DEPARTMENT OF GEO SCIENCES

Office in Natural Resources Building, Room 322
(970) 491-7826
warnercnr.colostate.edu/geosciences-home (http://warnercnr.colostate.edu/geosciences-home)

Richard Aster, Department Head

Undergraduate Majors
• Major in Geology
  • Environmental Geology Concentration
  • Geology Concentration
  • Geophysics Concentration
  • Hydrogeology Concentration

Minors
• Minor in Geology

Graduate
Graduate Programs in Geosciences
The department offers graduate programs leading to Master of Science in Geosciences and Doctor of Philosophy in Earth Sciences degrees. Students interested in graduate work should refer to the Graduate and Professional Bulletin and the Department of Geosciences. (http://warnercnr.colostate.edu/geosciences-home)

Master Programs
• Master of Science in Geosciences, Plan A*
• Master of Science in Geosciences, Plan B*

Ph.D.
• Ph.D. in Earth Sciences
• Ph.D. in Earth Sciences, Geosciences Specialization
• Ph.D. in Earth Sciences, Watershed Science Specialization

* Please see department for program of study.

Courses
Geosciences (GEOL)

GEOL 110 Introduction to Geology--Parks and Monuments Credits: 3 (3-0-0)
Course Description: Credit allowed for only one of the following GEOL 110, GEOL 120, GEOL 122, GEOL 124, GEOL 150. Offered only online.
Prerequisite: None.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: No.
Additional Information: Biological & Physical Sciences 3A, Natural & Physical Sciences w/o lab (GT-SC).

GEOL 120 Exploring Earth: Physical Geology (GT-SC2) Credits: 3 (3-0-0)
Course Description: Develops scientific understanding through introduction to earth processes, materials, resources, and hazards.
Prerequisite: None.
Registration Information: Credit allowed for only one of the following: GEOL 120, GEOL 122, GEOL 124, GEOL 150.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: No.
Additional Information: Biological & Physical Sciences 3A, Natural & Physical Sciences w/o lab (GT-SC2).

GEOL 121 Introductory Geology Laboratory (GT-SC1) Credit: 1 (0-2-0)
Course Description: Laboratory applications of introductory geology.
Prerequisite: GEOL 120, may be taken concurrently or GEOL 122, may be taken concurrently or GEOL 124, may be taken concurrently.
Registration Information: Credit not allowed for both GEOL 121 and GEOL 150.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: Yes.
Additional Information: Biological & Physical Sciences 3A, Natural & Physical Sciences w/ lab (GT-SC1).

GEOL 122 The Blue Planet: Geology of Our Environment (GT-SC2) Credits: 3 (3-0-0)
Course Description: Develops scientific understanding through introduction to geological processes, natural hazards, earth resources, and their impacts on society.
Prerequisite: None.
Registration Information: Credit allowed for only one of the following: GEOL 120, GEOL 122, GEOL 124, GEOL 150.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: No.
Additional Information: Biological & Physical Sciences 3A, Natural & Physical Sciences w/o lab (GT-SC2).

GEOL 124 Geology of Natural Resources (GT-SC2) Credits: 3 (3-0-0)
Course Description: Develops scientific understanding through introduction to the origin, use and environmental impact of geological resources extracted from the Earth.
Prerequisite: None.
Registration Information: Credit allowed for only one of the following: GEOL 120, GEOL 122, GEOL 124, GEOL 150.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.
Additional Information: Biological & Physical Sciences 3A, Natural & Physical Sciences w/o lab (GT-SC2).
GEOL 150 Physical Geology for Scientists and Engineers Credits: 4 (3-3-0)
Course Description: Earth materials, structures, and surface processes. Geologic analysis using field data, topographic and geologic maps, and aerial photos.
Prerequisite: None.
Registration Information: Must register for lecture and laboratory. Credit allowed for only one of the following: GEOL 120, GEOL 122, GEOL 124, GEOL 150. Credit not allowed for both GEOL 150 and GEOL 121. Required field trips.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: Yes.

GEOL 154 Historical and Analytical Geology Credits: 4 (3-3-0)
Course Description: Physical and biological history of Earth with introduction to laboratory, computer, and field techniques.
Prerequisite: GEOL 120 or GEOL 122 or GEOL 124 or GEOL 150.
Registration Information: Must register for lecture and laboratory. Required field trips.
Term Offered: Spring.
Grade Modes: S/U within Student Option, Trad within Student Option.
Special Course Fee: Yes.

GEOL 232 Mineralogy Credits: 3 (2-3-0)
Course Description: Crystal structures, crystal chemistry, rock-forming and economically important minerals, crystal growth and defects, physical properties of minerals.
Prerequisite: (CHEM 111, may be taken concurrently) and (GEOL 120 or GEOL 122 or GEOL 124 or GEOL 150) and (MATH 124 or MATH 155 or MATH 160 or MATH 161 or MATH 255).
Registration Information: Must register for lecture and laboratory. Required field trips.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: Yes.

