SCHOOL OF GEOSCIENCES

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General Information

What is Geosciences?

Geosciences is the study of the Earth and even other planets. Geoscience is a broad, multidisciplinary field that encompasses topics such as earth's history, processes that create various landforms, water, soils, and energy.

The **School of Geosciences**, part of the **Mewbourne College of Earth and Energy**, is located in the Sarkeys Energy Center on the main campus of the University of Oklahoma. Founded in 1900 by Charles Gould, the school has been a leader in the geosciences research and education for over a century. Today, the school's faculty mentor a diverse group of undergraduate and graduate students in B.S., M.S., and Ph.D. programs in Geology and Geophysics.

The School of Geosciences has traditionally been a global leader in education and research in topics related to energy, but now includes research programs spanning aspects of organic, inorganic and environmental geochemistry and hydrochemistry, planetary geology, structure and geophysics of earthquakes and induced seismicity, near-field and solid-Earth geophysics, paleoecology and paleoclimate, sedimentary geology, paleomagnetism, and mineralogy/petrology.

The school's mission is to provide students with high-quality education and research opportunities within a creative, inclusive, and interdisciplinary environment with an emphasis on fundamental and applied geosciences.

Toward this mission, students in our Geosciences program experience learning far beyond the classroom. Extended field trips to points across the U.S. are a key component of our educational programs at both the undergraduate and graduate levels, and faculty and students conduct field work that has spanned every continent. Additionally, our students learn and conduct research using state-of-the-art software and experimental facilities.

Vision Statement

The School of Geosciences is a leader in multidisciplinary studies of complex and dynamic geosystems and their impacts on society.

The School will provide students with high-quality education and research opportunities within a creative and interdisciplinary environment with an emphasis on fundamental and applied geosciences

Programs & Facilities

Programs for Academic Excellence

For the student, excellence can be achieved through immersion in the science itself.

- Students are encouraged to participate with their peers in professional societies through local chapters.
- Seminars and colloquia are regularly offered in the school featuring presentations of the latest advances in the geosciences by experts in the field.
- Students are actively encouraged to become involved in current faculty research projects, develop their own research projects, and present these results at regional and national meetings with school support.
- Opportunities for summer employment in professional and research settings are promoted.
- Strong connections are maintained with the Oklahoma Geological Survey, where many environmentally and economically important site-specific problems are being investigated.
- The school, together with the Oklahoma Geological Survey, maintains one of the best Geology and Geophysics libraries in the country.
- Interdisciplinary programs with other departments are encouraged.

Aqueous Geochemistry Laboratory

The newly established Aqueous Geochemistry Laboratory provides analytical and sample processing support for research on organic matter in natural waters. Instrumentation in the AGL includes:

- TOC analyzer (Shimadzu TOC-L™) that uses a 680°C Combustion Catalytic Oxidation/NDIR Detection Method to measure total organic carbon (TOC) in water. Estimated TOC detection limit is 30-50 ppb.
- Horriba Aqualog™ Spectrofluorometer that is used to measure the absorbance and fluorescence properties of organic matter. This instrument generates data that can be used to create Excitation-Emission Matrices (EEMs) commonly used by researcher to characterize organic matter.
- Organic matter isolation equipment. The AGL has several sizes of columns and ion-exchange resin that are used to isolate the humic substance (humic and fulvic acids) fraction of organic matter.
- Electrochemistry support includes a Fischer Scientific multi-parameter (pH, temperature, conductivity, TDS, ORP, Dissolved Oxygen) used to support laboratory experimentation needs. A cupric ion selective electrode (Cu2+ ISE) is also available for measuring free copper (Cu2+) in solution.
- Field instrumentation includes a Hanna Instrument multi-parameter field meter, GeoTech peristaltic pump, Hach digital alkalinity titration kit, and a variety of sample bottles and filtration.

The AGL facility also contains a large fume hood, analytical balance, digital pipettes, magnetic stirring hot plate, and a ASTM Type I nanopure water purification system.

Attribute Assisted Processing & Interpretation (AASPI)

During the past two decades, seismic attributes have become a key component not only in mapping structure and stratigraphy but also in a quantitative reservoir characterization. In addition to enhancing individual faults and discontinuities, geometric attributes help interpreters map axial planes for structural analysis, relate curvature to intensity and orientation of fractures, and map lateral changes in reflectivity to detect channels below seismic resolution. During the 2013 AASPI Consortium research program, we will continue our focus on poststack and prestack data conditioning, calibration of attributes to geological and engineering control, and the use of LMR and AVAz analysis of unconventional reservoirs. Our research is driven by the data provided by our sponsors, such that our primary efforts will be on the application of these attributes

over resource plays and mature fields of North America (US, Canada, and Mexico) that have a combination of proprietary 3D surveys, production data, well logs, microseismic data, image logs, production logs, and core, within a well-understood geologic framework. We believe that a better understanding of the impact of acquisition, processing and imaging on seismic attributes is key to quantifying the errors in reservoir characterization and hydrocarbon estimation provided by modern attribute-driven geostatistics, neural networks, and clustering technology. In addition to research reports, we provide algorithm source code to all sponsors and attribute volumes to those sponsors who wish to provide us with 3D seismic data. More information can be found on the AASPI website.

