

Geology

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Geol 101 Physical Geology (4 cr)

May be used as core credit in J-3-b or J-3-d. The earth, its composition, structure, and natural processes. Three lec and 2 hrs of lab a wk; one 1-day field trip.

Geol 102 Historical Geology (4 cr)

May be used as core credit in J-3-b or J-3-d. Evolution of the physical earth, plants, and animals; techniques used in interpretation of geologic history. Three lec and 2 hrs of lab a wk; one 1-day field trip.

Geol 111 Physical Geology for Science Majors (4 cr)

Introductory course in earth science for geology and other science majors. Three lec and one 2-hr lab a wk; two 1-day field trips.

Geol 203 (s) Workshop (cr arr)

Geol 204 (s) Special Topics (cr arr)

Geol 212 Principles of Paleontology (4 cr)

Studies of morphology, classification of fossil groups, and utility of fossils in interpreting depositional environments and ages of sedimentary rocks. Three lec and one 2-hr lab a wk; one 1- to 2-day field trip. Recommended Preparation: Geol 102.

Geol J236/J336 Processes in Glacial and Periglacial Environments (3-6 cr)

Quantitative treatment using examples from regions of existing glaciers and permafrost. Two lec and one 3-hr lab a wk or (for 6 cr) 6-wk intensive field session in Alaska and Canada.

Geol 249 Mineralogy and Optical Mineralogy (4 cr)

Principles of crystallography, crystal chemistry, and crystal structure; mineral identification; principles of optical mineralogy and use of the polarized light microscope. Three lec and one 2-hr lab a wk; two 1-day field trips.

Prereq: Geol 111 or Geol 101, and Chem 111

Geol WS285 Introduction to Astrobiology (3 cr) WSU Geol 285

Geol 290 Field Geology I (3 cr)

Introduction to field mapping and field techniques; interpretation of sedimentary sequences; introduction to tectonic structures; preparation of reports based on field observations and interpretations. Accident and health insurance required. Three week, off-campus field course. (Summer only)

Prereq: Geol 101 or 111, and 102

Geol 299 (s) Directed Study (cr arr)

Geol 308 Ground Water Geology (3 cr)

Geologic factors controlling the infiltration, accumulation and movement of ground water in igneous, metamorphic and sedimentary rock environments. (Spring only)

Prereq: Geol 101 or 111, and Math 130 or 143

Geol 309 Ground Water Hydrology (3 cr)

Occurrence, movement, and properties of subsurface water; intro to ground water geology and hydrology.

Prereq: Geol 101 or 111, and Math 130 or 143

Geol 323 Geology of the Pacific Northwest (3 cr)

Description and development of the distribution of rocks and mineral deposits in the Pacific Northwest. One 2-day field trip.

Prereq: Geol 101 or Geog 100.

Geol 324 Principles of Stratigraphy and Sedimentation (4 cr)

Description and identification of sedimentary rocks; organization and correlation of layered rocks in all scales, including factors controlling their distribution; cycles in sedimentation and stratigraphy; sequence stratigraphy and basin dynamics. Two lec and two 2-hr labs a wk; two 1-day field trips; optional 7-day field trip.

Prereq: Geol 102

Geol 326 Igneous and Metamorphic Petrology (4 cr)

Hard rock petrology plus megascopic and microscopic petrography of igneous and metamorphic rocks. Two lec and two 2-hr labs a wk; two 1-day or one 2-day field trips.

Prereq: Geol 249

Geol 335 Geomorphology (3 cr)

Classification, recognition, origin, and significance of land forms; land form analysis in interpretation of geologic structure and history. One 2-day field trip.

Prereq: Geol 101 or 102 or 111, or Geog 100, or Permission

Geol 336 Processes in Glacial and Periglacial Environments (3-6 cr)

See Geol J236/J336.

Geol ID344 Earthquakes and Seismic Hazards (3 cr) WSU Geol 444

The geology of earthquakes including the cause of fault rupture, seismic waves, focal mechanisms, and earthquakes associated with all fault types in a variety of tectonic settings; methods of identifying paleo-earthquakes in the geologic record, and the assessment of seismic hazard and risk in active fault environments. One 3-day field trip.

Prereq: Geol 101 or 111

Geol 345 Structural Geology (4 cr)

Investigation of deformed rocks; mechanics of brittle and continuum failure, stress and strain relations, characterization, description, classification of folded and fractured rocks. Three hours of lecture and one 2-hr lab a wk; two 1-day field trips (offered on a year by year basis). (Spring only)

Prereq: One semester high-school trigonometry or Math 144, Geol 101 or 111, and Phys 111 or 211

Geol 360 Geologic Hazards (3 cr)

Survey of natural geologic hazards, their controlling factors, recognition of hazard potential; emphasis on flash floods, earthquakes, landslides, volcanic hazards, subsidence. Three 1-day field trips.

