

BOONE PICKENS SCHOOL OF GEOLOGY

Earth is the residence of the human race; therefore, it is essential to develop a better understanding of the composition, internal and external processes that affect the Earth. Earth is an outdoor laboratory filled with opportunities to observe geologic processes in action. By applying knowledge of forces that shape Earth, geoscientists seek to reconstruct the past and anticipate the future. Geoscientists provide information to society for solving problems and establishing policy for resource management, environmental protection, and public health, safety and welfare.

Geology is concerned with the processes, the history, and the characteristics of the rocks and sediments that shape the Earth. Human activities, predominantly on or near the surface, have utilized rocks and rock products, mainly petroleum and metals, to contribute to the quality of life. Because the Earth is dynamic—that is, the land surface is constantly changing—knowledge of earthquakes, volcanoes, plate tectonics, floods and landslides, to name a few dynamic events, is critical to minimize human suffering and economic loss. Within geology, different specialties, such as petroleum geology, ground-water geology (hydrogeology), geomorphology (study of surface processes), structural geology, and paleontology (study of fossils), have developed.

The Boone Pickens School of Geology offers traditional academic program services, awards BS, MS and PhD degrees in geology and conducts various outreach programs. Geology majors are provided a quality education designed to develop leadership skills and enhance employment opportunities. The faculty of the Boone Pickens School of Geology conduct research in the areas of continental tectonics, conventional and unconventional energy resources, environmental issues, paleoclimatology, geophysics/remote sensing. In these areas, the school has already established a sound infrastructure—appropriate faculty appointments, laboratory and computer upgrades, and a sound record of productivity. Geology undergraduates are eligible for one of at least 10 available departmental scholarships, based on academic achievement and need. Teaching assistantships, research assistantships and fellowships are available for qualifying geology graduate students.

Geologists are employed extensively in applied and pure research and in teaching. Applied research includes the exploration for, and development of, oil and gas fields, metallic and nonmetallic mineral deposits, and reservoirs of ground water. The geologist is well prepared to pursue and direct environmental studies. Careers in research may be found with private employers, government agencies or universities. Teaching positions in geology are available at all levels, beginning with secondary education. As with most other sciences, more employment opportunities will be available to students with advanced training and a broad background. In general, careers as teachers in a college or university and in research are open only to those with graduate training.

Courses

GEOL 1013 Exploring Earth: An Introduction to Geology (LN)

Description: An introductory course for non-science majors which will investigate how chemical, physical and biological processes interact to shape and regulate the Earth's environment. Will build your understanding of how each part of the Earth system – the ocean, atmosphere and interior – work and interact over time.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

General Education and other Course Attributes: Scientific Investigation, Natural Sciences

GEOL 1014 Geology and Human Affairs (LN)

Description: The influence of geology and related earth sciences on the human environment. Energy and material resources, beneficial and hazardous natural processes, and the planetary and biological evolution of earth. Lab investigations environmentally oriented. Lab fees required for online section.

Credit hours: 4

Contact hours: Lecture: 3 Lab: 2

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

General Education and other Course Attributes: Scientific Investigation, Natural Sciences

GEOL 1022 Climate Change and Humanity

Description: Focus on the development of scientific inquiry and critical thinking skills needed to evaluate complex relationships among climate, energy production, and the environment. Students will explore causes and consequences of climate change and consider climate change science from alternative perspectives. Previously offered as GEOG 1022.

Credit hours: 2

Contact hours: Lecture: 2

Levels: Undergraduate

Schedule types: Lecture

Department/School: Geology

GEOL 1114 Physical Geology (LN)

Prerequisites: MATH 1513 or higher with a grade of "C" or better; or an acceptable math placement score (see <http://placement.okstate.edu>).

Description: Composition and structure of the earth and the modification of its surface by internal and external processes. Mineral resources, sources of energy, and environmental aspects of geology. Recommended introductory course for science majors. Field trip required.

Credit hours: 4

Contact hours: Lecture: 3 Lab: 2

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

General Education and other Course Attributes: Scientific Investigation, Natural Sciences

GEOL 1224 Evolution of the Earth (LN)

Prerequisites: High school biology and chemistry recommended.
Description: A survey of the physical and biological history of the Earth from the coalescence of the solar system to the present. Field trips required.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology
General Education and other Course Attributes: Scientific Investigation, Natural Sciences

GEOL 2254 Practical Mineralogy

Prerequisites: GEOL 1014 or GEOL 1114 and CHEM 1314 or CHEM 1414 completed with a grade of "C" or higher.
Description: Hand-specimen identification of minerals using physical and chemical properties. Introductory optical identification of common rock forming minerals. Society's utilization of mineral resources. Field trips required. Course previously offered as GEOL 2253.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 2364 Igneous and Metamorphic Petrology