GEOL 250 The Solid Earth Credits: 3 (2-2-0)
Course Description: Structure, flow, and composition of the deep Earth; introduction to geophysics; tests of plate tectonic theory.
Prerequisite: (GEOL 120 or GEOL 122 or GEOL 124 or GEOL 150) and (MATH 124) and (MATH 125 or MATH 155 or MATH 160 or MATH 161 or MATH 255).
Registration Information: Must register for lecture and laboratory.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: Yes.

GEOL 332 Optical Mineralogy Credits: 2 (1-2-0)
Course Description: Fundamental light optics in crystalline substances; optical indicatrix; isotropic, uniaxial, and biaxial substances; common minerals in thin section.
Prerequisite: GEOL 232, may be taken concurrently.
Registration Information: Must register for lecture and laboratory.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: Yes.

GEOL 342 Paleontology Credits: 3 (2-3-0)
Course Description: Description of invertebrates, vertebrates, and plants and their distribution in earth history.
Prerequisite: GEOL 154.
Registration Information: Must register for lecture and laboratory.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: Yes.

GEOL 344 Stratigraphy and Sedimentology Credits: 4 (3-3-0)
Course Description: Description, genesis, correlation, and age of sediments, sedimentary rocks and layered rock sequences.
Prerequisite: GEOL 154 with a minimum grade of C.
Registration Information: Must register for lecture and laboratory. Required field trips.
Term Offered: Fall.
Grade Modes: S/U within Student Option, Trad within Student Option.
Special Course Fee: Yes.

GEOL 346 Igneous and Metamorphic Petrology Credits: 4 (3-3-0)
Course Description: Identification, classification, geochemistry, petrogenesis of igneous and metamorphic rocks; textural interpretation of hand samples and thin sections.
Prerequisite: GEOL 232 with a minimum grade of C.
Registration Information: Must register for lecture and laboratory. Required field trips.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: Yes.

GEOL 364 Sedimentary Petrology and Geochemistry Credits: 4 (3-3-0)
Course Description: Composition, identification, and classification of sedimentary rocks; geochemical processes affecting sedimentary rocks and surficial deposits.
Prerequisite: CHEM 113 and GEOL 154 and GEOL 364.
Registration Information: Must register for lecture and laboratory.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: Yes.

GEOL 372 Structural Geology Credits: 4 (3-3-0)
Course Description: Stress and strain in rocks, geometry of deformed rocks, and tectonic principles.
Prerequisite: (GEOL 154 and PH 141, may be taken concurrently) and (MATH 125 or MATH 155 or MATH 160 or MATH 161 or MATH 255).
Registration Information: Must register for lecture and laboratory. Required field trips.
Term Offered: Spring.
Grade Modes: S/U within Student Option, Trad within Student Option.
Special Course Fee: Yes.

GEOL 376 Geologic Field Methods Credits: 3 (1-4-0)
Course Description: Scientific, surveying, and mapping methods used in geologic field studies; proposal, map, and report preparation.
Prerequisite: GEOL 344 and GEOL 372, may be taken concurrently.
Registration Information: Must register for lecture and laboratory. Required field trips.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: Yes.
GEOL 384 Supervised College Teaching Credits: Var[1-5] (0-0-0)
Course Description: Instruction and practice in laboratory instruction in lower-division departmental courses.
Prerequisite: None.
Registration Information: Written consent of instructor. A maximum of 10 combined credits for all 384 and 484 courses are counted towards graduation requirements.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

GEOL 401 Geology of the Rocky Mountain Region Credit: 1 (0-3-0)
Course Description: Field course; geology of the local Rocky Mountain region.
Prerequisite: GEOL 154.
Registration Information: May be taken up to 3 times for credit. Does not count as a geology elective in the departmental major. Required field trips.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: Yes.

GEOL 424 Modern Gas and Oil Credits: 3 (3-0-0)
Also Offered As: CIVE 424.
Course Description: Introduction to opportunities and challenges of modern gas and oil development, including synergies with other energy sources.
Prerequisite: None.
Registration Information: Junior standing or above; completion of AUCC category 3A. Credit not allowed for both GEOL 424 and CIVE 424.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

GEOL 436 Geology Summer Field Course Credits: 6 (0-18-0)
Course Description: Geologic mapping, measuring sections, interpreting geologic history in Colorado. Required comprehensive reports, geologic maps, and cross sections.
Prerequisite: GEOL 364 and GEOL 376.
Registration Information: Required field trips.
Term Offered: Summer.
Grade Mode: Traditional.
Special Course Fee: Yes.

