

GEOLOGICAL SCIENCE

Coordinator: Elizabeth Safran

Earth is a laboratory in which grand experiments in physics, biology, and chemistry unfold and interact. Perched on the Pacific Rim, Lewis & Clark is nestled in the crucible itself, surrounded by spectacular evidence of the behavior and functioning of our home planet. From the blasted remains of Mount St. Helens to the flood-gouged Columbia River Basalts, the landscapes of the Pacific Northwest provoke us to ask ourselves, "Why did this happen? When?" Geological science addresses these questions. At Lewis & Clark, geology courses are designed to provide students with a basic understanding of major Earth processes while emphasizing environmental implications and regional issues.

Training in geological science enhances understanding of critical environmental problems, an invaluable asset for natural scientists, consultants, environmental lawyers, teachers, and all citizens. It also heightens appreciation for natural settings by illuminating the fascinating ways in which they evolve.

Faculty

Jessica M. Kleiss. Assistant professor of environmental studies. Oceanography, interface between the atmosphere and the ocean. PhD 2009 Scripps Institution of Oceanography, University of California at San Diego. BS 2000 Massachusetts Institute of Technology.

Elizabeth B. Safran. Associate professor of geological science, coordinator of the Geological Science Program. Geomorphology. PhD 1998 University of California at Santa Barbara. MSc 1993 University of Washington. BA 1989 Harvard University.

Courses

GEOL 114 The Origins of Life in the Universe

Faculty: Clifton, Loening, Safran, Tufte

Content: Processes of stellar evolution and planet formation that set the stage for life on Earth. Theories and evidence from diverse scientific disciplines on the origins of life and how physical and chemical aspects of the environment contributed to the emergence and transformations of life-forms. Scientific evaluation of the possibility of extraterrestrial life. Attention is devoted both to the processes and content of scientific discovery. Lecture, discussion, laboratory. Cross-listed with BIO 114, CHEM 114, and PHYS 114. Not applicable toward any major.

Prerequisites: QR 101 or equivalent.

Corequisites: GEOL 114L.

Usually offered: Alternate Years, spring semester.

Semester credits: 4.

GEOL 150 Environmental Geology

Faculty: Safran

Content: Introduction to major geological processes that impact human activity. Emphasis on regional issues. Plate tectonics, loci of seismic and volcanic activity, distribution of mountain ranges, and sediment sources. Floods, landslides, mudflows, tsunamis. Assessment of anthropogenic shifts in landscape functioning. Consequences of standard logging practices, dams, channel modification. Chronic versus catastrophic environmentally significant events. Lecture and laboratory. Weekly laboratory includes two required daylong field trips, held on weekends.

Prerequisites: QR 101.

Corequisites: GEOL 150L.

Usually offered: Alternate Years, fall semester.

Semester credits: 5.

GEOL 170 Climate Science

Faculty: Kleiss

Content: Introduction to the earth's climate from a physical, earth-systems perspective. Prehistoric and historic fluctuations in the earth's climate, the current climate system, and projections for future climate and climate impacts. Topics will include the radiative balance of the earth's atmosphere, the greenhouse effect, albedo, aerosols, clouds, climate feedbacks, ocean circulation, climate variability including El Niño and the Pacific decadal oscillation, the carbon cycle, paleoclimate proxy records, ocean acidification, and climate models. We will examine some responses to climate change, including geoengineering, adaptation, and mitigation. Weekly laboratory exercises with climate data observations and models (computer-based), and physical mechanisms (lab- and field-based). Lecture and lab.

Prerequisites: QR 101.

Corequisites: GEOL 170L.

Usually offered: Annually, fall semester.

Semester credits: 5.

GEOL 270 Issues in Oceanography

Faculty: Kleiss

Content: Exploration of the geological, biological, chemical, and physical dynamics of the global oceans, including implications of ocean policy. Topics include geology of the sea floor, coastal erosion, waves, tides, storm surge, sea-level rise, ocean circulation, composition of seawater, biogeochemical cycles and ocean acidity. The course will be organized around compelling issues in oceanography that may include deep-ocean mining, coastal development, tsunami hazards, ocean pollution, or others. Weekly labs provide hands-on experience with course concepts.

Prerequisites: GEOL 150, GEOL 170, CHEM 110, PHYS 141, or MATH 132.

Corequisites: GEOL 270L.

Restrictions: Sophomore standing required.

Usually offered: Alternate Years, spring semester.

Semester credits: 5.

GEOL 280 The Fundamentals of Hydrology

Faculty: Geological Science Faculty

Content: The behavior and movement of water in natural and modified environments. Major components of the hydrologic cycle, including precipitation, interception, evaporation, evapotranspiration, runoff, groundwater. Introduction to river channel behavior, flood hazard calculation, water supply issues. Quantification, through measurements and calculations, of water fluxes through various pathways, with allusion to planning applications. Lecture, laboratory, and one daylong field trip.

Prerequisites: GEOL 150 or GEOL 170.

Restrictions: Sophomore standing required.

Usually offered: Alternate Years, fall semester.

Semester credits: 5.

GEOL 340 Spatial Problems in Earth System Science

Faculty: Kleiss, Safran

Content: Recognition and interpretation of spatial patterns in Earth system science. Firsthand analysis of current research questions with a strong spatial component. Familiarization with the background of the research questions and their broader contexts. Hypothesis development about Earth processes from remote data (e.g., topographic data, satellite imagery), articulation of appropriate field tests for hypotheses. Development of analytical skills and use of spatial analysis tools, including geographic information systems software. Lecture and laboratory.

Prerequisites: GEOL 150, GEOL 170, or GEOL 270.

Restrictions: Sophomore standing required.

Usually offered: Alternate Years, spring semester.

Semester credits: 5.

GEOL 390 Oregon Field Geology West

Faculty: Geological Science Faculty

Content: Field study of geologic processes at an active continental margin in western Oregon. Field focus on the Pacific Coast to the Cascade Mountains. Examination of evidence for subduction zone earthquakes, docked seamounts, and active stratovolcanoes. Interpretation of the landscape using the theory of plate tectonics, recognition of regional geologic hazards, and representation of interpretations via cross-sectional diagrams, stratigraphic columns, geologic maps, and chronologies. Emphasis on development of introductory-level field skills and communication of understandings gained to general audiences.

Prerequisites: None.

Restrictions: Junior standing required.

Usually offered: Alternate Years, summer only.

Semester credits: 2.

GEOL 391 Oregon Field Geology East

Faculty: Geological Science Faculty

Content: Field study in north central and northeastern Oregon of Cenozoic paleostratigraphy and accretionary plate tectonics. Exploration of geologic formations exposed in the John Day River Basin and observation of fragments of ancient terranes to the east. Recognition of signatures of climate change in the fossil record and of evidence of past subduction and accretionary events on the western margin of North America. Attention to present-day geomorphological processes, such as landsliding and attendant influences on river channel processes. Emphasis on development of introductory-level field problem solving skills, including construction of stratigraphic columns, geologic maps, and geologic cross-sections. Focus on communicating understanding gained to general audiences.

Prerequisites: None.

Restrictions: Junior standing required.

Usually offered: Alternate Years, summer only.

Semester credits: 2.