Prerequisites: GEOL 2254 completed with a grade of "C" or higher.
Description: Origin, occurrence and classification of igneous and metamorphic rocks; hand-specimen and thin section identification. Optional field trip.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 3
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 3004 Earth Science for Teachers

Prerequisites: GEOL 1114 or equivalent.
Description: Teaching natural earth systems and their environmental impact. Use of an adaptation approach in organizing, presenting, and evaluating earth science concepts in the curriculum. Field trips required.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 3
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 3014 Structural Geology

Prerequisites: GEOL 1114 and PHYS 2014 each with a grade of "C" or higher.
Description: Behavior of earth materials during various deformational processes and analysis of the resulting structural features such as folds, faults and fractures.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 3
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 3034 Principles of Stratigraphy and Sedimentology

Prerequisites: GEOL 1224 and GEOL 2254 each with a grade of "C" or higher.
Description: Principles of stratigraphy and their applications. Survey of sedimentary rock types, principles of description and classification, origin of sedimentary deposits, analysis of stratigraphic sequences. Topics include depositional systems; litho- and biostratigraphy; geochronology and chronostratigraphy; magnetic, seismic, and sequence stratigraphy; tectonic vs. climatic controls. Field work required. Previously offered as GEOL 3033.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 3
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 3043 Geology of the National Parks (N)

Prerequisites: GEOL 1014 or equivalent recommended.
Description: The geologic characteristics of national parks and scenic regions in North America and throughout the world. Intended for non-majors.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Geology
General Education and other Course Attributes: Natural Sciences

GEOL 3073 Geomorphology

Prerequisites: GEOL 1114.
Description: Study of land forms and the processes that form them, using topographic maps, air photos, remotely-sensed images, soils maps and field techniques. Field trips required.
Credit hours: 3
Contact hours: Lecture: 3 Lab: 0
Levels: Graduate, Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 3103 Paleontology

Prerequisites: GEOL 1224 or consent of instructor.
Description: Basic principles of paleontology involving invertebrates, vertebrates and plants. Lab focused on the morphology, identification, paleoecology and biostratigraphy of marine invertebrates. Field trips required.
Credit hours: 3
Contact hours: Lecture: 3 Lab: 0
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 3413 Petroleum Geology for Engineers

Prerequisites: CHEM 1314 or CHEM 1414 with a grade of "C" or better.
Description: Examination of the fundamental concepts of petroleum geology with an emphasis on applications to drilling and reservoir engineering. Topics include reservoir architecture, traps and seals, the subsurface environment, wireline logs, geophysics and depositional systems. Field trip required. No degree credit for geology majors.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Geology

GEOL 3503 Environmental Geology**Prerequisites:** GEOL 1114 or consent of instructor.**Description:** Application of geologic principles to environmental issues, including human use of the surface and subsurface of the earth and human interaction with extreme natural events such as earthquakes, floods and landslides. Field trip is required.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 3513 Earthquakes, Volcanoes, and Disasters (N)****Description:** An examination of the causes and effects of natural disasters related to earthquakes, volcanic activity, severe weather, flooding and other natural disasters. The course also examines the effects of these natural hazards on societies and approaches to mitigate the associated risks.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Geology**General Education and other Course Attributes:** Natural Sciences**GEOL 3546 Field Geology****Prerequisites:** Minimum grade of "C" in GEOL 2364, GEOL 3014, and GEOL 3034.**Description:** Six weeks of field methods in geology. Required of all geology majors. Transportation and room and board fees required.**Credit hours:** 6**Contact hours:** Lab: 12**Levels:** Undergraduate**Schedule types:** Lab**Department/School:** Geology**GEOL 4023 Petroleum Geology****Prerequisites:** GEOL 3014 and GEOL 3034.**Description:** Origin, migration and accumulation of petroleum, requirements for source rock, reservoir rock and traps. Structure and stratigraphy of selected oil fields. Field trips required.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate, Undergraduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 4030 Geologic Field Investigation****Prerequisites:** GEOL 1014 or GEOL 1114.**Description:** One to three weeks of required field study at sites of geological interest and significance. Field trip charges apply. Does not substitute for GEOL 3546. No credit for students who have credit in GEOL 5030. Offered for variable credit, 1-3 credit hours, maximum of 3 credit hours.**Credit hours:** 1-3**Contact hours:** Lecture: 1**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 4103 Introduction to Geophysical Exploration****Prerequisites:** PHYS 2114 and MATH 2153, each with a grade of "C" or better.**Description:** An overview of geophysical methods and their applications to exploration, environmental and engineering problems. Seismic reflection and refraction methods, gravity, magnetic, resistivity and electromagnetic methods. A field trip required.**Credit hours:** 3**Contact hours:** Lecture: 2 Lab: 2**Levels:** Graduate, Undergraduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Geology**GEOL 4113 Seismic Interpretation****Prerequisites:** GEOL 4103, GEOL 3014, and GEOL 3034 each with grade of "C" or higher.**Description:** Examination of the reflection seismic interpretation methods with emphasis on the oil and gas industry. Both structural and stratigraphic methods. Hands-on interpretation using a standard industry software package.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 4213 Plate Tectonics****Prerequisites:** GEOL 3014 with a grade of "C" or higher.**Description:** Earth's evolution within the framework of plate tectonics. Examination of structural associations in relation to tectonic plate boundaries. Mechanisms for plate tectonics and implication for resources and the environment.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate, Undergraduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 4300 Geology Colloquium****Prerequisites:** Geology majors only.**Description:** Discussion of selected topics in the geological sciences with emphasis on professional presentation practices. Offered for fixed 1 credit hour, maximum of 4 credit hours.**Credit hours:** 1**Contact hours:** Lecture: 1**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 4303 Geophysical Field Methods****Prerequisites:** GEOL 4103.**Description:** Hands-on field investigations using the different geophysical surveying methods including electrical resistivity/induced polarization, self potential, electromagnetic, ground penetrating radar, gravity, magnetic, and seismic reflection and refraction. Instrumentation, field data acquisition, and interpretation will be emphasized. Several field trips and field projects required.**Credit hours:** 3**Contact hours:** Lecture: 2 Lab: 2**Levels:** Graduate, Undergraduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Geology