Prereq: Geol 101 or 111

Geol 361 Geology and the Environment (3 cr)

Environmental consequences of development of geologic resources; including issues of waste disposal, pollution and human health; natural hazards and their impact on humans and the environment. Two 1-day field trips.

Prereq: Geol 101 or 111

Geol 375 Geology of National Parks (3 cr)

Primarily for non-geology majors who want to acquire a better knowledge of geologic concepts and processes through study of geology of national parks. One 6-day field trip.

Prereq: Geol 101 or 102 or 111 or Geog 100

Geol 390 Petroleum Geology (2 cr)

Petroleum technology for geologists. (Fall only)

Prereq: Geol 101 or Geol 111

Geol 400 (s) Seminar (1 cr, max arr)

Participation in departmental colloquium.

Geol ID-J407/ID-J507 Basin Analysis (3 cr) WSU Geol 406/506

Characteristics of sedimentary basins and methods for studying them. For 500-level credit an additional research project is required. One 2-day field trip. (Spring only)

Prereq: Geol 324

Geol 410 Techniques of Ground Water Study (3 cr)

Collection and analysis of field data for reconnaissance ground water studies. Two weekend field trips.

Prereq or Coreq: Geol 309

Geol J414/J514 Geologic Hazards Field Workshop (2 cr, max arr)

Field study of natural geologic hazards. Primarily for non-geology majors and/or in-service K-12 educators. Held in July at a different off-campus location each year. For 500-level credit an additional research project is required. (Summer only)

Geol 416 Advanced Field Methods in Geosciences (3 cr)

Application of field techniques to the recognition and solution of problems of applied and research interest; design and implementation of integrated geological, geochemical, and geophysical programs. Accident and health insurance required. Three week field trip.

Prereq: Permission

Geol 417 Advanced Paleontology (3 cr)

Fossil assemblage analyses and report writing; marine faunal assemblage 1st half semester; nonmarine floral assemblage 2nd half semester. Three 2-hr labs a wk; one 1-day field trip.

Prereq: Geol 212 or Permission

Geol ID-J418/ID-J518 Geomicrobiology (3 cr) WSU Geol 418/518

Same as Hydr J418/J518. The role of microorganisms in the formation and dissolution of rocks and minerals; microbial processes in ground and surface water environments, extreme environments and the deep subsurface; early life on Earth and the possibility of life on other planetary bodies. Two additional research assignments and an additional question on two exams required for graduate credit.

Geol 422 Principles of Geophysics (3 cr)

Outline of geophysical methods for geological investigations. One 1-day field trip.

Geol 423 Principles of Geochemistry (3 cr)

Physiochemical principles applied to geologic processes. Topics covered include atmospheric geochemistry, environmental geochemistry, aqueous geochemistry, crystal chemistry, radiogenic and stable isotopes. Two lec and one 2-hr lab a wk.

Prereq: Geol 101 or 111, and Chem 112

Geol J432/ID-J532 Geologic Development of North America (3 cr) WSU Geol 529

Tectonic, magmatic, and sedimentary sequence studies of North American continent through time; concepts of metal and petroleum enrichment related to time and geological processes. Additional questions on two exams and written report of field trip reqd for grad cr. One 7-day field trip.

Geol J441/ID&WS-J541 (s) Structural Analysis (3 cr, max arr) WSU Geol 541

Structural analysis of complexly deformed rocks in orogenic belts. Independent research projects will be required for graduate credit. Field trip required.

Geol J448/ID&WS-J548 Tectonics (3 cr) WSU Geol 540

Fundamentals of global plate tectonics, evolution of ocean basins, and the development of continental orogenic belts; focus on theoretical aspects of global tectonics, the salient physical constraints leading to the paradigm, and practical application of the model to regional geological problems. Graduate credit requires additional work including independent research, presentation of the research results in a class presentation, writing a research paper, and answering an additional question in examinations. Two lec and 2 hrs of lab a wk; one or two 1- to 2-day field trips.

Prereq: Geol 345 or Permission

Geol ID&WS-J459/ID&WS-J559 Geodynamics (3 cr) WSU Geol 559

Dynamics, movement, and deformation of the earth's lithosphere, asthenosphere, and mantle; emphasis on deformation processes and constraints derived from investigation of active tectonics using geophysics, seismology, geodesy, and structural geology. Graduate credit requires additional paper and examination questions. (Alt/yrs)

Prereq: Geol 345

Geol J464/J564 The Geochemistry of Natural Waters (3 cr)

Same as Hydr J464/J564. Basic principles of aqueous geochemistry applied to natural waters (ground waters, lake and river waters, seawater), presented at an intermediate level; carbonate equilibria and alkalinity, solubility of minerals, sorption processes and surface reactions, redox reactions and Eh-pH diagrams, organic geochemistry, etc. For graduate credit, students are required to prepare two in-depth term papers and demonstrate through exam work and papers a more in-depth understanding of the material. One compressed video and one web-based lecture a wk. Recommended preparation: Geol 423.

