



# GEOLOGICAL SCIENCES

**B.A. IN GEOLOGICAL SCIENCES**  
**B.S. IN GEOLOGICAL SCIENCES**  
**B.A. IN ENVIRONMENTAL GEOLOGY**  
**B.A. IN ENVIRONMENTAL STUDIES (SECOND MAJOR ONLY)**

The geological sciences encompass a wide range of inquiries into the physical, chemical and biological processes that shape the earth and planets. Application of these inquiries to understanding a planet's evolution through time is a unique attribute of geological investigations. Knowledge of the past and present reveals the constraints of our environment and serves as a guide for the future. In recent years, significant advances have been made in the understanding of plate tectonics, properties of the earth's interior, the nature of surface and near-surface processes, the history of the earth's climate, the ecology of living and ancient organisms, and the comparative geology of other planets. Geological knowledge is fundamental to resource conservation, land use planning, environmental geochemistry, hydrology, engineering construction works and other environmental concerns. The Department of Geological Sciences also houses Environmental Studies, which is offered only as a second major.

## **DEGREE REQUIREMENTS AND COURSE OFFERINGS**

Typical four-year programs for the B.A. and B.S. degrees are illustrated in this brochure. The student and his/her adviser will design the remainder of the curriculum based on individual interests, consonant with departmental and college requirements. All majors participate in a three-semester senior project sequence in which they propose a research project, conduct the research, write a thesis and present it to the department.

Examples of undergraduate courses offered by the department are:

- GEOL 202 Global Environmental Problems
- GEOL 301 Stratigraphy and Sedimentation
- GEOL 303 Environmental Law
- GEOL 336 Aquatic Chemistry
- GEOL 345 Planetary Materials
- GEOL 352 Environmental Geochemistry

Please see the General Bulletin ([www.case.edu/bulletin](http://www.case.edu/bulletin)) for a complete listing of courses offered by the department and detailed course descriptions.

## **SPECIAL ACADEMIC PROGRAMS**

### **GEOL 360 (Summer Field Camp)**

This six-week course, scheduled between the junior and senior years, focuses on geological field methods and mapping. The course is taken at another college or university, and the transfer of credits must be approved by the department.

### **Integrated Graduate Studies**

The department participates in the IGS program for both B.A./M.S. and B.S./M.S. degrees in geological sciences. These programs are intended for gifted and highly motivated students whose objectives are a degree at the master's or doctoral level. By more closely integrating undergraduate and graduate studies, qualified students begin a program of graduate work in their senior year leading to the simultaneous completion of requirements for both the bachelor's and master's degrees, each within its specified framework. Students who want to pursue this dual degree program should apply during the sophomore year.

## **Cooperative education**

The co-op program offers full-time undergraduate students in good academic standing the opportunity to engage in full-time, paid employment, consistent with their major fields of study. Students typically participate for one or two seven-month periods, such as summer-fall and/or spring-summer, beginning after their sophomore or junior year. Although participation in the program extends the time required to achieve a bachelor's degree, students often benefit from higher starting salaries and greater lifetime earnings that can result from the experience acquired in co-op assignments.