GEOL 4313 Introduction to Well Log Analysis

Prerequisites: GEOL 3034 with a grade of C or better.

Description: Introduction for undergraduate Geology majors to basic properties of wireline well logs, including identification of lithology, influence of borehole fluids, porosity and permeability on well log properties. Some exercises involve concurrent interpretation of well logs and core samples. Course includes lectures, in-class exercises, homework and exams. No credit for students who have completed GEOL 4323 or GEOL 5353.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

GEOL 4323 Applied Well Log Analysis for Engineers

Prerequisites: GEOL 3413 with a grade of "C" or higher.

Description: This is a core course for the Minor in Petroleum Engineering. Course material builds on information to prerequisite course Geology 3413. This course covers geologic interpretation of reservoir characteristics based on a variety of well logs; quantitative determination of porosity and permeability, reservoir fluids and how they influence well log properties, calculation of water saturation, introduction to unconventional reservoirs, drilling and logging in lateral holes. May not be used for degree credit with GEOL 4313 or GEOL 5353.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Geology

GEOL 4403 Geochemistry

Prerequisites: GEOL 1014 or GEOL 1114 or consent of instructor; CHEM 1515 or concurrent enrollment.

Description: Application of chemical principles to geological processes. Modeling water-rock interaction and understanding water quality. May not be used for degree credit with GEOL 5403.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

GEOL 4433 Applied Geostatistics

Prerequisites: MATH 2144 with a grade of "C" or higher.

Description: Application of geostatistical principles and tools to solve geology problems associated with the uncertainty and spatial variability of geological data. The focus is on petroleum and hydrological systems. May not be used for degree credit with GEOL 5333.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Geology

GEOL 4453 Hydrogeology

Prerequisites: Minimum grade of "C" or better in PHYS 1114 or PHYS 2014.

Description: The water cycle and ground-water systems as well as general problems related to ground-water occurrence, quantity, quality and pollution. Field trip required.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Geology

GEOL 4463 Physical Hydrogeology

Prerequisites: GEOL 4453 or similar; PHYS 2114.

Description: Physical ground-water systems. Realistic problems to acquaint students with ground-water occurrence and movement. Geologic, geophysical, hydraulic testing and modeling techniques used to define an actual ground-water system. Ground-water regulations. Field trips required.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2

Levels: Undergraduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

GEOL 4503 Introduction to Oceanography (N)

Prerequisites: College-level chemistry recommended.

Description: Oceanography is an interdisciplinary field incorporating geology, physics, chemistry, and biology. This class will introduce students to oceanic and sedimentary processes, including plate tectonics, oceanic circulation, seawater chemistry, beaches and coastlines, benthic/pelagic sea life, and environmental concerns. Students will also discuss social, political, and economic topics that relate to the ocean.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Geology

General Education and other Course Attributes: Natural Sciences

GEOL 4513 Marine Geology

Prerequisites: CHEM 1314 or equivalent; PHYS 1114 or 2014 or equivalent; GEOL 3034 or equivalent. All with a grade of "C" or higher.

