Earth and Planetary Sciences

Degrees and Awards
Associate in Science: Geological Sciences
Associate in Science Degree (AS-T):
   Geology for Transfer
Associate in Arts: Environmental Studies (in conjunction with other departments; see Environmental Studies)
Associate in Arts: Geography (in conjunction with other departments; see Geography)

Program Description
Earth and planetary science is for explorers! Their discoveries are worlds away and also next door. They study mountains and plains, oceans and atmosphere, the history of the earth and the life it supports, and the origins of the universe.

At Santa Barbara City College, Earth and Planetary Sciences students can choose from a wide variety of courses, including Geology, Geography, Oceanography, Meteorology, Astronomy and Geographic Information Systems (GIS). All are designed to prepare them for exciting and rewarding careers.

The Geology Major
Geology is a multi-disciplinary science that applies biology, chemistry, physics, mathematics and engineering to the natural world around us. The rich variety of its fields of study includes oceanography, paleontology, geophysics, geochemistry, hydrogeology, engineering geology, environmental geology and more. That is what makes geology an exciting and challenging major for students with broad scientific interests and a love for natural systems, environments and our planet’s history.

Geology majors gain scientific observational reasoning, communication skills and an understanding of geological concepts and history. This blend of interpretive scientific ability and historical perspective gives geologists an important role in society. They apply their skills and knowledge to solve complex problems related to human interaction with natural systems, hazards and resources, and to communicate solutions and options to the public.

Geology majors who earn their Geology Associate in Arts Degree from Santa Barbara City College are thoroughly prepared to transfer to and excel in university-level geology programs throughout the state and the nation.

Program Student Learning Outcomes
1. Evaluate earth processes and/or earth history, using earth materials and geologic principles.
2. Classify and interpret rocks, minerals and fossils.
3. Recognize and assess geologic processes in the field.
4. Read and interpret geologic data.

Career Opportunities
Many job opportunities are available to geology graduates. Most opportunities are in private industry—in engineering geology (evaluating sites for homes, commercial buildings, highways, tunnels, etc.); environmental geology (environmental impact studies, evaluation and remediation of contaminated sites); and hydrogeology (development and quality control of groundwater resources).

Geologists are also employed in the discovery and extraction of earth resources, such as energy resources, and metallic and nonmetallic elements.

Besides private industry, all levels of government—city, county, state and federal—employ geologists for planning and regulatory (inspection and monitoring) activities.

A degree in geology is excellent background for academic research and for teaching physical science at the secondary school level.

Geography Major (see Geography)

Department Offices
Elizabeth Gans, Administrative Assistant (EBS-114, ext. 2315)
Eiko Kitao, Lab Technician (EBS-114, ext. 3637)
Kevin McNichol, Lab Technician (EBS-116, ext. 3480)
Marilynn Spaventa, Dean

Faculty and Offices
Michael A. Robinson, Chair (EBS-113, ext. 3741)
William Dinklage (EBS-111, ext. 4114)
Sean Kelly (EBS-116, ext. 3480)
Jeffrey W. Meyer (EBS-110, ext. 4270)
### AS Degree Requirements: Geological Sciences

The Geological Sciences AS Degree is designed to provide a strong foundation for geology students planning on transferring to a four-year school.

#### Department Requirements (37-38.5 units)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>ERTH 111</td>
<td>Dynamic Earth - Physical Geology or</td>
<td>3</td>
</tr>
<tr>
<td>ERTH 111H</td>
<td>Dynamic Earth - Physical Geol, Honors</td>
<td>4</td>
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<tr>
<td>ERTH 111L</td>
<td>Dynamic Earth - Physical Geol Lab</td>
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</tr>
<tr>
<td>ERTH 112</td>
<td>History of the Earth</td>
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</tr>
<tr>
<td>ERTH 112L</td>
<td>Historical Geology Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>ERTH 125</td>
<td>Mineralogy and Resources</td>
<td>5</td>
</tr>
<tr>
<td>ERTH 126</td>
<td>Petrology and Rock-Forming Minerals</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 155</td>
<td>General Chemistry I</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 156</td>
<td>General Chemistry II</td>
<td>5</td>
</tr>
<tr>
<td>MATH 150</td>
<td>Calculus with Analytic Geometry I</td>
<td>5</td>
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<tr>
<td>Plus 4 units selected from the following:</td>
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<tr>
<td>ERTH 131</td>
<td>Geologic Field Studies, Eastern Sierra Nevada Mountains</td>
<td>2</td>
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<tr>
<td>ERTH 132</td>
<td>Geologic Field Studies, Death Valley</td>
<td>2</td>
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<tr>
<td>ERTH 133</td>
<td>Introductory Geology Field Seminar, Colorado Plateau</td>
<td>4</td>
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<tr>
<td>ERTH 134</td>
<td>Geology Field Studies, West Sierra Nevada</td>
<td>2.5</td>
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<tr>
<td>ERTH 137</td>
<td>Introductory Field Geology</td>
<td>4.5</td>
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<tr>
<td>ERTH 138</td>
<td>Geologic Field Camp</td>
<td>4.5</td>
</tr>
<tr>
<td>ERTH 231A</td>
<td>Field Study - Mineralogy and Mineral Resources of the Eastern Sierra Nevada</td>
<td>2</td>
</tr>
<tr>
<td>ERTH 231B</td>
<td>Field Study - Energy Resources of the Eastern Sierra Nevada</td>
<td>2</td>
</tr>
<tr>
<td>ERTH 232A</td>
<td>Field Study - Petrology of the Death Valley Region</td>
<td>2</td>
</tr>
<tr>
<td>ERTH 232B</td>
<td>Field Study - Mineral Resources and Plate Tectonic History of the Death Valley Region</td>
<td>2</td>
</tr>
<tr>
<td>ERTH 233</td>
<td>Advanced Geologic Field Seminar - Colorado Plateau</td>
<td>4</td>
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</table>