Bartell Field Camp

The **OU Bartell Field Camp**, dedicated in 2011, is home to both the geology and geophysics field courses. The Bartell Field Camp is located on the northeastern edge of the Wet Mountains and overlooks the Cañon City Embayment, a structural reentrant in the Colorado Front Range. Snow#covered Pikes Peak is visible to the north and the Great Plains to the east. The area is an ideal geological field laboratory – the Phanerozoic section and faults associated with the mountain front are beautifully exposed and available for study. Combined with the near# perfect weather and closeness to a variety of outdoor activities and metropolitan Denver, it's no wonder OU students have been coming here since 1950! For more information: https://www.ou.edu/mcee/geosciences/explore/bartell-field-camp

Computational Geophysics Laboratory

The Computational Geophysics Laboratory includes several labs assigned to individual research teams and the Wick Cary Geoscience Processing & Imaging Center (GPIC). Their mission is to provide critical computational infrastructure for research activities in near-surface geophysics, exploration geophysics, basin- to crustal scale imaging, earthquake seismology, and microseismic monitoring. The labs are equipped with Linux, Mac and Windows workstations, Linux servers, and data storage servers. The labs also have access to dedicated computing resources at the OU's supercomputer center (http://www.oscer.ou.edu), which includes 7 dual 12-core nodes, 250TB storage nodes, and 390 LTO-6 tapes (~975 TB) for data archive.

The Wick Cary Geoscience Processing and Imaging Center (GPIC)

GPIC provides computer hardware, software, data, and user-support to students and researchers of the Mewbourne College of Earth and Energy for both teaching and research activities. GPIC is the primary high-end interpretation and computational facility of the School of Geosciences. Through the generosity of exploration companies, national oil companies, and data brokers, GPIC enables access to high-quality 3D seismic (including multicomponent), electric log, image log, microseismic, and production data for both interdisciplinary research and education. GPIC provides students education using state-of-the-art geophysical exploration and development applications via hands-on approaches. It provides the framework for laboratory exercises in reservoir characterization, seismic modeling and migration, 3D seismic processing, exploration geophysics, 3D seismic interpretation, and quantitative seismic interpretation. GPIC also serves as the computational platform for research in seismic processing and imaging, seismic geomorphology, computer-assisted structure and fracture analysis, reservoir characterization, and potential field imaging of the earth's crust. GPIC is housed in room 1010 Sarkeys Energy Center and includes 23 dual-monitor Windows 10 Dell Precision Tower Workstations (12-16 cores, 32 GB RAM). A Linux-based server cluster provides over 150 Terabytes of disk space and a total number of 132 dual cores. In addition, GPIC has access to dedicated processing power housed within OU's supercomputer center (http://www.oscer.ou.edu), where very large jobs can also be run using a batch queuing system.

Software

Through the generosity of software vendors, the School of Geosciences has access to a suite of commercial and academic software packages which our faculty and students use for research and teaching.

- Seismic Processing and Acquisition Design: SLB Vista; SLB OMNI; Haliburton Landmark; ProMAX; SeisSpace; Madagascar
- Seismic Modelling: Tesseral; ANRAY 3D Ray Tracing
- Seismic Interpretation: CPSGG AASPI; SLB Petrel; Geophysical Insights Paradise; Ikon Geosciences RokDok; CGG Hampson-Russell Geoview; IHS Kingdom; OpendTect; Haliburton Landmark Decision Space
- Passive Seismic Data Management and Processing: Antelope; Seismon
- Near-Surface Geophysical Imaging: ReflexW (GPR, Near-surface seismic); AGI EarthImager 2D (Electrical Resistivity Tomography)
- Magnetic and Gravimetric Data Processing: Geosoft OASIS Montaj; GMSYS 2D/3D
- Miscellaneous: MatLAB; ArcGIS; PlatteRiver; BasinMod; NHWave

Critical Zone Biogeochemistry Laboratory

Instruments in the Critical Zone Biogeochemistry laboratory include a LI-COR LI7815 trace gas analyzer with a small volume introduction module, an Elementar Vario EL CNS analyzer for solids and liquids, and a Thermo Fisher MultiSkan SkyHigh microplate UV-Vis analyzer with wavelength scanning capability. We also have two drying ovens, a freezer, a refrigerator, multiple shakers, a ball mill, a jar mill, a water purification system, a benchtop centrifuge with capacity to spin microcentrifuge through 50 mL centrifuge tubes up to 30,000 RCF, single and multichannel pipettes, multiple sets of soil sieves, and a full suite of reagents, glassware, and plasticware.Our field equipment consists of soil carbon dioxide sensors, soil oxygen sensors, soil moisture sensors, campbell scientific datalogers, field-deployable fixed-potential redox sensors, augers with extensions, soil probes, a bulk density sampling set, and a LICOR smartflux soil trace gas flux system.