Prereq: Chem 111-112

Geol J467/ID-J567 Volcanology (3 cr) WSU Geol 567

Eruption mechanisms, volcanic processes and landforms, and volcanic deposits. Additional projects/assignments reqd for grad cr. Two lec and one 2-hr lab a wk; seven days of field trips.

Geol ID-J476/ID-J576 Mineral & Petroleum Exploration Methods (3 cr)

Characteristics of mineral and petroleum resources and design of exploration programs through integration and evaluation of geological, geochemical, and geophysical exploration techniques in a project-based 3-D digital environment. Graduate credit requires an additional independent project and demonstration through papers of a more in-depth understanding of the material. Two 2-5 day field trips.

Prereq: Geol 249 and 345

Geol ID&WS490 Field Geology II (3 cr) WSU Geol 308

Advanced field problems and methods; interpretation of field data, preparation of reports based on field observations and interpretations. Accident and health insurance required. Three week, off-campus. (Summer only)

Prereq: Geol 290 and 345

Geol 497 (s) Practicum in Tutoring (1 cr, max 2)

Tutorial services performed by advanced students under faculty supervision. Graded P/F.

Prereq: Permission of department

Geol 498 Senior Thesis (1-4 cr, max 4)

Completion of original research and report. Course is taken over two semesters; first semester is graded IP until completion of second semester.

Prereq: Senior standing and Permission

Geol 499 (s) Directed Study (cr arr)

Geol 500 Master's Research and Thesis (cr arr)

Geol 501 (s) Seminar (1 cr, max arr)

Participation in departmental colloquium.

Geol 502 (s) Directed Study (cr arr)

Geol 503 (s) Workshop (cr arr)

Geol ID507 Basin Analysis (3 cr) WSU 506

See Geol J407/J507.

Geol 514 Geologic Hazards Field Workshop (2 cr, max arr)

See Geol J414/J514.

Geol ID517 Pre-Quaternary Paleoclimatology (1-3 cr) WSU Geol 516

This course will cover the sedimentological, paleontological, geochemical, and numerical methods used to study climate in the pre-Quaternary Phanerozoic geologic record. Assignments will include written and oral presentations, and the choice of projects will be partially tailored to the students' scholarly needs. Students may elect to take this for 1-3 credits, with assignments made accordingly. (Alt/yrs)

Geol ID518 Geomicrobiology (3 cr)

See Geol ID-J418/ID-J518.

Geol WS520 Advanced Topics in Sedimentary Rocks (3 cr) WSU Geol 520

(Alt/yrs)

Prereq: Geol 324

Geol WS523 Advanced Topics in Stratigraphy (3 cr) WSU Geol 523

Geol WS528 Clastic Depositional Systems (3 cr) WSU Geol 521

(Alt/yrs)

Geol WS529 Carbonate Depositional Systems (3 cr) WSU Geol 525

(Alt/yrs)

Geol ID532 Geologic Development of North America (3 cr)

See Geol J432/J532.

Geol 536 Advanced Field Glaciology (6 cr)

Same as Geog 516. Advanced quantitative treatment of glaciological problems carried out on selected glaciers of the Juneau Icefield, Alaska, or an alternative area in the Rocky Mountains or Cascades. (Intensive 7-wk summer field session)

Geol ID&WS538 Orogenic Systems I (3 cr) WSU Geol 538

Field-based course examines tectonic processes active in orogenic systems. Course work includes 1.5 hr lec/wk, one 2-week field trip, final research paper and presentation.

Prereq: Geol 345

Geol ID&WS539 Orogenic Systems II (3 cr) WSU Geol 539

Field-based course examines tectonic processes active in orogenic systems. Course work includes 1.5 hr lec/wk, one 2-week field trip, final research paper and presentation.

Prereq: Geol 345

Geol ID&WS541 Structural Analysis (3 cr) WSU Geol 541

See Geol J441/J541.

Geol ID542 Geomechanics (3 cr)

Concepts of linear elastic fracture mechanics as applied to the classification, origin and evolution of all types of rock fractures; continuum theory in rock mechanics; rock strength and failure criteria; stress tensors; elastic theory. Two 1-day field trips.

Prereq: Phys 111 or 211, Math 175

Geol ID546 Fault Mechanics (3 cr)

Examination of fundamental concepts of fault mechanics, including brittle failure, rock friction, fluid pressure effects, and variable rheological behaviors; examination of internal fault architectures to distinguish fault zone styles; stress, strain, and displacement

fields addressed from a theoretical perspective and the application of geodetic measurement techniques and secondary structure analyses; emphasis on interpretation of fault slip distributions and relationship to rock properties, fault shape, and mechanical interaction in echelon fault systems; such insights placed in context of 3-D fault systems geometric evolution as well as earthquake behavior and seismic hazard recognition. One weekend field trip.

