Geochemistry

Degrees Offered

- Master of Science (Geochemistry)
- Doctor of Philosophy (Geochemistry)
- Certificate in Analytical Geochemistry
- Professional Masters in Analytical Geochemistry (non-thesis)
- Professional Masters in Environmental Geochemistry (non-thesis)

Program Description

The Graduate Program in Geochemistry is an interdisciplinary program with the mission to educate students whose interests lie at the intersection of the geological and chemical sciences. The Geochemistry Program consists of two subprograms, administering two M.S. and Ph.D. degree tracks, two Professional Master's (non-thesis) degree programs, and a Graduate Certificate. The Geochemistry (GC) degree track pertains to the history and evolution of the Earth and its features, including but not limited to the chemical evolution of the crust and mantle, geochemistry of energy and mineral resources, aqueous geochemistry and fluid-rock/fluid-mineral interactions and chemical mineralogy. The Environmental Biogeochemistry (EBGC) degree track pertains to the coupled chemical and biological processes of Earth's biosphere, and the changes in these processes caused by human activities.

Master of Science and Doctor of Philosophy

1. Geochemistry degree track

Prerequisites

Each entering student will have an entrance interview with members of the Geochemistry subprogram faculty. Since entering students may not be proficient in both areas, a placement examination in geology and/or chemistry may be required upon the discretion of the interviewing faculty. If a placement examination is given, the results may be used to establish deficiency requirements. Credit toward a graduate degree will not be granted for courses taken to fulfill deficiencies.

Program Requirements

The Master of Science (Geochemistry degree track) requires a minimum of 36 credits including:

Course Work	24.0
Research Credits	12.0
Total Semester Hrs	**36.0**

To ensure breadth of background, the course of study for the Master of Science (Geochemistry degree track) must include:		
CHGC503	INTRODUCTION TO GEOCHEMISTRY	3.0
CHGC504	METHODS IN GEOCHEMISTRY	3.0
Master of Science (Geochemistry) students select at least 8 credits of the following:		
CHGC509	INTRODUCTION TO AQUEOUS GEOCHEMISTRY	3.0
CHGC514	GEOCHEMISTRY THERMODYNAMICS AND KINETICS	3.0
CEEN550	PRINCIPLES OF ENVIRONMENTAL CHEMISTRY	3.0
GEGN530	CLAY CHARACTERIZATION	2.0
GEGN586	NUMERICAL MODELING OF GEOCHEMICAL SYSTEMS	3.0
GEGN587	HYDROCHEMICAL AND TRANSPORT PROCESSES	3.0
GEGX571	GEOCHEMICAL EXPLORATION	3.0
GEOL512	MINERALOGY AND CRYSTAL CHEMISTRY	3.0
GEOL513	HYDROTHERMAL GEOCHEMISTRY	3.0
GEOL523	REFLECTED LIGHT AND ELECTRON MICROSCOPY *	2.0
GEOL540	ISOTOPE GEOCHEMISTRY AND GEOCHRONOLOGY	3.0

* Students can add one additional credit of independent study (GEOL599) for XRF methods which is taken concurrently with GEOL523.

Master of Science (Geochemistry degree track) students must also complete an appropriate thesis, based upon original research they have conducted. A thesis proposal and course of study must be approved by the student's thesis committee before the student begins substantial work on the thesis research.

The requirements for the Doctor of Philosophy (Geochemistry degree track) program will be established individually by a student's thesis committee, but must meet the minimum requirements presented below. The Doctor of Philosophy (Geochemistry degree track) program will require a minimum of 72 credits beyond the Bachelor degree. A total of 24 course credits beyond the Bachelor's degree are required, with at least 9 credits being completed at Mines.

Students who enter the PhD program with a thesis-based Master's degree may transfer up to 36 credits in recognition of the coursework and research completed for that degree. At the discretion of the student's Thesis Committee, up to 24 credits of previous graduate-level coursework (at Mines or elsewhere) can be applied towards the course requirement of the Doctor of Philosophy (Geochemistry degree track) program.