Description: All with a grade of "C" or higher. Comprehensive examination of the geology of the ocean basins. Topics include techniques of data collection and interpretation; shoreline, shelf and deep ocean processes; physical oceanography; origin and distribution of marine sediments; paleoceanography; marine mineral resources; marine tectonics and ocean history.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Undergraduate

Schedule types: Lecture

Department/School: Geology

GEOL 4543 Introduction to Exploration Seismology**Prerequisites:** GEOL 4103 and GEOL 4303.**Description:** Introduction to theory, techniques, and application of seismic to field of hydrocarbon, groundwater, and minerals exploration. Review of fundamentals of wave propagation, historical development of the science, and current literature on application and instrumentation.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 4573 Marine Biogeochemical Cycles****Prerequisites:** GEOL 3034 with a grade of "C" or better and GEOL 4403 or concurrent enrollment.**Description:** Analysis of the interactions between geological processes, biological activity, and chemical cycling for a range of elements. Limited discussion of atmospheric, terrestrial, and freshwater systems as they impact the oceans will also be discussed. Includes discussions of changes in elemental cycles through Earth's history and comparison to present-day patterns. May not be used for degree credit with GEOL 5573.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 4673 Economic Geology - Metals****Prerequisites:** GEOL 2364.**Description:** Descriptive geology, origin, exploration, economics and utilization of nonmetallic minerals and rocks. Field trips required.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate, Undergraduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 4753 Volcanology****Prerequisites:** GEOL 2364 completed with a grade of "C" or higher.**Description:** Examination of volcanic processes, products, and structures on Earth and other terrestrial bodies. Optional field trip. No credit for students with credit in GEOL 5753.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 4773 Planetary Geology****Prerequisites:** GEOL 1114 (required) and GEOL 3073 (recommended).**Description:** Geology of planets and planetary bodies, including geomorphology, tectonics, geochemistry, and geophysics; perspectives on exploration; and life in the universe.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 4981 Geoscience Internship****Prerequisites:** Consent of instructor.**Description:** Student participation in a research project during an internship in a Geoscience-related professional work setting. Graded on a pass/fail basis.**Credit hours:** 1**Contact hours:** Other: 1**Levels:** Undergraduate**Schedule types:** Independent Study**Department/School:** Geology**GEOL 4990 Special Problems in Earth Science****Prerequisites:** Permission of instructor.**Description:** Individually designed study projects involving assigned reading, library work, field work, laboratory work or a combination of these. Field trips may be required. Offered for variable credit, 1-3 credit hours, maximum of 9 credit hours.**Credit hours:** 1-3**Contact hours:** Other: 1**Levels:** Undergraduate**Schedule types:** Independent Study**Department/School:** Geology**GEOL 4993 Senior Honors Thesis****Prerequisites:** Departmental invitation, senior standing,**Description:** Honors Program participation. A guided reading and research program ending with an honors thesis under the direction of a senior faculty member, with second faculty reader and oral examination. Required for graduation with departmental honors in geology.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 5000 Master's Thesis****Prerequisites:** Approval of graduate committee.**Description:** Work toward master's thesis in geology. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.**Credit hours:** 1-6**Contact hours:** Other: 1**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Geology**GEOL 5030 Geologic Field Investigation****Description:** One to three weeks of required field study at sites of geological interest and significance. Emphasis will be placed on applicability to graduate research. Field trip charges apply. No credit for students who have credit in GEOL 4030. Offered for variable credit, 1-3 credit hours, maximum of 3 credit hours.**Credit hours:** 1-3**Contact hours:** Lecture: 1**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Geology

GEOL 5093 Quaternary Geology and Geochronology

Prerequisites: GEOL 3034; MATH 1715 or equivalent; PHYS 2014 and PHYS 2114 or equivalent. All with a grade of "C" or higher.

Description: Examination of the causes and effects of climate change during the ice ages. Survey of dating methods applicable to the Quaternary, including radiocarbon and optical luminescence. Topics include the use of oxygen isotope proxy records, paleomagnetism, cosmogenic nuclides, isostasy and post-glacial rebound, causes of sea-level change, and ice age history.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 5100 Problems in Hydrogeology

Prerequisites: GEOL 4453.

Description: Advanced problems in hydrogeology with emphasis on quantitative methods. Field trips may be required. Offered for variable credit, 1-4 credit hours, maximum of 8 credit hours.

Credit hours: 1-4

Contact hours: Other: 1

Levels: Graduate

Schedule types: Independent Study

Department/School: Geology

GEOL 5133 Structural Styles in Oil and Gas Exploration

Prerequisites: GEOL 3014 with a grade of "C" or higher.

Description: The theoretical, experimental and descriptive approach to structural styles formed by different tectonic stresses (i.e. extensional, contractional, strike-slip and salt tectonics) and their importance in oil and gas exploration. Course previously offered as GEOL 5203.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 5183 Paleontology of Depositional Sequences

Prerequisites: Graduate standing or permission of instructor.