Recommended for Transfer

These additional courses should be considered when planning a program of study for transfer as a geology major:

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>MATH 160</td>
<td>Calculus with Analytic Geometry II</td>
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<tr>
<td>PHYS 102</td>
<td>Introduction to Physics for Science Majors</td>
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### AS-T Degree Requirements: Geology for Transfer

#### Department Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>CHEM 155*</td>
<td>General Chemistry I</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 156*</td>
<td>General Chemistry II</td>
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</tr>
<tr>
<td>ERTH 111*</td>
<td>Dynamic Earth - Physical Geology or</td>
<td>3</td>
</tr>
<tr>
<td>ERTH 111H*</td>
<td>Dynamic Earth - Physical Geol, Honors</td>
<td>4</td>
</tr>
<tr>
<td>ERTH 111L*</td>
<td>Dynamic Earth - Physical Geol Lab</td>
<td>1</td>
</tr>
<tr>
<td>ERTH 112*</td>
<td>History of the Earth</td>
<td>3</td>
</tr>
<tr>
<td>ERTH 112L*</td>
<td>Historical Geology Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>MATH 150*</td>
<td>Calculus with Analytic Geometry I</td>
<td>5</td>
</tr>
<tr>
<td>MATH 160*</td>
<td>Calculus with Analytic Geometry II</td>
<td>5</td>
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</tbody>
</table>

*These courses fulfill an IGETC requirement. Visit [www.assist.org](http://www.assist.org) or [http://articulation.sbcc.edu](http://articulation.sbcc.edu) for a complete list of IGETC requirements.

#### College Requirements

For complete information, see “Graduation Requirements” in the Catalog Index.

#### Planning a Program of Study

Careers in the earth and planetary sciences are increasingly dependent upon completion of one year of calculus, college chemistry and college physics, along with a sound foundation in the earth sciences. The student is therefore urged to plan a program to ensure the orderly completion of the required courses outside the earth sciences. Students having deficiencies, particularly in mathematics, should correct these deficiencies early in their programs.

Not all courses in the Department of Earth and Planetary Sciences are offered each semester. Courses currently offered only during the Fall Semester are ERTH 125 (Mineralogy and Resources), ERTH 114 (The Geology of California), ERTH 121 (Geology Seminar), and ERTH 131 (Geology Field Studies, Eastern Sierra).
Courses currently offered only during the Spring Semester are ERTH 126 (Petrology and Rock-Forming Minerals), ERTH 113 (The Geology of National Parks), ERTH 132 (Geology Field Studies, Death Valley), and ERTH 133 (Geology Field Seminar, Colorado Plateau).

Preparation for Transfer
Course requirements for transfer vary depending upon the college or university a student wishes to attend. Therefore, it is most important for a student to consult a departmental adviser before planning an academic program for transfer.

Honors and Awards
During the latter part of each Spring Semester, an awards event is held to recognize students for their academic achievements and service to the department and college. Many awards are given.

Scholarships
Various organizations provide scholarships for students in the Earth and Planetary Sciences. These scholarships may be awarded for academic excellence and/or financial need. A partial list of these scholarships:
- Petrolog, Inc. Scholarship
- Thomas Bennett Scholarship
- Harold Alexander Scholarship
- Karen Armstrong Scholarship
- Ronald Chromy Scholarship
- Carl Sagan Scholarship
- Ventura Gem and Mineral Society Award
- William Kennett Geology Scholarship
- Jeff Marshall Mineralogy Award
- Soil Moisture Award
- Coast Geological Society Scholarship
- Phil Olsen Award
- American Petroleum Institute Scholarships
- Dr. Robert S. Gray Award, Outstanding Geological Sciences Major

Field Courses
The department has an impressive field program. Special courses directly related to field orientation are:

ERTH 130V — Geologic Field Studies - Hawaii Volcanology
A twelve-day field-studies course with an emphasis on the structural, plutonic and volcanic features of Kilauea volcano, Hawaii. Kilauea’s long-documented eruptive history and easy accessibility make it a training ground for USGS volcanologists. Focuses on the history and features of the volcano and its interactions with the people that live on it.

ERTH 131 — Geologic Field Studies in the Eastern Sierra
This field course provides an intensive hands-on experience in geologic education, and is open to anyone who has taken or is taking an Earth Science class. Students spend all daylight hours in the field. They have the opportunity to study glacial features, volcanic processes, the tectonics of mountain building, active faults, geomorphology and the processes of erosion and mass wasting. For more information, contact the department office (EBS-114).