Doctor of Philosophy (Geochemistry degree track) students must take:		
CHGC503	INTRODUCTION TO GEOCHEMISTRY	3.0
CHGC504	METHODS IN GEOCHEMISTRY	3.0
Students must also select at least 5 credits of the following:		
CHGC509	INTRODUCTION TO AQUEOUS GEOCHEMISTRY	3.0
CHGC514	GEOCHEMISTRY THERMODYNAMICS AND KINETICS	3.0
CEEN550	PRINCIPLES OF ENVIRONMENTAL CHEMISTRY	3.0
GEGN530	CLAY CHARACTERIZATION	2.0
GEGN532	GEOLOGICAL DATA ANALYSIS	3.0
GEGN586	NUMERICAL MODELING OF GEOCHEMICAL SYSTEMS	3.0
GEGX571	GEOCHEMICAL EXPLORATION	3.0
GEOL512	MINERALOGY AND CRYSTAL CHEMISTRY	3.0
GEOL513	HYDROTHERMAL GEOCHEMISTRY	3.0
GEOL523	REFLECTED LIGHT AND ELECTRON MICROSCOPY *	2.0

GEOL540	ISOTOPE GEOCHEMISTRY AND GEOCHRONOLOGY	3.0

* Students can add one additional credit of independent study (GEOL599) for XRF methods which is taken concurrently with GEOL523.

Doctor of Philosophy (Geochemistry degree track) students must also complete an appropriate thesis, based upon original research they have conducted. A thesis proposal and course of study must be approved by the student's thesis committee before the student begins substantial work on the thesis research.

Master of Science (Geochemistry degree track) will be expected to give one public seminar on their research and Doctor of Philosophy (Geochemistry degree track) students are required to give at least one public seminar in addition to their thesis defense presentation.

2. Environmental Biogeochemistry (EBGC) Degree track

Prerequisites

A candidate for an MS or PhD in the EBGC degree track should have an undergraduate science or engineering degree with coursework including multivariable calculus, two semesters each of physics and chemistry, and one semester each of biology and earth science. Applicants who do not fulfill these requirements may still be admitted, but will need to undergo an entrance interview to establish deficiency requirements. Credit toward a graduate degree will not be given for undergraduate courses taken to fulfill deficiencies.

Program Requirements

Required Curriculum: A thesis proposal and thesis are required for all MS and PhD degrees in the EBGC degree track. MS thesis advisors (or at least one co-advisor) must be members of the EBGC subprogram. PhD thesis committees must have a total of at least four members. PhD advisors (or at least one of two co-advisors) and one additional committee member must be members of the EBGC subprogram. MS students will be expected to give one public seminar on their research; PhD students are required to give at least one, in addition to their thesis defense presentation.

In addition, both MS and PhD students in the EBGC degree track must complete the following coursework:

1. Two Required Classes:		
CHGC503	INTRODUCTION TO GEOCHEMISTRY	3.0
CHGC504	METHODS IN GEOCHEMISTRY	3.0
2. One Chemistry-Focused Class, chosen from the following list:		
CHGC509	INTRODUCTION TO AQUEOUS GEOCHEMISTRY	3.0
CEEN550	PRINCIPLES OF ENVIRONMENTAL CHEMISTRY	3.0
CEEN551	ENVIRONMENTAL ORGANIC CHEMISTRY	3.0
3. One Biology-Focused Class, chosen from the following list:		
CEEN560	MOLECULAR MICROBIAL ECOLOGY AND THE ENVIRONMENT	3.0
CEEN562	ENVIRONMENTAL GEOMICROBIOLOGY	3.0
4. One Earth Science-Focused class, chosen from the following list:		
CHGC514	GEOCHEMISTRY THERMODYNAMICS AND KINETICS	3.0
GEGN530	CLAY CHARACTERIZATION	2.0
GEGN586	NUMERICAL MODELING OF GEOCHEMICAL SYSTEMS	3.0
GEGN532	GEOLOGICAL DATA ANALYSIS	3.0
GEGX571	GEOCHEMICAL EXPLORATION	3.0
GEOL540	ISOTOPE GEOCHEMISTRY AND GEOCHRONOLOGY	3.0
Total Credits Required for MS:		**36.0**
Total Credits Required for PhD:		**72.0**

The student’s thesis committee may specify additional course requirements and makes final decisions regarding transfer credits.

Students who enter the PhD program with a thesis-based Master's degree may transfer up to 36 credits in recognition of the coursework and research completed for that degree. At the discretion of the student's Thesis Committee, up to 24 credits of previous graduate-level coursework (at Mines or elsewhere) can be applied towards the course requirement of the Doctor of Philosophy (Geochemistry degree track) program.

A total of 24 course credits are required with at least 9 credits being completed at Mines.

Comprehensive Examination

Doctor of Philosophy (Geochemistry) students in both degree tracks must take a comprehensive examination. It is expected that this exam will be completed within three years of matriculation or after the bulk of coursework is finished, whichever occurs earlier. This examination will be administered by the student's thesis committee and will consist of an oral and a written examination, administered in a format to be determined by the thesis committee. Two negative votes in the thesis committee constitute failure of the examination.

