

# GEOLOGY

## DEPARTMENT OFFICE

Darwin Hall 116  
(707) 664-2334  
www.sonoma.edu/geology

## DEPARTMENT CHAIR

Matthew J. James

## ADMINISTRATIVE COORDINATOR

Elisabeth Meyers

## EQUIPMENT TECHNICIAN

Ronnie Goodlund

## Faculty

Matthew J. James

Matty Mookerjee

Michael E. Smith

## Programs Offered

- Bachelor of Science in Geology
- Bachelor of Arts in Earth Science
- Minor in Geology
- Minor in Paleontology
- Secondary Education Teaching Credential Preparation

Geology is the study of the materials, structures, processes, and history of the earth. Philosophically, it allows us to realize our place in the physical universe within the enormity of geologic time. Practically, it leads to understanding of earth processes, the formation of rocks and minerals, and the energy supplies and materials that support our civilization.

The evolution of modern geologic thought is based on field studies and empiricism. A solid foundation in quantitative field and laboratory analysis provides a firm background in the principles of geology. Students take a fundamental curriculum that concentrates on the analysis of rocks and minerals, geologic mapping, and report writing. Required courses in physics, chemistry, and mathematics support understanding of geologic principles.

## Careers in Geology and Earth Science

Within the general field of geology, students may choose from major programs that lead to either a B.S. in Geology or a B.A. in Earth Science. The B.S. in Geology provides an excellent background for graduate school and for work in geology in such fields as engineering geology, environmental geology, hydrology, and mineral exploration. Many of our geology graduates work for consulting firms with specialties in one or more of these areas. The B.A. in Earth Science provides our students with the background to become teachers, environmental consultants, to work in the energy industry or in

governmental positions. Because of the selectivity involved in choosing a program that meets their own particular interests and goals, students must consult with a departmental advisor about their plan of study and their course load each semester.

## Bachelor of Science in Geology

(See pages 147-148 for sample four-year programs.)

This plan is intended to give the student basic professional competence in geology. A calculus-based series of support courses is highly recommended for students intending to pursue a more quantitative geoscience career. It provides an excellent foundation for graduate school or a professional career in the geosciences such as a Professional Geologist, Hydrologist, or Geophysicist registered with the State of California.

Degree Requirements	Units
General education	41*
Major requirements	50
Supporting courses	22-24
General electives	5-7
<b>Total units needed for graduation</b>	<b>120</b>

### Major Core Requirements

GEOL 205/205a Mineralogy	4/1
GEOL 303 Advanced Principles of Geology	4*
GEOL 304 Geologic Mapping and Report Writing	1
GEOL 307 Igneous and Metamorphic Petrology	4
GEOL 308 Igneous and Metamorphic Field	1
GEOL 309 Computer Application in Geology	4
GEOL 311 Sedimentary Geology	4
GEOL 312 Sedimentary Geology Field	1
GEOL 313 Paleontology	4
GEOL 314 Paleontology Field	1
GEOL 317 Structural Geology	4
GEOL 318 Structural Geology Field	1
GEOL 420 Integrative Field Experience (Senior field)	4
GEOL 427 Advanced Field Geology (Summer field)	4
<b>Total units in the major core</b>	<b>41</b>

### Major Electives

Choose 9 units of upper-division geology electives in consultation with a departmental advisor.

**Total units in major electives 9**

### Required Supporting Courses

CHEM 115AB General Chemistry	10
PHYS 114 Introduction to Physics I or PHYS 210A General Physics	3/4
PHYS 116 Introductory Laboratory or PHYS 209A General Physics Laboratory	1
PHYS 214 Introduction to Physics II † or PHYS 210B General Physics †	3/4

PHYS 216 Introductory Laboratory †	
or PHYS 209B General Physics Laboratory †	1
MATH 161 Calculus I with Analytic Geometry	4*
<b>Total units in supporting courses</b>	<b>22/24</b>
<b>Total units in the major</b>	<b>72/80</b>

\* The standard 51 units of GE are reduced by 3 units each from GEOL 102, GEOL 303, and MATH 161, which are major requirements. These three classes satisfy requirements in GE categories B1, B3, and B4, respectively.

