

# GEOLOGY

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## Faculty

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## Undergraduate Degrees

### Bachelor of Arts (BA)

- Geology (<http://catalog.ewu.edu/science-technology-engineering-mathematics/geology/geology-ba>)

### Bachelor of Science (BS)

- Geology (<http://catalog.ewu.edu/science-technology-engineering-mathematics/geology/geology-bs>)

### Undergraduate Minors

- Geology (<http://catalog.ewu.edu/science-technology-engineering-mathematics/geology/geology-minor>)
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## Undergraduate Programs

Geology is the science of planet Earth. Geologists use elements of chemistry, physics, biology and mathematics in interpreting the evolution of the Earth and its life forms. Applied geology addresses exploration of Earth resources, environmental quality and hazards and practical understanding of the planet on which we live.

Geology is a field-oriented science and our curriculum emphasizes field studies. However, geologists increasingly employ advanced chemical and physical analytic techniques and use computers to model natural systems. Eastern has specialized laboratory facilities for various sub-disciplines in geology. Extensive collections of minerals, rocks and fossils are available for study and research.

Nationwide, approximately half of recent geology graduates are employed in environmental fields while a third go on to graduate school. Most of the rest go into the petroleum industry, teaching, government or mining. The Geology Department has close relations with geotechnical/environmental consulting firms, government agencies and mining companies in the Pacific Northwest.

Students should decide on declaring their geology major early to ensure timely graduation with the many credits needed in the Bachelor of Science program. Course substitutions in the Geology program must be approved by the Department. Most graduate schools require a full year of calculus.

An opportunity exists to earn a double major with a BS in both Geology and Environmental Science. (See catalog section on Environmental Science (<http://catalog.ewu.edu/science-technology-engineering-mathematics/environmental-science>.)

## General Admissions Requirements for Geology

High school students planning to major in Geology should take two years of algebra, one year of geometry/trigonometry and one year of chemistry and physics. They are also encouraged to take four years of English. The ability to express ideas and concepts clearly and concisely, both orally and in written form, is fundamental to all sciences.

Entering freshmen and transfer students electing to major in Geology should contact the Department for advising as soon as possible. Failure to do so may result in an additional year to finish the BS program. Especially important for beginning students is early completion of the chemistry sequence.

## Enrollment in GEOL 120 and GEOL 121 requires a major declaration in Geology.

### Grade Requirement

- $\geq 2.50$  cumulative average
- $\geq 2.0$  in required supporting and geology classes

**Required courses in the following programs of study may have prerequisites. Reference the course description section for clarification.**

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## Geology Courses

### GEOL 100. DISCOVERING GEOLOGY. 5 Credits.

**Satisfies:** a GECR for natural sciences, geology.

This course explores the interactions between human beings and their geological environment. The earth is a dynamic planet affected by sudden, violent events such as volcanic eruptions, earthquakes and floods, as well as by slower processes operating over long time spans that create, move, and destroy continents and oceans. Other topics include study of energy, mineral and water resources and their importance to modern society. Topics are presented at a level intended for nonscience majors. Satisfies lab science requirement at most universities.

### GEOL 115. INVESTIGATING EARTH SCIENCE. 5 Credits.

**Cross-listed:** GEOG 115.

**Pre-requisites:** pre-university basic skills in mathematics.

**Satisfies:** a GECR for natural sciences, geology.

For students planning to teach elementary school. Includes inquiry-based earth science investigations that support science instruction outlined in the National Science Education Standards and Washington Essential Academic Learning Requirements.

### GEOL 120. PHYSICAL GEOLOGY - THE SOLID EARTH. 5 Credits.

**Pre-requisites:** MTHD 104 or equivalent and restricted to the following: Computer Science (BS only), Earth and Space Science, Environmental Science or Geology or by permission of the instructor.

**Satisfies:** the completion of GEOL 120 counts as one course for the GECR in natural sciences, geology; the completion of GEOL 120 and GEOL 121 counts as two courses for the GECR for natural sciences, geology.

Introduction to physical geology for students interested in earth and environmental science. This course covers the origin of the earth, its internal structure and minerals, rocks and volcanoes. Earthquakes, mountains and continental drift are discussed in the context of plate tectonics. The formation of mineral deposits is also covered. Weekly laboratories and one field trip are required.

**GEOL 121. PHYSICAL GEOLOGY - SURFICIAL PROCESSES. 5 Credits.**

**Pre-requisites:** computer literacy, MTHD 104 or equivalent and restricted to the following: Computer Science (BS only), Earth and Space Science, Environmental Science or Geology or by permission of the instructor.