Devon Powder X-ray Diffraction and Clay Mineralogy Laboratory

The Devon lab includes equipment for the preparation and analysis of rock and mineral samples by powder X-ray diffraction, including clay mineral separations. A Rigaku Ultima-IV X-ray diffractometer features cross-beam optics, allowing rapid switching between Bragg-Brentano and parallel-beam optical configurations. Scintillation and Si-strip detectors are mounted with a Y-arm system that facilitates either extremely rapid or extremely precise data collection. The Ultima IV can also be configured for grazing incidence measurements of thin films on diffracting surfaces. Additionally, the lab is equipped for preparation of bulk rock samples, with tools such as a McCrone Micronizing mill, and for the treatment of rock samples for clay analysis, requiring a sequence of extraction steps involving a number of chemical and physical treatments. To accomplish the clay separations, the lab contains a centrifuge, a dialysis bath, desiccators, a drying oven, a furnace, a heating water bath, and a microbalance. For data analysis, updated software tools such as MDI Jade, MDI ClaySim, and Rigaku PDXL are interfaced with databases from the International Centre for Diffraction Data.

Electron Microprobe Laboratory

The electron microprobe laboratory is built around a fully automated CAMECA SX100 microanalyzer. The five wavelength-dispersive spectrometers, Thermo Ultra-Dry SDD energy-dispersive detector, and GATAN PanaCL/F cathodoluminescence detector (CL) are fully integrated for all analytical and imaging functions (x-ray, secondary electron, backscattered electron, absorbed current, and CL signals). The system provides quantitative elemental microanalysis of boron to uranium; digital acquisition of electron, x-ray intensity, and cathodoluminescence images; image analysis and other data processing routines. A full description of the laboratory and its functions is available at: http://ors.ou.edu/Microprobe/OUEMPLHome.html

Experimental Petrology Laboratory

The experimental petrology laboratory has facilities for mineral synthesis, calibration of phase equilibrium reactions, and petrologic analogue or simulation experiments. In addition to sample preparation facilities, the experimental laboratory contains 18 externally heated cold-seal reaction vessels for routine operation to 850° C, 200 MPa, and two vessels capable of operation to 700° C, 400 MPa.

Field Geophysics Lab

The mission of the field geophysics lab is to provide equipment for research and field-based teaching activities by students and faculty in the School of Geosciences. The lab includes a wide range of equipment for near-surface studies, basin- to crustal-scale geophysical imaging and monitoring, rapid aftershock responses, infrastructural monitoring, and field-based classes.

Fluid Inclusion Microthermometry Laboratory

This facility is used to assess the compositions and physical properties of fluid inclusions through microthermometric techniques. In addition to specialized sample preparation equipment, the laboratory includes a new Linkam TH600 programmable heating/freezing stage on a Zeiss Research Photomicroscope.

Gas Hydrates Laboratory

The Gas Hydrates Laboratory at the University of Oklahoma is fully equipped to conduct, monitor, and analyze gas hydrate thermodynamic and kinetic experiments. Two Parr® pressure vessels are used as hydrate reactors with external heating/cooling systems which can achieve experimental temperatures from -50 to 400 degrees Celsius. The reactors are instrumented with digital thermocouples and pressure transducers which are monitored and recorded with a custom designed Labview® system.

Geo-Thermochronology

At OU we have an Axio Imager M2m microscope with scanning stage for fission-track analysis of zircon, apatite, and monazite. The fission-track laboratory is integrated with a New Wave 213 nm laser ablation (LA) system coupled with a PerkinElmer NexION2000 inductively coupled plasma mass spectrometer (ICPMS). The LA-ICPMS is run by the Mass Spectrometry, Proteomics & Metabolomics core is part of the Department of Chemistry and Biochemistry. Our system is set-up to run U-Th-Pb isotopic and concentration analysis plus few trace element concentrations. We have established methods for apatite, monazite, and zircon U-Th-Pb dating.

High Resolution Mapping Raman User Facility

OU's High Resolution Mapping Raman User Center is housed within the School of Geosciences and managed by Dr. Megan Elwood Madden. The Renishaw InVia mapping Raman microscope and spectrometer utilizes both a 532 nm green laser and a 785 nm red laser, as well as the Wire 4.1 software for data analysis.

Mineral Processing

At OU we maintain a Chipmunk Jaw Crusher, a tungsten carbide disk mill, a Jasper Cayon water table, a Franz magnetic separater, and heavy liquids. This set-up is suitable to follow a range of standard mineral separation procedures.

