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### Geology

Geology is the study of the Earth and encompasses a broad range of topics including Earth’s history, composition, physical and chemical processes and the evolution of life. It has a unique perspective of time and scale, extending billions of years in the past and to global events. Because of human interaction with many Earth systems, geology is an environmental science that is vital to the resolution of such problems as climate change; groundwater supply and pollution; prediction and mitigation of earthquake, flooding and volcanic hazards; and natural resource discovery and utilization. Students majoring in geology acquire knowledge of value to many science and non-science professions.

The geology degree programs consist of a set of core courses that provide a foundation of geological principles and specialization tracks and elective courses that students choose to design a curriculum relevant to their interests. Many courses have a laboratory component where a hands-on, practical problem-solving approach to learning is emphasized. Students are introduced to basic and specialized computer programs and instrumental techniques used to gather and interpret data. Field trips to geological sites or field-based projects are regular features of several courses. Most classes for geology majors are small enough for students to receive individual attention and enjoy close contact with faculty in the classroom.

In the field of geology a student may work toward either a Bachelor of Arts or Bachelor of Science degree.

The Bachelor of Arts degree requires a major in geology but is a flexible program, permitting a student to combine education in geology with courses in other areas, such as other sciences, management or pre-law. A minor is optional. Having obtained a Bachelor of Arts degree, students may continue their education toward a Master of Science degree in geology.

The Bachelor of Science degree requires a core of Geology courses and courses in biology, chemistry, mathematics, physics and science electives. This degree requires a specialization to be obtained in one of the following: Geology, Environmental Geology, Geophysics, or Resource Geology. The specializations allow students to pursue specific career goals in the field of geology and related areas. The summer field course, usually taken between the junior and senior years, is part of the geology core. It is taught at a permanent field camp in the Beartooth Mountains near Red Lodge, Montana. Students desiring to do graduate work or to become a professional geologist will ordinarily pursue the Bachelor of Science degree.

### Bachelor of Arts (B.A.) in Geology Degree Requirements

| Degree Requirements  | Credit Hours |
|--|--------------|
| University Core Curriculum Requirements  | 39           |
| Geology Major Requirements   | 45-50        |
| GEOL 220, GEOL 222, or GEOL 225, GEOL 221, GEOL 223, GEOL 224, GEOL 302, GEOL 310, GEOL 315, GEOL 325 (3 hours included in the UCC Physical Science hours) | 21           |
| GEOL 450 or GEOL 454   | 3-6          |

| <b>Degree Requirements</b>   | <b>Credit Hours</b> |
|--|---------------------|
| CHEM 200, CHEM 201 or CHEM 202, CHEM 210, CHEM 211, CHEM 212   | 10                  |
| PHYS 203A, PHYS 253A   | 4                   |
| MATH 109 or MATH 111   | 1-3                 |
| Supportive Skills: CS 200B or CS 201 or CS 202 or ENGR 222, ENGL 290 or ENGL 291 or ENGL 491, GEOG 416, GEOG 417, GEOG 404 or GEOG 412, 2 semesters of remote sensing (GEOG 406 and GEOG 408), 2 semesters of GIS (GEOG 401 and GEOG 420), or 2 semesters of foreign language. | 6                   |
| Free Electives   | 31-36               |
| <b>Total</b>   | <b>120</b>          |

### **Bachelor of Science (B.S.) in Geology Degree Requirements**

| <b>Degree Requirements</b>   | <b>Credit Hours</b> |
|--|---------------------|
| University Core Curriculum Requirements  | 39                  |
| Requirements for Major in Geology  | 64-65               |
| GEOL 220 or GEOL 222 or GEOL 225; GEOL 221, GEOL 223, or GEOL 225, GEOL 224, GEOL 302, GEOL 310, GEOL 315, GEOL 325, GEOL 454 (3 hours included in the UCC Physical Science hours)   | 27                  |
| MATH 150   | 4                   |
| CHEM 200, CHEM 201, or CHEM 202, CHEM 210, CHEM 211, CHEM 212  | 10                  |
| PHYS 203A, PHYS 253A, PHYS 203B, PHYS 253B   | 8                   |
| Supportive skills: 6 credit hours of the following<br>CS 200B or CS 201 or CS 202 or ENGR 222, GEOG 416, GEOG 417, MATH 282 or GEOG 404 or GEOG 412, 2 semesters of remote sensing (GEOG 406 and GEOG 408), 2 semesters of GIS (GEOG 401 and GEOG 420) | 6                   |
| Writing Requirement: ENGL 290 or ENGL 291 or ENGL 491  | 3                   |
| One of the following specializations:  | 9-10                |

| Degree Requirements   | Credit Hours |
|---|--------------|
| Geology Specialization - 9 hours of 400-level geology approved by the program advisor   | 9            |
| Environmental Geology Specialization - Three courses from GEOL 418, GEOL 421, GEOL 436, GEOL 470/GEOL 471, GEOL 474, GEOL 476 | 9-10         |
| Geophysics Specialization - Three courses from GEOL 435, GEOL 436, GEOL 437, GEOL 466, GEOL 470, GEOL 471                     | 9            |
| Resource Geology Specialization - Three Courses from GEOL 418, GEOL 419, GEOL 420, GEOL 421, GEOG 434, GEOL 480, GEOL 482     | 9            |
| Electives in Geology, Science, Mathematics or Technology  | 16-17        |
| Total   | 120          |

## Geology Minor

A minor in Geology consists of 16 hours of courses in or related to the program. A plan of study is determined through consultation with the academic advisor for geology.