**Satisfies:** the completion of GEOL 121 counts as one course for the GECR in natural sciences, geology; the completion of GEOL 120 and GEOL 121 counts as two courses for the GECR for natural sciences, geology.

Introduction to physical geology for students majoring in geology, earth science or environmental science. This course emphasizes the quantitative analysis of processes that shape the earth's surface (gravity, wind, water and ice) including weathering and erosion, the creation of sediments and sedimentary rocks and the development of landforms. Energy resources and the concept of earth systems are also explored. Weekly laboratories and one field trip are required.

**GEOL 122. HISTORICAL GEOLOGY. 5 Credits.**

**Pre-requisites:** GEOL 121.

Introduction to earth history for students majoring in geology, earth science, or environmental science. This course covers the diversity of life, catastrophic extinctions, and the effect of biologic change on the environment. The basic principles of stratigraphy, use of stable isotopes to interpret sedimentary environments, and the stratigraphic and tectonic history of the earth are also explored. Other topics include identification of the common fossil groups, survey of the fossil record in the context of geological evolution, and practice using geologic maps. Weekly laboratories and one field trip are required.

**GEOL 196. EXPERIMENTAL COURSE. 1-5 Credits.****GEOL 197. WORKSHOP, SHORT COURSE, CONFERENCE, SEMINAR. 2 Credits.****GEOL 296. EXPERIMENTAL COURSE. 1-3 Credits.****GEOL 297. WORKSHOP, SHORT COURSE, CONFERENCE, SEMINAR. 1-5 Credits.****GEOL 299. SPECIAL STUDIES. 1-5 Credits.**

**Pre-requisites:** permission of the instructor, department chair and college dean.

Topics vary with interest of student and instructor.

**GEOL 311. EARTH MATERIALS. 4 Credits.**

**Pre-requisites:** GEOL 120 and CHEM 151.

This course is an introduction to the materials that comprise the solid earth, including minerals, igneous, sedimentary and metamorphic rocks. The course includes discussions of their occurrence, associations and uses. Methods of identification are stressed during laboratory exercises.

**GEOL 312. CRYSTALLOGRAPHY AND OPTICAL MINERALOGY. 4 Credits.**

**Pre-requisites:** GEOL 311.

This second course of a three-course series covers how to describe the external morphology of well-formed crystals using crystallographic techniques. In addition, the techniques of optical mineralogy using a petrographic microscope are introduced as a tool for identifying rock-forming (silicate) minerals.

**GEOL 313. IGNEOUS AND METAMORPHIC PETROLOGY. 4 Credits.**

**Pre-requisites:** GEOL 311 and GEOL 312.

The third course in a series is a comprehensive study of the classification, description, and origin of igneous and metamorphic rocks. Students will learn about the use of minerals in helping to interpret the geologic and tectonic significance of the rocks in which they are found. The course builds on skills learned in GEOL 311 and GEOL 312 and stresses hand sample and thin section descriptive techniques. Weekly laboratories as well as one weekend field trip are required. Additional field trips may be offered.

**GEOL 320. ENVIRONMENTAL GEOLOGY. 4 Credits.**

**Pre-requisites:** GEOL 100, GEOL 120 or GEOL 121.

Relationship of human activities with earth materials and processes, water quality, atmospheric composition, waste disposal, natural resources, the importance of an interdisciplinary approach to environmental problems. Field trips emphasize local environmental problems. Laboratory.

**GEOL 338. DISCOVERING WOMEN IN SCIENCE. 1 Credit.**

**Cross-listed:** BIOL 338, CHEM 338, HIST 338, PHYS 338, PSYC 338, WMST 338.

The course uses several scientific themes to rediscover from the past and find in contemporary research, the women who have made significant contributions to science.

**GEOL 360. GEOLOGIC HAZARDS. 4 Credits.**

**Pre-requisites:** GEOL 100, GEOL 115, GEOL 120, GEOL 121 or GEOG 100 or GEOG 115.

Introduction to geologic hazards affecting humankind; emphasis on earthquakes, volcanism, floods and landslides. Applications to geological site engineering and city/regional planning.

**GEOL 380. WORLD RESOURCES AND POPULATION. 5 Credits.**

**Satisfies:** international studies university graduation requirement.

Interaction between population and resource utilization. Renewable and non-renewable energy resources, food and water supply, soil erosion and degradation and deforestation will be related to population growth.

**GEOL 390. EARTH SCIENCE TEACHING METHODS. 1 Credit.**

**Cross-listed:** GEOG 390.

**Pre-requisites:** GEOL 120, GEOL 121, GEOG 314, PHYS 121; EDUC 303 or permission of the instructor. SCED 390 co-requisite.