ERTH 132 — Geologic Field Studies in Death Valley
This five-day field course duplicates some of the logistics and rigorous educational experiences of EARTH 131; however, the similarities end there. Death Valley presents a completely different geologic environment for study. Two billion years of earth history is exposed in the rocks. Students reconstruct geologic history by actually observing the geologic processes, fossils and rock exposures. The rocks tell the story of the evolution of Death Valley. This course is offered to anyone who has taken or is taking an Earth Science class. For more information, contact the department office (EBS-114).

ERTH 133 — Geology Field Seminar, Colorado Plateau
This 14-day field course is designed for the more advanced geology student. Field work involves the study of the general geology of the Colorado Plateau, with emphasis on features of the Grand Canyon, Canyonlands, San Rafael Swell, and Bryce and Zion National Parks. There is no other place in the world which offers the earth science student such a diversity of geologic features to study, and this amongst some of the most magnificent scenery on earth. For more information, contact the department office (EBS-114).

ERTH 134 — Geologic Field Studies, Western Sierra Nevada
Eight-day field course to study and interpret the geologic features and history of the western Sierra Nevada region. Topics include plutonism, landform evolution,
glaciation, tectonic and geologic history, and uplift processes of the modern Sierra Nevada. For more information, contact the department office (EBS-114).

ERTH 135 — Geologic Field Seminar, Western North America
A 25-day field study of the geology of the Western United States and Western Canada. Emphasis on the features, processes and geologic history of the regions’ parks: Grand Teton, Yellowstone, Glacier/Waterton, Banff, Jasper, Crater Lake and Lassen National Parks. Designed for students with previous geologic background. For more information, contact the department office (EBS-114).

ERTH 137/138 — Introductory Field Geology
These courses consist of four weeks in the Summer Session classroom and two weeks in the field camp in the Cuyama Valley. Courses are limited to Geology majors and are intended as a rigorous experience in field methods. The student learns the use of mapping tools by actually doing geologic mapping in the field. The student also learns to do geologic field reports and to operate geological surveying equipment. Students learn to share work and knowledge in the field as they work in several different assigned teams. This course has proved to be of extreme importance in preparing students for upper-division geology fieldwork when transferring to a four-year institution.

ERTH 121 — Geology Seminar
The Department of Earth and Planetary Sciences offers a three-unit seminar course (ERTH 121), which meets as a short course on Fridays. The geology seminar includes local field trips and outside lectures. The seminar is designed to bring students in contact with professionals in the earth sciences and to acquaint them with local geology.

Tutorial Opportunities
Each semester, qualified advanced Earth Science students are selected to tutor beginning Earth Science students. This program has direct benefits for both the beginning student and the tutor. The Earth Science tutorial program provides one-on-one instruction and is free.

Special Department Resources
The Earth and Planetary Sciences Department has one of the most completely equipped facilities of any two-year college in the state. This includes research-quality petrographic microscopes, a complete rock processing and thin section laboratory, a complete stock of mineral, rock and fossil material, geophysical instruments, a number of field vehicles, field survey instruments, GPS units, advanced astronomy telescopes and a planetarium, and other specialized earth science equipment. This equipment offers students unparalleled opportunities for “hands-on” instruction.

Advising
In addition to the college counselor for Earth and Planetary Sciences and the Career Center staff, the department faculty is available to students who are planning academic programs and career goals in the earth sciences. For further information on programs or courses of study at Santa Barbara City College, contact Jan Schultz (EBS-117, schultz@sbcc.edu) or Jeff Meyer (EBS-110, (805) 965-0581, ext. 4270)

Student Participation
Students have many opportunities to become involved in department-related activities through the Geology Club, which sponsors numerous field trips, outings, and social events throughout the school year. If you are interested in this club, please check with a staff member. Also, another club is the Student Chapter, AAPG.

Earth Studies Courses
ERTH 101 — Introductory Astronomy
(3) — CSU, UC*
Skills Advisories: MATH 1 and ENG 103
Hours: 54 lecture
Non-mathematical presentation of our knowledge of the universe. Includes birth and death of stars, formation of the solar system, black holes, quasars, the fourth dimension and the fate of the universe. Also considered are common phenomena such as eclipses, the motion of the planets and their moons, comets, and meteors. (*UC Transfer Limit: ERTH 101 and 101H combined: maximum credit, one course)
ERTH 101H — Introductory Astronomy, Honors
(4) — CSU, UC*
Skills Advisories: MATH 1 and Eligibility for ENG 110 or 110H
Course Advisories: ERTH 102
Limitation on Enrollment: Admission to Program*
Hours: 72 lecture
Introduces students to the universe throughout its history. It emphasizes astronomical knowledge from Earth, as a planet in the solar system, to quasars at the edge of the known universe. The motions of objects within the galaxy are also examined. (*UC Transfer Limit: ERTH 101 and 101H combined: maximum credit, one course)

ERTH 102 — Observational Astronomy Laboratory
(1) — CSU, UC
Skills Advisories: MATH 1 and ENG 103
Corequisites: ERTH 101 or 101H
Hours: 54 lab
Emphasizes nighttime observation of the stars, galaxies and constellations with real-time observations. Simulation programs are used to graphically examine astronomical phenomena. Celestial navigation, motions of the earth and moon, and study of the celestial sphere emphasized.