## Ancient Practices Minor

How — without the aid of modern technology — were ancient peoples able to construct catapults and compute the heavens, raise pyramids and other colossal buildings, craft weapons and statues in bronze, navigate across oceans, and brew beer and wine? How, without the benefit of centuries of accumulated knowledge available to us today, did people living in the distant past achieve intellectual milestones and execute monumental feats of engineering that have only recently been rivaled? Modern life is profoundly influenced by solutions to challenges that were first faced, and overcome, in the distant past. The Ancient Practices program allows students to explore these questions. It is a transdisciplinary course of study designed to allow students to explore life in the ancient world, with the opportunity to focus on those aspects of life in the past that are most relevant to their own interests and academic goals.

### Ancient Practices Minor Requirements

To assure that all of the requirements are completed as efficiently as possible, students wishing to complete a Minor in Ancient Practices must be approved by faculty responsible for the Ancient Practices program, who will provide guidance in selection of courses that best align with the student's individual interests. The minor requires completion of a minimum of 12 credit hours, consisting of at least 9 credit hours of 200-400 level course work from an approved list of courses, (see below) and at least 3 credit hours of UNIV 431 or an approved capstone equivalent that simultaneously satisfies requirements within the student's major.

Courses taken at other institutions may apply toward the minor only if those courses are acceptable for transfer credit by the program or school that offers the course being substituted. No more than 6 credit hours of transfer credit may be counted towards the minor. Transfer credit may not be applied to satisfaction of the requirement for UNIV 431.

In addition to UNIV 431, approved Ancient Practices courses include the following:

AD 350 - Ancient Artistic Practices

ANTH 340E/ANTH 430E - Intro to the Archaeology of Ancient Egypt

ARC 314I - (Ancient) Expressions in Architecture

ENGR 305 – Archae-Engineering

GEOL 329I - Geomythology

HND 300 – Wining and Dining in the Ancient World

PHIL 304B - Ancient Technologies and the Greek Philosophers

Other relevant courses may be substituted with the approval of the responsible faculty. The list of approved courses will be updated periodically and will be available from the responsible faculty.

## Geology Honors Program

Students admitted to the University Honors Program (UHP) and majoring in Geology may participate in the Geology Honors Program. This program offers students more challenging course options and helps them better develop their skills in the geological sciences. Students in the Geology Honors Program must complete at least three honors courses which have special assignments arranged with the course instructor. Honors students are also encouraged to complete an Honors thesis with a member of the Geology faculty. The UHP requirements are found at: [honors.siu.edu](http://honors.siu.edu).

## Technology Fee

The College of Agricultural, Life, and Physical Sciences assesses undergraduate majors a technology fee of \$4.58 per credit hour up to 12 credit hours. The fee is charged Fall and Spring semester.

## Geology Courses

**GEOL111 - Geology and the Environment** (University Core Curriculum Course) [IAI Course: P1 908] Examines human interaction with geologic processes and hazards, including earthquakes, volcanoes, landslides and flooding; occurrences and availability of geologic resources, such as energy, water and minerals; and human impacts on the environment including global warming, waste disposal, and pollution. Two lectures per week. Must be taken concurrently with or upon completion of Geology 112 or 113. If Geology 111 is dropped the laboratory course must also be dropped. Credit Hours: 2

**GEOL112 - Geology and the Environment Laboratory Learning** (University Core Curriculum) [IAI course: P1 908L] Laboratory to accompany Geology 111. Hands-on and inquiry-based learning in topics such as earth materials, topographic maps, stream dynamics, floods, coastal processes, landslides, groundwater, earthquakes, volcanoes, and human impacts on the environment. One laboratory session per week. Must be taken concurrently with or upon completion of Geology 111. Lab fee: \$10. Credit Hours: 1

**GEOL113 - Field Geology of Southern Illinois and Vicinity** (University Core Curriculum Course) Class will highlight the geological history and geological processes that have shaped southern Illinois and its surroundings, using the field as a natural laboratory. Schedule will include up to 7 Saturday field trips to nearby parks and outcrops, with a possible weekend trip outside of Illinois. Prerequisite: This class must be taken concurrently or following completion of GEOL 111, 220, 221, or 222. If GEOL 111, 220, 221, or 222 are dropped, then GEOL 113 must also be dropped. Activities fee: \$150. Credit Hours: 1

**GEOL121 - The History of the Earth** (University Core Curriculum Course) Geological processes shape the surface of our planet over millions of years. These forces provide the ever changing conditions for life. Fossils are "footprints" in time which recorded those changes, giving us the opportunity to unravel Earth's past. This class will study the story of Earth's geological and evolutionary past events. Two lectures per week. Must be taken concurrently with or upon completion of GEOL 124 or GEOL 113. If GEOL 124 or GEOL 113 is dropped then GEOL 121 must be dropped. Credit Hours: 2

**GEOL122 - Natural Hazards and Catastrophes** (University Core Curriculum Course) The Earth is shaped by dynamic geological forces such as earthquakes, volcanoes, and floods. While these phenomena construct the landscapes around us, they can be extremely destructive when in contact with human civilization and/or infrastructure. This class examines the natural forces capable of catastrophic impact on society providing a greater understanding of the sometimes violent geologic processes that shape the planet along with their human impact. Two lectures per week. Must be taken concurrently with or upon completion of GEOL 123 or GEOL 113. If GEOL 123 or GEOL 113 is dropped then GEOL 122 must be dropped. Credit Hours: 2

