

# DEPARTMENT OF GEOLOGICAL AND ENVIRONMENTAL SCIENCES

Department of Geological and Environmental Sciences

Room 2120 Moser Hall

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Department Chairperson: Dr. Jeffrey C. Dick (jcdick@ysu.edu)

## Welcome

Welcome to the Department of Geological and Environmental Sciences at Youngstown State University. Our programs in Environmental Studies and Geology are distinguished by our applied approach to learning. Our dedicated faculty consists of six PhD degree professors and nine adjunct faculty members with strong backgrounds in academics and real world experience. Our courses and degree programs prepare graduates for immediate employment and graduate studies opportunities by going well beyond the traditional class room experiences with a variety of field experiences, study abroad experiences, access to high-end analytical laboratories and instrumentation, internship opportunities and faculty-led undergraduate research experiences. Our laboratory facility instruments include plasma spectrophotometry, ion chromatography, gas chromatography, laser particle size analysis and a wide variety of bench-top instrumentation. In addition, students have access to TEM, SEM, XRF, XRD and other high-end end instrumentation through the Department of Chemistry.

The Department has a strong emphasis on remote sensing and geophysical investigations. Field instruments include a DJI Matrice 600 drone with infra-red and optical imaging capability, ground penetrating radar, hand held x-ray fluorescence, 24 channel refraction seismograph, earth resistivity, proton magnetometer, high resolution GPS and total station surveying equipment.

Graduates of our programs find personally rewarding and high-paying careers in the fields of petroleum geology, environmental geology, public health, engineering geology, government regulations and compliance, mining, hydrogeology, environmental safety, geophysics and related fields. Many graduates choose to continue their education by pursuing master of science and doctoral degrees in geology and environmental science.

The Department of Geological and Environmental Sciences is also the home of the Clarence R. Smith Mineral Museum, a world-class collection of rare and amazing minerals and fossils from around the world. The museum is free and open to the public.

### Chair

**Jeffrey C. Dick**, Ph.D., Professor, Chair

### Professor

**Isam E. Amin**, Ph.D., Professor

**Felicia P. Armstrong**, Ph.D., Associate Professor

**Raymond E. Beiersdorfer**, Ph.D., Professor

**Alan M. Jacobs**, Ph.D., Professor

**Colleen McLean**, Ph.D., Associate Professor

### Part-Time Faculty

**Diana M. Alexander**, M.S.

**Susie L. Beiersdorfer**, M.S.

**Anna C. Woodard (Draa)**, M.S.

**Lawrence P. Gurlea**, M.S.

**Heidi L. Haug**, M.S.

**Thomas E. Jordan**, Ph.D.

**Tamara M. Kerr-Sahli**, M.S.

**Daniel J. Kuzma**, M.S.

**Debbie A. M. Smith**, M.S.

## Majors

- BS in Environmental Studies (<http://catalog.yosu.edu/archives/2017-2018/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/bs-environmental-studies>)
- BA in Geology (<http://catalog.yosu.edu/archives/2017-2018/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/ba-geology>)
- BS in Geology (<http://catalog.yosu.edu/archives/2017-2018/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/bs-geology>)

## Minors

- Minor in Engineering Geology (<http://catalog.yosu.edu/archives/2017-2018/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/minor-engineering-geology>)
- Minor in Environmental Geology (<http://catalog.yosu.edu/archives/2017-2018/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/minor-environmental-geology>)
- Minor in Environmental Studies (<http://catalog.yosu.edu/archives/2017-2018/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/minor-environmental-studies>)
- Geoscience Minor (<http://catalog.yosu.edu/archives/2017-2018/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/geoscience-minor>)
- Natural Gas and Water (<http://catalog.yosu.edu/archives/2017-2018/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-geological-environmental-sciences/minor-natural-gas-and-water>)

## Geology

### GEOL 1500 Environmental Geology 4 s.h.

An introductory course that examines interactions between human society and our changing planet, the affects of natural/geologic hazards on humans, and anthropogenic (human-caused) impacts on nature, geology, and society. Three hours of lecture and two hours lab per week.