ERTH 103A — Advanced Observational Astronomy Laboratory - Fall
(1) — CSU, UC*
Prerequisites: ERTH 102
Hours: 54 lab
Follow-up course to ERTH 102. Use of planetarium and observatory to illustrate constellations, celestial motions, and to observe stars, planets and deep sky objects. Emphasis for continuing students is on stars and constellations of the Fall sky, use of larger and more advanced telescopes, and in-depth observations of deep sky objects of the Fall sky. (*UC Transfer Limit: ERTH 103A, 103B, 103C combined, maximum credit: one course)

ERTH 103B — Advanced Observational Astronomy Laboratory - Spring
(1) — CSU, UC*
Prerequisites: ERTH 102
Hours: 54 lab
Follow-up course to ERTH 102. Use of planetarium and observatory to illustrate constellations, celestial motions, and to observe stars, planets and deep sky objects. Emphasis for continuing students is on stars and constellations of the Spring sky, use of larger and more advanced telescopes, and in-depth observations of deep sky objects of the Spring sky. (*UC Transfer Limit: ERTH 103A, 103B, 103C combined, maximum credit: one course)

ERTH 103C — Adv Observational Astronomy Lab - Summer
(1) — CSU, UC*
Prerequisites: ERTH 102
Hours: 54 lab
Follow-up course to ERTH 102. Use of planetarium and observatory to illustrate constellations, celestial motions, and to observe stars, planets and deep sky objects. Emphasis for continuing students is on stars and constellations of the Summer sky, use of larger and more advanced telescopes, and in-depth observations of deep sky objects of the Summer sky. (*UC Transfer Limit: ERTH 103A, 103B, 103C combined, maximum credit: one course)

ERTH 104 — Introductory Astrophysics
(3) — CSU
Skills Advisories: Eligibility for ENG 103. Proficiency in MATH 104 or 107 or 111
Hours: 54 lecture
Introductory astronomy course that integrates mathematics of physics in the study of objects in the universe.

ERTH 105 — Topics in Astronomy
(0.5-3) — CSU
Skills Advisories: MATH 1 and ENG 103
Hours: 9-54 lecture
Designed for students wanting to go beyond the regular introductory astronomy courses. Lectures, discussions, guest speakers, activities and field trips help students explore specific topics in physics and astronomy. Different topics are offered different semesters and may include planetary exploration, the space station and other space missions, new solar systems, astrobiology, relativity, cosmology, black holes, quasars, dark matter, etc. (*UC Transfer Limit: ERTH 105 computed as Independent Studies; see counselor)
ERTH 105A — Planetary Geology of Recent NASA Missions
(1) — CSU
Skills Advisories: MATH 1 and Eligibility for ENG 103
Hours: 16-18 lecture
Designed for students wanting to go beyond the regular introductory astronomy courses. Lectures, discussions, guest speakers, activities and field trips help students explore specific topics in physics and astronomy, such as discoveries from planetary space flight missions to Mercury, Mars, Saturn, Saturn’s moon Titan and comets. (*UC Transfer Limit: ERTH 105 computed as Independent Studies; see counselor)

ERTH 106 — Black Holes and the Universe
(3) — CSU, UC
Skills Advisories: MATH 1 and ENG 103
Course Advisories: ERTH 101 or 101H
Hours: 54 lecture
Basic introduction to relativity, cosmology, quantum mechanics, string theory, black holes, time travel, higher dimensions and other abstract theories of the universe. Provides students with a broad-based overview of these physics theories and allows them to explore various current topics in astronomy.

ERTH 111 — Dynamic Earth - Physical Geology
(3) — CSU, UC*
Skills Advisories: MATH 1 and Eligibility for ENG 103
Course Advisories: ERTH 111L and 131 or 132
Hours: 54 lecture
Introduction to the physical development of the earth. Emphasis on earth materials (rocks and minerals), hydrologic processes (weathering, streams, glaciers, beaches and ground water), tectonic processes (plate tectonics, earthquakes, mountain building and volcanism) and structures (folds, faults). Current theories on structure and evolution of the earth are discussed. (*UC Transfer Limit: ERTH 111 and 111H combined: maximum credit, one course)

ERTH 111L — Dynamic Earth - Physical Geology Laboratory
(1) — CSU, UC
Corequisites: ERTH 111 (prior to or concurrently) or ERTH 111H (concurrently)
Skills Advisories: MATH 1 and ENG 103
Hours: 54 lab
Laboratory approach to earth materials and processes, including rock and mineral identification and interpretation, plate tectonic rock cycle, topographic map and aerial photo interpretation, structural geology (folds and faults), geologic cross sections and geologic maps. Activities include four field trips to local areas of geologic interest. Required of all Geology majors.

ERTH 112 — History of the Earth
(3) — CSU, UC
Skills Advisories: ENG 103
Course Advisories: Concurrent enrollment in ERTH 112L and 131 or 132
Hours: 54 lecture
Introduction to the geologic history of the earth, using plate tectonic concepts, stratigraphy, geologic dating, fossils and evolution. Emphasis on the origin and evolution of continents, oceans, the atmosphere and life on earth. Designed to accommodate both non-science majors and Earth Science majors. Required of Geology majors.

