Geology

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Geology deals with the physical, chemical, and biological study of the earth from its conception to the present day. A background in earth science not only increases the general student's appreciation of the world, but it also increases the depth of understanding of a science student's own field. Serious students of geology find opportunities in the environmental, petroleum, mining, teaching, engineering, and geophysics fields, and in hydrology, space science, and oceanography.

A student who enters Whitman without any prior college-level preparation in geology will have to complete 50 credits (36 in geology) to fulfill the requirements for the geology major. Courses completed in the geology major apply to the science and quantitative analysis (selected courses) distribution areas.

The Geology major: A minimum of 36 credits to include either Geology 110, 120, or 210, and 220, 320, 345, 346, 350, 360, 420, 470; a minimum of one credit of Geology 358, and a minimum of three credits of Geology 480; Chemistry 125, 126, 135; Mathematics 125; Physics 155.

It is strongly recommended that geology majors complete English 210 *Expository Writing*, and Rhetoric 110 *Fundamentals of Public Address*, no later than their junior year. For those planning to pursue graduate programs in the earth sciences, Mathematics 126 and Physics 156, and courses in Geographic Information Systems (GIS), computer science, statistics, physical chemistry, and biology are strongly recommended. Seniors completing a geology or geology combined major shall take a comprehensive senior assessment consisting of a four-hour written exam constructed by the geology faculty. In addition, Geology majors shall take an oral exam, which may be conducted in the field.

The Geology minor: Either Geology 110, 120, or 210, and a minimum of one credit in 358, plus additional work in geology for a minimum of 16 credits.

The Astronomy-Geology combined major: Astronomy 177, 178, 179, two credits of 490, one of the following: 310, 320, 330, 340, 350, 380, and at least two additional credits in courses numbered 310-392; either Geology 110, 120 or 210, and 220, 345, 350, 470, and a minimum of one credit in 358, two credits of 490, and two of the following: 310, 346, or 420; Physics 155, 156, Mathematics 125, 126, and Chemistry 125, 135 are also required. Mathematics 167, 225, 235, 236, 244, Chemistry 126, 136, and Physics 245, 246, 255, 256 are strongly recommended. In the final semester the student must pass a senior assessment consisting of a two-part comprehensive written examination and an approximately one-hour oral exam conducted jointly by astronomy and geology faculty.

The astronomy-geology combined major requires coursework in astronomy, geology, chemistry, physics, and mathematics. A student who enters Whitman with no prior college-level work in any of these areas would need to complete 20 credits in astronomy, 23 to 24 credits in geology, four credits in chemistry, eight credits in physics, and six credits in mathematics. Courses completed in this major apply to the science and quantitative analysis (selected courses) distribution areas.

The Biology-Geology combined major: Biology 111, 112, 205; 215 or 277; 310 (note: Biology 309 is recommended prior to 310), 488, and at least four additional credits in biology and/or BBMB courses numbered 200 or above; either Geology 110, 120, or 210, and 320, 345, 346, 350, 360, 470, and a minimum of one credit in 358; either three credits of Geology 480, 490 or 498 or three credits of Biology 489 and 490 (or 498); Chemistry 125, 126, 135, 136, or ,Chemistry 140; 245; Mathematics 125, 126. Two semesters of physics and field experience are strongly recommended. Courses completed in this major apply to the science and quantitative analysis (selected courses) distribution areas.

The Chemistry-Geology combined major: Either Chemistry 125, 126, 135, 136 (or 140), 240; Chemistry 345; either Geology 110,

120, or 210, and 220, 345, 346, 350, 460, 470, a minimum of one credit in 358; Mathematics 125, 126; Physics 155, 156. Courses completed in this major apply to the science and quantitative analysis (selected courses) distribution areas.

The Geology-Physics combined major: Physics 155, 156, 245, 246, 255, 256, either 325 or 347, and three credits from physics courses numbered from 300-480, or from BBMB 324 and BBMB 334; either Geology 110, 120, or 210, and 220, 310, 345, 346, 350, 420, 470 and a minimum of one credit in 358; Mathematics 225, 235, 236, and 244; Chemistry 125. Courses completed in this major apply to the science and quantitative analysis (selected courses) distribution areas.

