Geology

The major and minor in Geology are administered by the Department of Geology and Geography: Professors Dunn, Kebbede (chair), McMenamin (on leave 2015-16), Millette, Werner; Associate Professor Markley; Assistant Professor Houston.

Overview

The geology major offers students hands-on learning in the classroom, lab, and field. Intermediate and upper-level courses are relatively small and explore geologic materials, physical and biological processes, and earth history and change. We recommend strongly, but do not require, courses in the cognate sciences (biology, chemistry, and physics), as well as calculus and/or statistics.

Contact Info

Girma Kebbede, chair
Cecile Vasquez, senior administrative assistant

Requirements for the Major

Credits

- A minimum of 36 credits

Courses

- An introductory survey course: Geology 100, 101, 103, 107 or 108
- Geology 201, Rocks and Minerals
- Geology 202, History of Earth
- Geology 203, Surface Processes
- Geology 224, Paleontology-Stratigraphy
- Geology 322, Igneous and Metamorphic Petrology
- Geology 333, Structural Geology and Orogenesis
- 8 additional credits in geology at the 200 level or above

No more than 4 credits of independent study (Geology 295 or 395) may be counted toward the major. A summer field course may count for 4-6 credits in geology. Geography, environmental studies, astronomy, and other geology courses in the Five Colleges and from abroad may also apply toward the major as electives or, in some cases, as substitutes for required courses.

Requirements for the Minor

Credits

- The geology minor consists of any geology course at the 100 level (100, 101, 102, 103, 107 or 108) and at least 16 credits at the 200 level or above.
  At least four of these credits must be at the 300 level.

Teacher Licensure

Students interested in pursuing licensure in the field of earth science can create a special earth science major and combine this course work with a minor in education. For specific course requirements for licensure in earth science within the field of geology (and related disciplines), please consult your advisor or the chair of the geology and geography department. For information about the requirements for the minor in education, please consult "Teacher Licensure" in the Other Degree and Certificate programs chapter and Sarah Frenette (sfrenett@mtholyoke.edu or x3300) of the psychology and education department.

Licensure also requires a formal application as well as passing scores on the Massachusetts Test of Educator Licensure (MTEL) in both the literacy component and the subject matter component. Copies of the test objectives for the MTEL are available in the Department of Psychology and Education. Licensure application information and materials are available in the Department of Psychology and Education.

Course Offerings

GEOL-100 Physical Geology

Not Scheduled for This Year

Humans are intimately connected with and dependent upon the physical environment. We have only been present on the Earth for a brief span, but we try to understand how the Earth has evolved since its formation over four billion years ago. Our knowledge of the Earth is critical, not only for reconstructing its history, but also for helping us to understand issues relevant to our lives, such as the availability of natural resources, pollution, climate change, and natural hazards. In this course, we will perform a general survey of the physical Earth. In classroom, lab and field, we will examine rocks and minerals of which the solid Earth is composed, processes that generate the Earth's landforms, natural hazards associated with those processes, and geologic time.

Applies to requirement(s): Math & Sciences
M. Markley
Restrictions: This course is limited to First-year and Sophomore students.
Coreq: GEOL-100L
Credits: 4

GEOL-101 Environmental Geology with Lab

Not Scheduled for This Year

The only planet known to sustain life, Earth provides all the resources that sustain us, yet it can be an unpredictable and sometimes dangerous home. Floods, earthquakes, volcanic eruptions, and other natural processes challenge our ingenuity, while we also contend with self-induced problems such as pollution, desertification, and even global climate change. This course examines earth processes, how these affect our lives, and how we can best live with and sustain our environment. The labs cover selected geologic topics including methods for recognizing and interpreting environmental hazards, and developing strategies to address environmental problems.

Applies to requirement(s): Math & Sciences
S. Dunn
Coreq: GEOL-101L
Credits: 4

GEOL-103 Oceanography

Spring

Because more than seventy percent of our planet is covered by oceans, the study of marine systems is crucial to our understanding of Earth History and life on the planet. We will examine chemical, physical, geological, and biological processes in the oceans at a variety of scales in time and space. We will explore how the Earth's oceans formed, how they provided the foundations for life, and how they continue to affect weather and climate, stabilize global chemical cycles, erode coastlines and provide access to resources. We will conclude the semester with a discussion of the human impact on the ocean environment including sea level rise, acidification, coral bleaching and over-fishing.

