Geology is the scientific study of planet Earth and involves the observation and interpretation of processes that form and change our world. Some of these processes, such as earthquakes, tsunamis, and volcanic eruptions, proceed rapidly, often with catastrophic consequences. Others, such as erosion or mountain building can progress so slowly that their results are scarcely noticeable over a human lifetime. Each of these processes, however, can exert a profound influence on human activities and can, in turn, be influenced intentionally or unintentionally by human activities.

The courses offered by this department are designed to serve the needs of five groups of students:

1. Those who desire a general knowledge of geology as part of a liberal education;
2. Those who need geological information as a cognate subject in other professions;
3. Those who wish to major in geology as part of a broad liberal arts education;
4. Those who wish to major in environmental science;
5. Those who plan to become professional geologists.

Introductory courses are primarily general, but they also provide a foundation in geology for the student who desires to continue an intensive program of study. Students with an interest in environmental problems will find a number of relevant courses among those offered by the Department of Geology. In addition, a variety of courses in various phases of geology is available to the general student. Intermediate and advanced courses are designed to develop the principles of geology beyond the elementary level and to give a firm technical foundation for advanced study.

Environmental Science investigates the many interconnected systems and processes that formed our world, continuously change it, and, ultimately, sustain life on it. The Environmental Science Program at Wayne State offers an interdisciplinary approach combining a strong foundation from both geological and biological perspectives, and a broad choice of electives. This program focuses on the urban environment and urban impacts on the natural environment. It will prepare students for graduate study, or for careers in various areas of environmental science including environmental impact assessment, air and water quality monitoring, regulatory compliance, and environmental remediation.

BASKARAN, MARK: Ph.D., Physical Research Laboratory, India; M.S., M.K. University; B.S., V.H.N.S.N. College; Professor and Chair
BROWNLEE, SARAH J.: Ph.D., University of California, Berkeley; B.A., Princeton University; Associate Professor
BURDICK, SCOTT: Ph.D., Massachusetts Institute of Technology; B.S., Purdue University; Assistant Professor
HOWARD, JEFFREY L.: Ph.D., University of California, Santa Barbara; M.S., B.S., Virginia Polytechnic Institute and State University; Professor
PAPUGA, SHIRLEY: Ph.D., University of Colorado; B.A., Kalamazoo College; Associate Professor
SPERONE, FELICE G.: M.A., University of Illinois at Chicago; Lecturer

- Environmental Science (B.S.) (http://bulletins.wayne.edu/undergraduate/college-liberal-arts-sciences/environmental-science-geology/environmental-science-bs)
- Geology (B.A.) (http://bulletins.wayne.edu/undergraduate/college-liberal-arts-sciences/environmental-science-geology/geology-ba)
- Geology (B.S.) (http://bulletins.wayne.edu/undergraduate/college-liberal-arts-sciences/environmental-science-geology/geology-bs)
- Environmental Science Minor (http://bulletins.wayne.edu/undergraduate/college-liberal-arts-sciences/environmental-science-geology/environmental-science-minor)
- Geology Minor (http://bulletins.wayne.edu/undergraduate/college-liberal-arts-sciences/environmental-science-geology/geology-minor)
- Geochemistry Minor (http://bulletins.wayne.edu/undergraduate/college-liberal-arts-sciences/environmental-science-geology/geochemistry-minor)

Environmental Science

EVS 1500 Introduction to Environmental Science Cr. 3
This introductory course is focused and organized around environmental problems and issues that we face in the world today using real stories. Students will be provided the scientific background to these issues, the tools for helping to build a sustainable future, and a strong foundation in environmental science education. Offered Fall.