In case of failure of the comprehensive examination, a re-examination may be given upon the recommendation of the thesis committee and approval of the Dean of Graduate Studies. Only one re-examination may be given.

Tuition

The Master of Science (Geochemistry) and Doctor of Philosophy (Geochemistry) programs have been admitted to the Western Regional Graduate Program. This entity recognizes the Geochemistry Program as unique in the region. Designation of the Geochemistry Program by Western Regional Graduate program allows residents of western states to enroll in the program at Colorado resident tuition rates. Eligible states include Alaska, Arizona, California, Hawaii, Idaho, Montana, Nevada, New Mexico, North Dakota, South Dakota, Utah, Washington and Wyoming.

Mines’ Combined Undergraduate / Graduate Degree Program

Students enrolled in Mines’ combined undergraduate/graduate program may double count up to six credits of graduate coursework to fulfill requirements of both their undergraduate and graduate degree programs. These courses must have been passed with “B-” or better, not be substitutes for required coursework, and meet all other University, Department, and Program requirements for graduate credit.

Students are advised to consult with their undergraduate and graduate advisors for appropriate courses to double count upon admission to the combined program.

Graduate Certificate of Analytical Geochemistry

This program offers an opportunity for working professionals to complete graduate level coursework leading to a Graduate Certificate in a short time. The program focuses on providing instruction in a.) the fundamentals of geochemical analysis, which give students the flexibility to respond to changing opportunities in earth and environmental science, and b.) the mechanics of common techniques (sample collection and preparation, XRF, SEM, and ICP), which prepare students for immediate entry into the jobs market. The Certificate program is comprised of 12.0 credits of coursework. Up to 3.0 credits can be at the 400-level and the remainder will be 500- or 600-level as listed below.

Students working towards a Graduate Certificate of Analytical Geochemistry are required to take at least 6.0 credits out of the following core courses, courses cannot be used in fulfilling the requirements of other Certificates:

Core Courses:		
CHGC504	METHODS IN GEOCHEMISTRY	3.0
CHGC508	ANALYTICAL GEOCHEMISTRY	3.0
GEGN532	GEOLOGICAL DATA ANALYSIS	3.0
GEOL523	REFLECTED LIGHT AND ELECTRON MICROSCOPY *	2.0
GEOL540	ISOTOPE GEOCHEMISTRY AND GEOCHRONOLOGY	3.0
Students working towards a Graduate Certificate of Analytical Geochemistry can choose up to 6.0 credits out of the following elective courses, courses cannot be used in fulfilling the requirements of other Certificates:		
Electives:		
CHGC503	INTRODUCTION TO GEOCHEMISTRY	3.0
CEEN560	MOLECULAR MICROBIAL ECOLOGY AND THE ENVIRONMENT	3.0
CEEN562	ENVIRONMENTAL GEOMICROBIOLOGY	3.0
CHGN583	PRINCIPLES AND APPLICATIONS OF SURFACE ANALYSIS TECHNIQUES	3.0
GEGN530	CLAY CHARACTERIZATION	2.0
GEGN586	NUMERICAL MODELING OF GEOCHEMICAL SYSTEMS	3.0
GEGN587	HYDROCHEMICAL AND TRANSPORT PROCESSES	3.0
GEGX571	GEOCHEMICAL EXPLORATION	3.0
GEOL513	HYDROTHERMAL GEOCHEMISTRY	3.0
GEOL628	ADVANCED IGNEOUS PETROLOGY	3.0
MNGN556	MINE WATER AND ENVIRONMENT	3.0
MTGN605	ADVANCED TRANSMISSION ELECTRON MICROSCOPY	2.0
PHGN504	RADIATION DETECTION AND MEASUREMENT	3.0

* Students can add one additional credit of independent study (GEOL599) for XRF methods which is taken concurrently with GEOL523.

Professional Masters' Degree in Analytical Geochemistry

This program is designed for both full time students and working professionals who want to increase their knowledge and skills, while gaining a thorough up-date of advances across the spectrum of geochemical analysis.

A minimum of 30 credits are required for the PM degree. Students working towards a PM in Analytical Geochemistry are required to take at least 9.0 credits from courses in the Certificate in Analytical Geochemistry core and 3.0 credits from the electives. Up to 6 credits of the additional electives can include an independent study project (CHGC 598) at Mines, federal agencies, or industry, and is highly encouraged.

