Geology (GEO)

Major and Minor in Geology
Department of Geosciences, College of Arts and Sciences

CHAIRPERSON: Teng-fong Wong  DIRECTOR OF UNDERGRADUATE STUDIES: Hanna Nekvasil  E-MAIL: Hanna.Nekvasil@stonybrook.edu
OFFICE: 255 Earth and Space Sciences  PHONE: (631) 632-8200  WEB ADDRESS: http://www.geo.sunysb.edu

Minors of particular interest to students majoring in Geology and Earth and Space Sciences: Environmental Studies (ENS), Marine Sciences (MAR), engineering minors

Faculty
Daniel M. Davis, Professor, Ph.D., Massachusetts Institute of Technology: Geophysics.
Robert T. Dodd, Jr., Professor Emeritus, Ph.D., Princeton University: Geochemistry.
Steven C. Englebright, M.S., Curator, Stony Brook University: Geology.
Gilbert N. Hanson, Professor, Ph.D., University of Arizona: Geophysics.
Robert C. Liebermann, Professor and Distinguished Service Professor, Ph.D., Columbia University: Geophysics.
Donald H. Lindsley, Distinguished Professor Emeritus, Ph.D., Johns Hopkins University: Geochemistry; petrology.
Scott M. McLennan, Professor, Ph.D., Australian National University: Geochemistry.
William J. Meyers, Professor Emeritus, Ph.D., Rice University: Sedimentology.
Hanna Nekvasil, Professor, Ph.D., Pennsylvania State University: Geochemistry; petrology.
John B. Parise, Professor, Ph.D., James Cook University: Crystallography; mineral physics.
Brian L. Phillips, Assistant Professor, Ph.D., University of Illinois: Geochemistry, mineralogy.
Troy Rasbury, Assistant Professor, Ph.D., Stony Brook University: Geochemistry; sedimentology.
Richard J. Reeder, Professor, Ph.D., University of California, Berkeley: Geochemistry; sedimentology.
Martin A. Schoonen, Professor, Ph.D., Pennsylvania State University: Geochemistry.
Donald J. Weidner, Distinguished Professor, Ph.D., Massachusetts Institute of Technology: Geophysics.
Lianxing Wen, Assistant Professor, Ph.D., California Institute of Technology: Global geophysics.
Teng-fong Wong, Professor, Ph.D., Massachusetts Institute of Technology: Geophysics.

Affiliated Faculty
Robert C. Aller, MSRC
Henry J. Bokuniewicz, MSRC
J. Kirk Cochran, MSRC
Marvin Geller, MSRC

David W. Krause, Anatomical Sciences
Charles Nittouer, MSRC

Teaching Assistants
Estimated number: 12

The Department of Geosciences offers two undergraduate programs: the Geology major, leading to a Bachelor of Science degree, and the Earth and Space Sciences major, leading to a Bachelor of Arts degree. Minimum course requirements for the B.S. program in Geology are detailed below. For requirements for the B.A. program in Earth and Space Sciences, see the entry in the alphabetical listing of Approved Majors, Minors, and Programs. Upon declaring the major, the student is assigned a faculty advisor who will assist in the selection of a course sequence leading to the degree. Students should consult frequently with their faculty advisors regarding their progress and regarding appropriate science courses. Because the position of the scientist in society is responsible and complex, the student is cautioned to pay careful attention to general education in the arts, humanities, and social sciences.

Geology

The science of geology is concerned with the physical and chemical nature of the earth (and other planets) and the evolution of the earth over the vast expanse of geological time. The B.S. program in Geology includes four specializations: Geology, Environmental Geoscience, Engineering Geology, and Geological Oceanography. The major aims at providing the student with maximum preparation to carry out graduate and professional work in each of these fields. Students graduating with a B.S. in Geology typically go on to graduate school or obtain professional employment with environmental consulting firms or various government organizations.

Courses in Geology

See the Course Descriptions listing in this Bulletin for complete information.