EVS 3000 Introduction to Environmental Analysis Using Geographic Information Systems (GIS) Cr. 3
Geographic Information Systems (GIS) is a powerful tool for environmental analysis. This course is designed to introduce students to the use of GIS to analyze, explore and visualize the spatial relationships and patterns of the biological, ecological, social and physical processes that can affect the environment and human health. Offered Fall.
EVS 3100 Air and Water in Environmental Systems Cr. 3
Development of quantitative skills related to applying an understanding of the basic properties of air and water and the dynamics of these fluids at rest and in motion, critical to addressing almost any environmental issue. Applications will include the role of air and water in environmental problems at multiple scales (and in both urban and natural settings) and integrating a systems approach. Offered Fall.
Prerequisites: GEL 1010 with a minimum grade of D- and MAT 1800-6ZZZ with a minimum grade of D-
Equivalent: GEL 3100

EVS 3990 Directed Study in Environmental Science Cr. 1-4
Facilitates the student's research experience to further develop their undergraduate training in concert with their studies in the environmental science program. Offered Every Term.
Repeatable for 4 Credits

EVS 4900 Internship in Environmental Science Cr. 2
Approved work experience for students studying in environmental science that provides entry-level, career-related experience and workplace competencies. Offered Every Term.
Restriction(s): Enrollment is limited to students with a major in Environmental Science.

Geology
GEL 1010 Geology: The Science of the Earth Cr. 3
Satisfies General Education Requirement: Natural Scientific Inquiry, Physical Sciences
Introduction to continental drift and plate tectonic theory, geophysics and structure of earth's crust and interior; rocks and minerals; igneous and volcanic geology; work of running water, glaciers and ground water; geologic time; oceanography. One day field trip. Offered Every Term.
Course Material Fees: $15

GEL 1011 Geology: The Science of the Earth Laboratory Cr. 1
Introduction to continental drift and plate tectonic theory, geophysics and structure of earth's crust and interior; rocks and minerals; igneous and volcanic geology; work of running water, glaciers and ground water; geologic time; oceanography Offered Every Term.
Corequisite: GEL 1010
Course Material Fees: $15

GEL 1020 Interpreting the Earth Cr. 4
Sedimentary rocks, sedimentary structures and fossils as tools for interpreting the history of the earth. Paleoecology of the geologic past and the structure of the earth are emphasized. Offered Fall, Winter.
Prerequisites: GEL 1010 with a minimum grade of C

GEL 1050 Oceanography Cr. 4
Introductory course in oceanography; includes origin of the ocean basins; ocean currents, waves and tides; life in the oceans and marine ecology; food, mineral and energy resources of the sea. Offered Intermittently.

GEL 1370 Meteorology: The Study of Weather Cr. 3
Weather theory including cloud types, cloud formation; types and formation of winds; rain, snow, other precipitation. Storm theory: formation of and dangers in thunderstorms, hurricanes and tornadoes. Atmospheric phenomena: aurora, rainbows, the mirage, twinkling of stars, twilight crepuscular rays; weather forecasting, instruments, maps. Offered Winter.

GEL 2130 Mineralogy Cr. 4
Mineral identification using physical and optical properties. Introduction to petrographic microscope and electron microscope/microprobe. Properties and occurrences of major mineral groups and their environmental significance. Check with instructor for field trip destination; field trip to Canada frequently part of course. Offered Fall.
Course Material Fees: $125

GEL 3100 Air and Water in Environmental Systems Cr. 3
Development of quantitative skills related to applying an understanding of the basic properties of air and water and the dynamics of these fluids at rest and in motion, critical to addressing almost any environmental issue. Applications will include the role of air and water in environmental problems at multiple scales (and in both urban and natural settings) and integrating a systems approach. Offered Fall.
Prerequisites: GEL 1010 with a minimum grade of D- and MAT 1800-6ZZZ with a minimum grade of D-
Course Material Fees: $40
Equivalent: EVS 3100

GEL 3160 Petrology Cr. 4
Classification of igneous and metamorphic rocks using macroscopic and microscopic material and textural characteristics. Occurrence and alteration of each major rock type related to tectonic settings. Mandatory four-day field trip. Offered Winter.
Prerequisites: GEL 1020 with a minimum grade of D- and GEL 2130 with a minimum grade of D-
Course Material Fees: $125