Description: Paleocology and biostratigraphy of depositional sequences. Evenly divided on lecture and laboratory components and field trips are mandatory.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2

Levels: Graduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

GEOL 5213 Seismic Interpretation

Prerequisites: GEOL 4103, GEOL 3014 and GEOL 3034 with grades of "C" or higher.

Description: Examination of reflection seismic interpretation methods with emphasis on the oil and gas industry. Includes structural and stratigraphic methods. Hands-on interpretation using a standard industry software package. Same course as GEOL 4113. Previously offered as GEOL 4203.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 5223 Advanced Methods in Structural Geology

Prerequisites: GEOL 3014.

Description: Advanced geometric techniques and analysis of complex structural terrains. Elucidation of geometry and history of geological structures by interpreting seismic reflection profiles and constructing balanced cross-sections. Field trips required.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 5233 Trace Element Geochemistry

Prerequisites: One year of chemistry and GEOL 4403 or equivalent and GEOL 3034 or equivalent.

Description: Examination of the behavior of various trace elements in aqueous and sedimentary environments. Availability and mobility of trace elements, characterization of geochemical environments, and application to geologic problems.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2

Levels: Graduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

GEOL 5243 Research Methods and Techniques in Geosciences

Description: Application of the scientific method to geosciences research; introduction to library and internet searches; writing competitive research proposals; managing research activities; and disseminating research results.

Credit hours: 3

Contact hours: Lecture: 2 Other: 1

Levels: Graduate

Schedule types: Discussion, Combined lecture & discussion, Lecture

Department/School: Geology

GEOL 5253 Petrology and Diagenesis of Clastic Rocks

Prerequisites: GEOL 2364, GEOL 3034.

Description: Examination of petrology and depositional facies of sandstones and shales. Identification of detrital and diagenetic constituents and determination of paragenetic sequence of diagenetic events. The effect of burial and thermal history on reservoir quality. Field trips required.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2

Levels: Graduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

GEOL 5273 Depositional Systems

Prerequisites: GEOL 3034, GEOL 3546.

Description: Examination of the processes within depositional environments and the facies they form. Focus on the environmental interpretation of rocks, cores and seismic profiles based on their composition, texture, character, stacking pattern and sedimentary structures. Emphasis on clastic systems. Field trips required.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 5283 Subsurface Geologic Methods**Prerequisites:** GEOL 3014, GEOL 3034.**Description:** Use of subsurface geologic information from cores and well logs to prepare maps and identify oil and gas prospects. Field trips required.**Credit hours:** 3**Contact hours:** Lecture: 2 Lab: 2**Levels:** Graduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Geology**GEOL 5300 Geology Colloquium****Prerequisites:** Graduate standing.**Description:** Discussion of selected topics in the geological sciences with emphasis on professional presentation practices. Offered for fixed 1 credit hour, maximum of 2 credit hours.**Credit hours:** 1**Contact hours:** Lecture: 1**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 5333 Applied Geostatistics****Prerequisites:** MATH 2144 with a grade of "C" or higher.**Description:** Application of geostatistical principles and tools to solve geology problems associated with the uncertainty and spatial variability of geological data. The focus is on petroleum and hydrological systems. May not be used for degree credit with GEOL 4433.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 5353 Advanced Well Log Analysis****Prerequisites:** GEOL 3034 or consent of instructor.**Description:** The geologic interpretation of a variety of well logs, emphasized, as well as quantitative methods. Some exercises involve concurrent interpretation of well logs and core samples, or well logs and bit cuttings. Field trips may be required. May not be used for degree credit with GEOL 4313 or GEOL 4323.**Credit hours:** 3**Contact hours:** Lecture: 2 Lab: 3**Levels:** Graduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Geology**GEOL 5363 Carbonate Depositional Systems****Prerequisites:** GEOL 3034 with a grade of "C" or higher.**Description:** Survey course of the main types of carbonate sediments and depositional environments. Additional flat fee of \$35.00 applies.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Geology**GEOL 5383 Sequence Stratigraphy****Prerequisites:** GEOL 5253, GEOL 5353, GEOL 5363.**Description:** Principles of sequence stratigraphy including carbonate and siliciclastic dominated intracratonic basins. Integration of surface and subsurface data in projects. Field trips required.**Credit hours:** 3**Contact hours:** Lecture: 2 Lab: 2**Levels:** Graduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Geology**GEOL 5393 Stratigraphy of the Midcontinent****Prerequisites:** GEOL 3034 with a grade of "C" or higher.**Description:** This course will examine Paleozoic stratigraphy of the North American Midcontinent consisting of Texas, Oklahoma, Kansas, Nebraska, Missouri, and northwestern Arkansas. The course will consist of lectures, student presentations, and extensive field work that will serve to familiarize the students with the surface and subsurface relationships of geologic formation and their potential for commercial exploitation for oil and gas resources.**Credit hours:** 3**Contact hours:** Lecture: 2 Lab: 3**Levels:** Graduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Geology**GEOL 5403 Geochemistry****Prerequisites:** Graduate Standing required.**Description:** Application of chemical principles to geological processes. Modelling water-rock interaction and understanding water quality. No degree credit for students with credit in GEOL 4403.**Credit hours:** 3**Contact hours:** Lecture: 2 Lab: 2**Levels:** Graduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Geology**GEOL 5433 Isotope Geochemistry****Description:** Introduction to the basic principles of stable isotope geochemistry. Study of the production, distribution, and use of naturally occurring and anthropogenically introduced stable isotopes in the earth's near surface environment with applications to hydrology, biogeochemistry, global change and petroleum systems.**Credit hours:** 3**Contact hours:** Lecture: 2 Lab: 2**Levels:** Graduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Geology**GEOL 5453 Groundwater Modeling****Prerequisites:** GEOL 4453 or equivalent, MATH 2144, MATH 2153 each with a grade of "C" or higher.**Description:** Modeling ground water systems. Realistic problems to acquaint students with the movement of geological fluids. Developing models of fluid movement through the subsurface using geological and geophysical data. Field trips required.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Graduate**Schedule types:** Lecture**Department/School:** Geology