**Gen Ed:** Environmental Sustainability, Natural Science, Social and Personal Awareness.

### GEOL 1500L Environmental Geology Laboratory 0 s.h.

Environmental Geology Laboratory.

**GEOL 1504 The Dynamic Earth 3 s.h.**

An examination of earth as consisting of interrelated geologic systems which are dynamic and constantly changing. Includes study of surface, lithologic and tectonic systems.

**Gen Ed:** Natural Science.

**GEOL 1505 Physical Geology 4 s.h.**

A study of the various physical and chemical processes acting on and within the earth, and their products. The laboratory component includes identification of minerals and rocks, and the interpretation of topographic and geologic maps. Three hours of lecture, two hours of lab per week.

**Gen Ed:** Natural Science.

**GEOL 1505H Honors Physical Geology 4 s.h.**

Concepts of the earth as a dynamic planet, investigated through a variety of lectures, text and journal readings, and independent library-research assignments.

**Prereq.:** Eligibility for the Honors Program or consent of instructor.

**Gen Ed:** Natural Science.

**GEOL 1505L Physical Geology Laboratory 0 s.h.**

Physical Geology Laboratory.

**GEOL 1508 Geology of Gemstones and Allied Minerals 3 s.h.**

Formation, occurrence, and distribution of gem materials. Properties and identification of gem stones; factors affecting their value. Introduction to synthetic/artificial gem materials. Not applicable toward the geology major.

**GEOL 1509L Geoscience Laboratory 1 s.h.**

Problem solving and assessment of case histories to illustrate the scientific method and geologic principles and concepts. Two hours laboratory per week.

**GEOL 1510 Geology of National Parks 3 s.h.**

Geologic history of national parks; geologic processes observed in North American parks and Hawaii. Simulated field trips to several major parks. Not applicable toward the geology major.

**GEOL 2602 Introduction to Oceanography 3 s.h.**

Survey of geological, physical, chemical, and biological oceanography; description and distribution of properties and their relationship to circulation, shorelines, ocean features, sediments, organisms, and environments.

**Gen Ed:** Natural Science.

**GEOL 2605 Historical Geology 4 s.h.**

An in depth study of the origin and evolution of the Earth and its systems and life forms throughout geologic time. The course is designed to develop student critical thinking skills through analysis of concepts and issues, and the integration of maps, lithologic information, and fossil information. Three hours lecture and two hours lab per week. Field trips are an integral part of the course.

**Prereq.:** GEOL 1505 and GEOL 1505L.

**GEOL 2611 Geology for Engineers 3 s.h.**

Study of geologic principles, processes, and materials; focus on recognition of geologic factors as they apply to engineering operations and projects. Laboratory work includes examination of minerals, rocks, maps, and case histories. Two hours lecture, two hours laboratory per week.

**Gen Ed:** Natural Science.

**GEOL 2614 Mesozoic Dinosaurs and Other Reptiles 3 s.h.**

A survey of major Mesozoic dinosaurs and reptiles, including discussion of their environment, organic evolution, diversity, and controversies pertaining to their classification and extinction.

**Prereq.:** GEOL 3713.

**GEOL 2615 Geology and the Environment 1 3 s.h.**

A study of the interrelationship of human activity and the geologic environment. An examination of geologic hazards, geologic considerations in waste disposal, resource utilization, and land use.

**Prereq.:** GEOL 1504 or GEOL 1505 or GEOL 2611.

**GEOL 2620 Intro to Natural Gas and Water Resources 3 s.h.**

A survey of the history, science and technology of oil and gas exploration and production and water resource related issues with an emphasis on non-conventional production in the Appalachian Basin.

**Prereq.:** MATH 1513, CHEM 1516 and CHEM 1516L.

**GEOL 2699 Individual Study 1-3 s.h.**

The introductory study of problems or issues in geology, or a review of literature relating to a specific geologic topic. A maximum of 3 s.h. may be taken.