**GEOL123 - Natural Hazards and Catastrophes Laboratory** (University Core Curriculum Course) Laboratory to accompany GEOL 122. This lab examines natural processes associated with hazard and catastrophe in human history and modern society, such as earthquakes, volcanoes, landslides, and floods. Labs provide a greater understanding of the processes and driving forces shaping the planet along with their human impact while fostering skills of scientific inquiry. One laboratory session per week. Must be taken concurrently with or upon completion of GEOL 122. If GEOL 123 is dropped then GEOL 122 must be dropped. \$10 Lab Fee. Credit Hours: 1

**GEOL124 - History of the Earth Laboratory** (University Core Curriculum Course) Laboratory to accompany GEOL 121. Inquiry based laboratory sessions teaching the concepts of deep time, plate tectonics, evolution and the fossil record, biostratigraphy, rise and fall of the dinosaurs, evolution of mammals and humans. One laboratory session per week. Must be taken concurrently with or upon completion of GEOL 121. If GEOL 124 is dropped then GEOL 121 must be dropped. \$10 Field Trip Fee. Credit Hours: 1

**GEOL128 - The Dinosaurian World** (University Core Curriculum Course) An introduction to Dinosaurs and the world in which they lived, and died. Topics will include Mesozoic continents; Plants of the Mesozoic; Dinosaur paleoenvironments; Dinosaur origins; Dinosaur biology; Dinosaur fossilization; Dinosaur hunters and Dinosaur extinction. Must be taken concurrently with or upon completion of GEOL 129 or GEOL 113. If GEOL 129 or GEOL 113 is dropped then GEOL 128 must be dropped. Credit Hours: 2

**GEOL129 - DinoLab** (University Core Curriculum Course) A physical science lab that provides hands-on and inquiry based learning in geologic concepts necessary to fully understand dinosaur paleontology and paleobiology. Must be taken concurrently with or upon completion of GEOL 128, The Dinosaurian World. If GEOL 128 is dropped then GEOL 129 must be dropped. \$10 Lab Fee. Credit Hours: 1

**GEOL130 - The Planets** (University Core Curriculum) This course provides a general overview of the origin of the solar system, the composition of the planets and moons of the solar system, and the search for other planetary systems and life in the universe. The planetary processes of meteorite impact, volcanism, tectonics, and weathering on the various planets and the newest discoveries by NASA and other Space Agencies will be discussed. Planetary exploration efforts center on the search for life itself-"extant" life that is either active today or is dormant but still alive will be examined and compared across the solar system. Examines the methods of discovering information about the solar system involving the interdisciplinary application of pertinent basic scientific concepts of geology, chemistry, biology, meteorology, and cosmology. Two lectures per week. Must be taken concurrently or upon completion of laboratory course GEOL 131. If GEOL 130 is dropped then GEOL 131 must also be dropped. Credit Hours: 2

**GEOL131 - The Planets Laboratory Learning** (University Core Curriculum) Laboratory to accompany GEOL 130. This lab will provide hands on inquiry-based learning in topics such as building materials of planets and their moons, meteorites and their origin and composition, volcanoes and plate movement, the internal structure and the atmospheric composition of planetary bodies across the solar system, the sun-earth interactions, the impacts and their effects on planetary development, and the search for "extant" life that is either active today or is dormant but still alive across the solar system. One laboratory session per week. Must be taken concurrently with Geology 130. Credit Hours: 1

**GEOL220 - The Dynamic Earth** (University Core Curriculum Course) [IAI Course: P1 907] Introduction to the materials which form the Earth and the dynamic processes that change them. Three lectures per week. With 223 satisfies University Core Curriculum Science Group I requirement in lieu of 111 and 112.

Field trip required. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field Trip Fee not to exceed \$25. Credit Hours: 3

**GEOL220H - The Dynamic Earth** (University Honors Course) (University Core Curriculum Course) [IAI Course: P1 907] Introduction to the materials which form the Earth and the dynamic processes that change them. Three lectures per week. With 223 satisfies University Core Curriculum Science Group I requirement in lieu of 111 and 112. Field trip required. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field Trip Fee not to exceed \$25. Restricted to University Honors Program students. Credit Hours: 3

**GEOL221 - Earth Through Time** (University Core Curriculum Course) [IAI Course: P1 907] Concepts and methods of interpreting earth history. Development of earth's major features and environment systems. Emphasis on ancient environments and life forms, major changes in paleoclimate, paleocommunities and biodiversity. Students must complete a research project. With 224 satisfies University Core Curriculum Group I Science requirement in lieu of Geology 111 and 112. Field trips required. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field Trip Fee not to exceed \$15. Credit Hours: 3

**GEOL221H - Earth Through Time** (University Honors Course) (University Core Curriculum Course) [IAI Course: P1 907] Concepts and methods of interpreting earth history. Development of earth's major features and environment systems. Emphasis on ancient environments and life forms, major changes in paleoclimate, paleocommunities and biodiversity. Students must complete a research project. With 224 satisfies University Core Curriculum Group I Science requirement in lieu of Geology 111 and 112. Field trips required. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field Trip Fee not to exceed \$15. Restricted to University Honors Program students. Credit Hours: 3