GEOL 5463 Physical Hydrogeology

Prerequisites: GEOL 4453 or equivalent with a grade of C or better; PHYS 2114 with a grade of C or better.

Description: Physical ground-water systems. Realistic problems to acquaint students with ground-water occurrence and movement. Geologic, geophysical, hydraulic testing and modeling techniques used to define an actual ground-water system. Ground-water regulations. Field trips required. May not be used for degree credit with GEOL 4463.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 5483 Integrated Petroleum Water Resources Management

Prerequisites: GEOL 4453 or similar, MATH 2144 and MATH 2153 each with grade of "C" or higher.

Description: Developing, maintaining, and disposing or recycling water for use in the petroleum industry. Problems associated with water production and disposal including water quality issues and seismicity. Field trips required.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 5513 Marine Geology

Prerequisites: CHEM 1314 or equivalent; PHYS 1114 or 2014 or equivalent; GEOL 3034 or equivalent; all with a grade of "C" or higher.

Description: Comprehensive examination of the geology of the ocean basins. Topics include: techniques of data collection and interpretation; shoreline, shelf and deep ocean processes; physical oceanography; origin and distribution of marine sediments; paleoceanography; marine mineral resources; marine tectonics and ocean history. Same course as GEOL 4513.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 5523 Environmental Organic Geochemistry

Prerequisites: CHEM 1314 and 1515 or equivalent; GEOL 3034 or equivalent; GEOL 4403 or equivalent or permission of instructor.

Description: Introduction to some environmental aspects of organic geochemistry. Soils and sediments as pollutant receptors, sources of pollutants and selected aspects of environmental health.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 5533 Organic Geochemistry

Prerequisites: CHEM 1314 and CHEM 1515 or equivalent; GEOL 3034 or equivalent.

Description: Chemistry of organic matter in sediments and rocks with an emphasis on marine and petroleum systems.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 5543 Introduction to Exploration Seismology

Prerequisites: GEOL 4103 and GEOL 4303.

Description: Introduction to theory, techniques, and application of seismic to field of hydrocarbon, groundwater, and minerals exploration. Review of fundamentals of wave propagation, historical development of the science, and current literature on application and instrumentation. No credit for students with credit in GEOL 4543.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 5573 Marine Biogeochemical Cycles

Prerequisites: GEOL 1224 and GEOL 4403 and CHEM 1314.

Description: Analysis of the interactions between geological processes, biological activity, and chemical cycling for a range of elements. Limited discussion of atmospheric, terrestrial, and freshwater systems as they impact the oceans will also be discussed. Includes discussions of changes in elemental cycles through Earth's history and comparison to present-day patterns. No credit for credit in GEOL 4573.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 5603 Basin Evolution

Prerequisites: GEOL 3014, GEOL 3034, GEOL 4403.

Description: Advanced topics in sedimentary basin studies, including tectonics, sequence stratigraphy, facies analysis, regional diagenesis, thermal evolution, regional hydrogeology, and distribution of natural resources.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 5633 Exploration Prospect Evaluation

Prerequisites: Graduate standing and permission of the instructor.

Description: Evaluation of exploration prospects in frontier and underdeveloped petroleum provinces using borehole-derived and geophysical data. Team taught course that uses industry provided datasets and current data management and interpretation software to reach drill or no-drill decisions based on science, risk analysis and economics.

Credit hours: 3

Contact hours: Lab: 6

Levels: Graduate

Schedule types: Lab

Department/School: Geology

GEOL 5753 Volcanology

Prerequisites: GEOL 2364 or equivalent with a grade of "C" or higher.