The Geology-Environmental Studies combined major: The requirements are fully described in the Environmental Studies listing of the Catalog. Courses completed in this major apply to the science and quantitative analysis (selected courses) distribution areas.

After a geology or geology combined major is declared, no geology course may be taken P-D-F.

110 The Physical Earth
4, 4 Fall: Bader; Spring: Pogue

Physical geology including earth materials, the processes responsible for uplift and erosion, landforms, plate tectonics and the earth's interior. The laboratory will emphasize mineral and rock identification and the study of topographic and geologic maps. Three lectures and one three-hour laboratory per week; field trips. *Open* only to first-year students and sophomores; others by consent. Students who have received credit for Geology 120 or 210 may not receive credit for Geology 110.

120 Geologic History of the Pacific Northwest
4, x Spencer

An examination of the geologic history of the Pacific Northwest, including Washington, Idaho, Oregon, northern California, and southern British Columbia. Fundamental geologic processes that have shaped the Pacific Northwest will be examined through detailed study of different locales in the region. Lab will emphasize rocks and minerals, and topographic and geologic maps representing the areas examined in lecture. Three lectures and one three-hour lab per week, optional and required field trips. *Prerequisites*: none. *Open* to first and second year students, others by consent. *Offered* fall of odd-numbered years. Students who have taken Geology 110 or 210 for credit may not receive credit for Geology 120.

130 Weather and Climate
3, x Pogue

An introductory course in meteorology designed for non-science majors with an emphasis on the weather patterns and climate of the Pacific Northwest. Topics covered include Earth's heat budget, atmospheric stability, air masses, midlatitude cyclones, global circulation patterns and climates, and the origins of violent weather phenomenon.

158 Regional Geology
1-3, 1-3 Staff

The geology of part of the United States or elsewhere, with emphasis on geologic history, including petrology, stratigraphy, tectonics, and geomorphology. Lectures on the geology and other aspects of the area will precede field trips, which will take place during vacations and on long weekends. Geologic mapping may be involved. May be repeated for credit for different areas. *Prerequisite:* consent of instructor. *Fee:* variable. Graded credit/no credit.

158W Regional Geology: Northwestern Wyoming

x, 1 Carson

A seminar on and field trip to the Yellowstone caldera and vicinity. We will examine Archean plutonic and metamorphic rocks, Paleozoic and Mesozoic sedimentary rocks, and Cenozoic volcanic rocks. Emphasis on glacial, volcanic, fluvial, and periglacial landforms. Field trip in late May/early June. *Co-requisite:* Environmental Studies 260W. *Fee.*

180 Oceanography
3; not offered 2007-08

An introduction to the geological, physical, and chemical characteristics of the world ocean. Subjects include: plate tectonics, bathymetry, sea floor sedimentation, ocean currents and weather, waves, tides, and coastal processes. Three lectures per week. Field trip required. *Not open* to seniors.

210 Environmental Geology
x, 4 Nicolaysen

Geologic aspects of the environment: human effects upon and interaction with such phenomena as landslides, erosion and deposition of sediments, surface waters, groundwater, volcanism, earthquakes, and permafrost. Environmental effects of land use, waste disposal, and mineral and petroleum usage as they relate to geologic processes and materials. Three lectures and one three-hour lab per week; field trips. Students who have received credit for Geology 110 or 120 may not receive credit for Geology 210. Open to first- and second-year students; others by consent.

220 History of the Earth
x, 4 Bader

The physical and biological events during the geologic past. Special consideration given to plate tectonics and fossils in the lectures, and to fossils

and geologic maps in the laboratories. Three lectures and one three-hour laboratory per week; required and optional field trips. *Prerequisite*: Geology 110, 120, or 210 or consent of instructor.