**Prereq.:** 8 s.h. in Geology, consent of department chairperson and instructor.

**GEOL 3700 Mineralogy 4 s.h.**

The occurrence, composition, and crystallography of common and economically important minerals. Identification of minerals using physical, chemical, optical and x-ray properties. The theory and use of the polarizing microscope and its application to the study of crystalline material, including asbestos materials. Two hours lecture, four hours of lab per week.

**Prereq.:** CHEM 1515 (may be concurrent) and GEOL 2605.

**GEOL 3701 Geomorphology 3 s.h.**

A study of landforms and the processes which create them, using aerial photographs, geologic maps, and topographic maps. The laboratory work emphasizes recognition and interpretation of landforms. Two hours lecture, two hours laboratory per week.

**Prereq.:** GEOL 2605.

**GEOL 3702 Glacial Geology 3 s.h.**

A study of glacier types: their origin, movement, erosional/depositional contributions, and their relationship to various non-glacial features. Emphasis is on the Pleistocene glacial succession in North America. Field trips are an integral part of the course.

**Prereq.:** GEOL 2605.

**GEOL 3704 Structural Geology 2 s.h.**

Description and interpretation of geologic structures, mechanical properties; stress-strain relationships, regional structure of North America, and major tectonic theories. Geology majors must take GEOL 3704L concurrently with GEOL 3704.

**Prereq.:** GEOL 3701 and GEOL 3718.

**GEOL 3704L Structural Geology Laboratory 1 s.h.**

Structural geology techniques and analyses, including orthographic solutions, stereographic projections, and interpretation of maps. Two hours lab per week.

**Prereq. or concurrent:** GEOL 3704.

**GEOL 3706 Geology of Economic Mineral Deposits 3 s.h.**

A study of the occurrence, origin, and distribution of mineral deposits, with special attention to their economic use. Field trips are mandatory.

**Prereq.:** GEOL 3700.

**GEOL 3709 Subsurface Investigations 3 s.h.**

An introduction to subsurface investigative methods that integrate principles of geophysics, geochemistry, interpretation of well logs and other bore hole data, outcrops and published information in the solution of actual geological problems. Two hours lecture, two hours lab per week. Students are expected to perform field work in addition to regularly scheduled class time.

**Prereq.:** GEOL 3701; MATH 1571 recommended.

**GEOL 3714 Principles of Paleontology 3 s.h.**

A detailed study of fossil invertebrates, including their origin, classification, paleoecology and stratigraphic utilization. Two hours lecture and two hours lab per week.

**Prereq.:** GEOL 2605.

**GEOL 3716 Environmental Impact of Abandoned Mines 3 s.h.**

Mining methods, types of mines, information retrieval, mine stabilization, and the effects of abandoned mines on environmental and human activities, especially of deep coal mines in the Mahoning valley and adjacent areas. Two hours lecture and two hours lab per week.

**Prereq.:** GEOL 2605.

**GEOL 3718 Igneous and Metamorphic Petrology 4 s.h.**

An in-depth study of the petrogenesis of igneous and metamorphic rocks based on their chemical and petrographic characteristics. Three hours lecture, three hours lab per week.

**Prereq.:** GEOL 3700.

**GEOL 3720 Field Investigations in Geology 1-4 s.h.**

A field-based approach to the study of geologic concepts and problems. Class and travel supervised by the Geology faculty; location, duration of stay, hours, credit, and grading criteria dependent on the site and nature of the geologic concepts and problems investigated. The course may be repeated. A maximum of 4 s.h. may be applied toward Geology major requirements.

**Prereq.:** By permit only.

**GEOL 3720H Field Investigation Geology 1-4 s.h.**

A field-based approach to the study of geologic concepts and problems. Class and travel supervised by the Geology faculty; location, duration of stay, hours, credit, and grading criteria dependent on the site and nature of the geologic concepts and problems investigated. The course may be repeated. A maximum of 4 s.h. may be applied toward Geology major requirements.

**Prereq.:** By permit only.

**GEOL 3750 Geoscience Seminar 1 s.h.**

Guest lecture and student presentation forum course designed to provide students with exposure to a broad range of topics and current research relevant to the geosciences. Course may be repeated.