This course is designed for Earth Science majors planning to teach middle school, junior or senior high school. It includes the development of curriculum and the organization of teaching materials, techniques and evaluation.

**GEOL 396. EXPERIMENTAL COURSE. 1-6 Credits.****GEOL 397. WORKSHOP, SHORT COURSE, CONFERENCE, SEMINAR. 1-5 Credits.****GEOL 399. DIRECTED STUDY. 1-5 Credits.****GEOL 408. INVERTEBRATE PALEONTOLOGY. 4 Credits.**

**Pre-requisites:** GEOL 121, GEOL 122 or permission of the instructor.

Principles of paleontology including methods of description and analyses of invertebrate fossils. Emphasis on principles of morphology and evolutionary development of invertebrates and the use of invertebrate fossils in biostratigraphy and paleoecology. Laboratory.

**GEOL 411. SEDIMENTOLOGY AND STRATIGRAPHY. 4 Credits.**

**Pre-requisites:** GEOL 122 and GEOL 311.

Study of the origin of sediments and sedimentary rocks for advanced geology majors. Description and interpretation of facies and environments of deposition and classification of clastic and chemical sedimentary rocks is emphasized. Stratigraphic principles, nomenclature and correlation is also treated. Lecture and weekly laboratory.

**GEOL 425. GEOLOGY OF EASTERN WASHINGTON. 4 Credits.**

**Pre-requisites:** GEOL 122 or permission of the instructor.

Study of the local geology in lectures and a series of field trips. Includes field projects and techniques used during geologic mapping. Observing and recording geologic data in the field, and presenting it in terms of a written report and a sketch geologic map of a site-specific area.

**GEOL 430. STRUCTURAL GEOLOGY I. 4 Credits.****Pre-requisites:** GEOL 411.

Analysis of the kinematics and mechanics of rock deformation and an introduction to geologic structures. Laboratory introduces the solution of structural geology problems, the map-based interpretation of geologic structures and the creation of geologic cross sections. Weekly laboratory exercises. Designed to be taken in series with GEOL 431.

**GEOL 431. STRUCTURAL GEOLOGY II. 4 Credits.****Pre-requisites:** GEOL 430.

Continuation of an introduction to geologic structures from GEOL 430 and an exploration of the plate tectonic setting of geologic structures. Introduction to the field study of geologic problems with weekly field trips that emphasize the collection and analysis of geologic field data to solve structural problems. Weekly field trips and laboratory exercises required.

**GEOL 449. GIS SPATIAL ANALYSIS FOR THE ENVIRONMENTAL SCIENCES. 5 Credits.****Cross-listed:** ENVS 449, GEOG 449.**Pre-requisites:** GEOG 426, GEOG 323 or ENVS 323.

This is an advanced course where students learn to build Geographic Information System models for environmental applications. In the course, students design, collect data, process data and build several spatial models of increasing complexity. Students will learn advanced techniques in Geographic Information Systems including raster processing, analysis methods and layout design and document their projects in a report form and create production quality maps. This course stresses independent project design and the development of problem solving skills.

**GEOL 450. KARST AND CAVE GEOLOGY. 5 Credits.****Pre-requisites:** GEOL 120, GEOL 121, GEOL 122, GEOL 311.

An advanced examination of karst geomorphology and cavern development, including cave mineralogy and hydrology.

**GEOL 455. GEOLOGY OF THE COLORADO PLATEAU. 4 Credits.****Notes:** course fee.**Pre-requisites:** GEOL 100 or permission of the instructor.

This course is a week-long field study of the rocks and landforms of the Colorado Plateau region, specifically in Arches and Canyonlands National Parks. Geologic evolution and structural geology of the region will be discussed and the ancient sedimentary environments of deposition will be emphasized. A field trip will be held during the week of spring break.

**GEOL 462. PRINCIPLES OF GEOCHEMISTRY. 5 Credits.****Pre-requisites:** GEOL 311, GEOL 312, GEOL 313 or permission of the instructor.

Abundance of elements in the solar system. Origin, chemical evolution, and composition of the earth; distribution and migration of chemical elements; differentiation history of the earth into crust, mantle and core. Origin and evolution of the hydrosphere and atmosphere. Chemical processes involved in weathering of rocks, chemical sedimentation and diagenesis.

**GEOL 466. ISOTOPIC TRACERS IN THE ENVIRONMENT. 4 Credits.****Pre-requisites:**  $\geq 2.0$  in CHEM 153.

This course focuses on the principles and application of radioactive, cosmogenic and stable isotopes as environmental tracers in soil, water, atmosphere and biological materials. Topics include the variations in isotopic composition of natural materials and the processes behind these variations (e.g., fractionation, radioactive decay, mineral dissolution).