ERTH 112L — Historical Geology Laboratory
(1) — CSU, UC
Corequisites: ERTH 112
Skills Advisories: ENG 103
Hours: 54 lab
Laboratory approach to understanding the scientific method as it applies to deciphering earth history. Topics include sedimentary rock identification and interpretation, stratigraphy, paleogeographic maps and fossil identification. Activities include field trips to local areas of geologic interest. Required of Geology majors.
ERTH 113 — Geology of National Parks
(3) — CSU, UC*
Skills Advisories: ENG 103
Three lecture hours, plus one additional hour weekly.
Hours: 54 lecture
Study of geologic processes and phenomena responsible for shaping the modern landscape, as exemplified within selected National Parks and Monuments. Plate tectonic setting and history emphasized. Designed to accommodate both science and non-science majors.
(*UC Transfer Limit: ERTH 113, 131, 132, 133, 135, 137, 138, 233 any or all of these courses combined: maximum credit, one course; no credit for ERTH 113 if taken after ERTH 111, 111H or 112)

ERTH 114 — The Geology of California
(3) — CSU, UC
Skills Advisories: ENG 103
Hours: 54 lecture
Landscapes of California interpreted by introductory plate tectonics. Volcanism, earthquakes and other geologic processes are studied in relation to the origins and feature of the geomorphic provinces of the state. Provinces include the Sierra Nevada, Coast Ranges, Transverse Ranges, Cascades, Klamath Mountains, Modoc Plateau, Central Valley, Mojave, and the Basin and Range. Appropriate for science and non-science majors.

ERTH 115/ENVS 115 — Environmental Geology
(3) — CSU, UC
Skills Advisories: MATH 1 and ENG 103
Course Advisories: Concurrent enrollment in ERTH 115L/ENVS 115L and ERTH 131 or 132
Hours: 54 lecture
Introduction to the problems of volcanism, earthquakes, fire, floods, landslides and other geologic hazards; air and water pollution; hazardous materials; and land use planning. Applications to the Santa Barbara area emphasized. Required of Environmental Studies majors.

ERTH 115L/ENVS 115L — Environmental Geology Laboratory
(1) — CSU, UC
Corequisites: ERTH 115/ENVS 115
Skills Advisories: MATH 1 and ENG 103
Hours: 54 lab
Laboratory approach to topics covered in ENVS 115, with emphasis on rock and mineral identification, hazard assessment, geologic resource management, and land use planning. In-lab field trips.

ERTH 116/ENVS 116 — Energy and Natural Resources
(3) — CSU, UC
Skills Advisories: MATH 4 and ENG 103
Hours: 54 lecture
Study of formation, exploration, development and judicious use of natural resources in relation to present and future energy requirements; electricity, conservation, fossil fuels, solar, geothermal, nuclear and hydrogen. Required of Environmental Studies majors.

ERTH 121 — Geology Seminar
(1) — CSU
Corequisites: ERTH 111 or 112 or 111H or 115 or ENVS 115 or ERTH 113 or 114
Hours: 18 lecture
Available to students enrolled in Earth Science courses. Attendance is required at the short course each week and select number of department-sponsored seminars, weekend field trips and lectures sponsored by professional associations and institutions. Required of Geology majors. (*UC Transfer Limit: ERTH 121 computed as Independent Studies; see counselor)

ERTH 122 — Dinosaurs
(3) — CSU, UC
Skills Advisories: ENG 103
Hours: 54 lecture
Introduction to the science of dinosaurs, stressing their evolution, ecology, bone structures and extinction. Emphasizes dinosaurian diversity, rise of dinosaurs, and their extinction in a Mesozoic world. Provides for a better perspective on the patterns and trends of all life, living and extinct. Scientific videos and fossil material used in course.

ERTH 125 — Mineralogy and Resources
(5) — CSU, UC*
Skills Advisories: MATH 4 and ENG 103
Course Advisories: ERTH 111 or 112 and CHEM 101
Hours: 162 (54 lecture, 108 lab)
Introduction to identification and basic concepts of mineralogy, emphasizing crystallography, crystal chemistry, mineral chemistry, paragenesis of economic mineral and plate tectonics of mineral resources. A portion of the course is devoted to optical mineralogy.
Hand identification of minerals stressed. (*UC Transfer Limit: ERTH 125 and 232B combined: maximum credit, one course).

**ERTH 126 — Petrology and Rock-Forming Minerals (5) — CSU, UC**
Skills Advisories: MATH 4 and ENG 103
Course Advisories: ERTH 111 or 112 and CHEM 101
Hours: 162 (54 lecture, 108 lab)

Designed to familiarize students with the basic fundamentals and classification of rock-forming mineralogy, textures, origins and occurrences of igneous, sedimentary and metamorphic rocks. Use of the polarizer, X-ray and field identification procedures stressed. (*UC Transfer Limit: ERTH 126 and 232A combined: maximum credit, one course).

**ERTH 130V — Geologic Field Studies - Hawaii Volcanology (2.5) — CSU**
Skills Advisories: ENG 103
Corequisites: ERTH 111 or 111H or 112 or 113 or 114 or 115 or ENVS 115 or ERTH 125 or 126 or 131 or 132 or 133 or 141 or GEOG 101 or ERTH 151
Hours: 117 (9 lecture, 108 lab)

A twelve-day field-studies course with an emphasis on the structural, plutonic and volcanic features of Kilauea volcano, Hawaii. Kilauea's long-documented eruptive history and easy accessibility make it a training ground for USGS volcanologists. Focuses on the history and features of the volcano and its interactions with the people that live on it.