240 Volcanoes
3; not offered 2007-08
An investigation of volcanoes including morphology and composition, as well as eruption processes, periodicity and hazards. This course emphasizes the plate tectonic context for volcanism and focuses on regions such as the Cascades, the Aleutians, Hawaii, mid-ocean ridges, Latin America, or Africa. Research paper and field trip required. *Prerequisite*: Geology 110, 120 or 210 or consent of instructor. Fee: foreign field trips only. Offered in alternate years.

310 Geophysics
3; not offered 2007-08
The physical principles and instrumentation involved in studying the earth. Special attention will be given to seismic, magnetic, gravitational and thermal properties and methods. Term paper and class presentations. *Prerequisites*: Geology 110, 120, or 210; Physics 155, 156; or consent of instructor. *Offered* in alternate years.

320 Sedimentology and Stratigraphy
x, 4 **Spencer**
Sedimentary and volcaniclastic rocks and the processes by which they were formed: description, classification, origin, and interpretation of sediments. The interpretation of rock strata in terms of environment and geologic history. Text, professional articles, discussions, research paper, field trip. Three lectures and one three-hour laboratory per week. *Prerequisite*: Geology 220 or consent of instructor.

345 Mineralogy
4, x **Nicolaysen**
This intermediate-level course promotes mineral identification skills and an understanding of conditions for mineral growth and weathering. Activities emphasize elementary crystallography, descriptive morphology, chemistry, hand sample identification, and genesis of minerals commonly found at Earth's surface. Labs will include phase experiments, optical microscopy, and X-ray techniques. Two three-hour classes per week. *Prerequisites*: Geology 110, 120, or 210; Chemistry 125 or 140. Open only to juniors and seniors; others by permission of instructor.

346 Igneous and Metamorphic Petrology
x, 4 **Nicolaysen**
Identification, classification and interpretation of igneous and metamorphic rocks. Development of the chemical and physical background necessary to study rocks as chemical systems at equilibrium. Emphasis on using observed features, chemistry, and experimental results to interpret rock origin and evolution. Laboratories will be devoted to the identification and interpretation of rock hand specimens affected by high-temperature environments and processes. Three lectures and one three-hour laboratory per week. *Prerequisite*: Geology 345.

350 Geomorphology
4, x **Carson**
Description, origin, development, and classification of landforms. Relationships of soils, surficial materials, and landforms to rocks, structures, climate, processes, and time. Maps and aerial photographs of landscapes produced in tectonic, volcanic, fluvial, glacial, periglacial, coastal, karst, and eolian environments. Exercises on photo-geology. Lectures, discussions, laboratories, and field trips. *Prerequisite*: consent of instructor. Distribution area: science and quantitative analysis.

358 Field Geology of the Northwest
1, 1 **Staff**
The geology of part of the Pacific Northwest, with emphasis on geologic history including petrology, stratigraphy, tectonics, and mineralogy. Geologic mapping, paleontology, and mineralogy may also be involved. Most field trips will take place on long weekends. Each student will be required to write a report. May be repeated for credit for different areas. *Required of all geology and geology combined minors*. *Prerequisite*: consent of instructor. *Fee*: variable.

360 Paleontology
3; not offered 2007-08
A seminar course focused on discussion of various topics of current interest in paleontology and their applications. Content will vary from year-to-year, but will include such topics as Pacific Northwest biostratigraphy; analysis of significant extinction events in earth history; controversies in paleontology; analysis of the significance of important fossil localities such as the Burgess Shale. Required readings will be gathered from professional journals, scholarly books, and relevant Web sites. Laboratories will demonstrate practical applications of topics discussed. Student-led discussions, short writing assignments, field trips, and a major research paper. *Prerequisite*: Geology 220 or consent of instructor.

390 Independent Study
1-3, 1-3 **Staff**
A reading or research project in an area of the earth sciences not covered in regular courses and of particular interest to a student. Maximum of six credits. *Prerequisite*: consent of instructor.