The Certificate in Analytical Geochemistry can be combined with the Certificate in Exploration Methods to be used towards the Professional Masters in Analytical Geochemistry (Non-thesis), which will allow part-time students to stack their education. When stacking the Certificates, the additional 6 credits required to complete the PM can include an independent study project (CHGC 599) at Mines, federal agencies, or industry, and is highly encouraged. Independent study projects that connect students with local entities will be a priority and will establish a network of future employers for the students and collaborations for CSM.

Professional Master's Degree in Environmental Geochemistry

The Professional Master's in Environmental Geochemistry program is intended to provide:

1. an opportunity for Mines undergraduates to obtain, as part of a fifth year of study, a Master's in addition to the Bachelor's degree; and
2. additional education for working professionals in the area of geochemistry as it applies to problems relating to the environment.

This is a non-thesis Master's degree program administered by the Environmental Biogeochemistry subprogram of the Geochemistry program, and may be completed as part of a Combined degree program by individuals already matriculated as undergraduate students at Mines, or by individuals already holding undergraduate or advanced degrees and who are interested in a graduate program that does not have the traditional research requirement. The program consists primarily of coursework in geochemistry and allied fields with an emphasis on environmental applications. No research is required though the program does allow for independent study, professional development, internship, and cooperative experience.

A 9 Credit Core Program Consists of:		
CHGC503	INTRODUCTION TO GEOCHEMISTRY	3.0
CHGC509	INTRODUCTION TO AQUEOUS GEOCHEMISTRY	3.0
or CEEN550	PRINCIPLES OF ENVIRONMENTAL CHEMISTRY	
GEGN466	GROUNDWATER ENGINEERING	3.0
Total Semester Hrs		**9.0**

In addition, 15 credits must be selected from the list below, representing the following core areas: geochemical methods, geographic information system, geological data analysis, groundwater engineering or modeling, hydrothermal geochemistry, isotope geochemistry, physical chemistry, microbiology, mineralogy, organic geochemistry, and thermodynamics.

CHGC504	METHODS IN GEOCHEMISTRY	3.0
CEEN560	MOLECULAR MICROBIAL ECOLOGY AND THE ENVIRONMENT	3.0
CEEN562	ENVIRONMENTAL GEOMICROBIOLOGY	3.0
CHGC555	ENVIRONMENTAL ORGANIC CHEMISTRY	3.0
CHGN503	ADV PHYSICAL CHEMISTRY I	3.0
GEGN530	CLAY CHARACTERIZATION	2.0
GEGN532	GEOLOGICAL DATA ANALYSIS	3.0
GEGN575	APPLICATIONS OF GEOGRAPHIC INFORMATION SYSTEMS	3.0
GEGN581	ANALYTICAL HYDROLOGY	3.0
GEGN583	MATHEMATICAL MODELING OF GROUNDWATER SYSTEMS	3.0
GEGN586	NUMERICAL MODELING OF GEOCHEMICAL SYSTEMS	3.0
GEGX571	GEOCHEMICAL EXPLORATION	3.0
GEOL540	ISOTOPE GEOCHEMISTRY AND GEOCHRONOLOGY	3.0

An additional 6 credits of free electives may be selected to complete the 30 credit requirement. Free electives may be selected from the course offerings of the Department of Geology and Geological Engineering, the Department of Chemistry, or the Department of Civil and Environmental Engineering, and may also be independent study credits taken to fulfill a research cooperative, or other professional development experience. A course program will be designed in advanced through consultation between the student and an advisor from the Geochemistry Committee of the Whole

Courses

CHGC503. INTRODUCTION TO GEOCHEMISTRY. 3.0 Semester Hrs.
(I) A comprehensive introduction to the basic concepts and principles of geochemistry, coupled with a thorough overview of the related principles of thermodynamics. Topics covered include: nucleosynthesis, origin of earth and solar system, chemical bonding, mineral chemistry, elemental distributions and geochemical cycles, chemical equilibrium and kinetics, isotope systematics, and organic and biogeochemistry. Prerequisite: Introductory chemistry, mineralogy and petrology. 3 hours lecture; 3 semester hours.

CHGC504. METHODS IN GEOCHEMISTRY. 3.0 Semester Hrs.
(II) Field sampling of natural earth materials including rocks, soils, sediments, and waters. Preparation of naturally heterogeneous materials, digestions, and partial chemical extractions. Principles of instrumental analysis including trace elemental analysis by ICP-atomic spectroscopy, isotope analysis by ICP-MS, EM/X-ray methods, and chromatography. Quality assurance and quality control. Interpretation and assessment of geochemical data using statistical methods. Course format is hands-on, project oriented. Prerequisite: Graduate standing in geochemistry or environmental science and engineering. 2 hours lecture, 3 hours lab; 3 semester hours.