† GEOL 310 may be substituted.

## Bachelor of Arts in Earth Science

(See page 148 for sample four-year programs.)

The Earth Science B.A. is designed to provide students with a firm foundation in the geological sciences. A diversity of elective courses allow students interested in related fields to build a supplementary minor. It provides a clear path to graduation and is ideal for students pursuing careers in earth science education, state agencies, environmental geology, and hydrogeology.

Degree Requirements	Units
General education	41
(50 units, 9 units satisfied by major requirements)	
Major requirements	51
Supporting courses	10-14
General electives	14-18
<b>Total units needed for graduation</b>	<b>120</b>

### Required Major Core Courses

#### (I) One 100-Level Geology Course

GEOL 102+§	3
GEOL 105+	3
GEOL 107	3
GEOL 110	3
GEOL 120	3

#### (II) Both of the Following

GEOL 303 Advanced Principles of Geology#	4
GEOL 304 Geologic Mapping and Report Writing	1

#### (III) Two of the Following 300-Level Courses

GEOL 307/308 Igneous and Metamorphic Petrology and Field Course†	5
GEOL 311/312 Sedimentary Geology and Field Course	5
GEOL 313/314 Paleontology and Field Course	5
GEOL 317/318 Structural Geology and Field Course	5
<b>Total units in the major core</b>	<b>18</b>

### (IV) Major Electives

Choose 33 additional units of Earth Science-related courses in consultation with a major advisor. See list of suggested courses on the following page. Major Elective courses must be approved by a major advisor. At least 20 units must be 200-level or above, and at least 15 units must be Geology courses.

<b>Total units in major electives</b>	<b>33</b>
---------------------------------------	-----------

### Required Supporting Courses

MATH 107	
or MATH 161	
or MATH 165**	4
CHEM 102*§	
or CHEM 110	
or CHEM 115A	3-5
Any 100 or 200-level Physics or Astronomy course	3-5

<b>Total units in supporting courses</b>	<b>10-14</b>
--	--------------

<b>Total units in the major</b>	<b>61-65*</b>
---------------------------------	---------------

+ Also counts toward GE B1 requirement

# Also counts toward GE B3 requirement

§ Satisfies GE lab requirement

† GEOL 205 is a prerequisite

\*\* Also counts towards GE B4 requirement

### Suggested Major Elective Courses

#### Geology

GEOL 102 Our Dynamic Earth	3
GEOL 105 The Age of Dinosaurs	3
GEOL 107 Introduction to Earth Science	3
Highly recommended for students pursuing a teaching credential	
GEOL 110 Natural Disasters	3
GEOL 120 Regional Field Geology	3
GEOL 205 Mineralogy	4
GEL 301 Natural History of the Hawaiian Islands	3
GEOL 302 The Geology of Climate Change	3
GEOL 306 Environmental Geology	3
GEOL 307 Igneous and Metamorphic Petrology	4
GEOL 308 Igneous and Metamorphic Petrology Field Course	1
GEOL 310 Geophysics	4
GEOL 311 Sedimentary Geology	4
GEOL 312 Sedimentary Geology Field Course	1
GEOL 313 Paleontology	4
GEOL 314 Paleontology Field Course	1
GEOL 317 Structural Geology	4
GEOL 318 Structural Geology Field Course	1
GEOL 320 Basin Analysis	4
GEOL 321 Burgess Shale Paleontology	3
GEOL 323 Hydrology	3
GEOL 326 Stratigraphy and Earth History	4
GEOL 420 Integrated Field Experience	4
GEOL 427 Advanced Field Geology	4
GEOL 422 Geochemistry	3
GEOL 425 Economic Geology	3
GEOL 495 Special Studies	1-4