## BACHELOR OF SCIENCE, MAJOR IN GEOLOGICAL SCIENCES\*

<b>Freshman Year</b>	<b>Credit Hours</b>	<b>Junior Year</b>	<b>Credit Hours</b>
<b>Fall</b>		<b>Fall</b>	
CHEM 105 Principles of Chemistry I or equivalent . . . . .	(3)	GEOL 301 Stratigraphy and Sedimentation . . . . .	(3)
ECES 131 Elementary Computer Programming . . . . .	(3) <sup>a</sup>	or GEOL 341 Introductory Mineralogy and Petrology . . . . .	(4) <sup>d</sup>
MATH 121 Calculus for Science and Engineering I . . . . .	(4)	Upper level mathematics or science course . . . . .	(3) <sup>e</sup>
SAGES First Year Seminar . . . . .	(4)	GER course . . . . .	(3)
General Education Requirement (GER) course . . . . .	(3)	Approved elective . . . . .	(6)
PHED 101 Physical Education Activities . . . . .	(0)	<b>Spring</b>	
<b>Spring</b>		Approved elective . . . . .	(3)
CHEM 106 Principles of Chemistry II or equivalent . . . . .	(3)	or GEOL 210 Historical Geology and Paleontology . . . . .	(3) <sup>c</sup>
CHEM 113 Principles of Chemistry Laboratory . . . . .	(2)	GEOL 315 Structural Geology & Geodynamics . . . . .	(3)
MATH 122 Calculus for Science and Engineering II . . . . .	(4)	or GEOL 344 Igneous and Metamorphic Petrology . . . . .	(4) <sup>f</sup>
PHYS 121 General Physics I . . . . .	(4)	GEOL 317 Spring Field Course . . . . .	(3) <sup>g</sup>
SAGES University Seminar . . . . .	(3)	SAGES Department Seminar . . . . .	(2)
PHED 102 Physical Education Activities . . . . .	(0)	Upper level mathematics or science course . . . . .	(3) <sup>e</sup>
<b>Sophomore Year</b>		GER course . . . . .	(3)
<b>Fall</b>		<b>Summer between Junior and Senior years</b>	
GEOL 110 Physical Geology . . . . .	(3) <sup>b</sup>	GEOL 360 Summer Field Camp . . . . .	(6)
GEOL 119 Geology Laboratory . . . . .	(1)	<b>Senior Year</b>	
PHYS 122 General Physics II . . . . .	(4)	<b>Fall</b>	
Upper level mathematics or statistics course . . . . .	(3)	GEOL 341 Introductory Mineralogy and Petrology . . . . .	(4)
SAGES University Seminar . . . . .	(3)	or GEOL 301 Stratigraphy and Sedimentation . . . . .	(3) <sup>d</sup>
GER course . . . . .	(3)	SAGES Capstone . . . . .	(3)
<b>Spring</b>		Approved elective . . . . .	(3)
GEOL 210 Historical Geology and Paleontology . . . . .	(3)	Elective . . . . .	(3)
or approved elective . . . . .	(3) <sup>c</sup>	<b>Spring</b>	
PHYS 221 General Physics III . . . . .	(3)	GEOL 344 Igneous and Metamorphic Petrology . . . . .	(4)
Upper level mathematics or statistics course . . . . .	(3)	or GEOL 315 Structural Geology & Geodynamics . . . . .	(3) <sup>f</sup>
GER course . . . . .	(3)	GEOL 317 Spring Field Course . . . . .	(3) <sup>g</sup>
GER course . . . . .	(3)	SAGES Department Seminar . . . . .	(2)
Approved elective . . . . .	(3)	Approved electives . . . . .	(6)
		Elective . . . . .	(3)

\* Suggested outline only. Program is finalized in consultation with the departmental adviser.

a. Another computer programming course may be substituted for ECES 131.

b. GEOL 101 or 115 may be substituted for GEOL 110.

c. GEOL 210 is offered even-numbered years.

d. GEOL 301 (3) is offered even-numbered years, GEOL 341 (4) odd-numbered years.

e. Upper level Science course must be in a discipline other than geology.

f. GEOL 315 (3) is offered odd-numbered years, GEOL 344 (4) even-numbered years.

g. GEOL 317 is offered odd-numbered years.