Applies to requirement(s): Math & Sciences
A. Werner
Credits: 4

GEOL-107 Environmental Geology

Fall

The only planet known to sustain life, Earth provides all the resources that sustain us, yet at the same time it can be an unpredictable and sometimes dangerous home. Floods, earthquakes, volcanic eruptions, and other natural
processes challenge our ingenuity, while we also contend with self-induced problems such as pollution, desertification, and even global climate change. This course examines earth processes, how these affect our lives, and how we can best live with and sustain our environment. May be taken for 200-level credit with permission of instructor.

Applies to requirement(s): Math & Sciences
S. Dunn
Credits: 4

Fall
Are we running out of drinking water? Is fracking safe? When is peak oil? This course is a basic geology course that focuses on two earth materials we use every day: fresh water and fossil fuels. We cover where groundwater is found and why, the depletion and contamination of groundwater, and some major aquifers. We will also explore the formation, worldwide distribution, and extraction of coal, oil, and natural gas. This course introduces students to physical and historical geology, focusing particularly on plate tectonics and sedimentary basins, with attention to current events and illustrations from around the world.

Applies to requirement(s): Math & Sciences
M. Markley
Credits: 4

GEOL-201 Rocks and Minerals
Fall
In this course you will learn to recognize the common rock-forming minerals and principal rock types, and to understand their origins, properties, associations, and geological significance. Observational skills and hand sample identification will be emphasized in lab and on field trips. Students must have either a one-year high school earth science class or any 100- or 200-level geology course or Geography 107. One or more field trips required.

Applies to requirement(s): Math & Sciences
S. Dunn
Coreq: GEOL-201L.
Credits: 4

GEOL-202 History of Earth
Spring
This course explores the evolution and interaction of life, rocks, oceans, and air during the past 4 billion years of earth history. Some topics covered are: ice ages and greenhouse atmospheres, continental drift, extinctions and radiations of flora and fauna, the early evolution of earth, absolute and relative dating of rocks, and the geologic time scale. Oral presentations and writing assignments focus on the design and testing of earth science hypotheses, critical analysis of recently published research on earth history, and proposal writing. The final exam involves memorization of the geologic time scale and significant events in earth history.

Applies to requirement(s): Humanities
Other Attribute(s): Speaking-Intensive; Writing-Intensive
M. Markley
Prereq: Any introductory Geology or Environmental Studies course.
Credits: 4

GEOL-203 Surface Processes
Fall
The surface of the Earth is a history book of past environmental change. Every hill and valley, every erosional feature and every deposit is the result of processes acting at the Earth’s surface. In this course we study these processes (e.g. glaciers, rivers, slopes, coastlines, arid regions, frozen ground, cave formation, soil development and groundwater) to understand how they work and to understand the resulting landforms and deposits. With this understanding we can then observe different landforms and deposits and infer past processes (environments of deposition). Field work and trips allow students to explore first-hand the processes that have created and modified the Earth’s surface.

Applies to requirement(s): Math & Sciences
A. Werner
Prereq: Any introductory Geology or Environmental Studies course.; Coreq: GEOL-203L.
Credits: 4

GEOL-210 Plate Tectonics
Not Scheduled for This Year
Plate tectonic theory explains the origins of volcanoes and earthquakes, continental drift, and the locations of mountain belts and oceans. This course focuses on the geometry of plate tectonics. Topics include mid-ocean ridge systems, transform faults, subduction zones, relative plate motion, earthquake analysis, triple point junctions, and stereographic projection. Work includes individual research projects on active plate boundaries.

