

Geology

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The Geology major provides a broad background in the physical sciences, with a strong focus on geology and its pivotal role in understanding our environment. Our graduates enter graduate school for continuing education, or move into the workforce prepared to contribute as leaders addressing the many local and global issues facing society.

The major emphasizes experiential learning through field studies and outdoor education. Courses include real projects and original research participation. The program is enriched through department field trips across New England, eastern Canada, and the western United States. All Geology majors take a pair of capstone courses involving an original research project and a seminar designed to synthesize their education and tie scientific thought to issues in society.

Students majoring in Geology have access to equipment for analyses of ground and surface water, soil, sediment, and rock. This equipment enables terrestrial and lake coring, collection of hydro-geochemical data, determination of sediment characteristics, subsurface studies, geological mapping, and more. Specific analytical tools include X-ray diffractometer, scanning electron microscope, and inductively coupled plasma spectrophotometer. The program also has a range of geophysical exploration equipment, including a gravity meter, seismographs, electromagnetometers, a magnetometer, and ground penetrating radar instruments.

Goals:

- To provide a Liberal Arts degree program in Geology having a broad background in the physical sciences with a focus on geology and its pivotal role in understanding our environment.

- To provide instruction and experiences with emphasis on field studies, solution of active problems, and communication in a professional format.

Outcomes:

- Know the procedures for identification of rocks, minerals and fossils,
- Understand the stresses produced in a dynamic Earth and their resulting products, and know the fundamentals of plate tectonic theory,
- Understand the materials and processes involved in the constitution and transformation of the Earth, both on the surface and within,
- Know how to define a problem, design a study to acquire data, critically analyze and interpret data, and discuss the implications of results, and
- Be able to think critically about published professional work, synthesize the content of such work, and present findings at a professional level both in writing and orally.
- Meet the University's General Education Goals.

Careers for this Major:

- Graduate school
- State and federal surveys
- Military
- Teaching
- Industry and consulting

B.S. in Geology – Curriculum Map

Freshman			
Fall	Credits	Spring	Credits
CH 103 General Chemistry I	4	CH 104 General Chemistry II	4
GL 110 Introduction to Geology (General Education Lab Science)	4	EN 102 Composition and Literature II	3
EN 101 Composition and Literature I	3	GL 156 Introduction to Earth Evolution (General Education Lab Science)	4
MA 107 Precalculus Mathematics (General Education Math)	4	MA 108 Applied Calculus (General Education Math)	4
	15		15
Sophomore			
Fall	Credits	Spring	Credits
EN 201 World Literature I (General Education Literature)	3	EN 202 World Literature II	3
General Education Social Science	3	General Education Arts & Humanities	3
GL 200 level Elective ¹	4	GL 200 level Elective ¹	4
GL 251 Sophomore Seminar in Geology	1	PS 202 General Physics II	4
PS 201 General Physics I	4	Free Elective	3-4
Free Elective	3-4		
	18-19		17-18
Junior			
Fall	Credits	Spring	Credits
General Education History	3	General Education Ethics ³	3
GL 200 level Elective ¹	4	GL 200 level Elective ¹	4
MA 232 Elementary Statistics	3	GL 340 Project Development in Geology	1
Tech Elective ²		Tech Elective ²	3-4
Free Elective	3-4	Free Elective	3-4
		Free Elective	3-4
	13-14		17-20
Senior			
Fall	Credits	Spring	Credits
GL 2XX Elective ¹	4	GL 200 level Elective ¹	4
GL 440 Research Project in Geology (General Education Capstone)	3	GL 451 Geology Seminar (Capstone)	3
Tech Elective ²	3-4	GL 460 Project Completion in Environmental Geology	1
Free Elective	3-4	Tech Elective ²	3-4
Free Elective	3-4	Free Elective	3-4
		Free Elective	3-4
	16-19		17-20
Total Credits: 128-140			

¹ These six electives must include Sedimentation (GL 257), Structural Geology (GL 262), and Mineralogy (GL 263).

² Technical Electives for this degree include Science courses (GL, ES, CH, BI, PS), Mathematics (above MA 103 College Algebra I), Engineering, or Computer Science courses to include CS 140 or any CS 200-level course.

³ PH 323 Environmental Ethics strongly recommended.

Geology Minor

GL Elective	3
GL Elective	3

GL Elective (200 level or higher)	3
GL Elective (200 level or higher)	3
GL Elective (200 level or higher)	3
GL Elective (200 level or higher)	3
Total Credits	18

Courses

GL 110 Introduction to Geology 4 Credits

An introduction to Earth's internal and external physical processes, its materials and landforms, and the connection between natural phenomena and humans. Topics include: minerals, rocks, water and natural resources; plate tectonics, mountain building, volcanism, earthquakes, slope failure and related hazards; rivers and flood management; erosion, soil degradation, desertification and sustainable agriculture; sea-level rise, coastal and wetland erosion and shore zone management. Discussion of human interaction with the Earth will range from local policy to global economic decisions. Offered fall and spring semesters. Classroom 3 hours, laboratory 2 hours.

GL 111 Oceanography 4 Credits

A basic survey of the physical, chemical, and geologic character of the world's oceans. Topics include patterns of energy exchange, chemical cycles, geological environments within the sea, and evolution of ocean basins. Classroom 3 hours, laboratory 2 hours. Offered spring semester only.

GL 156 Introduction to Earth Evolution 4 Credits

The course introduces the 4600 million year history of the evolution of Earth and life. Data and scientific theories for earth history are presented for major events including; the birth of the planet; plate tectonics and evolution of continents, mountains and ocean basins; evolution of the atmosphere and oceans; long-term climate change; and the evolution of life and mass extinction events. The lab focuses on the rock record, fossil life, and dating methods as they pertain to Earth history. Classroom 3 hours, laboratory 2 hours. Offered spring semester only.