Laurence S. Youngblood Energy Library

The current collection contains over 170,000 map sheets and approximately 92,000 catalogued volumes on the subjects of geochemistry, geology, geomorphology, geophysics, hydrology, mineralogy, paleontology, petrology, stratigraphy, structure and tectonics. The interdisciplinary nature of the earth sciences is supported by Chemistry, Math, Physics, and Engineering branch Libraries. Bizzell Memorial Library contains the biological sciences and the internationally recognized History of Science Collections.

Organic Geochemistry/Stable Isotope Laboratory

The organic geochemistry /stable isotope laboratories have wet chemistry facilities and instrumentation for the isolation and analysis of organic compounds from geologic materials. Dr. Engel has two HPLC systems and a HP GC/MSD instrument used for the analysis of amino acids and peptides. He has a conventional stable isotope laboratory equipped with vacuum lines and a Delta E isotope ratio mass spectrometer for high precision stable carbon isotope analyses of organic matter and carbonates and stable oxygen isotope analyses of carbonates and water. Dr. Engel also has a state of the art Thermo Delta V Plus isotope ratio mass spectrometer that is equipped for continuous flow as well as with a dual inlet for conventional off-line analyses. For continuous flow, the instrument is interfaced to a Costech Elemental Analyzer for stable carbon, nitrogen and sulfur isotope analyses and a Thermo TC/EA system for stable hydrogen isotope analyses. The instrument is also interfaced to a Thermo gas bench system for automated analyses of carbonates (carbon, oxygen) and water samples (oxygen). Dr. Liu has Agilent 1290 series ultra-high-performance liquid chromatography (UHPLC) system equipped with an Agilent 6530 quadrupole time-of-flight (qTOF) mass spectrometer for high-resolution accurate mass analysis on pigments and polar lipids in various types of biological and geological samples. An Agilent 5977B Inert Plus MSD system is also installed in Dr. Liu's lab for the analysis of small volatile compounds.

Paleomagnetics Laboratory

The shielded Paleomagnetics laboratory is used for paleomagnetic and rock-magnetic studies. Equipment includes a 2G cryogenic magnetometer with DC squids, AF and thermal demagnetizers, impulse magnetizer, field equipment, and several magnetic susceptibility systems including a AGICO MFK-FA1 Multifunction Kappabridge.

Paleontology Laboratories, Sam Noble Oklahoma Museum of Natural History

Paleontological research is concentrated at the Sam Noble Museum, which includes fully equipped labs for invertebrate paleontology, vertebrate paleontology and paleobotany. Large collection areas house more than half-a-million specimens. In addition to various specimen preparation equipment, there are facilities for scanning electron microscopy and digital macrophotography. Exhibits in the Ancient Life Gallery are fully integrated into undergraduate classes (GEOL 1024;

GEOL 3513; GEOL 4413), and allow detailed study of fossils ranging from trilobites to dinosaurs.

Physical and Environmental Geochemistry Laboratory

The Physical and Environmental Geochemistry Laboratory is equipped for a wide range of low to moderate temperature geochemical experiments and field sample processing. Geochemical reactors of various types including polyacrylate columns, pressure vessels, and custom-designed batch reactors, as well as stir plates, water baths, and shakers, are used to synthesize analyze the reactivity and rates of natural and laboratory materials. The solution chemistry of field water samples and laboratory experiments are characterized with various electrodes and meters, calorimetric methods using a Thermo Scientific Genesys 10S scanning UV-visible spectrophotometer, and elemental analysis with a PerkinElmer AAnalyst 800 combined flame / graphite furnace Atomic Absorption Spectrophotometer (AAS). Graphite-furnace capability allows determination of elements in the ppb range. Kinetic Phosphorescence Analysis (KPA) allows determination of sub-ppb levels of dissolved uranium. Trace element work is facilitated by a Barnstead Nanopure Diamond ultrapure water system. A Coy Labs anaerobic chamber allows experiments to be conducted at low oxygen fugacity, mimicking many subsurface/deep water environments. A Quantachrome gas adsorption analyzer determines BET surface area and pore size distribution. Contact Andy Elwood Madden or Megan Elwood Madden for more information.

Reservoir Characterization and Modeling Laboratory (RCML)

The RCML is directed by **Professor Matt Pranter** - Dr. Pranter and his students investigate the controls that stratigraphy, sedimentology, and structure play in regard to reservoir architecture, lithological and petrophysical-property heterogeneity, and reservoir performance. A fundamental goal is to assess the dominant controls on reservoir quality (both matrix and fracture) to more accuratelymap and model the spatial distribution of reservoir properties.

Rock Deformation Facilities

The School of Geosciences has laboratories that are dedicated to:

- determinations of earthquake physics (fault behavior) at conditions relevant for earthquake nucleation and propagation
- the creation of fractures and determination of their mechanical parameters
- the characterization of deformation and measurement of rock properties at shallow crustal conditions

Experimental Earthquake Physics and Geotribology Lab

This laboratory has three different experimental platforms:

Rotary Shear Apparatus

Experiments can be performed on solid rock specimens at loading rates consistent with earthquake nucleation and propagation. Further, at slow velocities, off-fault strain and radiated energy can be measured and analyzed, i.e., the ability to record a laboratory earthquake in the near-field at high rates. Additionally, this apparatus can run experiments on powdered gouge under dry and saturated conditions. In total this apparatus offers the ability to characterize the strength and slip behavior of different geologic materials as it relates to fault slip and earthquake physics.