GEOL 442 Applied Geophysics Credits: 4 (3-2-0)
Course Description: Geophysical exploration methods emphasizing hydrocarbon and mineral exploration, hydrogeology, and engineering applications.
Prerequisite: GEOL 372 and MATH 161 and PH 142.
Registration Information: Must register for lecture and laboratory.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

GEOL 446 Environmental Geology Credits: 3 (3-0-0)
Course Description: Geology applied to environmental problems.
Prerequisite: (GEOL 120, may be taken concurrently or GEOL 122 or GEOL 124 or GEOL 150) and (PH 141 and CHEM 111).
Registration Information: Required field trips.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

GEOL 447 Mineral Deposits Credits: 3 (2-3-0)
Course Description: Occurrence, origin, and exploration of economic metallic mineral deposits.
Prerequisite: GEOL 366, may be taken concurrently and GEOL 372.
Registration Information: Must register for lecture and laboratory.
Term Offered: Fall (odd years).
Grade Mode: Traditional.
Special Course Fee: Yes.

GEOL 452 Hydrogeology Credits: 4 (3-3-0)
Course Description: Interaction of water and geologic materials; surface and groundwater; quantitative analysis and geologic effects on quality and flow of groundwater.
Prerequisite: (GEOL 120 or GEOL 122 or GEOL 124 or GEOL 150 or GR 210) and (MATH 161 or MATH 255) and (PH 141).
Registration Information: Must register for lecture and laboratory.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: Yes.

GEOL 454 Geomorphology Credits: 4 (3-3-0)
Course Description: Origin of landforms; morphology and processes.
Prerequisite: (GEOL 120 or GEOL 122 or GEOL 124 or GEOL 150 or GR 210) and (STAT 301 or STAT 307 or STAT 315).
Registration Information: Must register for lecture and laboratory.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

GEOL 492 Seminar Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Terms Offered: Fall, Spring.
Grade Mode: Instructor Option.
Special Course Fee: No.

GEOL 494A Independent Study: Environmental/Engineering Geology Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

GEOL 494B Independent Study: Geomorphology Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

GEOL 494C Independent Study: Mineralogy/Petrology Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.
**GEOL 494D** Independent Study: Geoscience Field Studies 
**Credits:** Var[1-18] (0-0-0)
**Course Description:**
**Prerequisite:** None.
**Terms Offered:** Fall, Spring, Summer.
**Grade Mode:** Instructor Option.
**Special Course Fee:** No.

**GEOL 494E** Independent Study: Paleontology/Stratigraphy 
**Credits:** Var[1-18] (0-0-0)
**Course Description:**
**Prerequisite:** None.
**Terms Offered:** Fall, Spring, Summer.
**Grade Mode:** Instructor Option.
**Special Course Fee:** No.

**GEOL 494F** Independent Study: Sedimentology 
**Credits:** Var[1-18] (0-0-0)
**Course Description:**
**Prerequisite:** None.
**Terms Offered:** Fall, Spring, Summer.
**Grade Mode:** Instructor Option.
**Special Course Fee:** No.

**GEOL 494G** Independent Study: Structural Geology 
**Credits:** Var[1-18] (0-0-0)
**Course Description:**
**Prerequisite:** None.
**Terms Offered:** Fall, Spring, Summer.
**Grade Mode:** Instructor Option.
**Special Course Fee:** No.

**GEOL 498** Research 
**Credits:** Var[1-6] (0-0-0)
**Course Description:**
**Prerequisite:** None.
**Registration Information:** Written consent of instructor.
**Term Offered:** Spring.
**Grade Mode:** Instructor Option.
**Special Course Fee:** No.

**GEOL 546** Sedimentary Basin Analysis 
**Credits:** 4 (3-3-0)
**Course Description:** Sedimentologic data base, correlation, mapping, facies models, classification, and evolution of sedimentary basins. Applications to petroleum exploration.
**Prerequisite:** GEOL 344.
**Registration Information:** Must register for lecture and laboratory. Required field trips.
**Term Offered:** Spring.
**Grade Mode:** Traditional.
**Special Course Fee:** Yes.

**GEOL 547** Ore Deposit Geochemistry 
**Credits:** 3 (3-0-0)
**Course Description:** Geochemical techniques applied to the geology, exploration, and environmental analysis of ore deposits.
**Prerequisite:** GEOL 447.
**Term Offered:** Spring (odd years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.

**GEOL 551** Groundwater Modeling 
**Credits:** 3 (3-0-0)
**Course Description:** Groundwater modeling from a geologic perspective. Conceptual models and computer modeling of groundwater flow and solute transport.
**Prerequisite:** CIVE 423 or GEOL 452.
**Term Offered:** Spring.
**Grade Mode:** Traditional.
**Special Course Fee:** No.