**GEOL222 - Environmental Geology** (University Core Curriculum course) A study of the environment from a geological perspective. A critical study of geological hazards (earthquakes, floods), earth resources (minerals, water), proper land use (waste disposal), and other environmental concerns. Three lectures per week. One Saturday field trip required. Prerequisite: with 223 satisfies University Core Curriculum Science Group I requirement in lieu of 111 and 112. Lab fee: \$5. Credit Hours: 3

**GEOL223 - Introductory Geology Laboratory** (University Core Curriculum Course) Understanding the earth's processes, materials and environment through hands-on laboratory and field experience. One three-hour session per week. Prerequisite: completion of, or concurrent enrollment in, 220 or 222, with 220 or 222 satisfies University Core Curriculum Science Group I requirement in lieu of 111 and 112. Lab fee: \$10. Credit Hours: 1

**GEOL224 - Earth Through Time Laboratory** (University Core Curriculum Course) Concepts and methods of interpreting earth's history. One two-hour laboratory per week. Weekend day field trip required. Prerequisite: completion of or concurrent enrollment in 221. With 221 satisfies University Core Curriculum Group I Science requirement in lieu of Geology 111 and 112. Lab fee: \$10. Credit Hours: 1

**GEOL225 - Physical Geology in the Field** (University Core Curriculum Course) This class is an introductory geology course performed exclusively in the field and fulfills the introductory science course with lab requirement. The class will spend three weeks in the field and visit Yellowstone, Grand Tetons, Craters of the Moon, and Glacier National Parks, as well as spending time near Dillon, MT. Students will learn the basics of rock and mineral identification, how to recognize and identify types of faults, introductory stratigraphy, map reading, and landscape evolution. Credit Hours: 3

**GEOL240 - Geology of National Parks** A study of the geology of the national parks of the United States. Will include background material in plate tectonics, rocks, minerals, structural geology, geologic time, and geomorphology as applied to the physical geology and geologic history of several national parks and monuments. National parks and monuments studied will include, but not be limited to, Yellowstone, The Grand Canyon, Crater Lake, Glacier, Grand Teton, Great Smoky Mountains, and Theodore Roosevelt. Three lectures per week. Credit Hours: 3

**GEOL250 - Sustainable Earth and Energy** The study of renewable energy resources and practices that can help build a sustainable energy and resource future. Includes an overview of the history of energy and resource use, origin of fossil fuels and their use, what it means to be sustainable and renewable, and

sustainable practices. Resources studied include fossil fuels, nuclear, hydroelectric, wind, solar, tidal, ocean, and others. Three lectures per week. Credit Hours: 3

**GEOL250H - Sustainable Earth and Energy** The study of renewable energy resources and practices that can help build a sustainable energy and resource future. Includes an overview of the history of energy and resource use, origin of fossil fuels and their use, what it means to be sustainable and renewable, and sustainable practices. Resources studied include fossil fuels, nuclear, hydroelectric, wind, solar, tidal, ocean, and others. Three lectures per week. Restricted to University Honors Program students. Credit Hours: 3

**GEOL302 - Fundamentals of Structural Geology** An introduction to structural geology including a study of the forces involved in the deformation of the earth's crust, with special emphasis on the recognition and interpretation of the resultant geologic features. Laboratory required. Up to 3 one- or two-day field trips may be required on weekends. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Prerequisite: GEOL 220 or 222 with a grade of C or better; 223 with a grade of C or better; MATH 109 or 111. Recommended: Physics 203 or 205, or concurrent enrollment. Field trip fee not to exceed \$199. Credit Hours: 4

**GEOL302H - Fundamentals of Structural Geology** (University Honors Course) An introduction to structural geology including a study of the forces involved in the deformation of the earth's crust, with special emphasis on the recognition and interpretation of the resultant geologic features. Laboratory required. Up to 3 one- or two-day field trips may be required on weekends. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field trip fee not to exceed \$199. Prerequisite: GEOL 220 or 222 with a grade of C or better; 223 with a grade of C or better; MATH 109 or 111. Recommended: Physics 203 or 205, or concurrent enrollment. Restricted to University Honors Program students. Credit Hours: 4

**GEOL310 - Mineralogy** Introduction to the internal structure morphology and chemistry of crystals. Study of the properties, chemistry, occurrence and identification of rock-forming and economically important minerals. Rudiments of the use of a petrographic microscope and the optical properties of common rock-forming minerals. Up to 3 one- or two-day field trips may be required on weekends. Prerequisite: GEOL 220 or 222 with a grade of C or better; 223 with a grade of C or better; CHEM 200, 201 recommended. Lab fee: \$15. Credit Hours: 4

**GEOL315 - Petrology** Introduction to the classification, nature, origin, and processes of igneous, sedimentary, and metamorphic rocks. Hand specimen and thin-section analysis of rocks. Lecture-laboratory. Up to 3 one- or two-day field trips may be required on weekends. Prerequisite: GEOL 310 with a grade of C or better. Lab fee: \$15. Required Field Trip Fee not to exceed \$60. Credit Hours: 4

**GEOL315H - Petrology** (University Honors Course) Introduction to the classification, nature, origin and processes of igneous, sedimentary and metamorphic rocks. Hand specimen and thin-section analysis of rocks. Lecture-laboratory. Up to 3 one- or two-day field trips may be required on weekends. Prerequisite: GEOL 310 with a grade of C or better. Lab fee: \$15. Restricted to University Honors Program students. Credit Hours: 4