Description: Examination of volcanic processes, products, and structures on Earth and other terrestrial bodies. Optional field trip. No credit for students with credit in GEOL 4753.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 5773 Planetary Geology

Prerequisites: GEOL 1114, and GEOL 3073 recommended.

Description: Geology of planets and planetary bodies, including geomorphology, tectonics, geochemistry and geophysics; perspectives on exploration; and life in the universe. Course previously offered as GEOL 4773.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2

Levels: Graduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

GEOL 5981 Geoscience Internship

Prerequisites: Consent of instructor.

Description: Student participation in a research project during an internship in a Geoscience-related professional work setting for graduate credit. Graded on a pass/fail basis.

Credit hours: 1

Contact hours: Other: 1

Levels: Graduate

Schedule types: Independent Study

Department/School: Geology

GEOL 5990 Advanced Studies in Geology

Prerequisites: Consent of instructor.

Description: Individual library, laboratory and/or field projects on facets of geology not covered by existing courses. Field trips may be required. Course previously offered as GEOL 5710. Offered for variable credit, 1-4 credit hours, maximum of 8 credit hours.

Credit hours: 1-4

Contact hours: Other: 1

Levels: Graduate

Schedule types: Independent Study

Department/School: Geology

GEOL 6000 Doctoral Dissertation Research

Description: Work toward doctoral dissertation in Geology. Offered for variable credit, 1-12 credit hours, maximum of 60 credit hours.

Credit hours: 1-12

Contact hours: Other: 1

Levels: Graduate

Schedule types: Independent Study

Department/School: Geology

GEOL 6103 Gravity and Magnetic Methods

Prerequisites: GEOL 4103.

Description: Principles of gravity and magnetic methods applied to petroleum, mineral, and groundwater exploration. Engineering applications will also be discussed. Data acquisition, processing and modeling using standard industry software will be emphasized.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2

Levels: Graduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

GEOL 6133 Unconventional Petroleum Reservoirs

Prerequisites: GEOL 4023.

Description: Review of unconventional sources of oil and gas production including coalbed methane, tight gas-sandstones, gas and oil-bearing shales and transition zone, high-water saturation sandstones and carbonates.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 6283 Geology of Shales

Prerequisites: Graduate standing or permission of instructor.

Description: Team-taught course that combines different geological techniques towards gaining a better understanding of shales as source and reservoir rock. These include petrography, XRD, SEM, Organic and Inorganic chemistry, geophysical logs, paleoecology and biostratigraphy. This course will involve lecture as well as laboratory techniques.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2

Levels: Graduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

GEOL 6303 Electrical and Electromagnetic Methods

Prerequisites: GEOL 4103.

Description: Principles of the different geoelectrical methods, including electrical resistivity, induced polarization, self potential, electromagnetic, and ground penetrating radar will be emphasized. Geophysical instrumentation, laboratory measurements of physical properties, field procedures, and basic interpretation and near surface geophysical applications will be discussed. Recent advances in geoelectrical methods and case studies will be examined by reviewing current literature. Field trip required.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2

Levels: Graduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

GEOL 6363 Carbonate Reservoir Characterization

Prerequisites: GEOL 5363 with a grade of "B" or better.

Description: Integrated study and application of modern and ancient depositional systems, diagenesis, petrophysics, sequence stratigraphy, and geostatistical modeling towards the understanding of the three dimensional distribution and reservoir characterization of carbonate and mixed carbonate/siliciclastic systems. This is a seminar and project-based course. Field trip required.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 6373 Advanced Carbonate Petrology and Geochemistry

Prerequisites: GEOL 4403 with a grade of "C" or higher and GEOL 5363 with a grade of "B" or higher or equivalents or consent of instructor.

Description: This course will cover advanced topics in carbonate petrology and geochemistry with emphasis on both early and late diagenetic processes, dolomitization, porosity and permeability, geochemical evolution of seawater and carbonate sediments, and regional diagenetic patterns in carbonate rocks and related strata.

Credit hours: 3

Contact hours: Lecture: 3

Levels: Graduate

Schedule types: Lecture

Department/School: Geology

GEOL 6386 Sequence Stratigraphy of Shales

Prerequisites: Graduate standing. Intensive field course focusing on hydrocarbon-bearing shales of the Midcontinent.

Description: Advanced field techniques including high resolution spectral gamma ray analysis and highly detailed measured sections will be taught. Fifty localities including Devonian-Early Mississippian (Woodford and Chattanooga shales), Upper Mississippian (Barnett, Caney, and Fayetteville shales) and Pennsylvanian-Lower Permian shales will be analyzed.