**Prereq.:** GEOL 1505.

**GEOL 3775 Research Methods for Undergraduates 1 s.h.**

This course introduces the student to the fundamental and practical aspects of conducting research. The course emphasizes the scientific method, research methodologies, literature review, writing research proposals, and how research results are presented. Learn the process of developing, funding and conducting research. This course must be taken prior to any undergraduate research.

**Prereq.:** junior or senior standing.

**GEOL 4804 Ground Water 3 s.h.**

A study of the geologic and hydrologic factors controlling the occurrence and behavior of water beneath the earth's surface. Two hours lecture, two hours lab per week.

**Prereq.:** GEOL 2605; MATH 1571 recommended.

**GEOL 4812 GIS Applications to Geology 3 s.h.**

This course covers a variety of geologic applications of GIS software; topics covered include: flood mapping, landslide hazard mapping, modeling soil erosion, watershed delineation, etc. Although you will be exposed to the basic functions of ArcGIS, the course is designed primarily to provide experience in obtaining, managing, interpreting, displaying, and presenting geo-spatial data in a meaningful context.

**Prereq.:** GEOL 3701, GEOG 2611.

**GEOL 4820 Water Pollution Control 3 s.h.**

Sources and prevention methods of water pollution, human activities and natural conditions that influence water quality, protection methods and regulations of water quality, contamination and remediation of groundwater.

**Prereq.:** GEOL 1505 or ENST 2600.

**GEOL 4824 Tectonics 3 s.h.**

Geodynamics and the workings of plate tectonics. Kinetics and dynamics of plate motion, plate driving forces, thermal structure of the earth, and thermal convection in the earth. Tectonic and structural features on the earth. Geophysical, stratigraphic and structural signatures of extensional rifting, strike-slip faulting, subduction zones, plate collisions and mountain belts.

**Prereq.:** GEOL 3704.

**GEOL 4825 Geophysical Well Log Analysis 3 s.h.**

An introduction to geophysical well logging, analysis, and interpretation applications in the oil and gas industry. Topics include well construction, drilling mud properties, and interpretation of gamma ray, SP, resistivity, sonic, neutron density, and cement bond logs.

**Prereq.:** GEOL 2620 or permission of instructor, GEOL 3704, PHYS 1502 or PHYS 2611 recommended.

**GEOL 4830 Senior Thesis 4 s.h.**

Designed to be completed during the student's senior year and is expected to be a significant research-based contribution to the geosciences. A typical senior thesis topic will support the research program of full-time GES faculty. Students may develop their own research topic provided they have the support of one or more full-time GES faculty.

**Prereq.:** Junior standing, minimum cumulative GPA of 3.0, submission of approved research proposal, permission of GES Chairperson.

**GEOL 4899 Special Topics 1-3 s.h.**

Selected aspects of geology not covered in existing courses. Topics to be announced each time course is offered. May be repeated for different topics.

**Prereq.:** appropriate 3700- or 4800- geology course and permission of the chairperson.

**GEOL 5802 Sedimentology and Stratigraphy 3 s.h.**

The study and interpretation of sedimentary rocks, including physical characteristics, petrography, depositional environments, principles of correlation, and principles of basin analysis. Two hours lecture, two hours lab per week.

**Prereq.:** GEOL 3704.

**Gen Ed:** Capstone.

**GEOL 5805 Special Problems in Geology 1-4 s.h.**

An in-depth study of a specific problem in one of the branches of geology. The problem depends on the student's interest and qualifications and the equipment availability. A maximum of 8 s.h. may be taken.

**Prereq.:** 8 s.h. in Geology, consent of the department chairperson and instructor.

**GEOL 5810 Groundwater Resource Evaluation 3 s.h.**

Geologic and hydrologic interpretation of groundwater data with emphasis on regional groundwater resources, groundwater management, groundwater supplies, and design and construction of water wells.