CHGC505. INTRODUCTION TO ENVIRONMENTAL CHEMISTRY. 3.0 Semester Hrs.
Equivalent with CHGN403,
(II) Processes by which natural and anthropogenic chemicals interact, react, and are transformed and redistributed in various environmental compartments. Air, soil, and aqueous (fresh and saline surface and groundwaters) environments are covered, along with specialized environments such as waste treatment facilities and the upper atmosphere. Meets with CHGN403. CHGN403 and CHGC505 may not both be taken for credit. Prerequisites: GEGN101, CHGN122 and CHGN209 or CBEN210. 3 hours lecture; 3 semester hours.

CHGC506. WATER ANALYSIS LABORATORY. 2.0 Semester Hrs.
Instrumental analysis of water samples using spectroscopy and chromatography. Methods for field collection of water samples and field measurements. The development of laboratory skills for the use of ICP-AES, HPLC, ion chromatography, and GC. Laboratory techniques focus on standard methods for the measurement of inorganic and organic constituents in water samples. Methods of data analysis are also presented. Prerequisite: Introductory chemistry, graduate standing. 3 hour laboratory, 1 hour lecture, 2 semester hours.

CHGC508. ANALYTICAL GEOCHEMISTRY. 3.0 Semester Hrs.
Sample preparation and instrumental analysis of geochemical materials using ICP-AES, ICP-MS, LA-ICP-MS, XRF and XRD are key activities in the field of earth resources and environmental monitoring. Course format is hands-on, project oriented. Laboratory techniques focus on industry-standard methods for the measurement of inorganic constituents, QA/QC, instrument trouble-shooting, and practical exercises with field collected samples. Methods of data interpretation are also key aspects of the course. Prerequisites: Enrollment in a Mines Graduate or Certificate Program. CHGN122, GEGN101, CHGN335 or equivalent.

CHGC509. INTRODUCTION TO AQUEOUS GEOCHEMISTRY. 3.0 Semester Hrs.
Analytical, graphical and interpretive methods applied to aqueous systems. Thermodynamic properties of water and aqueous solutions. Calculations and graphical expression of acid-base, redox and solution-mineral equilibria. Effect of temperature and kinetics on natural aqueous systems. Adsorption and ion exchange equilibria between clays and oxide phases. Behavior of trace elements and complexation in aqueous systems. Application of organic geochemistry to natural aqueous systems. Light stable and unstable isotopic studies applied to aqueous systems. Prerequisite: CHGN209 or CBEN210.

CHGC511. GEOCHEMISTRY OF IGNEOUS ROCKS. 3.0 Semester Hrs.
A survey of the geochemical characteristics of the various types of igneous rock suites. Application of major element, trace element, and isotope geochemistry to problems of their origin and modification. Prerequisite: Undergraduate mineralogy and petrology. 3 hours lecture; 3 semester hours. Offered alternate years.

CHGC514. GEOCHEMISTRY THERMODYNAMICS AND KINETICS. 3.0 Semester Hrs.
(II) Fundamental principles of classical thermodynamics and kinetics with specific application to the earth sciences. Volume-temperature ? pressure relationships for solids, liquids, gases and solutions. Energy and the First Law, Entropy and the Second and Third Laws. Gibbs Free Energy, chemical equilibria and the equilibrium constant. Solutions and activity-composition relationships for solids, fluids and gases. Phase equilibria and the graphical representation of equilibira. Application of the fundamentals of kinetics to geochemical examples. Prerequisite: Introductory chemistry, introductory thermodynamics, mineralogy and petrology. 3 hours lecture, 3 semester hours. Offered in alternate years.

CHGC527. ORGANIC GEOCHEMISTRY OF FOSSIL FUELS AND ORE DEPOSITS. 3.0 Semester Hrs.
A study of organic carbonaceous materials in relation to the genesis and modification of fossil fuel and ore deposits. The biological origin of the organic matter will be discussed with emphasis on contributions of microorganisms to the nature of these deposits. Biochemical and thermal changes which convert the organic compounds into petroleum, oil shale, tar sand, coal and other carbonaceous matter will be studied. Principal analytical techniques used for the characterization of organic matter in the geosphere and for evaluation of oil and gas source potential will be discussed. Laboratory exercises will emphasize source rock evaluation, and oil-source rock and oil-oil correlation methods. Prerequisite: CHGN221, GEGN438. 2 hours lecture; 3 hours lab; 3 semester hours. Offered alternate years.