## BACHELOR OF ARTS, MAJOR IN ENVIRONMENTAL GEOLOGY\*

<b>Freshman Year</b>	<b>Credit Hours</b>	<b>Junior Year</b>	<b>Credit Hours</b>
<b>Fall</b>		<b>Fall</b>	
CHEM 105 Principles of Chemistry I or equivalent. . . . .	(3)	ESTD 101 Introduction to Environmental Thinking . . . . .	(3)
MATH 125 Calculus I . . . . .	(4)	BIOL 110 Principles of Biology . . . . .	(3)
SAGES First Year Seminar . . . . .	(4)	Approved elective . . . . .	(3)
General Education Requirement (GER) course . . . . .	(3)	or GEOL 303 Environment and Law . . . . .	(3) <sup>b, c</sup>
GER course . . . . .	(3)	STAT 201 Basic Statistics for Social and Life Sciences . . . . .	(3)
PHED 101 Physical Education Activities . . . . .	(0)	or GEOL 321 Hydrogeology . . . . .	(3) <sup>b</sup>
		GER course . . . . .	(3)
<b>Spring</b>		<b>Spring</b>	
CHEM 106 Principles of Chemistry II or equivalent . . . . .	(3)	Approved elective . . . . .	(3)
CHEM 113 Principles of Chemistry Laboratory . . . . .	(2)	or GEOL 210 Historical Geology and Paleontology . . . . .	(3) <sup>a</sup>
MATH 126 Calculus II. . . . .	(4)	GEOL 220 Environmental Geology . . . . .	(3)
SAGES University Seminar . . . . .	(3)	Elective . . . . .	(3)
GER course . . . . .	(3)	or GEOL 305 Geomorphology and Remote Sensing . . . . .	(3) <sup>a</sup>
PHED 102 Physical Education Activities . . . . .	(0)	GEOL 317 Spring Field Course. . . . .	(3) <sup>b</sup>
		SAGES Department Seminar. . . . .	(2)
<b>Sophomore Year</b>		<b>Senior Year</b>	
<b>Fall</b>		<b>Fall</b>	
GEOL 110 Physical Geology. . . . .	(3)	GEOL 303 Environment and Law. . . . .	(3) <sup>b, c</sup>
GEOL 119 Geology Laboratory . . . . .	(1)	or approved elective . . . . .	(3)
PHYS 115 Introductory Physics I. . . . .	(4)	GEOL 321 Hydrogeology . . . . .	(3) <sup>b</sup>
SAGES University Seminar . . . . .	(3)	or STAT 201 Basic Statistics for Social and Life Sciences . . . . .	(3)
Electives . . . . .	(6)	SAGES Capstone. . . . .	(3)
		Elective . . . . .	(3)
<b>Spring</b>		<b>Spring</b>	
GEOL 210 Historical Geology and Paleontology . . . . .	(3) <sup>a</sup>	GEOL 305 Geomorphology and Remote Sensing . . . . .	(3) <sup>a</sup>
or approved elective . . . . .	(3)	or elective . . . . .	(3)
GER course . . . . .	(3)	GEOL 317 Spring Field Course. . . . .	(3) <sup>b</sup>
Approved elective. . . . .	(3)	SAGES Department Seminar. . . . .	(2)
Electives . . . . .	(6)	Electives . . . . .	(6)

\* Suggested outline only. Program is finalized in consultation with the departmental adviser.  
a. GEOL 210, 305, and 317 are offered even-numbered years.  
b. GEOL 303 or 317 and 322 are offered odd-numbered years.  
c. GEOL 202 (offered in Fall of even-numbered years) may be substituted for GEOL 303.

## BACHELOR OF ARTS, MAJOR IN ENVIRONMENTAL STUDIES

Environmental Studies is a multidisciplinary program that introduces students to the societal determinants and implications of environmental problems. Emphasis is given to the moral, cultural and political dimensions of environmental problems and solutions. It brings to bear the issues and methods of the humanities and social sciences as well as the sciences and professions on environmental questions. The program is designed to serve the needs of students seeking a liberal arts education as well as of those who desire a broad intellectual base for more technical training in environmental sciences.

The Environmental Studies program offers a major leading to the Bachelor of Arts degree. However, it may be elected only as a second major. The double major is required to that the multidisciplinary perspective offered by the program may be complemented by a concentrated disciplinary major. To declare the major, students should have declared a first major and have sophomore or junior standing. In the past, students with first majors in departments as diverse as English, philosophy, anthropology, psychology, geological sciences and biology have declared the environmental studies major. Up to six credits in required and elective courses taken by students for their first major may be applied to their environmental studies major.