Fracture Mechanics Apparatus

The testing apparatus has the ability to acquire fracture mechanical parameters from rock samples, including fracture toughness, subcritical fracture growth index, and the curves of stress intensity factor vs fracture velocity under saturated conditions (where fluid chemistry can be an experimental variable). Such measurements have direct application to operations that create fractures in the subsurface.

Bruker Tribometer System and Profilometer

This system, originally designed for engineering purposes, is used to test the friction/wear/hardness of geomaterials over a range of velocities and at various conditions. The capabilities of the platform allow for experiments that target such topics as fault mechanics, friction and wear along bimaterial faults, the evaluation of friction laws at high temperatures, and the mechanics of glacial sliding and silt production.

Experimental Rock Deformation and Poromechanics Lab (formerly the integrated PoroMechanics Institute)

The equipment in this lab offers an integrated approach to researchers of various disciplines including petroleum engineering, geology, geophysics, civil engineering, computer science, and electrical engineering to conduct general and applied research on the mechanics of porous materials, in particular, geomechanics applied to hydrocarbon exploration/production, geothermal energy production, and carbon dioxide sequestration.

Sedimentology Laboratory

Quantitative Grain Size and Grain Shape Analysis. Grain size and texture are measured in the lab using the Malvern Mastersizer 3000 and the Malvern Morphologi G3. The Malvern Mastersizer 3000 uses laser diffraction to measure grain size distributions of sediment samples. Different modules allow the measurement of a wide range of sample sizes and grain sizes (sub micron to 2 mm). The Malvern Morphologi G3 quantitatively measures particle size and 2-D shape by photographing and analyzing each individual grain. Grain metrics and bulk geometrical statistics are calculated with the Malvern software.

Structural Geology Labs

The digital workroom includes two dual monitor Dell PC workstations, a Sun Blade workstation, and a SGI Octane workstation. The PCs are primarily used for GIS applications, Cross section construction and 3-D modeling. The Sun Blade and SGI workstations are primarily used for seismic interpretation (Landmark and Geoquest) and 3-D visualization. The physical modeling laboratory is equipped with controlled hydraulic and electric displacement equipment. These are employed to exert a variety of displacement boundary conditions on models made of sand, clay or plaster. Most of the experiments done in this laboratory are directed toward studies of upper crustal deformation, primarily faulting and fracturing.

Thin Section Petrography Laboratory

This laboratory contains research quality microscopes for graduate and undergraduate students, as well as faculty and researchers, to conduct petrographic research. It contains two Zeiss microscopes, including a Zeiss Imager Z1 which is capable of taking thin section photomicrographs. The lab also includes a Nikon reflecting light microscope and a Nikon binocular microscope.

Social, Political, Earth & Environmental Research (SPEER)

The Social, Political, Earth & Environmental Research (SPEER) group is dedicated to advancing our understanding of the complex interplay between social, psychological, and environmental factors shaping public

attitudes and behaviors related to climate change, severe weather, and energy policies. Our interdisciplinary approach bridges the gap between Earth sciences and social sciences, recognizing that human perceptions and actions are integral to addressing environmental challenges.

We strive to produce high-quality, comprehensive research that informs effective climate communication strategies and policy interventions. By examining the multifaceted influences on climate attitudes—including political ideologies, religious beliefs, personal experiences, and psychological constructs—we aim to provide insights that can help society navigate the pressing environmental issues of our time.

Our ultimate goal is to contribute to the development of more targeted and impactful approaches to climate change mitigation and adaptation, fostering a more sustainable and resilient future for all.

Research Themes

SPEER encompasses a wide range of interconnected research themes:

- Climate Change Attitudes: Exploring beliefs, concerns, and risk perceptions related to global warming and its impacts.
- Severe Weather Experiences and Perceptions: Investigating past experiences and future expectations of extreme weather events.
- Energy Attitudes: Assessing views on various energy sources and technologies.
- Political and Social Tolerance: Examining willingness to accept others, particularly in the context of climate-related issues.
- Environmental Values: Utilizing the New Ecological Paradigm to assess ecological worldviews.
- Social Capital and Community Resilience: Exploring neighborhood cohesion and support networks.
- Psychological Factors: Investigating fears, conspiracy beliefs, cultural worldviews, and moral foundations.
- Religious and Political Influences: Examining how religious beliefs and political orientations relate to climate attitudes.
- Demographic Influences: Assessing how factors such as age, gender, race, education, and income relate to climate and energy attitudes.
- Solution Aversion: Exploring how proposed climate solutions affect willingness to acknowledge climate change.
- Trust in Climate Messaging: Investigating how messenger characteristics influence receptiveness to climate information.