Prereq: Geol 345

Geol ID&WS548 Tectonics (3 cr)

See Geol J448/J548.

Geol WS550 Advanced Mineralogy (3 cr) WSU Geol 550

(Alt/yr)

Geol WS552 X-ray Analysis in Geology (3 cr) WSU Geol 552

Geol ID554 Physical Petrology (3 cr) WSU Geol 554

Applications of continuum mechanics and fluid dynamics to generation, rise, storage, and eruption of magmas.

Geol 555 Thermochemistry of Geological Processes (3 cr)

Thermodynamic principles applied to geological problems; specific topics include real gases at high P and T, estimation and measurement of thermodynamic data, solid solution modeling, geobarometry, geothermometry, thermodynamics of magmas. (Alt/yr)

Prereq: Chem 302 or Permission

Geol ID557 High-Temperature Aqueous Geochemistry I (3 cr) WSU Geol 557

Application of solution chemistry to hydrothermal solutions; Eh-pH, $\log f(O_2)$ - pH, activity - activity diagrams; estimation techniques; water structure; metal complexation; solubility, transport and deposition; equilibrium speciation; geothermal fields; experimental methods; activity coefficients. Two lec and three hrs of lab a wk; one 4-day field trip. (Alt/yr)

Prereq: Chem 302 and Geol 555 or Permission

Geol ID558 High-Temperature Aqueous Geochemistry II (3 cr) WSU Geol 558

Expands on topics covered in Geol J457/J557 through seminar format. Selected readings from primary literature followed by presentations and discussions in class. (Alt/yr)

Prereq: Chem 302, Geol 555 and J557, or Permission

Geol ID&WS559 Geodynamics (3 cr)

See Geol J459/J559.

Geol WS560 Advanced Igneous Petrology (3 cr) WSU Geol 560

Geol 564 The Geochemistry of Natural Waters (3 cr)

See Geol J464/J564.

Geol ID567 Volcanology (3 cr)

See Geol J467/J567.

Geol ID576 Mineral & Petroleum Exploration Methods (3 cr)

See Geol J476/J576.

Geol 578 Advanced Geochemistry of Natural Waters (3 cr)

Same as Hydr 578. Detailed application of aqueous geochemistry to natural waters at an advanced level; advanced treatment of subjects introduced in Geol J464/J564, especially carbonate equilibria, alkalinity, mineral solubility, and aqueous complexation. Two 75 min lec a wk.

Prereq: Geol J464/J564 or Permission

Geol 579 Advanced Geochemistry of Natural Waters Laboratory (1 cr)

Must be taken concurrently with Geol 578. Lab will stress familiarity with analytical techniques for natural waters including those adaptable for field use, computer modeling of aqueous equilibria. Three hrs of lab a wk; one 2-day field trip.

Prereq: Geol J464/J564 or Permission

Coreq: Geol 578

Geol ID&WS583 Radiogenic Isotopes and Geochronology (3 cr) WSU Geol 583

Nuclear structure, radioactive decay, isochrons, the age of meteorites, the earth, and the timing of various major differentiation events, applications of radiometric (including cosmogenic) dating in a wide range of fields, and the use of radiogenic isotopes as tracers of multi-reservoir evolution.

Geol WS586 Methods in Radiogenic Isotope Geochemistry (3 cr) WSU Geol 588

Geol 587 Instrumental Techniques in Geochemistry (3 cr)

Modern instrumentation for geochemical analyses including: ion chromatography, gas chromatography, FTIR spectroscopy, ICP-AES, ICP-MS, atomic absorption, UV-visible absorption spectrophotometry, geological sampling preparation. Students must carry out a term project involving the design, testing, and use of analytical protocol using one or more of the instruments covered in class; this project will be reported as a term paper worth a significant proportion of the grade and must reflect an in-depth understanding of the subject material. Two lec and one 3-hr lab a wk. (Alt/yrs)

Prereq: Permission

Geol WS592 Advanced Topics in Structural Geology (1-4 cr, max 6) WSU Geol 592

Geol ID593 (s) Advanced Topics in Geomechanics (1-4 cr, max arr)

Advanced treatment of current topics in geomechanics and related disciplines such as structural geology, hydrogeology, engineering geology, and petroleum engineering.

Geol 597 (s) Practicum (cr arr)

Geol 598 (s) Internship (cr arr)

Geol 599 (s) Non-thesis Master's Research (cr arr)

Research not directly related to a thesis or dissertation.

Prereq: Permission

Geol 600 Doctoral Research and Dissertation (cr arr)