GEO 101-E Environmental Geology
GEO 102-E The Earth
GEO 103-E The Earth Through Time
GEO 107-E Natural Hazards
GEO 109-E Life Through Time
GEO 112 Physical Geology Laboratory
GEO 113 Historical Geology Laboratory
GEO 121 Principles of Geology
GEO 122-E Physical Geology
GEO 287 Introductory Research in Geology
GEO 302 GIS For Geologists
GEO 305 Field Geology
GEO 306 Mineralogy and Petrology I
GEO 309 Structural Geology
GEO 310 Introduction to Geophysics
GEO 311-H Geoscience and Global Concerns
GEO 315 Groundwater Hydrology
GEO 316 Geochemistry of Surficial Processes
GEO 318 Engineering Geology and Coastal Processes
GEO 320-E Glacial Geology
GEO 327 Computerized Modeling of Geological Phenomena
GEO 353 Marine Ecology
GEO 401 Optical Mineralogy
GEO 403 Stratigraphy
GEO 405 Field Camp
GEO 407 Mineralogy and Petrology II
GEO 420 Environmental Analysis Using Remote Sensing and Geographic Information Systems
GEO 447 Senior Tutorial in Geology
GEO 452 Seismology

Independent research, teaching practica, and internship courses
Requirements for the Major in Geology (GEO)

The major in Geology leads to the Bachelor of Science degree. All courses offered for the major must be passed with a letter grade of C or higher.

Completion of the major requires 66-68 credits.

Geology and Environmental Geoscience Specializations

A. Required departmental courses
Geology Specialization
- GEO 103 The Earth Through Time
- GEO 113 Historical Geology Laboratory
- GEO 122 Physical Geology
  or GEO 102 The Earth and GEO 112 Physical Geology Laboratory
- GEO 306 Mineralogy and Petrology I
- GEO 309 Structural Geology
- GEO 310 Introduction to Geophysics
- GEO 401 Optical Mineralogy
- GEO 403 Stratigraphy
- GEO 405 Field Camp
- GEO 407 Mineralogy and Petrology II
- Laboratory
Environmental Geoscience Specialization
- GEO 101 Environmental Geology
- GEO 122 Physical Geology
  or GEO 102 The Earth and GEO 112 Physical Geology Laboratory
- GEO 306 Mineralogy and Petrology I
- GEO 309 Structural Geology
- GEO 310 Introduction to Geophysics
- GEO 401 Optical Mineralogy
- GEO 403 Stratigraphy
- GEO 405 Field Camp
- GEO 407 Mineralogy and Petrology II
- Laboratory
- GEO 102 The Earth
- GEO 112
- GEO 122 Physical Geology
  or GEO 102 The Earth and GEO 112 Physical Geology Laboratory
- GEO 306 Mineralogy and Petrology I
- GEO 309 Structural Geology
- GEO 310 Introduction to Geophysics
- GEO 401 Optical Mineralogy
- GEO 403 Stratigraphy
- GEO 405 Field Camp
- GEO 407 Mineralogy and Petrology II
- Laboratory

B. Required courses in the related sciences

A coherent set of upper-division science courses, totaling 12 credits, that has been approved by the department.

D. Upper-Division Writing Requirement
All students majoring in Geology must submit two papers (term papers, laboratory reports, or independent research papers) to the director of undergraduate studies for Department evaluation by the end of the junior year. If this evaluation is satisfactory, the student will have fulfilled the upper-division writing requirement. If it is not, the student must fulfill the requirement before graduation.

Engineering Geology Specialization

A. Required courses
- GEO 101 Environmental Geology
- GEO 122 Physical Geology
  or GEO 102 The Earth and GEO 112 Physical Geology Laboratory
- GEO 306 Mineralogy and Petrology I
- GEO 309 Structural Geology
- GEO 310 Introduction to Geophysics
- GEO 401 Optical Mineralogy
- GEO 403 Stratigraphy
- GEO 405 Field Camp
- GEO 407 Mineralogy and Petrology II
- Laboratory

C. Related science electives

A coherent set of science and engineering courses, totaling at least six credits, approved by the Department.