More about SPEER Contact: Heather Bedle, hbedle@ou.edu

Research Opportunities

Faculty-supervised research is an important component of the School of Geosciences graduate program. Most graduate students are supported financially through research assistantships funded by federal and private industry grants and contracts. Other graduate students are financially supported through teaching assistantships awarded by their academic unit. In either case, faculty-supervised student research leads to master's theses and doctoral dissertations as part of the overall graduate degree requirements. This research is often published in scientific journals which may be useful in assisting graduates to obtain employment. Talented undergraduate students are encouraged to work with faculty on research projects. These student research projects can be an important component of the Honors Program and/or a source of part-time income and scholarship support. Such research participation provides the student with important experience in his or her discipline in addition to meeting normal academic requirements.

Career Opportunities

According to the National Science Foundation, there are approximately 125,000 geologists and geophysicists at work in the United States today. Most are employed by private industry as petroleum geologists and geophysicists whose work is vital to oil and gas companies. Other geologists and geophysicists work for mining companies to locate ore deposits and estimate reserves. Geologists are also employed in other commercial fields such as cement and ceramic industries; sand and gravel firms; railroads; engineering companies; environmental agencies and in the banking industry. The largest single employer of geoscientists in the U.S. is the federal government. Most work for the United States Geological Survey, but others work for the U.S. Department of Energy national laboratories, Soil Conservation Service, Bureau of Land Management, Environmental Protection Agency, National Aeronautics and Space Administration, National Park Service, Bureau of Mines, Forest Service, or the U.S. Army Corps of Engineers. Many geoscientists work for the 50 state geological surveys. Colleges and universities employ about 8,000 geoscientists in teaching and research positions. Many geoscientists are self-employed. Some are independent oil operators; others work as consultants. Most consultants have acquired prior experience in industry, teaching or research. Opportunities also now exist in public school teaching.

The curricula for the Bachelor of Science in Geology and the Bachelor of Science in Geophysics are designed to provide the necessary preparation for professional work or graduate study. Options are available in petroleum geology, environmental geology, paleontology, and geophysics.

The Master's Degree in Geology or Geophysics is designed to provide a professional level degree for industry employment. Traditionally, this degree level has been favored by major petroleum companies.

The Ph.D. in Geology is a research-oriented degree which provides students the opportunity to seek employment in a variety of areas including academia, industry and government.

Undergraduate Employment Opportunities

Geology and geophysics students are eligible to participate in research projects and part-time employment opportunities with faculty members. Other opportunities for research and employment exist at the Oklahoma Geological Survey and the Youngblood Energy Library.

Financial Support — Graduate Studies

Several types of financial aid are available to students on a competitive basis. Prospective graduate students are considered automatically for financial aid at the time of application. The school offers annually approximately 20 teaching assistantships with stipends which include a partial waiver of tuition. International students are required to pass an English language proficiency exam (administered by the English Assessment Program) before they can hold a teaching assistantship. Additionally, the school awards several research assistantships and fellowships using funds from industrial and other private sources. Funds for graduate support are also available from the Oklahoma Geological Survey, and the Institutes of the Sarkeys Energy Center. Grant-supported research assistantships are available through faculty conducted federal-, foundation- or industry-sponsored research. These assistantships carry a stipend comparable to teaching assistantships. Ph.D. students are encouraged to write research proposals with their graduate advisors for financial support and to apply for National Science Foundation Graduate Fellowships.

Undergraduate Study

Geology Bachelor of Science Programs

These curricula are designed to provide the necessary background for professional work or graduate studies in geology and allied sciences.

- Environmental Geology, Bachelor of Science
- Geology, Bachelor of Science
- Paleontology, Bachelor of Science
- Petroleum Geology, Bachelor of Science

Geophysics, Bachelor of Science

The Geophysics, Bachelor of Science curriculum constitutes a preparation for professional work and also provides the necessary background for graduate work in geophysics and geology.

Minor

The Geology Minor provides complimentary knowledge for students enrolled in all majors at the University of Oklahoma. The minor should give students a broad overview of Geology and the variety of subset topics within the field.

Graduate Study

The School of Geosciences offers the Master of Science and Doctor of Philosophy degrees. Some important aspects of these degree programs are described below.

Master of Science

The Geology, Master of Science and the Geophysics, Master of Science degree programs are intended primarily for those students who plan careers in the petroleum or minerals industries or with state and federal government agencies. The goal of the M.S. degree program is to prepare students by providing a broad background in the Earth sciences and related science and engineering fields through coursework; and encouraging critical thinking and analysis in the solution of geological and geophysical problems through independent thesis research.