**GEOL325 - Sedimentology and Stratigraphy** An overview of the relationship between tectonics and climate, and the origin of sedimentary rocks; the course outlines: the plate-tectonics setting of sedimentary basins, their geometry, and subsidence mechanisms; the relationship between sediment supply, basin subsidence, and global sea-level change in determining the sequence stratigraphy of sedimentary-basin fill; and principles of interpretation of environment of deposition within a sequence stratigraphic framework. Prerequisite: GEOL 220 or 222 with a grade of C or better, 221 with a grade of C or better, 223 with a grade of C or better, 224 with a grade of C or better. Lab and field trips required. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field trip fee not to exceed \$60. Credit Hours: 4

**GEOL327I - The World's Oceans** (University Core Curriculum: Students with a catalog year prior to Summer, 2012 only) The world's ocean comprises up to 80% of the earth's surface. It plays a significant role in global climate, contains mineral resources and harbors a wealth of plant and animal life. "The World's Oceans", through the scientific method, will provide a greater understanding of the processes and components of the oceans and their importance to our everyday life. The course will include

lectures, discussion sessions, readings and exercises from the text, laboratory exercises and short field excursions. Credit Hours: 3

**GEOL329H - Geomythology** (University Core Curriculum Course) (University Honors Course) Natural disasters have been the source of countless myths and legends throughout human history. This course will examine ways in which regional geology influenced ancient civilizations, and explore the possibility that some of their myths and legends preserve a record of actual geologic events. This class will include lectures, discussions, media sources and readings. An introductory geology course is recommended but not necessary. Prerequisite: GEOL 111, 220, 221 or 222 recommended. Restricted to University Honors Program students. Credit Hours: 3

**GEOL329I - Geomythology** (University Core Curriculum Course) Natural disasters have been the source of countless myths and legends throughout human history. This course will examine ways in which regional geology influenced ancient civilizations, and explore the possibility that some of their myths and legends preserve a record of actual geologic events. This class will include lectures, discussions, media sources and readings. An introductory geology course is recommended but not necessary. Prerequisite: GEOL 111, 220, 221 or 222 recommended. Credit Hours: 3

**GEOL330H - The Planets** (University Honors Course) (University Core Curriculum: Students with a catalog year prior to Summer 2012 only) The geology of the planets and moons of the solar system, their origin and history, the origin of the universe and the solar system and the search for other planetary systems and life in the universe. The geologic processes of vulcanism, tectonism, weathering and meteorite impact on the various planets will be examined and compared. A main focus of the course will be examining the methods for discovering information about the solar system involving the interdisciplinary application of pertinent basic scientific concepts of geology, geochemistry, geophysics, meteorology and cosmology. Restricted to University Honors Program students. Credit Hours: 3

**GEOL330I - The Planets** (University Core Curriculum: Students with a catalog year prior to Summer 2012 only) The geology of the planets and moons of the solar system, their origin and history, the origin of the universe and the solar system and the search for other planetary systems and life in the universe. The geologic processes of vulcanism, tectonism, weathering and meteorite impact on the various planets will be examined and compared. A main focus of the course will be examining the methods for discovering information about the solar system involving the interdisciplinary application of pertinent basic scientific concepts of geology, geochemistry, geophysics, meteorology and cosmology. Credit Hours: 3

**GEOL360 - Old Humans, New Humans** The evolution of humans and the development of civilization depended and depends on the immediate and surrounding environment. Climate, availability of natural resources, and susceptibility to natural hazards all have and continue to play a role in directing evolution and civilization. This course will give the student context of the exquisite hominid fossils and natural resources presented today in South Africa. Drawing on these examples, we will examine how geologic processes and hazards influence human evolution and how our dependence on resources influence civilization today. Credit Hours: 3

**GEOL401 - Physical Nature of the Earth for Teachers** This is an on-line course that offers an overview of the materials that form the Earth and the dynamic processes that shape the Earth, including both surficial processes and plate tectonics. This course will cover content appropriate for science teachers preparing to teach Physical Geology as a Dual-Credit course in high schools. Topics include: components and processes that create rocks and the cycles that change one rock into another; how plate tectonics has shaped the Earth; surficial processes (weathering, landslides, movement of ice, water, and wind); hazardous processes (earthquakes, volcanoes, flooding); and resources such as water, soil, and mineral and energy sources. This course is designed to be taken in conjunction with GEOL 402, a 1-hr laboratory course. Only open to students in the Dual Credit Certificate for Teachers program. Credit Hours: 3

**GEOL402 - Physical Nature of the Earth Laboratory for Teachers** Through active learning activities, this course offers examination of the materials that form the Earth and the dynamic processes that shape the earth, including surficial processes and plate tectonics. This course will cover content appropriate for science teachers preparing to teach labs associated with Physical Geology as a Dual-Credit course in high schools. This is offered as a hybrid distance education (on-line) class and includes both at-home and in-class laboratory assignments. For the in-class components, students will come to SIUC's campus for 2 half days (Saturdays) as indicated in the schedule. This course is designed to be taken in conjunction with



GEOL 401, a 3-hr online course in which the students learn about earth materials and earth processes in greater depths. Only open to students in the Dual Credit Certificate for Teachers program. Credit Hours: 1

**GEOL403 - Historical Geology Teacher Enhancement** GEOL 403 is an online course designed to train science teachers to teach Historical Geology as a Dual Credit course in high schools. This course covers the basic principles involved in the study of geology and the history of the Earth preserved in the rock record. We begin with the large-scale components of Earth systems and geologic time, and then learn about the evolution of life recorded in the fossil record from the earliest life through the present. This course covers not just WHAT we know, but how we know it. This course is designed to be taken in conjunction with GEOL 404, a 1-hr laboratory course. Only open to students in the Dual Credit Certificate for Teachers program. Credit Hours: 3