**GEOL 552** Advanced Topics in Hydrogeology 
**Credits:** Var[2-3] (0-0-0)
**Course Description:** Current literature, new techniques, legislative and political developments in hydrogeology, and appropriate case histories.
**Prerequisite:** GEOL 452.
**Term Offered:** Spring.
**Grade Mode:** Traditional.
**Special Course Fee:** No.

**GEOL 560** Clay Mineralogy 
**Credits:** 3 (2-3-0)
**Course Description:** Crystallography and chemistry of clay minerals. Applications to geology, engineering, and soil sciences, x-ray analysis of clays.
**Prerequisite:** GEOL 364.
**Registration Information:** Must register for lecture and laboratory.
**Term Offered:** Spring (even years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.

**GEOL 562** Statistical Data Analysis in Earth Resources 
**Credits:** 3 (3-0-0)
**Course Description:** Statistical parameters, sequential data, map analysis, and multivariate data.
**Prerequisite:** STAT 340 and STAT 350.
**Term Offered:** Fall (odd years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.

**GEOL 565** Petroleum Geochemistry and Geology 
**Credits:** 3 (3-0-0)
**Course Description:** Geochemistry and geology of hydrocarbon generation, migration, and accumulation. Applications to hydrocarbon exploration.
**Prerequisite:** GEOL 366 and GEOL 372.
**Term Offered:** Spring (odd years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.
GEOL 567 Sedimentary Geochemistry Credits: 3 (3-0-0)
Course Description: Geochemical processes affecting sedimentary rocks and other surficial materials.
Prerequisite: GEOL 366.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

GEOL 570 Plate Tectonics Credits: 3 (3-0-0)
Course Description: Examination of the historical development of plate tectonic theory and its application to understanding geological processes.
Prerequisite: GEOL 364 and GEOL 372 and PH 142.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

GEOL 572 Advanced Structural Geology Credits: 4 (3-3-0)
Course Description: Rheology, deformation mechanisms, structural associations and advanced methods of structural analysis.
Prerequisite: GEOL 436.
Registration Information: Must register for lecture and laboratory. Required field trips. Graduate standing can substitute for prerequisite course.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

GEOL 574 Geodynamics Credits: 3 (3-0-0)
Course Description: Continuum mechanics applied to understanding of deformation within the earth. Stress and strain as tensors, with application to various geological settings; plate flexure and isostasy; steady state and time dependent heat conduction in a geological context; fluid mechanics of the earth.
Prerequisite: GEOL 250 and MATH 261 and PH 141.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

GEOL 575 Subsurface Geophysical Mapping Credits: 4 (3-2-0)
Course Description: Advanced techniques for creating subsurface geological maps based on seismic reflection and well log data.
Prerequisite: GEOL 344 and GEOL 372 and MATH 161 and PH 142.
Registration Information: Must register for lecture and laboratory.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

GEOL 576 Exploration Seismology Credits: 3 (3-0-0)
Course Description: Seismic exploration methods, including theory, data acquisition, and data processing.
Prerequisite: GEOL 344 and GEOL 372 and MATH 161 and PH 142.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

GEOL 578 Global Seismology Credits: 4 (3-2-0)
Course Description: Quantitative introduction to seismology; basics of seismic data analysis; fundamentals of wave propagation; earthquakes; structure of the Earth.
Prerequisite: PH 142 and MATH 261.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

GEOL 579 Solid Earth Inverse Methods and Practices Credits: 3 (3-0-0)
Prerequisite: (MATH 161 or MATH 255) and (MATH 229) and (STAT 301 or STAT 315).
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

GEOL 601 Geoscience Approaches and Thesis Proposals Credit: 1 (0-0-1)
Course Description: Core concepts of scientific approaches, local geology of Colorado, and preparation of geoscience thesis proposals.
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Graduate standing in geosciences. Required field trips.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

GEOL 652 Fluvial Geomorphology Credits: 3 (3-0-0)
Course Description: Geomorphology of channels, slopes, and drainage systems.
Prerequisite: GEOL 120.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall.
Grade Modes: S/U within Student Option, Trad within Student Option.
Special Course Fee: Yes.

GEOL 684 Supervised College Teaching Credits: Var[1-5] (0-0-0)
Course Description: Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Written consent of instructor.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

GEOL 692 Seminar Credits: Var[1-18] (0-0-0)
Course Description: Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

GEOL 695 Independent Study Credits: Var[1-18] (0-0-0)
Course Description: Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.
GEOL 696 Group Study Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

GEOL 698 Research Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

GEOL 699 Thesis Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

GEOL 747 Advanced Sedimentary Petrology Credits: 4 (3-3-0)
Course Description: Classification, origin, depositional history, and diagenesis of detrital sedimentary rocks as determined from thin sections.
Prerequisite: GEOL 344.
Restriction: Must be a: Graduate, Professional.
Registration Information: Must register for lecture and laboratory.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

GEOL 798 Research Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

GEOL 799 Dissertation Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.