#### Anthropology

ANTH 201 Introduction to Biological Anthropology	3
ANTH 202 Introduction to Archaeology	3
ANTH 301 Human Fossils and Evolution	4
ANTH 201 or BIOL 115 prerequisite	
ANTH 322 Historical Archaeology	4
ANTH 315 World Prehistory	4

## Studio Art

ARTS 202 Beginning Drawing

## Astronomy

ASTR 100 Descriptive Astronomy

ASTR 231 Introductory Observational Astronomy

*ASTR 100 prerequisite*

ASTR 350 Cosmology

*ASTR 100 prerequisite*

## Biology

BIOL 312 Biological Oceanography

*BIOL 110, 115, or 121/122 pre- or corequisite*

BIOL 333 Ecology

*BIOL 121, 122, and MATH 165 prerequisite*

BIOL 335 Marine Ecology

*BIOL 121, 122, and MATH 165 prerequisite*

## Environmental Studies and Planning

ENSP 200 Global Environmental Issues

*ENGL 101 or PHIL 101 prerequisite*

ENSP 302 Applied Ecology

ENSP 309 Soil Science

ENSP 322 Conservation Biology

*ENSP 302 and BIOL 122 prerequisite*

ENSP 330 Energy, Technology and Society

ENSP 451 Water Regulation

## Geography

GEOG 204 Global Environmental Systems

GEOG 205 Introduction to Map Reading and Interpretation

GEOG 315 Field Methods in Geography

*GEOG 205 and MATH 165 pre- or corequisite*

GEOG 340 Conservation of Natural Resources

GEOG 360 Geomorphology

*GEOG 204 and GEOL 102 prerequisite*

GEOG 365 Biogeography and Landscape Ecology

*BIOL 115, 121 or 122 prerequisite*

GEOG 370 Weather and Climate

*GEOG 204 prerequisite*

GEOG 380 Remote Sensing and Image Processing

*GEOG 205 prerequisite*

GEOG 387 Geographic Information Systems

*GEOG 205 prerequisite*

## Minor in Geology

Completion of a minimum of 20 units from Geology Department courses will constitute a minor in geology. Six of the 20 units must be upper-division. Students should consult with an advisor in the Geology Department regarding required courses.

## Minor in Paleontology

### PROGRAM COORDINATOR

Matthew J. James / Geology Department (707) 664-2301,  
james@sonoma.edu

### ADVISORS

Matthew J. James / Geology Department (707) 664-2301,  
james@sonoma.edu

Nicholas R. Geist / Biology Department (707) 664-3056,  
geist@sonoma.edu

Karin E. Jaffe / Anthropology Department (707) 664-2944,  
karin.jaffe@sonoma.edu

Alexis Boutin / Anthropology Department (707) 664-2729,  
alexis.boutin@sonoma.edu

## Minor in Paleontology

The Minor in Paleontology offers students from any major on the SSU campus a cross-disciplinary concentration in the study of ancient life on Earth. Paleontology is by its very nature an inter-disciplinary field of study, blending both laboratory and field studies of modern organisms and extinct organisms. Some paleontologists approach the field from a geological perspective, and others approach it from a biological perspective. For a Minor in Paleontology, students must complete 20 units as described below.