**GEOL404 - Historical Geology Teacher Enhancement Lab** GEOL 404 is the laboratory section that accompanies the online Historical Geology Teacher Enhancement. This laboratory course offers hands-on activities to complement the online lectures and will provide teachers with a structure to teach labs in their own Dual Credit high school courses. This course covers the basic principles involved in the study of geology and the history of the Earth preserved in the rock record. We study sedimentary rocks, and learn how to read the clues to past environments and life preserved within samples. This course is done partially at home, but requires a six hour in house lab session. Only open to students in the Dual Credit Certificate for Teachers program. Credit Hours: 1

**GEOL405 - Science Writing and Scientific Communication** Course will teach "survival skills" in scientific reading, writing, communicating, and publishing for new graduate students. Topics will include database search, analysis of journal articles, abstracts, figures, and tables, Powerpoint presentations, proposals, posters, thesis writing, and preparation of journal submissions. Enrollment is open to graduate students in the sciences and is by permission of the instructor. Credit Hours: 2

**GEOL411 - Volcanology** Study of volcanoes, their distribution, forms, composition, eruptive products and styles of potential hazards. Relationship of magmatic characteristic, eruptive style, and depositional products to the geologic framework is examined. Prerequisite: GEOL 315. Credit Hours: 3

**GEOL412 - Advanced Petrology** In-depth study of the rock forming processes. The relations of rock forming processes to petrographic analysis will be emphasized. Laboratories will deal with hand-specimen and thin-section analysis from selected rock suites with genetic modeling of the resulting data. Prerequisite: GEOL 310, 315. Credit Hours: 3

**GEOL413 - Quantitative Methods of Geology** An introduction to quantitative methods in a geological and earth sciences context. Topics introduced include sampling plans for geologic studies, non-parametric test of geological data, comparisons of geological samples, analysis of sequential geological data. Laboratories will deal with numerical examples from all areas of geology. Restricted to advanced standing. Special approval needed from the instructor. Credit Hours: 3

**GEOL415 - Optical Mineralogy** The optical properties of minerals and the use of the petrographic microscope for identification of crystals by the immersion method and by thin section. Lecture, laboratory. Prerequisite: GEOL 310, PHYS 203B or 205B. Credit Hours: 3

**GEOL416 - The Geochemistry of Natural Waters** The purpose of this class is to provide students with a strong theoretical background in aqueous geochemistry, environmental geochemistry, and groundwater geochemistry for application in a wide range of research topics. The approach combines conceptual knowledge with quantitative skills in a cyclic fashion to build independent understanding and chemical intuition. Prerequisites: GEOL 310, CHEM 200, 201, 210, 211 or consent of instructor. Lab fee: \$15. Credit Hours: 3

**GEOL417 - Isotope Geochemistry** Isotope fractionation in natural systems containing D/H, carbon, oxygen, nitrogen, and sulfur. Application of stable isotope studies to environmental processes, paleoclimatology, and geothermometry. Stable and radioactive isotopes as tracers in hydrologic processes, ore deposits, sedimentology, and in crust-mantle differentiation processes. Prerequisite: GEOL 310, CHEM 200, 201, 210, 211, or equivalent. Credit Hours: 3

**GEOL418 - Low Temperature Geochemistry** The application of chemical principles to geologic processes that occur on and near the earth's surface. Lecture, laboratory. Prerequisite: GEOL 310, CHEM 200, 201, 210, 211 or equivalent. Credit Hours: 3

**GEOL419 - Ore Deposits** Overview of the occurrence, geology and origin of metalliferous mineral deposits. Geologic principles and research techniques important to the understanding of mineral deposits. Introduction to exploration and mining methods. Lectures, laboratories and field trips required. Prerequisite: GEOL 302, 315 or consent of instructor. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field trip fee not to exceed \$60. Credit Hours: 3

**GEOL420 - Petroleum Geology** The geological occurrences of petroleum including origin, migration and accumulation; a survey of exploration methods, and production problems and techniques. Laboratory study applies geological knowledge to the search for and production of petroleum and natural gas. Prerequisite: GEOL 221, 224. Credit Hours: 3

**GEOL421 - Organic Geochemistry** The nature, origin and fate of natural and artificial organic materials in rocks and sediments. Topics include characterization of fossil fuels using biological marker compounds, petroleum source rock evaluation, and organic pollutants in the environment. Prerequisite: GEOL 325 or consent of instructor. Credit Hours: 3

**GEOL423 - Geomicrobiology** (Same as MICR 423 and MBMB 423) The course will focus on the role that microorganisms play in fundamental geological processes. Topics will include an outline of the present understanding of microbial involvement of weathering of rocks, formation and transformation of soils and sediments, and genesis and degradation of minerals. Elemental cycles will also be covered with emphasis on the interrelationships between the various geochemical cycles and the microbial trophic groups involved. Prerequisite: Microbiology 301 and Chemistry 210 and 211. Recommended: GEOL 220, 221 or 222. Credit Hours: 3

**GEOL425 - Invertebrate Paleontology and Paleocology** (Same as ZOO 425) Concepts of paleontology and paleocology. Emphasis on functional morphology, lifestyles and habitats of fossil invertebrates and algae. The nature and evolution of marine and coastal paleocommunities. The effects of extinction events on paleocommunities and biodiversity. Laboratory. Field trips required. Prerequisite: GEOL 325 or a biology course. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field trip fee not to exceed \$199. Credit Hours: 3