GEL 3300 Structural Geology Cr. 4
Description and interpretation of features which result from the origin or deformation of rock masses. Offered Winter.
Prerequisites: GEL 1020 with a minimum grade of D-
Course Material Fees: $125
GEL 3400 Principles of Sedimentology and Stratigraphy Cr. 4
Processes which produce sediments, environments of deposition, changes after deposition. Relationship between tectonics and sedimentation. Origin of sedimentary strata. Facies and correlations. Offered Fall.
Prerequisites: GEL 1020 with a minimum grade of D- and GEL 2130 with a minimum grade of D-
Course Material Fees: $20

GEL 3450 Principles of Paleontology Cr. 4
The history of life on earth as recorded in the fossil record. Using fossils to document the evolutionary history of plants, animals and ecosystems through geological time, as well as the practical applications of fossil material in stratigraphic correlation, basin analysis and resource exploration. Offered Fall.
Prerequisite: GEL 1010

GEL 3600 Special Topics in Geology Cr. 2-3
Subjects of general interest to geology majors. Topics may include: soil and groundwater pollution; petroleum geology; engineering geology; geochronology; gems and minerals. Offered Intermittently.
Prerequisites: GEL 1010 with a minimum grade of D-
Repeatable for 16 Credits

GEL 3650 Field Geology Cr. 1-10
Field studies involving problems in individual geologic mapping and related techniques. Offered Intermittently.
Repeatable for 16 Credits

GEL 3800 Team Research Cr. 2
Students work in teams to design and implement a fieldwork based geologic research project. Students develop hypotheses, tests, and fieldwork plans, and they make thin sections and collect data on the scanning electron microscope, finishing with poster presentations. Offered Fall.
Prerequisite: GEL 1010 with a minimum grade of D-

GEL 3990 Directed Study Cr. 1-6
Offered Every Term.
Repeatable for 10 Credits

GEL 4200 Geomorphology Cr. 4
Principles underlying development of landforms by geologic agents. Offered Every Other Year.
Prerequisites: GEL 1020 with a minimum grade of D-
Course Material Fees: $15

GEL 4400 40-Hour HAZWOPER Training Cr. 2
Restriction(s): Enrollment limited to students with a class of Junior or Senior.
Course Material Fees: $40

GEL 4860 Research Cr. 3-4
Primarily for honors students. Independent laboratory and field work. Offered Every Term.
Repeatable for 8 Credits

GEL 4998 Honors Thesis Cr. 3
Preparation of an Honors thesis on a subject of general interest to geology majors. Satisfactory completion assures Honors graduation, providing performance in preceding Honors courses has been at Honors level; to be taken under direction of Geology faculty. Offered Every Term.
Restriction(s): Enrollment limited to students with a class of Senior.

GEL 5000 Geological Site Assessment Cr. 4
Geologic methods for Phase I Environmental Site Assessments. Application of geostatistics to site characterization. Offered Every Other Year.
Prerequisites: GEL 1010 with a minimum grade of D- or GEL 1000 with a minimum grade of D-

GEL 5120 Environmental Geochemistry Cr. 4
Survey of some of the geochemical interactions which take place in Earth environments (water, soils, atmosphere, etc.) brought about by natural and human-induced chemical processes. Offered Every Other Year.
Prerequisites: CHM 1000-6XXX with a minimum grade of D- and GEL 1010 with a minimum grade of D-
Course Material Fees: $20

GEL 5150 Soils and Soil Pollution Cr. 4
Prerequisites: CHM 1220 with a minimum grade of D- and CHM 1230 with a minimum grade of D-
Course Material Fees: $40
GEL 5210 Environmental and Applied Geophysics Cr. 4
Introduction to geophysical methods used in characterizing the Earth's subsurface for environmental, engineering, and exploration applications. Students will learn the basics of near-surface seismic, gravity, magnetic, electrical resistivity, and electromagnetic methods and data analysis. Offered Every Other Year.
Prerequisites: ((GEL 1010 with a minimum grade of D-, PHY 2130 with a minimum grade of D-, and PHY 2140 with a minimum grade of D-) or (PHY 2170 with a minimum grade of D- and PHY 2180 with a minimum grade of D-)) and MAT 2010 with a minimum grade of D-
Course Material Fees: $40

GEL 5360 Hydrology of Natural and Urban Environments Cr. 4
Focuses on surface water processes including how water movement, storage and transformation on the Earth's surface is influenced by landscape characteristics, including human modifications of those characteristics, and weather. Offered Every Other Year.
Prerequisites: MAT 1800 with a minimum grade of D-
Course Material Fees: $55

GEL 5420 Mathematical Methods in Earth Science Cr. 4
An introduction to mathematical methods in Earth Science focusing on an introduction to programming in Matlab, using statistical methods, Monte Carlo, and building towards finite difference numerical methods. Offered Every Other Year.