The required courses are:

ESTD 101 Introduction to Environmental Thinking

ESTD 398 Seminar in Environmental Studies

In addition to the two required courses, one course must be selected from each of the three following areas of emphasis:

### Humanities

HSTY 378 History of the American Environment

RLGN 206 Religion and Ecology

### Social Policy

ECON 368 Environmental Economics

GEOL 303 Environmental Law

### Science and Engineering

ESYS 340 Introduction to Global Issues

BIOL 350 Introduction to Ecosystem Analysis

GEOL 201 Global Environmental Problems

At least 15 credit hours must be taken from a list of approved electives. This list will change from time to time as departmental offerings change. An approved Washington Semester internship may be used to satisfy part or all of the elective requirement. Students should consult with the Director of Environmental Studies for current information. All student programs must be approved by the director.

The minor in the College of Arts and Sciences consists of 15 credit hours: ESTD 101, one course from each of two of the three disciplinary groups, and two of the approved electives, which may include courses from the third unselected disciplinary grouping.

The sequence in environmental studies in the Case School of Engineering consists of 9 credit hours: ESTD 101, a course from the disciplinary list, and any two of the approved electives, which may include courses from the two unselected disciplinary groupings. Both ESTD 101 and GEOL 201 meet the GER Science and Society requirement. GEOL 303 meets the Social Institutions requirement.

## PROGRAM HIGHLIGHTS

- ESTD 387 is a course that offers a closer multidisciplinary look at single environmental problems, and includes a student independent research component. Past topics have included green building construction, environmental hazards of lead in the urban environment and community environmental priorities.
- ESTD 398 is a seminar course that has a different topic every year, and includes a week-long field trip at the end of the semester. In the past, classes have studied the Lewis & Clark expedition of 1802–04 and retraced the trip by van and canoe up the Missouri River Valley from St. Louis to Yellowstone; studied intentional communities and the ecovillage movement, and visited active communities in Ohio, Tennessee and North Carolina; and examined the best American nature writing from Thoreau to the present, traveling to Walden Pond and Cape Cod.
- The Washington Semester allows students to earn up to 15 hours of academic credit for supervised internships in Washington, D.C. The program involves an internship and seminar, and students are required to prepare a portfolio of their experience. Excellent hands-on learning opportunities include internships in Capitol Hill, in the White House and in interest group offices.

## FACILITIES

Research facilities include:

- thin sectioning and mineral separation facilities
- laboratories for chemical analysis of water including an ion chromatograph, colorimetric spectrometer, electrochemistry and an environmental glove box
- alpha and gamma spectroscopic facilities for analysis of environmental nuclides
- equipment for studying animal-sediment relations, including a scanning gamma spectrometer
- scanning electron microscope, electron microprobe and two double-collecting gas source mass spectrometers and extraction equipment for stable isotope studies
- chemical reactors and a diamond anvil press for high-temperature and high-pressure geochemical experiments
- high-speed computing equipment

Also housed in the department are laboratories for paleontological and micropaleontological investigations, and for work in ecology and sedimentology. A well field owned by the university is available for groundwater sampling and analysis. Geology students can use the four research ponds and laboratories located at Case's Squire Valleevue Farm.

The department also contains a wide range of additional equipment including reflected and transmitted light microscopes, fluid inclusion microscope, cathodoluminescence microscope, submicron and clay-silt-sand particle size analyzers, high magnetic field mineral separator, X-ray diffractometer and field equipment.

### FOR MORE INFORMATION

#### **General Bulletin**

[www.case.edu/bulletin](http://www.case.edu/bulletin)

#### **Office of Undergraduate Admission**

Phone: 216/368-4450

E-mail: [admission@case.edu](mailto:admission@case.edu)

Web site: <http://admission.case.edu>

**Case Western Reserve University**  
10900 Euclid Avenue  
Cleveland, OH 44106