### Minor Core Requirements

	<i>Units</i>
GEOL 102 Our Dynamic Earth	3
GEOL 313 Paleontology	4
BIOL 121 Diversity, Structure, and Function, or BIOL 122 Genetics, Evolution, and Ecology	4
<b>Total units in the minor core</b>	<b>11</b>

### Minor Electives

In addition to the Minor Core, choose 9 units of electives from other paleontology courses and/or courses with an emphasis on interpreting the history of life on Earth, and at least 1 unit that is a field course (marked by asterisk below). All SSU majors may select the Minor in Paleontology, and if you are majoring in either Biology or Geology, at least 3 upper division elective units must be from outside your home department. Additional courses may be counted toward the minor with approval of one of the minor advisors above. The 9 elective units must include at least one 4-unit upper division course with a laboratory from the following list:

ANTH 301 Human Fossils and Evolution	4
ANTH 326 Bioarchaeology [Topics in Archaeology]	4
ANTH 412 Human Osteology	4
*ANTH 415 Forensic Anthropology	4
*BIOL 220 Human Anatomy	4
*BIOL 322 Invertebrate Biology	4
*BIOL 327 Vertebrate Biology	4

<sup>†</sup> BIOL 328 Vertebrate Evolution and Morphology	4
BIOL 385 Biology of the Dinosaurs	3
GEOG 370 Weather and Climate	4
GEOG 372 Climate Change	4
GEOL 105 The Age of Dinosaurs	3
GEOL 120 Regional Field Geology	3
GEOL 302 Geology of Climate Change	3
<sup>†</sup> GEOL 303 Advanced Principles of Geology	4
*GEOL 304 Geologic Mapping and Report Writing	1
*GEOL 314 Paleontology Field Course	1
*GEOL 321 Burgess Shale Paleontology	3
<sup>†</sup> GEOL 326 Stratigraphy and Earth History	4

**Total elective units in the minor 9**

\* Field courses – one course is required for the minor

<sup>†</sup> 4-unit laboratory courses – one course is required for the minor

Some of these elective courses above might have additional prerequisites not listed here. Refer to the University catalog for additional information.

**Total units for the paleontology minor 20**

## Secondary Education Teaching Credential Preparation

Geology and Earth Science students must demonstrate competence in the natural sciences by passing the subject matter examination required by the California Commission on Teacher Credentialing (CCTC). One part of the examination will test breadth of knowledge in biology, chemistry, physics, astronomy, and geology. Another part of the examination will test depth of knowledge in a particular area, such as geology. The B.S. in Geology or the B.A. in Earth Science degrees are recommended to prepare for the part of the examination that tests depth of knowledge in geology. For recommended course selection to help prepare for the part of the examination that tests breadth of scientific knowledge, please see the Teaching Credential section of the SSU catalog. GEOL 107, Introduction to Earth Science, is specifically designed for students who are preparing to take the CCTC single-subject exam.

For more information, please contact the Department of Geology, (707) 664-2334.

### Department Policy for Senior Theses (GEOL 426A/426B)

1. The student must have a 3.00 or higher departmental grade point average.
2. The student must have demonstrated ability to work independently and do quality work in both the lecture and field classes.
3. The student must have time in his/her schedule to complete two semesters of research (three credit hours each) and register for both 426A (in the Fall) and 426B (in the Spring).
4. The student must submit a detailed proposal of research, a schedule, a budget and an initial hypothesis.
5. The student must have a faculty sponsor who is willing to advise the project and will set up a schedule of meetings for this purpose.

6. Two copies of the final paper/report will be filed with the department office before a grade will be assigned.
7. The student will present the results of her/his project at the department colloquium.

## Sample Four-year Plan for Bachelor of Science in Geology

### FRESHMAN YEAR: 29 Units

<i>Fall Semester (14 Units)</i>	<i>Spring Semester (15 Units)</i>
GEOL 102 (3)	MATH 161 (4)
CHEM 115A (5)	CHEM 115B (5)
GE (6)	GE (6)

### SOPHOMORE YEAR: 28 Units

<i>Fall Semester (15 Units)</i>	<i>Spring Semester (13 Units)</i>
GEOL 303 (4)	PHYS 114 (4)
GEOL 304 (1)	PHYS 116 (1)
GEOL 205 (4)	GEOL 311 (4)
GEOL 309 (4)	GEOL 312 (1)
GE (2)	GE (3)