410 Problems in Earth Science
1-4
Specific problems in the geological sciences will be considered. Textbook and/or professional articles, discussions, paper, possible field trips. May be repeated for credit with different topics. *Prerequisite*: consent of instructor.

410A Introduction to Geographic Information Systems
3, x **Bader**

Concepts and methods of the geographic information systems (GIS) approach to managing and analyzing spatial information. GIS has become the primary way in which spatial information is managed and analyzed in a wide range of fields including the physical sciences, social sciences, business, and government. Lectures, readings, and hands-on exercises explore different approaches used and the wide array of applications of GIS. Guest speakers will discuss professional experiences with GIS. The final third of the course is dedicated to individual projects. One lecture and one three-hour lab meeting per week. *Prerequisites:* Geology 220 or consent of instructor.

420 Structural Geology
4, x **Pogue**

The description and analysis of intermediate- to large-scale rock structures. Topics include the analysis and graphical representation of stress and strain in rocks, deformation mechanisms and fabric development, the geometry and mechanics of folding and faulting, and structures related to intrusive bodies. Geologic map interpretation and cross-section construction are used to analyze the structural geology of selected regions. Three lectures and one three-hour lab per week; field trip(s). *Prerequisite:* either Geology 220, 320, or 350.

430 Cordilleran Tectonics
x, 3 **Pogue**

An in-depth study of the tectonic events that shaped the western United States. A review of plate tectonic theory emphasizing plate interactions and orogenesis and the tectonic evolution of the western U.S. beginning with the amalgamation of Precambrian basement and ending with the development of the San Andreas transform and Cascadia subduction systems. Each week two class periods are devoted to lectures, discussions and student presentations. The third class period is reserved for practical exercises, particularly geologic map interpretation. There is one required weekend field trip. *Prerequisite*: Geology 420 or consent of instructor. *Offered* in alternate years.

450 Late Cenozoic Geology and Climate Change
3; not offered 2007-08

The geology of the last few million years of earth history, including glaciology, Pleistocene stratigraphy, glacial and periglacial geomorphology, and changes in flora and fauna. What are the causes of ice ages and the alternating glaciations and interglaciations within them? What are the roles of nature and humans in the current global climate change? Research paper and field trip. *Prerequisites:* Geology 350 or consent of instructor. *Offered* in alternate years.

460 Geochemistry
3; not offered 2007-08

A broad spectrum of problems that describe earth systems and processes. Use will be made of the principles of equilibrium, thermodynamics, kinetics, oxidation-reduction, and solution chemistry to assess the origin of the earth and the various chemical systems that operate at the surface and at depth. Among the processes studied will be weathering and soils, mineral deposits, water chemistry, environmental geochemistry, and various chemical cycles. *Prerequisites*: Geology 110, 120, or 210, Chemistry 126 or 140, and consent of instructor. *Offered* in alternate years.

470 Senior Seminar
x, 1 **Pogue**

Seminar on various topics in the earth sciences. Topics to be chosen by the instructors, but are likely to include discussions of the history of geology, controversial principles of geology (such as uniformitarianism), and the ethics of the profession of geology. Students are expected to complete assigned readings and make an oral presentation. *Required of all senior geology majors and combined majors.*

480 Field Mapping
1-4; not offered 2007-08

An advanced course in geological field methods. In a typical course students make maps in stratified and crystalline terranes, with rocks in varying degrees of deformation. Maximum of nine credits. *Prerequisites*: Geology 320, 345, 346, 420, and consent of department. *Note:* Geology 480 is not regularly offered by Whitman College. Students wishing to complete major requirements with a field experience should plan to complete an approved summer field course offered by another collegiate institution.

490 Senior Research
1-3, 1-3 **Staff**

A project involving field and laboratory research in the geological sciences. Written and oral reports are required during the senior year. Maximum of six credits. *Prerequisite*: consent of instructor.

498 Honors Thesis
3, 3 **Staff**

Designed to further independent research or projects leading to the preparation of an undergraduate thesis. *Required of* and limited to senior honors candidates in geology. *Prerequisite*: admission to honors candidacy.