CHGC555. ENVIRONMENTAL ORGANIC CHEMISTRY. 3.0 Semester Hrs.
A study of the chemical and physical interactions which determine the fate, transport and interactions of organic chemicals in aquatic systems, with emphasis on chemical transformations of anthropogenic organic contaminants. Offered in alternate years. 3 hours lecture; 3 semester hours.

CHGC563. ENVIRONMENTAL MICROBIOLOGY. 2.0 Semester Hrs.
An introduction to the microorganisms of major geochemical importance, as well as those of primary importance in water pollution and waste treatment. Microbes and sedimentation, microbial leaching of metals from ores, acid mine water pollution, and the microbial ecology of marine and freshwater habitats are covered. Prerequisite: none. 1 hour lecture, 3 hours lab; 2 semester hours. Offered alternate years.

CHGC564. BIOGEOCHEMISTRY AND GEOMICROBIOLOGY. 3.0 Semester Hrs.
Designed to give the student an understanding of the role of living things, particularly microorganisms, in the shaping of the earth. Among the subjects will be the aspects of living processes, chemical composition and characteristics of biological material, origin of life, role of microorganisms in weathering of rocks and the early diagenesis of sediments, and the origin of petroleum, oil shale, and coal. Prerequisite: none. 3 hours lecture; 3 semester hours.

CHGC598. SPECIAL TOPICS. 1-6 Semester Hr.
(I, II, S) Pilot course or special topics course. Topics chosen from special interests of instructor(s) and student(s). Usually the course is offered only once, but no more than twice for the same course content. Prerequisite: none. Variable credit: 0 to 6 credit hours. Repeatable for credit under different titles.

CHGC599. INDEPENDENT STUDY. 0.5-6 Semester Hr.
(I, II, S) Individual research or special problem projects supervised by a faculty member, also, when a student and instructor agree on a subject matter, content, and credit hours. Prerequisite: ?Independent Study? form must be completed and submitted to the Registrar. Variable credit: 0.5 to 6 credit hours. Repeatable for credit under different topics/experience and maximums vary by department. Contact the Department for credit limits toward the degree.

CHGC698. SPECIAL TOPICS. 1-6 Semester Hr.
(I, II, S) Pilot course or special topics course. Topics chosen from special interests of instructor(s) and student(s). Usually the course is offered only once, but no more than twice for the same course content. Prerequisite: none. Variable credit: 0 to 6 credit hours. Repeatable for credit under different titles.

CHGC699. INDEPENDENT STUDY. 0.5-6 Semester Hr.
(I, II, S) Individual research or special problem projects supervised by a faculty member, also, when a student and instructor agree on a subject matter, content, and credit hours. Prerequisite: ?Independent Study? form must be completed and submitted to the Registrar. Variable credit: 0.5 to 6 credit hours. Repeatable for credit under different topics/experience and maximums vary by department. Contact the Department for credit limits toward the degree.

Professors

Zhaoshan Chang, Geology and Geological Engineering

Linda A. Figueroa, Civil and Environmental Engineering

Christopher P. Higgins, Civil and Environmental Engineering

John McCray, Civil and Environmental Engineering

Thomas Monecke, Geology and Geological Engineering

James F. Ranville, Chemistry

Jonathan Sharp, Civil and Environmental Engineering

John R. Spear, Civil and Environmental Engineering

Bettina M. Voelker, Chemistry

Associate Professors

Mathias Burisch, Geology and Geological Engineering

Yvette Kuiper, Geology and Geological Engineering

Alexis Navarre-Sitchler, Geology and Geological Engineering

Assistant Professor

Ryan Venturelli, Geology and Geological Engineering

Affiliate Faculty

Nigel Kelly, Geology and Geological Engineering

Katharina Pfaff, Geology and Geological Engineering

Emeriti Professor

John B. Curtis, Geology and Geological Engineering

Wendy J. Harrison, Geology and Geological Engineering

Donald L. Macalady, Chemistry

Patrick MacCarthy, Chemistry

Samuel B. Romberger, Geology and Geological Engineering

Richard F. Wendlandt, Geology and Geological Engineering

Thomas R. Wildeman, Chemistry

Emeriti Associate Professor

L. Graham Closs, Geology and Geological Engineering

E. Craig Simmons, Chemistry