### JUNIOR YEAR: 29 Units

<i>Fall Semester (14 Units)</i>	<i>Spring Semester (15 Units)</i>
GEOL 313 (4)	GEOL 307 (4)
GEOL 314 (1)	GEOL 308 (1)
GEOL 317 (4)	GEOL 310 (4)
GEOL 318 (1)	GEOL 323 (3)
GE (4)	GE (3)

### SENIOR YEAR: 30 Units

<i>Fall Semester (15 Units)</i>	<i>Spring Semester (15 Units)</i>
Geology Elective (3)	GEOL 420 (4)
GE (12)	Geology Elective (3)
	GE (8)

### SENIOR SUMMER: 4 Units

GEOL 427 (4) [Summer Field Camp]

### TOTAL SEMESTER UNITS: 120

## Sample Four-year Plan for Bachelor of Arts in Earth Science

### FRESHMAN YEAR: 30 Units

#### Fall Semester (16 Units)

Major Core I § (3)  
GE (13)

#### Spring Semester (14 Units)

MATH 107 § (4)  
CHEM 110 (3)  
GE (7)

### SOPHOMORE YEAR: 30 Units

#### Fall Semester (15 Units)

GEOL 303 (4)\*  
GEOL 304 (1)  
GEOL Electives (8)  
GE (2)

#### Spring Semester (15 Units)

Major Core II (5)  
PHYS 100 (3)  
PHYS 102 (1)  
GE (6)

### JUNIOR YEAR: 29 Units

#### Fall Semester (13 Units)

Major Core II (5)  
GEOL Electives (5)  
Upper Division GE (3)

#### Spring Semester (16 Units)

GEOL Electives (8)  
Upper Division GE (3)  
GE (5)

### SENIOR YEAR: 31 Units

#### Fall Semester (16 Units)

GEOL Electives (8)  
GE (8)

#### Spring Semester (15 Units)

GEOL Electives (4)  
Upper Division GE (3)  
GE (3)  
General Electives (3)

### TOTAL SEMESTER UNITS: 120

\* Fulfills upper division and GE B3 requirement

§ Fulfills GE B4 requirement

## Sample Two-year Plan for Transfer Students Bachelor of Science in Geology

### JUNIOR YEAR: 33 Units

#### Fall Semester (18 Units)

GEOL 303 (4)  
GEOL 304 (1)  
GEOL 205 (4)  
GEOL 309 (4)  
CHEM 115A (5)

#### Spring Semester (15 Units)

GEOL 307 (4)  
GEOL 308 (1)  
GEOL 311 (4)  
GEOL 312 (1)  
CHEM 115B (5)

### SENIOR YEAR: 31 Units

#### Fall Semester (14 Units)

GEOL 317 (4)  
GEOL 318 (1)  
GEOL 313 (4)  
GEOL 314 (1)  
MATH 161 (4)

#### Spring Semester (17 Units)

GEOL 310 (4)  
GEOL 323 (3)  
PHYS 209A&B (4)  
GEOL 420 (4)  
Geology Elective (2)

### SENIOR SUMMER: 4 Units

GEOL 427 (4)

### TOTAL SEMESTER UNITS: 68

## Sample Two-year Plan for Transfer Students Bachelor of Arts in Earth Science

### JUNIOR YEAR: 30 Units

#### Fall Semester (15 Units)

GEOL 303 (4)\*  
GEOL 304 (1)  
GEOL Electives (7)  
CHEM 110 (3)

#### Spring Semester (15 Units)

Major Core II (5)  
GEOL Elective (4)  
MATH 165 § (4)  
GE (2)

### SENIOR YEAR: 32 Units

#### Fall Semester (16 Units)

Major Core II (5)  
GEOL Electives (8)  
Upper Division GE (3)

#### Spring Semester (16 Units)

GEOL Electives (14)  
Upper Division GE (2)

### TOTAL SEMESTER UNITS: 62