Analysis of Geospatial Data Using GIS

An introduction to analysis of geospatial data, theory and the practice of geospatial reasoning. As part of this introduction students will gain experience in using one or more GIS software packages and be introduced to data gathering in the field by remote sensing. Each student is expected to undertake an independent project that uses the approaches and tools presented. (Compton, Wright, Division II or Quantitative Skills; cross-listed as Biology 328 and Classical and Near Eastern Archaeology 328)

GEOL B336 Evolutionary Biology: Advanced Topics

A seminar course on current issues in evolution. Discussion based on readings from the primary literature. Topics vary from year to year. One three-hour discussion per week. (Gardiner, Saunders, Murphy; cross-listed as Anthropology 336 and Biology 336) *Not offered in 2005-06.*

GEOL B350 Advanced Topics in Geology

A seminar course offered occasionally covering topics on areas of geology not otherwise offered in the curriculum. Prerequisites: advanced standing in geology and consent of the instructor. (staff)

GEOL B397 Senior Seminar in Environmental Studies

A seminar course allowing environmental studies concentrators to explore topics of common interest from the various perspectives represented by student majors in the class. Students choose readings, lead discussion, and write papers. Collaborative research projects also are possible. Three hours per week. (Riihimaki; cross-listed as Anthropology 397, Biology 397 and Growth and Structure of Cities 397)

GEOL B403 Independent Research

An independent project in the field, laboratory or library culminating in a written report and oral presentation. Required for all geology majors in the senior year. (staff)