GL 251 Sophomore Seminar in Geology 1 Credit

This course introduces the fundamentals of scientific investigation and communication. A research project introduces the Scientific Method, while reading and comprehension of scientific literature is coupled with instruction in and application of technical and scientific writing. Other forms of scientific communication, including poster and oral presentations, are addressed. Students learn the appropriate techniques for displaying and interpreting scientific data. Students may not earn credit for both ES 251 and GL 251. Offered Fall semester.

GL 253 Geomorphology 4 Credits

A course on the origin and evolution of Earth's surface features by geological processes acting upon various earth materials and geological structures. Classroom 2 hours, laboratory and/or field work 4 hours. Prerequisite: GL 110. Offered spring of even-numbered years.

GL 255 Hydrogeology 3 Credits

This course provides examination of the basic principles of groundwater, including its occurrence, flow and development, the assessment and remediation of groundwater contamination, and the protection of groundwater as a natural resource. Offered spring semester. Classroom: 3 hours. Prerequisites: MA 107, and EG 109 or GL 110 or GL 156.

GL 257 Sedimentation 4 Credits

A course that provides the analysis and interpretation of sedimentary rocks, sedimentary processes and environments of deposition. Classroom 2 hours, laboratory and/or field work 4 hours. Prerequisite: GL 110, GL 111 or GL 156. Offered fall of even-numbered years.

GL 258 Stratigraphy and Tectonics 4 Credits

An introduction to the fundamentals of stratigraphy and tectonics. Plate tectonic theory is investigated, from its inception to the present. Stratigraphic concepts are presented, at the general level and in light of tectonics, with focus on Vermont and regional stratigraphy and tectonic history. Classroom 3 hours, laboratory 3 hours. Prerequisite: GL 110. Offered Spring of odd-numbered years.

GL 260 Projects in Geology 1-4 Credit

A course that provides a geological field or laboratory project on a topic chosen by mutual consent of the student and the instructor. A written report is required. Prerequisites: GL 110, GL 111 or GL 156 and permission of the instructor.

GL 261 Field Geology 4 Credits

A study of the techniques used in the measurement of large and small scale geologic structures. Emphasis is placed on field recognition of features such as bedding, cleavage, folds, faults and their use in geologic mapping. Classroom 2 hours, laboratory 4 hours. Prerequisite: GL 110 or GL156 or permission of the instructor. Offered fall of even-numbered years.

GL 262 Structural Geology 4 Credits

A course that provides the analysis and interpretation of patterns in the structural features of the Earth's crust. Topics include the genesis of tectonic features, analysis of strain in rocks, the interpretation of multiply-deformed rocks, and modeling of faults and fractures. Classroom 3 hours, laboratory 3 hours. Prerequisite: GL 261 or permission of the instructor. Offered spring of odd-numbered years.

GL 263 Mineralogy 4 Credits

Introductory crystallography and crystal chemistry are used to explain the properties of minerals. Each of the major mineral groups is studied in the laboratory with a focus on developing competency in the identification of the ore minerals and the rock-forming minerals. Development of an understanding of mineral associations is emphasized and field trips allow opportunity to improve these skills. Classroom 2 hours, laboratory 4 hours. Prerequisite: GL 110 or GL 156 or permission of the instructor. Offered fall of odd-numbered years.

GL 264 Petrology 4 Credits

Following an introduction to optical identification of the rock-forming minerals using the polarizing microscope, the mineralogy and textures of common rocks are studied by means of thin sections. The genesis of these rocks is explained through a study of the physical and chemical systems they represent. Classroom 2 hours, laboratory 4 hours. Prerequisite: GL 263. Offered spring of even-numbered years.

GL 265 Glacial Geology and Paleoclimate 4 Credits

The first half of this course covers glaciology and glacial deposits and landforms, with a strong focus on field investigation. The second half of the course presents the data and hypotheses on Quaternary climate change, including traditional glacial chronology and marine and ice core data and resultant chronology. Global climate change, both past and present, is a central theme of the course. Classroom 3 hours, laboratory 3 hours. Prerequisite: GL 110. Offered Fall of odd-numbered years.

GL 340 Project Development in Geology 1 Credit

A course for students majoring in Geology aimed to develop the skills for designing and executing an original scientific research project. Topics include research plan development, literature research to inform methodology, generation of site maps and protocols for collecting field and laboratory data, and generation of a properly formatted research proposal. Prerequisite: Junior-year status and permission of instructor. Offered spring semesters.

GL 399 Junior Topics 4 Credits**GL 440 Research Project in Geology 3 Credits**

A capstone original research project under the direction of a faculty member in coordination with others taking this course. Field and laboratory work will generate new data on an expanding base; after analysis and interpretation, data will be presented in a technical format. All aspects of the project will be interpreted in the context of the literature. Prerequisite: ES340/GL340 or permission of the instructor. Students cannot receive credit for both ES440 and GL440. Offered fall semester.

GL 451 Geology Seminar 3 Credits

A capstone course for fourth-year students designed to review advanced geological concepts in a seminar format. The course also includes oral and poster presentations of senior research projects, and examination of codes of ethics in the geological sciences. Prerequisite: Senior Geology major or permission of the instructor. Offered spring semester as needed. Student cannot receive credit for this course and ES 451.

GL 460 Project Completion in Environmental Geology 1 Credit

Designed to follow senior research work in GL 440, this course provides the support for students to turn their technical product into a professional technical paper in which the research is integrated into the peer-reviewed knowledge base for the subject. The course is writing intensive and self-driven directed, with a student working collaboratively with their research advisor. Prerequisite: GL 440 and permission of the instructor. Offered spring semesters.

GL 499 Geo Res 4 Credits