**Prereq.:** GEOL 2605 or permission of instructor.

**GEOL 5815 Geology and the Environment 2 3 s.h.**

In-depth examination of earth processes, earth resources, and properties of earth materials as they relate to human activities, and their geologic consequences.

**Prereq.:** GEOL 2615 or ENST 2600.

**GEOL 5817 Environmental Geochemistry 3 s.h.**

An application of low-temperature aqueous geochemistry and geochemical computer modeling to environmental problems such as acid mine drainage, geochemical cycling of trace elements and nutrients, hazardous waste remediation, nuclear waste disposal, and surface and ground-water contamination.

**Prereq.:** GEOL 3700 and CHEM 1516.

## Environmental Studies

**ENST 1500 Introduction to Environmental Science 3 s.h.**

Basic environmental science literacy for informed citizens as inhabitants and stewards of Earth. The use of science and the scientific method to understand, assess, and manage the environment to improve human health, conserve energy and resources, preserve nature, and sustain quality of life.

**Gen Ed:** Environmental Sustainability, Natural Science, Social and Personal Awareness.

**ENST 1500L Introduction to Environmental Science Lab 1 s.h.**

The use of the scientific method to explore various fields in environmental science including water quality, risk assessment, biodiversity and mineral uses. This field and laboratory work supplements ENST 1500.

**Prereq. or concurrent:** ENST 1500.

**ENST 2600 Foundations of Environmental Studies 3 s.h.**

A survey of the principles and issues of environmental studies including basic ecology, biodiversity, hazardous and solid waste management, sustainable development, energy production and conservation, environmental ethics, air, water and soil pollution.

**ENST 2600L Foundations of Environmental Studies Laboratory 1 s.h.**

Laboratory and field investigations identified in ENST 2600. Emphasis on the scientific method, problem solving and critical thinking skills in environmental assessment techniques, active exploration of environmental concerns and their solutions. Three hours per week. Three to five Saturday field trips required in lieu of some laboratory time.

**ENST 2650 Independent Study 1-3 s.h.**

The introductory study of problems or issues in Environmental Studies or a review of the literature relating to a specific environmental topic. May be repeated for different topics for a total of 6 s.h.

**Prereq.:** Permission of the director.

**ENST 3700 Environmental Chemistry 4 s.h.**

Study of the fundamental chemical principles underlying common environmental problems, including water pollution, toxicology, chemical biotransformation and degradation. Chemistry of pesticides, petroleum hydrocarbons and heavy metals are also investigated.

**Prereq.:** ENST 2600 and CHEM 1515; Concurrent with: ENST 3700L Environmental Chemistry Lab.

**ENST 3700L Environmental Chemistry Lab 0 s.h.**

Students will investigate various analytical and instrumental techniques used in the examination of chemicals in environmental media (soil, water, biota). Includes proper handling, storage and precautions in the laboratory and the environment.

**Concurrent with:** ENST 3700 Environmental Chemistry.

**ENST 3730 Air Quality 3 s.h.**

Sources, dispersions, consequences and abatement of air pollutants emanating from industry and transportation. Topics also include the history, legislation, standards and economics of air pollution.

**Prereq.:** CHEM 1515.

**ENST 3750 Seminar 1 s.h.**

Guest lecturers will examine current topics in environmental issues, including current research, application of technology, management strategies to reduce environmental impact, environmental ethics, policy, etc.

**Prereq.:** ENST 2600.

**ENST 3751 Water Quality Analysis 3 s.h.**

Introduction to physical, chemical, and biological measurements of water quality. Sample collection and laboratory analysis of natural waters, drinking water, and wastewater. Interpretation of environmental data. Two hours lecture and three hours laboratory per week. Identical to CEEN 3751.

**Prereq.:** CEEN 3736 OR ENST 2600; CHEM 1515.

**ENST 3751L Water Quality Analysis Lab 0 s.h.**

Laboratory experience in the analysis of natural waters, drinking water and wastewater. Emphasizes procedures for the collection and interpretation of data on current environmental problems. Three hours laboratory per week. Must be taken concurrently with ENST 3751. Identical to CEEN 3751.