**ERTH 131 — Geologic Field Studies – Eastern Sierra Nevada (2) — CSU, UC**
Corequisites: ERTH 111 or 111H or 112 or 113 or 114 or 115 or ENVS 115 or ERTH 122 or 125 or 126 or 132 or 141 or GEOG 101 or ERTH 151
Hours: 72 (18 lecture, 54 lab)

Fee required – see department for information. Five-day field course to study and interpret the geologic features and history of the Death Valley region. Topics include the volcanic, tectonic and hydrologic history of the region. (*UC Transfer Limit: ERTH 113, 131, 132, 133, 135, 137, 138, 233 any or all of these courses combined: maximum credit, one course).

**ERTH 132 — Geologic Field Studies – Death Valley (2) — CSU, UC**
Corequisites: ERTH 111 or 111H or 112 or 113 or 114 or 115 or ENVS 115 or ERTH 122 or 125 or 126 or 131 or 141 or GEOG 101 or 106 or ERTH 151
Hours: 72 (18 lecture, 54 lab)

Fee required – see department for information. Five-day field course to study and interpret the geologic features and history of the Death Valley region. Topics include the volcanic, tectonic and hydrologic history of the region. (*UC Transfer Limit: ERTH 113, 131, 132, 133, 135, 137, 138, 233 any or all of these courses combined: maximum credit, one course).

**ERTH 133 — Introductory Geologic Field Seminar – Colorado Plateau (4) — CSU, UC**
Skills Advisories: ENG 103
Corequisites: ERTH 111 or 111H or 112 or 113 or 114 or 115 or ENVS 115 or ERTH 125 or 126 or 131 or 132 or 141 or GEOG 101 or ERTH 151 (concurrent)
Hours: 170 (23 lecture, 147 lab)

Fee required – see department for information. Fifteen-day intensive field study of the geology of the Colorado Plateau region. Emphasis on the geologic processes and features of the parks of the Southwest, including the Grand Canyon, Canyonlands, Arches, Capitol Reef, Bryce and Zion National Parks. Designed for students with previous geologic background. (*UC Transfer Limit: ERTH 113, 131, 132, 133, 135, 137, 138, 233 any or all of these courses combined: maximum credit, one course).

**ERTH 134 — Geologic Field Studies – Western Sierra Nevada (2.5) — CSU**
Skills Advisories: ENG 103
Hours: 81 (27 lecture, 54 lab)

Fee required – see department for information. Eight-day field course to study and interpret the geologic features and history of the western Sierra Nevada region. Topics include plutonism, landform evolution, glaciation, tectonic and geologic history, and uplift processes of the modern Sierra Nevada.
ERTH 135 — Geologic Field Seminar – Western North America
(5) — CSU, UC*
Skills Advisories: ENG 103
Corequisites: ERTH 111 or 111H or 112 or 113 or 114 or 115 or ENVS 115 or ERTH 125 or 126 or 131 or 132 or 133
Hours: 198 (36 lecture, 162 lab)
Fee required – see department for information. A 23-day field study of the geology of the Western United States and Western Canada. Emphasis on the features, processes and geologic history of the regions' parks: Grand Teton, Yellowstone, Glacier/Waterton, Banff, Jasper, Crater Lake and Lassen National Parks. For students with previous geologic background. (*UC Transfer Limit: ERTH 113, 131, 132, 133, 135, 137, 138, 233 any or all of these courses combined: maximum credit, one course).

ERTH 137 — Introductory Field Geology
(4.5) — CSU, UC*
Prerequisites: ERTH 111 or 111H or 112 or 125 or 126 or 131 or 132 or 133
Skills Advisories: MATH 4 and ENG 103
Course Advisories: ERTH 111L or 112L
Hours: 153 (45 lecture, 108 lab)
Provides intensive field experience in application of field geology equipment, methods, techniques and maintenance procedures. “Hands-on” approach includes use of Brunton compass and tape, aerial photos, plane table and alidade, and geological mapping. (*UC Transfer Limit: ERTH 113, 131, 132, 133, 135, 137, 138, 233 any or all of these courses combined: maximum credit, one course).

ERTH 138 — Geology Field Camp
(4.5) — CSU, UC*
Skills Advisories: MATH 4 and ENG 103
Corequisites: ERTH 137
Hours: 176 (28 lecture, 148 lab)
Summer Session course, offered during the last two weeks. Consists of 14 consecutive days at a geologic field camp, followed by five eight-hour days in an on-campus laboratory. Provides for rigorous work experience in field geology for Earth Science majors. Includes field mapping of a “badlands” area, using aerial photographs, topographic maps, geological surveying equipment and earth materials. (*UC Transfer Limit: ERTH 113, 131, 132, 133, 135, 137, 138, 233 any or all of these courses combined: maximum credit, one course).

ERTH 141/GEOG 101 — Physical Geography
(3) — CSU, UC
Skills Advisories: MATH 1 and ENG 103
Course Advisories: Concurrent enrollment in ERTH 141L/GEOG 101L
Hours: 54 lecture
Spatial study of Earth’s dynamic physical systems and processes. Interrelationships between the basic elements of the physical and human environments are examined, including geology (plate tectonics; volcanoes and earthquakes), geomorphology (formation and modification of landforms; river, coastal, and glacial processes), meteorology (Earth’s atmosphere; weather and climate), and hydrology (water on Earth).