Credit hours: 6

Contact hours: Lecture: 2 Lab: 12

Levels: Graduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

GEOL 6403 Biogeophysics

Prerequisites: GEOL 5443 or GEOL 4103 or GEOL 6303.

Description: Introduces students to the important role that microbes play in geologic processes and explores current cutting-edge research available to investigate these processes. Interactions of microorganisms with earth materials (soils, rocks, water, etc.) and geophysical methods used to investigate microbial processes will be emphasized.

Credit hours: 3

Contact hours: Lecture: 2 Lab: 2

Levels: Graduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

GEOL 6503 Rock Fractures

Prerequisites: GEOL 3014.

Description: Mechanical analysis and tectonic implications of brittle structural features such as joints, veins, and faults. Examination of topics such as mechanical stratigraphy in layered rocks, factors controlling joint spacing, and the dependence of failure mode on lithology. Field trips may be required.

Credit hours: 3

Contact hours: Lecture: 2 Other: 1

Levels: Graduate

Schedule types: Discussion, Combined lecture & discussion, Lecture

Department/School: Geology

GEOL 6553 Contaminant Transport

Prerequisites: CHEM 1314 and CHEM 1515 or consent of instructor.

Description: Origin and evolution of natural water quality, with emphasis on anthropogenic and natural contaminants. Distribution and mobility of elements in the secondary environment. Computational methods for the interpretation of water analyses. Course previously offered as GEOL 5553.

Credit hours: 3

Contact hours: Lecture: 1 Lab: 4

Levels: Graduate

Schedule types: Lab, Lecture, Combined lecture and lab

Department/School: Geology

Undergraduate Programs

- Geology, BS (<http://catalog.okstate.edu/arts-sciences/geology/bs>)
- Geology: Environmental Geology, BS (<http://catalog.okstate.edu/arts-sciences/geology/environmental-bs>)
- Geology: Petroleum Geology, BS (<http://catalog.okstate.edu/arts-sciences/geology/petroleum-bs>)
- Geology: Pre-Law, BS (<http://catalog.okstate.edu/arts-sciences/geology/pre-law-bs>)
- Geology: Secondary Teacher Certification, BS (<http://catalog.okstate.edu/arts-sciences/geology/secondary-teacher-certification-bs>)
- Geology (GEOL), Minor (<http://catalog.okstate.edu/arts-sciences/geology/geology-minor>)

Graduate Programs

Prerequisites

The student should have at least 30 credit hours in geology, including courses in physical geology, historical geology, mineralogy, petrology, sedimentology/stratigraphy, structural geology and field camp. Additional undergraduate requirements to enter the master's degree program include: two classes in chemistry or geochemistry, two classes in physics, math through calculus II and one biology course. Deficiencies in coursework must be made up by the student after entering the program. The Graduate Record Examination is recommended, but not required, for admission to the program.

The Master of Science Degree

The MS is awarded through the completion of a thesis. Each candidate must complete at least 30 semester credit hours of work beyond the prerequisites. As many as 12 of these may be taken in other departments of the University upon approval by the candidate's advisory committee. A final defense of the thesis and the research that it documents is required of all students.

The Doctor of Philosophy Degree

The PhD is awarded upon completion of a doctoral dissertation. A minimum of 60 credit hours (coursework and research hours) beyond the MS or MA degree are required for the PhD. Under normal circumstances, students must hold a master's degree in geology or a related field to be accepted into the PhD program. However, under exceptional circumstances, students may be accepted directly into the PhD program without a master's degree. Such students will be required to complete a total of 90 semester credit hours (coursework and research hours) to earn their degree. Such decisions are made by the entire faculty of the School of Geology, upon recommendation of the Graduate Adviser. To be

admitted to candidacy, students must pass a written and oral qualifying exam, and successfully defend their dissertation research proposal and pass an associated comprehensive exam. The PhD is conferred after the successful defense of the dissertation.

Faculty

Camelia Knapp, PhD—Professor and Head

Professors: Mohamed Abdelsalam, PhD (Boone Pickens Endowed Chair in Geophysics); G. Michael Grammer, PhD (Chesapeake Energy Corporation Chair of Petroleum Research); Jay M. Gregg, PhD (V. Brown Monnett Chair of Petroleum Geology); Todd Halihan, PhD; Jim Knapp, PhD (Boone Pickens Chair of Geoscience); Jack Pashin, PhD (Devon Energy Corporation Chair of Basin Research)

Associate Professors: Priyank Jaiswal, PhD; Daniel Laó Dávila, PhD; James Puckette, PhD; Tracy Quan, PhD

Assistant Professors: Ashley Burkett, PhD; Ahmed Ismail, PhD; Natascha Riedinger, PhD; Javier Vilcaez, PhD

Teaching Assistant Professors: Brendan Hanger, PhD

Visiting Assistant Professors: Mary Hileman, PhD