**Prereq.:** Must be taken concurrently with ENST 3751 (Note: already in course description).

**ENST 3775 Research Methods for Undergraduate 1 s.h.**

This course introduces the student to the fundamental and practical aspects of conducting research. The course emphasizes the scientific method, research methodologies, literature review, writing research proposals and the presentation of research results. Students will gain valuable experience in identifying a problem, developing a research plan and summarizing results. This course must be taken prior to engaging in undergraduate research.

**Prereq.:** junior or senior standing.

**ENST 3780 Environmental Research 1-4 s.h.**

A research project that involves problem identification, hypothesis formation, experimentation, data analysis and interpretation. The research may be either basic or applied.

**Prereq.:** Junior standing in ENST and permission of the director.

**ENST 3781 Environmental Sampling Methods 3 s.h.**

Sampling design, including number and types of samples and procedures for taking representative samples of air, water, soil and contents of storage and shipping containers. Two hours of lecture, three hours of laboratory.

**Prereq.:** ENST 2600 and STAT 2601 or equivalent.

**ENST 3790 Internship/Cooperative 1-4 s.h.**

Students work under the direction of a faculty supervisor in a governmental agency or in the private sector as environmental specialists. An activities log and summary report are required. The course may be repeated.

**Prereq.:** Junior standing in ENST and permission of the director.

**ENST 4822 Water Pollution Control 3 s.h.**

Sources and prevention methods of water pollution, human activities and natural conditions that influence water quality, protection methods and regulations of water quality, contamination and remediation of groundwater. 3.s.h.

**Prereq.:** GEOL 1505 or ENST 2600.

**ENST 4840 Topics 1-3 s.h.**

Independent study of special topics not included in available courses.

Students do extensive reading in, and write a formal report on, a specific area of Environmental Studies.

**Prereq.:** Junior standing or consent of instructor.

**ENST 5800 Environmental Impact Assessment 3 s.h.**

Analysis of the potential environmental effects resulting from the construction of buildings, highways, parking lots, mines, reservoirs, and waste disposal facilities. Standard procedures are taught for evaluating and reporting the environmental impact of these activities.

**Prereq.:** ENST 5860 and senior standing.

**ENST 5810 Environmental Safety 1 s.h.**

The proper use of environmental monitoring instruments and personal protective gear. Participation in a series of realistic, hands-on simulation exercises that address a variety of waste clean-up situations. Class meets three hours per week.

**Prereq.:** ENST 2600 or equivalent experience.

**ENST 5820 Sustainability, Climate Change, and Society 3 s.h.**

This course explores environmental, economic, and social aspects of sustainable development, with an emphasis on economy and society. Through topics such as water, food, and climate change, we examine the role of humans and institutions in sustainable development and possibilities for reconfiguring relationships between our institutions and the natural world.

**Prereq.:** junior, senior or graduate level standing.

**ENST 5830 Risk Assessment 3 s.h.**

An in-depth study of human health and ecological risk assessment. Includes hazard identification, dose-response evaluation, exposure assessment, and the characterization, limitations, management, communication, and perceptions of risk. Standard procedures to conduct a site-specific baseline risk assessment, to calculate risk-based concentrations that may be used to develop preliminary remediation goals, and to evaluate human health risks during the implementation of remedial alternatives.

**Prereq.:** ENST 3700, ENST 5860, and senior or graduate standing.

**Gen Ed:** Capstone.

**ENST 5860 Environmental Regulations 3 s.h.**

An examination of federal and state regulations that relate to cleanup of abandoned waste sites, management of waste from current waste generators, development of new hazardous products and chemicals, safety and health issues, and control of pollution into air and water.

**Prereq.:** ENST 2600 or equivalent.

**ENST 5888 Environmental Biotechnology 4 s.h.**

Lectures will cover the use of microbes for solving environmental problems. In the laboratory, teams of students will design and implement experiments in bioremediation. This course is intended for students in biology, environmental studies, chemistry, and engineering. Two hours lecture and four hours lab.

**Prereq.:** CHEM 3719 or CEEN 3736.