**GEOL 470. HYDROGEOLOGY. 4 Credits.****Pre-requisites:** GEOL 120 or GEOL 121, MATH 142, or permission of the instructor.

Relationship between groundwater and geologic materials, emphasizing quantitative analysis and principles governing groundwater flow. Lecture and weekly lab.

**GEOL 475. ENGINEERING GEOLOGY OF SOILS: INTRODUCTION TO GEOTECHNICAL ENGINEERING. 4 Credits.****Pre-requisites:** GEOL 313, GEOL 320, GEOL 411 or GEOL 470 or permission of the instructor.

Introduction to theory and lab practice in geotechnical engineering. Content includes engineering properties of soil and rock; ASTM standard laboratory tests for particle size distribution, liquidity/plasticity, compaction, shear strength, permeability, consolidation, CBR, and others; as well as Unified Soil Classification System.

**GEOL 485. GEOTECHNICAL ENGINEERING OF SOILS AND FOUNDATIONS. 4 Credits.****Pre-requisites:** GEOL 475.

This course uses the principles of rock and soil mechanics to evaluate the stability of natural and engineered slopes, aid in design of earthworks and foundations, and plan the construction of dams, levees, aqueducts and other waterworks.

**GEOL 490. SENIOR CAPSTONE: GEOLOGY FIELD CAMP. 10 Credits.****Pre-requisites:** junior or senior standing and permission of the instructor.**Satisfies:** senior capstone university graduation requirement.

This course applies geologic principles to the solution of field problems in the Rocky Mountain fold and thrust belt. This four-week course of study includes geologic mapping, description of stratigraphic relationships, structural analysis, and GPS data collection. Maps, cross sections, and a formal report of the field study are required. Location of the camp is Dillon, Montana. Prerequisites: Junior or senior standing and permission of the instructor. Course fee is to be determined.

**GEOL 490A. SENIOR CAPSTONE: WATER AND THE WEST, WATER RESOURCE ENGINEERING IN ARID LANDS. 4 Credits.****Pre-requisites:** senior standing.

**Satisfies:** senior capstone university graduation requirement. This course focuses on the relationships between human activities and water resources in the largely arid western United States. Topics include tectonic and meteorological controls on the distribution and quantity of water, the history of conflict over scarce surface and groundwater resources, and construction dams, aqueducts, and other engineered structures to solve water scarcity problems. Case studies involve examples from the western United States and other countries including dry-land irrigation in Israel, dam building in Egypt and China, and fishery loss in Mexico.

**GEOL 490B. CAPSTONE: ENVIRONMENTAL GEOCHEMISTRY. 5 Credits.****Cross-listed:** ENVS 490.**Pre-requisites:** CHEM 152 or permission of instructor.**Satisfies:** senior capstone university graduation requirement.

Application of principles of geochemistry to environmental problems, including air and water pollution, water-rock interactions, weathering and soil formation. Origin, distribution and transport of inorganic contaminants in air, water, soils, sediments and plants. The behavior of trace elements in near surface environments.

**GEOL 491. SENIOR THESIS. 4 Credits.**

**Pre-requisites:** senior standing and permission of the instructor.

**Satisfies:** senior capstone university graduation requirement.

Directed research on a geological problem and organization of the results for oral and written presentation. End of program assessment will be required.

**GEOL 495. PRACTICUM IN GEOLOGY. 1-5 Credits.**

**Pre-requisites:** permission of the instructor, department chair and college dean.

Participation in supervised experiences involving acquisition of data or applications of knowledge to help solve geologic problems. Credits earned in this course are not applicable to degree requirements.

**GEOL 496. EXPERIMENTAL COURSE. 1-10 Credits.**

**GEOL 497. WORKSHOP, SHORT COURSE, CONFERENCE, SEMINAR. 1-5 Credits.**

**GEOL 498. SEMINARS. 1-5 Credits.**

**GEOL 499. DIRECTED STUDY. 1-5 Credits.**

**Notes:** may be repeated for a total of 15 credits if a different study is undertaken each time.

**Pre-requisites:** permission of the instructor, department chair and college dean.

Seminar in a selected field of geology to suit a student's field of interest.

**GEOL 596. EXPERIMENTAL COURSE. 1-5 Credits.**

**GEOL 599. INDEPENDENT STUDY. 1-5 Credits.**

**GEOL 600. THESIS. 2-10 Credits.**

**Pre-requisites:** permission of the instructor, department chair and college dean.

Thesis credit is essential to the geology program. Every student will be expected to produce a resume of his/her research in the form of a formal report or thesis.