Geological Oceanography Specialization

A. Required courses
- GEO 122 Physical Geology
  or GEO 102 The Earth and GEO 112 Physical Geology Laboratory
- GEO 306 Mineralogy and Petrology I
- GEO/BIO 353 Marine Ecology
- GEO 401 Optical Mineralogy
- GEO 403 Stratigraphy
- MAR 104 Oceanography
- MAR 304 Waves, Tides, and Beaches
- MAR 333 Coastal Oceanography
- MAR 346 Marine Sedimentology
- MAR 350 Intro. to Ocean Physics

B. Required Courses in related sciences

MAT 131, 132 Calculus I, II (see Note 1 below)
AMS 261 Applied Calculus IV: Differential Equations
BIO 150 The Living World
BIO 201 Fundamentals of Biology: Organisms to Ecosystems
CHE 131, 132 General Chemistry
  or CHE 141, 142 Honors Chemistry
PHY 131/133, 132/134 Classical Physics I, II and labs
  or PHY 125, 126, 127 Physics A,B,C
  or PHY 141, 142 Classical Physics I, II: Honors

C. Upper-Division Writing Requirement

See D under “Geology and Environmental Geoscience Specializations” at left.

Notes:

1. The following alternate beginning calculus sequences may be substituted for MAT 131, 132 in major requirements or prerequisites: MAT 125, 126, 127 or 141, 142. Equivalency for MAT courses achieved by earning the appropriate score on a University mathematics placement examination will be accepted as fulfillment of the requirement without the necessity of substituting other credits. For detailed information about the various calculus sequences, see “Beginning Mathematics Courses” under the entry for the Department of Mathematics and the individual course descriptions.

2. In the Geology, Environmental Geoscience, and Engineering Geology specializations, the following physics courses are alternatives to PHY
Sample Course Sequences for the Major in Geology

<table>
<thead>
<tr>
<th>Geology</th>
<th>Environmental Geoscience</th>
<th>Engineering Geology</th>
<th>Geological Oceanography</th>
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**Freshman**

**Fall:**
- D.E.C. A (3cr)
- D.E.C. A (3cr)
- D.E.C. A (3cr)
- D.E.C. A (3cr)
- CHE 131 (4cr)
- CHE 131 (4cr)
- CHE 131 (4cr)
- CHE 131 (4cr)
- GEO 102 (3cr)
- GEO 102 (3cr)
- GEO 102 (3cr)
- GEO 102 (3cr)
- GEO 112 (1cr)
- GEO 112 (1cr)
- GEO 112 (1cr)
- GEO 112 (1cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)

**Credits:** 14 14 14 14

**Spring:**
- D.E.C. A (3cr)
- D.E.C. A (3cr)
- D.E.C. A (3cr)
- D.E.C. A (3cr)
- CHE 132 (4cr)
- CHE 132 (4cr)
- CHE 132 (4cr)
- CHE 132 (4cr)
- MAT 131 (4cr)
- MAT 131 (4cr)
- MAT 131 (4cr)
- MAT 131 (4cr)
- GEO 103 (3cr)
- GEO 103 (3cr)
- GEO 101 (3cr)
- GEO 101 (3cr)
- GEO 113 (1cr)
- GEO 113 (1cr)
- D.E.C. (3cr)
- D.E.C. (3cr)

**Credits:** 15 14 14 17

**Sophomore**

**Fall:**
- MAT 132 (4cr)
- GEO Elec (3cr)
- MAT 132 (4cr)
- AMS 261 (4cr)
- MAT 132 (4cr)
- PHY 131/133 (4cr)
- PHY 131/133 (4cr)
- PHY 131/133 (4cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)

**Credits:** 14 14 14 15

**Spring:**
- GEO 306 (4cr)
- GEO Elec (3cr)
- AMS 261 (4cr)
- GEO 306 (4cr)
- PHY 132/134 (4cr)
- PHY 132/134 (4cr)
- PHY 132/134 (4cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)