ERTH 141L/GEOG 101L — Physical Geography Laboratory
(1) — CSU, UC
Corequisites: ERTH 141/GEOG 101
Skills Advisories: MATH 1 and ENG 103
Hours: 54 lab
Laboratory approach to a combination of earth science disciplines, including cartography, geology, geomorphology, meteorology and oceanography. Remote sensing techniques are utilized in 75% of laboratory activities.

ERTH 142/GEOG 105 — Economic Geography
(3) — CSU, UC
Skills Advisories: MATH 1 and ENG 103
Hours: 54 lecture
Designed for students majoring in Geography. Addresses regional patterns of principal economic activities of the world, with an emphasis on economic development and the problems of urbanization, transportation and the environment.

ERTH 151 — Introductory Physical Oceanography
(3) — CSU, UC
Skills Advisories: MATH 1 and ENG 103
Hours: 54 lecture
Designed for students desiring a broadly based analysis of the physical aspects of the oceans. Study of the origin of the continents and oceans, marine geology, chemistry
of seawater, currents, waves, tides and the ocean environment. Required of Marine Science majors.

**ERTH 151L — Introductory Physical Oceanography Laboratory**
(1) — CSU, UC
Corequisites: ERTH 151
Skills Advisories: MATH 1 and ENG 103
Hours: 54 lab

Lab exercises in marine geology, sedimentation, navigation, currents, waves, chemical and physical properties of seawater and plate tectonics. Field trips to beach and mountains to study oceanographic processes and products. Required of Marine Science majors.

**ERTH 152/GEOG 152 — Weather and Climate**
(3) — CSU, UC
Skills Advisories: MATH 95 and ENG 103
Course Advisories: Concurrent enrollment in ERTH 152L/GEOG 152L
Hours: 54 lecture

Fundamentals of meteorology, including the nature of the atmosphere, solar radiation and energy balances, circulation of the atmosphere, air masses and fronts, atmospheric moisture, clouds and fog, precipitation, cyclones, weather analysis and forecasting, climate and climate change.

**ERTH 152L/GEOG 152L — Weather and Climate Laboratory**
(1) — CSU, UC
Corequisites: ERTH 152 or GEOG 152
Skills Advisories: MATH 95 and Eligibility for ENG 103
Hours: 54 lab

Laboratory approach to topics covered in the Weather and Climate lecture (ERTH 152/GEOG 152). Exercises introduce fundamentals of meteorology, including the nature of the atmosphere, circulation of the atmosphere, air temperature and humidity, and weather analysis and forecasting. Students collect and analyze a variety of environmental data.

**ERTH 171/GEOG 171 — Introduction to Geographic Information Systems and Maps**
(2) — CSU, UC
Corequisites: ERTH 172/GEOG 172
Skills Advisories: MATH 4 and ENG 103
Hours: 36 lecture

Techniques, tools and theories used to examine geographic information. Includes the structure, uses, and basic operations of a Geographic Information System (GIS). Cartography and cartographic design are incorporated, as well as overviews of aerial photography, remote sensing, and global positioning systems. Includes uses of GIS software in business, urban planning, resource management and scientific research.

**ERTH 172/GEOG 172 — Geographic Information Systems: Software Applications**
(2) — CSU, UC
Corequisites: ERTH 171/GEOG 171
Skills Advisories: MATH 4 and ENG 103
Hours: 54 (27 lecture, 27 lab)

Extensive practice with a GIS package, accompanied by exploration of the range of applications in which GIS is used (resource management, public works, business, planning, scientific research). Covers key skills for operating GIS software packages, including geographical data acquisition, creation, management, analysis and output.

**ERTH 175/GEOG 175 — Raster GIS Applications**
(2) — CSU
Prerequisites: ERTH 172 or GEOG 172 with a minimum grade of “C”.
Skills Advisories: Eligibility for ENG 103; MATH 4
Hours: 36 lecture

Hands-on introduction to basic Raster concepts, using ArcGIS Spatial Analyst extension within the ArcGIS environment. The underlying methodology required to solve real world problems is explored through a series of extensive course projects. Key skills in data acquisition, surface creation techniques, map algebra, database design and results reporting are covered.

**ERTH 231A — Field Study - Mineralogy and Mineral Resources of the Eastern Sierra Nevada**
(2) — CSU, UC
Concurrent Corequisites: ERTH 111 or 111H or 112 or 113 or 114 or 115 or ENVS 115 or ERTH 122 or 125 or 126 or 131 or 132 or 133 or 141 or GEOG 101 or ERTH 151 or 231B
Hours: 72 (18 lecture, 54 lab)

Fee required – see department for information. Five-day field course to study and interpret the mineralogy
and resources of the Eastern Sierra Nevada region. Topics include metallic and industrial mineral resources, energy resources and mining of the region.

**ERTH 231B — Field Study - Energy Resources of the Eastern Sierra Nevada**  
(2) — CSU, UC  
Concurrent Corequisites: ERTH 111 or 111H or 112 or 113 or 114 or 115 or ENVS 115 or ERTH 116 or ENVS 116 or ERTH 122 or 125 or 126 or 131 or 132 or 133 or 141 or GEOG 101 or ERTH 151 or 231A  
Hours: 72 (18 lecture, 54 lab)  
Fee required – see department for information. Five-day field course to study and interpret the energy resources of the Eastern Sierra Nevada region. Topics include wind, solar-thermal electric, solar photovoltaic, micro hydropower, hydropower and geothermal energy resources of the region.