GEL 5450 Hydrogeology Cr. 4
Characteristics and behavior of groundwater in earth materials. Principles of groundwater flow and solute transport. Introduction to numerical models and methods. Offered Every Other Year.
Prerequisites: GEL 1010 with a minimum grade of D- and MAT 2010-6XXX with a minimum grade of D-

GEL 5510 Environmental Fate and Transport of Pollutants Cr. 4
Basic principles of chemical behavior in the environment; sources, fate, and transport of contaminants. Offered Winter.
Prerequisites: (CHM 1220 with a minimum grade of D-, CHM 1240 with a minimum grade of D-, CHM 1230 with a minimum grade of D-, or CHM 1250 with a minimum grade of D-) and MAT 2010-6XXX with a minimum grade of D-

GEL 5600 Special Topics in Geology Cr. 4
Subjects of general interest to geology majors. Topics may include: mapping; soil and groundwater pollution; petroleum geology; engineering geology; mathematical methods in Earth Science; or others. Offered Intermittently.
Repeatable for 4 Credits

GEL 5610 Special Topics in Geology Cr. 1
Topics may be related themes such as current events, a specific area of geology or the Earth Sciences, or the development of professional skills relevant to careers in the Earth Sciences. Offered Every Other Year.
Repeatable for 3 Credits

GEL 5650 Applied Geological Mapping Cr. 4
Geographic Information Systems (GIS) is a powerful tool for analyzing spatial datasets, and for this reason it can be applied to many geological problems. This course will provide students the necessary skills to use GIS with an emphasis on geological applications. It will focus on geologic aspects of GIS analysis such as spatial analysis, geologic mapping, topographic analysis, and the importation and interpolation of aerial photos/satellite images and field data. Offered Winter.
Prerequisite: GEL 1010 with a minimum grade of C

GEL 5993 Writing Intensive Course in Geology Cr. 0
Satisfies General Education Requirement: Writing Intensive Competency
Disciplinary writing assignments under the direction of faculty member. Must be selected in conjunction with course designated as corequisite. See section listing in Schedule of Classes for corequisites available each term. Satisfies the University General Education Writing Intensive Course in the Major requirement. Required for all majors. Offered Every Term.
Prerequisites: (AFS 2390 with a minimum grade of C, ENG 2390 with a minimum grade of C, ENG 3010 with a minimum grade of C, ENG 3020 with a minimum grade of C, or ENG 3050 with a minimum grade of C), (GEL 3160 with a minimum grade of D- (may be taken concurrently), GEL 3300 with a minimum grade of D- (may be taken concurrently), GEL 3400 with a minimum grade of D- (may be taken concurrently), or GEL 3540 with a minimum grade of D- (may be taken concurrently))
Restriction(s): Enrollment is limited to Undergraduate level students.

GEL 6400 Nuclear Geology Cr. 4
Introduction to various physical and chemical age-dating methods applied to geological and cosmological objects. Offered Every Other Year.
Prerequisites: (PHY 2130 with a minimum grade of D- and PHY 2140 with a minimum grade of D-) or (PHY 2170 with a minimum grade of D- and PHY 2180 with a minimum grade of D-), (CHM 1220 with a minimum grade of D- and CHM 1230 with a minimum grade of D-), and GEL 1010 with a minimum grade of D-

GEL 6500 Earth Resources and the Environment Cr. 3
Examines the nature of Earth resources, as well as critical issues surrounding these resources. Analyzes the impacts of resource usage on the Earth environment. Covers all major types of Earth resources—energy, metallic, nonmetallic, water, soil. Offered Every Other Year.
Prerequisites: GEL 1010 with a minimum grade of C