Doctor of Philosophy

The Ph.D. degree programs in geology and geophysics are intended primarily for those students who plan research careers in the earth sciences in universities, industry or government agencies. The goals of the Ph.D. degree program are to prepare the student for a career in research by providing coursework in an area of specialization in geology or geophysics, provide a strong background in allied fields such as mathematics, physical science, biological science, and engineering to give the student the necessary tools to conduct original and significant geological research; and encourage critical thinking and analysis of geological problems through the design of original research projects.

The Ph.D. degree normally requires a minimum of three years beyond the M.S. degree. The Graduate College at the University of Oklahoma requires 90 post-baccalaureate semester hours of coursework. Generally, the first year of residence is devoted primarily to coursework in preparation for the general examination; the remaining two years are devoted to both coursework and research. There are no specified course requirements for the Ph.D. degree in Geology. Rather, a coursework program is designed for each student in consultation with a doctoral committee composed of at least five graduate faculty members, including at least one from outside the major department within the University and one member outside the University. The Ph.D. in Geophysics has specific core requirements which will be determined by the faculty advisor. The purpose of the coursework is to prepare the student for the general examination, which tests the mastery of the field of specialization and related fields as well as the capacity for synthesis, sound generalization, and critical thinking. The examination consists of a written section in the major field of study, written sections in related fields, and oral defense of an original research proposal. Frequently, the original research proposal is the student's dissertation topic.

The dissertation is the culmination of an original research project in the student's field of specialization and should make a significant contribution to scientific understanding in the field. Normally, the student works closely with the faculty advisor in the design and execution of the research project. The student and the advisor may submit proposals to foundations or industry for financial support to carry out the research, and they report the results of the research at regional, national and international meetings and in papers published by national and international journals.

Courses

GEOL 1003 Volcanoes and Earthquakes 3 Credit Hours
Prerequisite: high school chemistry and algebra. Worldwide distribution of volcanic and earthquake activity; types of volcanic eruptions and associated landforms and rocks; causes of and techniques for location of earthquakes; prediction of volcanic eruptions and earthquakes; social consequences of predictions and actual volcanic and earthquake activity. (F, Sp) [II-NS] .

GEOL 1013 Global Environmental Change 3 Credit Hours
Relationship between humanity and the environment from an intellectual and historical perspective. Principle of progress and the Industrial Revolution, the Enlightenment and Francis Bacon, the noble savage, conservation and land ethics. Malthusians and Cornucopians, the Gaia Hypothesis, risk analysis, global warming, fossil fuels and alternative energy sources. (Sp)

GEOL 1023 Geology of National Parks 3 Credit Hours
The amazing landforms and geologic features within the National Parks have a story to tell about their geologic history and tectonic setting, and are important for illustrating and describing concepts related to Earth processes and geologic time. This course blends an introduction to geology with geologic concepts as they apply to selected National Parks. (F, Sp) [II-NS].

GEOL 1024 The History of the Earth and Life 4 Credit Hours
Origin of the Earth/solar system. Rocks and minerals; geologic time; plate tectonics/continental drift. The ocean-atmosphere system; climate change over time; biological evolution. Fossil record of early life; the "Cambrian Explosion" of life in the oceans; invertebrate animals and their geological history. Geological history of fishes; evolution of plants. No student may earn credit for both GEOL 1024 and GEOL 1124 (Sp) [II-NSL].

GEOL 1033 Earth, Energy, Environment 3 Credit Hours
Explores Earth and its energy resources. Introduces physical geology and the link to global energy resources: their origin, properties, abundance, distribution in and on Earth, and environmental challenges. Emphasizes the advantages, disadvantages, and misconceptions of each energy resource. Also explores hydrogen as an energy resource, critical minerals and metals for energy applications, and possible methods to capture and store CO2. (Sp) [II-NS].

GEOL 1034 Native Science and Earth Systems of North America 4 Credit Hours
0 to 4 hours. (Crosslisted with METR 1034) Examines Earth systems of North America using both indigenous and Western perspectives, and an Earth science approach. This team-taught course will utilize a combination of geology, geography, meteorology, and Native American sciences, as expressed through the use of art. (Sp) [II-NSL].

GEOL 1104 The Dynamic Earth (Geology for non-Science Majors) 4 Credit Hours
Introduction to the fundamentals of geology and their application to land-use, groundwater, mineral use and fossil fuel problems facing society. Several guest lecturers from industry and state and federal surveys will contribute to the content of the course. Laboratory fee. Three hours lecture, two hours lab. Laboratory. (F, Sp) [II-NSL] .

GEOL 1114 Physical Geology for Science and Engineering Majors 4 Credit Hours
Prerequisite: equivalent knowledge of high school chemistry, algebra and trigonometry. Laboratory included. Plate tectonics, the makeup of continents and mountain building. Heat flow, magnetism, gravity, rock deformation, earthquakes and the earth's interior. Surface processes including weathering, erosion, transport and deposition. Landforms, rivers, groundwater, glaciers, ocean processes, and volcanoes. Minerals and rocks. Application of geology to land-use, groundwater, mineral and fossil fuel exploration. Laboratory. (F, Sp) [II-NSL] .