**GEOL428 - Paleocology and Environments of Deposition** Characteristics, distribution, and classification of recent and ancient environments. Criteria for recognizing ancient environments. Sedimentological and paleocological approaches. Recognition of ancient environments and environmental associations. Laboratory. Field trips required. Prerequisite: GEOL 425, 325, or concurrent enrollment. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field trip fee not to exceed \$199. Credit Hours: 3

**GEOL430 - Planetary Geology** Study of the solar system and planet formation, focusing on formation, differentiation and secondary processes. Geologic histories and geological processes of other planets are examined and compared with our understanding of the Earth. Prerequisite: GEOL 310. Credit Hours: 3

**GEOL431 - Catastrophes and Consequences** Much has been written in recent years about the impact of human civilization on the environment. There has been much less discussion of the impact of the environment on human civilization, but the fact is that gradual or rapid changes in the environment can profoundly affect human populations-in both direct and indirect ways. This is an interdisciplinary course that reviews both the short term/short range and long term/long range effects of natural perturbations of the environment on the development of civilization and the course of history. We will review historical case studies of the consequences of various kinds of natural disasters which resulted in major disruptions to the environment from local and regional phenomena to those that affected the entire planet. Examples include major volcanic eruptions, earthquakes and climate change. Credit Hours: 3

**GEOL432 - Energy Strategic Elements and Critical Minerals** Energy critical and strategic elements (ECSE) are essential to modern society. This course would introduce the ECSE and their various use in the energy efficient and national security technologies. Key concepts, such as ECSE physical and chemical properties, are introduced and then employed to describe the main controls on their behavior

in both natural and anthropocentric systems. Topics covered include: (1) the geological systems in which ECSE occur and the processes responsible for migration and enrichment of ECSE in the Earth's crust; (2) the ECSE global availability, supply risk, vulnerability to supply restriction, and environmental implications; and (3) strategies for addressing the criticality and sustainability of ECSE. This course will provide a training academy for students who want to join the emerging clean energy economy. Credit Hours: 3

**GEOL435 - Solid Earth Geophysics** Earth's size, shape, mass, age, composition, and internal structure are reviewed in detail as understood from gravity, magnetic fields, seismicity, thermal processes, and motion of continents and ocean basins. Prerequisite: MATH 150 or MATH 151 with a C or better. Credit Hours: 3

**GEOL436 - Applied Geophysics** Theory and practice of geophysics applied to exploration for natural resources including oil, minerals, coal, groundwater, and for archaeology, environmental, and meteorite impact sites and earthquake zones. Methods include seismic reflection, refraction, and surface waves also gravity, magnetic, and electrical. Up to 3 one-day field trips may be conducted on weekends. Recommend: GEOL 220 or 222, PHYS 203A/B or PHYS 253A/B. Prerequisite: MATH 150. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field trip fee not to exceed \$80. Credit Hours: 3

**GEOL437 - Field Course in Geophysics** Use of geophysical equipment for collection, analysis and interpretation of seismic, gravity, magnetic, electrical, and other types of geophysical data. Field trips required. Prerequisite: GEOL 436 or consent. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field trip fee not to exceed \$199. Credit Hours: 3

**GEOL440 - Advanced Topics in the Geological Sciences** Individual study or research or advanced studies in various topics. Restricted to advanced standing. Special approval needed from the instructor. Credit Hours: 1-9

**GEOL445 - Museum Studies in Geology** History, nature and purpose of geology in museums, relationships of geology to other museum disciplines, application of geologic methods to museum functions, preparation and preservation of specimens; nature, acquisition and utilization of geologic collections in museums; role of research in museums. Credit Hours: 3

**GEOL450 - Introduction to Field Geology** Introduction to field techniques, principles of geologic mapping and map interpretation. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Prerequisite: GEOL 310 with a grade of C or better. Credit Hours: 3

**GEOL451 - Field Experience in Geology** Preparation for and participation in academically rigorous field trips guided by faculty members. Trips will be to areas of geological interest and will occur during official breaks within or between semesters. Expense will vary in proportion to the distance traveled and duration of trip and will be determined before each trip. A student may only take a specific trip once for credit. Special approval needed from the instructor. Credit Hours: 1-12

**GEOL454 - Field Geology** Advanced field mapping in the Rocky Mountains, including problems in stratigraphy, structure, petrology, paleontology, geomorphology, and economic geology. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Prerequisite: GEOL 302, 315, 325. GEOL 450 recommended. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field trip fee not to exceed \$1,000. Credit Hours: 6

**GEOL464 - Earth's Deep Interior** Structure and composition of Earth's interior from the lithospheric mantle to the inner core. Mineralogy and petrology of the upper mantle, transition zone, lower mantle, outer core, and inner core, equilibrium phase relations and phase changes, equations of state, spin transitions, seismic discontinuities, seismic anisotropy, geomagnetic field, laboratory and seismic methods used to explore Earth's interior. Prerequisite: GEOL 310 and 315 with a grade of C or better, graduate status, or instructor approval. Credit Hours: 3

**GEOL466 - Tectonics** Fundamentals of geodynamics applied to plate tectonics: mantle composition and rheology, deformation of the lithosphere, structural characteristics of plate margins, stability of triple

junctions, and orogenesis will be examined in detail. One 3-day field trip may be required. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field trip fee not to exceed \$150. Prerequisite: GEOL 302 with a grade of C or better or consent. Credit Hours: 3