**ERTH 232A — Field Study – Petrology of the Death Valley Region**  
(2) — CSU, UC*  
Prerequisites: ERTH 112 or 113 or 114 or 115 or ENVS 115  
Corequisites: ERTH 111 or 111H or 122 or 125 or 126 or 131 or 132 or 133 or 141 or GEOG 101 or ERTH 151  
Skills Advisories: Eligibility for ENG 98 and 103  
Hours: 72 (18 lecture, 54 lab)  
Fee required – see department for information. Five-day field course to study and interpret the petrology of the Death Valley region. Topics include field recognition and interpretation of igneous, sedimentary and metamorphic rocks, and mining of the region. (*UC Transfer Limit: ERTH 126 and 232A combined: maximum credit, one course)

**ERTH 232B — Field Study – Mineral Resources and Plate Tectonic History of the Death Valley Region**  
(2) — CSU, UC*  
Corequisites: ERTH 111 or 111H or 112 or 113 or 114 or 115 or ENVS 115 or ERTH 122 or 125 or 126 or 131 or 132 or 133 or 141 or GEOG 101 or ERTH 151  
Skills Advisories: Eligibility for ENG 98 and 103  
Hours: 72 (18 lecture, 54 lab)  
Fee required – see department for information. Five-day field course to study and interpret the mineral resources and tectonic history of the Death Valley region. Topics include field recognition and interpretation of rocks, mineral deposits, and structures of the region. (*UC Transfer Limit: ERTH 125 and 232B combined: maximum credit, one course)

**ERTH 233 — Advanced Geologic Field Seminar – Colorado Plateau**  
(4) — CSU, UC*  
Prerequisites: ERTH 133  
Skills Advisories: Eligibility for ENG 103  
Hours: 170 (23 lecture, 147 lab)  
Fee required – see department for information. 15-day intensive field study of the geology of the Colorado Plateau region. Emphasis on the stratigraphy, tectonic evolution and geologic history of the parks of the Southwest, including the Grand Canyon, Canyonlands, Arches, Capitol Reef, Bryce and Zion National Parks. Designed for second-year geology students. (*UC Transfer Limit: ERTH 113, 131, 132, 133, 135, 137, 138, 233 any or all of these courses combined: maximum credit, one course).

**ERTH 299 — Independent Study in Earth Science**  
(1-4) — CSU  
Limitation on Enrollment: Completion of a minimum of 12 units at SBCC, with a 2.5 GPA, and a minimum of six units, with a 3.0 GPA within the department.  
Hours: 48-192 lab  
For complete information, see “Independent Study” in the Catalog Index. (*UC Transfer Limit: ERTH 299 computed as Independent Studies; see counselor).

**Environmental Studies Courses**

**ENVS 110 — Humans and the Biological Environment**  
(3) — CSU, UC  
Skills Advisories: Eligibility for ENG 110 or 110H  
Hours: 54 lecture  
Growth and variations in populations of organisms and their interactions with the physical environment. Characteristics of living natural resources and changes caused by expanding human populations and technological developments. Satisfies SBCC General Education requirement in Natural Sciences when combined with ENVS 111. Required for the Environmental Studies major.
ENVS 111 — Environmental Field Studies
(1) — CSU, UC
Corequisites: ENVS 110
Skills Advisories: Eligibility for ENG 110 or 110H
Hours: 54 lab
Field studies designed to demonstrate general ecological/environmental principles through exposure to and analysis of many different communities and sites of environmental concern. Satisfies SBCC General Education requirement in Natural Sciences when combined with ENVS 110.

ENVS 115/ERTH 115 — Environmental Geology
(3) — CSU, UC
Skills Advisories MATH 1 and ENG 103
Course Advisories: Concurrent enrollment in ENVS 115/ERTH 115L and 131 or 132
Hours: 54 lecture
Introduction to the problems of volcanism, earthquakes, fire, floods, landslides and other geologic hazards; air and water pollution; hazardous materials; and land use planning. Applications to the Santa Barbara area emphasized. Required of Environmental Studies majors.

ENVS 115L/ERTH 115L — Environmental Geology Laboratory
(1) — CSU, UC
Corequisites: ENVS 115/ERTH 115
Skills Advisories: MATH 1 and ENG 103
Hours: 54 lab
Laboratory approach to topics covered in ENVS 115, with emphasis on rock and mineral identification, hazard assessment, geologic resource management, and land use planning. In-lab field trips.

ENVS 116/ERTH 116 — Energy and Natural Resources
(3) — CSU, UC
Skills Advisories: MATH 4 and ENG 103
Hours: 54 lecture
Study of formation, exploration, development and judicious use of natural resources in relation to present and future energy requirements; electricity, conservation, fossil fuels, solar, geothermal, nuclear and hydrogen. Required of Environmental Studies majors.

ENVS 200 — Projects in Sustainability
(2) — CSU
Skills Advisories: Eligibility for ENG 110 or 110H
Hours: 36 lecture
Students work in groups to develop projects that make the college and local community more sustainable. Lectures, discussions and workshops provide the student with current knowledge in environmental science, sustainable practices and real-world skills needed to implement practical solutions to local environmental and social problems.