**Credits:** 17 14 14 17

**Junior**

**Fall:**
- GEO 401 (1cr)
- GEO 401 (1cr)
- MEC 260 (3cr)
- AMS 361 (4cr)
- GEO 403 (4cr)
- GEO 403 (4cr)
- GEO 403 (4cr)
- GEO 403 (4cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- UpperDiv Elec (3cr)
- UpperDiv Elec (3cr)

**Credits:** 17 15 17 15

**Spring:**
- GEO 309 (4cr)
- ATM 397 (3cr)
- MEC 363 (4cr)
- MAR 333 (3cr)
- GEO Elec (3cr)
- GEO 309 (3cr)
- GEO 315 (3cr)
- D.E.C. (3cr)
- GEO 303 (3cr)
- GEO 305 (3cr)
- GEO 305 (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- UpperDiv Elec (3cr)
- UpperDiv Elec (3cr)

**Credits:** 15 15 16 15

**Summer:**
- GEO 405 (3cr)

**Credits:** 16 (+3 Summer) 15 16 15

**Senior**

**Fall:**
- GEO 310 (3cr)
- AMS 210 (3cr)
- GEO 318 (3cr)
- MAR 304 (3cr)
- GEO 310 (3cr)
- GEO 310 (3cr)
- GEO 310 (3cr)
- MAR 346 (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- D.E.C. (3cr)
- UpperDiv Elec (3cr)
- UpperDiv Elec (3cr)
- UpperDiv Elec (3cr)
- UpperDiv Elec (3cr)

**Credits:** 18 15 15 14

**Spring:**
- GEO Elec (3cr)
- GEO Elec (3cr)
- GEO 309 (4cr)
- GEO/MAR 353 (3cr)
- UpperDiv Elec (3cr)
- UpperDiv Elec (3cr)
- UpperDiv Elec (3cr)
- UpperDiv Elec (3cr)
- UpperDiv Elec (3cr)
- UpperDiv Elec (3cr)
- UpperDiv Elec (3cr)
- UpperDiv Elec (3cr)
- UpperDiv Elec (3cr)
- UpperDiv Elec (3cr)

**Credits:** 15 15 16 15

131/133, 132/134: PHY 121/123, 122/124 or PHY 125, 126, 127 or PHY 141, 142.

**Honors Program in Geology**

Students in the Geology major who have maintained a grade point average of 3.50 in natural sciences and mathematics through the junior year may become candidates for Departmental honors in Geology by applying to the Department.

In addition to the academic program, the student must complete an honors thesis, which is evaluated by a committee composed of the student’s advisor and two other science faculty members including one from outside of the Department. If the honors program is completed with distinction and the student has maintained a minimum 3.50 grade point average in all coursework in natural sciences and mathematics, honors are conferred.

**Requirements for the Minor in Geology (GEO)**

For students majoring in other areas who are interested in obtaining a fundamental understanding of the earth sciences, a minor concentration in Geology with two distinct specializations—Geology and Environmental Geoscience—is available. The Geology specialization acquaints students with earth materials, the origin and evolution of life on earth, and physical processes that have shaped the earth through time. The Environmental Geoscience specialization acquaints students with the fundamental environmental problems that are dealt with by geoscientists.

All courses offered for the minor must be passed with a letter grade of C or higher. Completion of the minor requires 20 credits.

**Geology Specialization**

- GEO 103 and 113
- GEO 122 Physical Geology
  or GEO 102 The Earth and GEO 112 Physical Geology Laboratory

Twelve additional credits from among GEO courses numbered 300 or higher

**Environmental Geoscience Specialization**

- GEO 101
- GEO 122 Physical Geology
  or GEO 102 The Earth and GEO 112 Physical Geology Laboratory
- GEO 315 Groundwater Hydrology

Nine additional credits chosen from GEO 304, 306, 307, 309, 310, 311, 316, 318, 401, 403

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