**GEOL470 - Hydrogeology** Study of the distribution, origin, and movement of groundwater, and the properties of geologic materials that control groundwater flow and contaminant transport. Includes topics on the sustainable development of groundwater resources. Prerequisite: GEOL 220 or 222 with a C or better; or consent of instructor. Credit Hours: 3

**GEOL471 - Hydrogeology Laboratory** Problem sets, laboratory experiments, and field exercises in hydrogeology. Includes projects on the sustainable development of groundwater resources. Field trips required. Prerequisite: GEOL 220 or 222 with a C or better; or consent of instructor. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field trip fee not to exceed \$150. Credit Hours: 1

**GEOL474 - Geomorphology** Study of erosional and depositional processes operating at the earth's surface and landforms resulting from these processes. Relationship of processes and landforms to the geologic framework is examined. Laboratory. Field trips required. Prerequisite: GEOL 220 or 222; 223. Expense will vary in proportion to distance traveled and locations visited and will be determined before each semester. Field trip fee not to exceed \$60. Credit Hours: 3

**GEOL476 - Quaternary Geology** Methods used to identify, map, date and correlate Quaternary deposits and interpret Quaternary history. Covers glacial, fluvial, coastal, lacustrine and eolian chronologies, oxygen-isotope records from ocean sediments and continental ice cores, volcanic activity, and Quaternary climate change. Field trips required. Prerequisite: GEOL 220 or 222; 221, 223, 224; or consent of instructor; GEOL 474 recommended. Credit Hours: 3

**GEOL480 - Geology of Coal** Stratigraphy, sedimentation and structure of coal deposits; modern analogs; origin of splits and partings in coal seams; coal quality and rank; coal exploration and mining; methods of resource evaluation. Prerequisite: GEOL 220 or 222; 221, 223, and 224; or consent of instructor. Credit Hours: 3

**GEOL481 - Sedimentary Basin Analysis** The use of stratigraphy, structure, sedimentology and geophysics to determine the paleogeographic evolution of sedimentary basins. Topics include the study of the relationships between host strata and both primary and post-depositional non-renewable resources, plate tectonics and basin evolution and subsurface geologic methods. Special approval needed from the instructor. Lab fee: \$10. Credit Hours: 3

**GEOL482 - Organic Petrology** Petrology and geochemistry of coals and dispersed organics; emphasis on applications to the coal and oil industries; origin of coal and source rock constituents; geochemical and petrographic changes with increased maturation. Prerequisite: GEOL 220 or 222; 221, 223, and 224; or consent of instructor. Lab fee: \$50. Credit Hours: 3

**GEOL483 - Forensic Geology** An introduction to the use of geological materials and techniques in criminal investigation. Details from actual criminal cases will be used as examples in all the topics covered which include rock and mineral types, geological and topographic maps, fossils, sand, soils, spores and pollen, geological building materials, art fraud and gemstones. Techniques covered will include optical microscopy, scanning electron microscopy and x-ray diffraction. Lab fee: \$10. Credit Hours: 3

**GEOL484 - Geologic Remote Sensing** Applications of remote sensing using aerial photographs, multi-spectral imagery, hyperspectral imagery, thermal infrared imagery, and radar imagery, in structural geology, stratigraphy, geomorphology, oil and mineral exploration, geologic hazard analysis and planetary exploration. Prerequisite: GEOL 220 or consent of the instructor. Lab fee: \$25. Credit Hours: 3

**GEOL490 - Internship** Credit for supervised practical experience with an external geological agency or company; prior approval of the sponsoring agency and the program is required. Restricted to advanced standing. Credit Hours: 1-6

## Geology Faculty

**Anderson, Ken B.**, Professor and Director Advanced Coal and Energy Research Center, Geology, Ph.D., University of Melbourne, 1989; 2003. Clean coal technology, ambers and fossil resins, resource analysis.

**Conder, James A.**, Professor, Geology, Ph.D., Brown University, 2001; 2008. Mantle geodynamics and melt generation, active tectonics.

**Gilbertson, Lea**, Associate Lecturer, Geology, M.S., University of Western Washington, 1994; 2018. Geological sciences.

**Henson, Harvey**, Associate Professor and Interim Director STEM Education Research Center, Curriculum and Instruction/Geology, Ph.D., Southern Illinois University, 2015; 2016. Science education, geology, geophysics.

**Hummer, Daniel R.**, Associate Professor, Geology, Ph.D., The Pennsylvania State University, 2010; 2016. Mineralogy, crystallography, high temperature geochemistry.

**Lefticariu, Liliana**, Professor, Geology, Ph.D., Northern Illinois University, 2004; 2007. Geochemistry, low-temperature geochemistry, stable isotopic analysis, environmental geology.

**Potter-McIntyre, Sally**, Associate Professor, Geology, Ph.D., University of Utah, 2012; 2013. Clastic sedimentology, paleogeography and basin evolution, astrobiology, Mars sedimentology using terrestrial analogs.

## Emeriti Faculty

**Esling, Steven Paul**, Associate Professor, Emeritus, Ph.D., University of Iowa, 1984.

**Fifarek, Richard H.**, Associate Professor, Emeritus, Ph.D., Oregon State University, 1985.

**Rimmer, Sue**, Professor, Emerita, Ph.D., Pennsylvania State University, 1985.

**Sexton, John**, Professor, Emeritus, Ph.D., Indiana University, 1974; 1985.

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