Applies to requirement(s): Math & Sciences
Other Attribute(s): Speaking-Intensive; Writing-Intensive
M. Markley
Advisory: Comfort with geometry and trigonometry required.
Notes: Comfort with geometry and trigonometry required.
Credits: 4

GEOL-211 Uranium
Not Scheduled for This Year
From the A-bomb to zircon, uranium has revolutionized humanity’s destructive potential and wisdom about time. Uranium is the planet’s heaviest naturally occurring element, and it transforms by both radioactive decay and nuclear fission. This course uses computer modeling to explore these two transformations and what we make of them, specifically: the age of the earth, high-precision dating of recent geologic and climate events, nuclear power, nuclear weapons, plutonium production, and the uniquely long-term challenge of nuclear waste disposal and storage.

Applies to requirement(s): Math & Sciences
M. Markley
Prereq: 1 course in Chemistry, Geology, Math, or Statistics.
Credits: 4

GEOL-224 Paleontology/Stratigraphy
Not Scheduled for This Year
This course provides an intensive study of fossils, fossil preservation, relationships between major groups of organisms, depositional environments, sediments, sedimentary rocks, and the processes of sedimentation. We will employ the principles of stratigraphic analysis and correlation to interpret ancient environments and paleoclimate, reconstruct paleogeography, and probe the characteristics of sedimentary basins. Laboratory exercises and field trips will introduce a variety of analytical techniques used to study sedimentary rocks.

Applies to requirement(s): Math & Sciences
The department
Prereq: 4 credits in Geology at 100- or 200-level or First Year Seminar 110HL.; Coreq: GEOL-224L.
Credits: 4

GEOL-227 Groundwater
Spring
The demand for and the contamination of groundwater resources are major environmental concerns. To better understand the dynamics of the groundwater system, we will cover topics including the hydrologic cycle, surface and subsurface hydrology, groundwater resource evaluation, and groundwater geotechnical problems. Students are required to prepare weekly problem sets/labs, a term paper, and an oral presentation.

Applies to requirement(s): Math & Sciences
A. Werner  
Prereq: One Geology course.; Coreq: GEOL-227L.  
Credits: 4

GEOL-295 Independent Study  
Fall and Spring  
The department  
Instructor permission required.  
Credits: 1-4  
Course can be repeated for credit.

GEOL-322 Igneous and Metamorphic Petrology  
Spring  
This course covers mineralogical and chemical compositions, classification, genesis, and mode of occurrence of igneous and metamorphic rocks, including relationships between rock-forming processes and global plate tectonics; labs involve the study of representative rock suites in hand specimen and thin section, introduction to analytical techniques and in-depth coverage of mineral optics. One or more field trips required.  
Applies to requirement(s): Meets No Distribution Requirement  
S. Dunn  
Prereq: Geology 201.; Coreq: GEOL-322L.  
Credits: 4

GEOL-326 Seminar: Global Change  
Spring  
Humans are changing the climate. Although the climate system has changed ‘naturally’ over geologic time, taking the planet in and out of ice ages, the warming and all the corollary changes that are taking place now are due (primarily) to the use of fossil fuels and the associated release of carbon dioxide. This course reviews how the climate system works, what is known about climate change through geologic history and discusses the implications of current and future climate change.  
Applies to requirement(s): Math & Sciences  
K. Kanamaru  
Prereq: One course from the Geology department at the 200-level.  
Credits: 4

GEOL-333 Structural Geology & Orogenesis  
Fall  
This course covers the basic techniques of field geology and structural analysis. Lectures concentrate on field techniques, stress, strain, faulting, folding, rock strength, deformation mechanisms, and multidisciplinary approaches to mountain building (orogenesis). Many labs are field trips that involve data collection. Weekly writing assignments focus on presenting original research and distinguishing between observations and interpretations. During the final weeks of the semester, oral presentations emphasize fluency in the published literature of structural geology using a case study from Death Valley, California.  
Applies to requirement(s): Math & Sciences  
M. Markley  
Prereq: Geology 201.; Coreq: GEOL-333L.  
Credits: 4

GEOL-341 Seminar  
Seminars offer directed study and discussion of one or more selected topics in geology. Topics vary from year to year.

GEOL-342 Seminar in Geology  
Seminars offer directed study and discussion of one or more selected topics in geology. Topics vary from year to year. Consult the department for information about future seminars.