GEOL 1124 Earth History 4 Credit Hours
Prerequisite: none; 1114 helpful but not required. Laboratory included; field trip. Physical history of the earth from its origin as a planet through the Great Ice age. Origin and growth of continents and ocean basins. Systematic survey of the history of continents with emphasis on North America: growth and leveling of mountain chains, rift valleys, transgressions and regressions of seas; continental fragmentation, assembly and relative motions. Plate tectonics, particularly as it relates to continent history. Climate and evolutionary changes through geologic time. Principles and methods used to interpret earth history and date rocks. Geologic time. Laboratory includes historical studies of specific regions; study of maps and fossils. Laboratory (F, Sp)

GEOL 1203 The Age of Dinosaurs 3 Credit Hours
(Crosslisted with BIOL 1203) Introduction to basic principles and theories in biology (evolution, systematics, vertebrate morphology and relationships) and geology (geologic time, earth history, plate tectonics, sedimentation and stratigraphy), focusing on the evolutionary history of Dinosauria. May not be counted for major coursework in Biology or Geology. (F) [II-NS].

GEOL 2014 The Earth System 4 Credit Hours
An integrated overview of earth sciences emphasizing earth materials, the oceans and atmosphere, the solar system, and earth's evolution. The interrelationship among the different earth systems will be emphasized. Topics will be explored through a learning-cycle approach. The lab component includes both in-class experiments and one field-based research project. Laboratory (Sp) [II-NSL] .

GEOL 2224 Introduction to Mineral Sciences 4 Credit Hours
Prerequisite: GEOL 1114, CHEM 1315, and MATH 1823/1914 or concurrent enrollment. Main topics include crystal chemistry, optical properties and identification of minerals utilizing the petrographic microscope, mineral stability, crystal symmetry, and an introduction to the rock-forming minerals and their environments of formation. Laboratory (F)

GEOL 2970 Special Topics 1-3 Credit Hours
1 to 3 hours. Prerequisite: May be repeated; Maximum credit nine hours. Special topics course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research, and field projects. (Irreg.)

GEOL 3003 Structural Geology and Stratigraphy for Petroleum Engineers 3 Credit Hours
Prerequisite: 1114, Physics 2524 or concurrent enrollment. Treatment of structural and stratigraphic geology with an emphasis on aspects of importance to petroleum engineering. Includes an investigation of mechanical principles relating to the earth's crust, descriptive study of nomenclature, causes of tectonic deformation, sedimentary processes and environments, and stratigraphic principles. Laboratory. (Sp)

GEOL 3013 The Geology of Oklahoma 3 Credit Hours
Prerequisite: junior standing or permission of instructor. Provides an overview of geology emphasizing earth materials, surface processes, natural hazards, and the earth's evolution using Oklahoma as our natural laboratory. The course emphasizes problem solving and includes impact of anthropogenic changes and resources extraction. Required field trip. Grading based on exams, research paper and in-class exercises. (F) [II-NS].

GEOL 3023 The Geology of Natural Resources in Sub-Saharan Africa 3 Credit Hours
Prerequisite: Junior standing and one Natural Science General Education course 1000-level or higher, or instructor permission. Content will include the carbon cycle, rock/tectonic cycle, and water/climate cycle. Students will explore, through data analysis, processes that lead to the formation, distribution and variation of fossil fuels, mineral deposits, and lake and grassland ecosystems. These concepts will be highlighted through Oil/Gas Development, Mineral Mining, Land-use and Climate Change. (Fall) (F) [II-NS].

GEOL 3033 Earth Resources and the Environment 3 Credit Hours
Prerequisite: junior standing or permission of instructor. A geological perspective on Earth's water, energy, soil, and mineral resources, including their past, present, and potential future impact on society. By examining intersections between Earth resources and society, we will investigate the nature of science, role of science and scientists in society, evaluate scientific versus non-scientific sources of information, and communicate appropriately using scientific sources of information. (Sp) [II-NS].

GEOL 3063 Exploring Planetary Worlds 3 Credit Hours
Prerequisite: Six credits of introductory (1000 or 2000-level) natural science coursework; permission of instructor or department. Topics will include solar system and planet formation, planetary materials, and geologic processes that likely formed planetary features we observe today. Students will design a rover, lander, orbiter, or fly-by mission to gather data and test key hypotheses on a selected Planetary Body. Students will present on mission concept, including an outreach plan, in a written proposal and group presentation. (F) [II-NS].

GEOL 3114 Structural Geology 4 Credit Hours
Prerequisite: GEOL 2224 and PHYS 2514. An introduction to the fundamental concepts of structure and deformation in the lithosphere. It discusses recognition, interpretation, and mechanics (stress, strain) of faults, folds, structural features of igneous and metamorphic rocks, and introduces regional structural geology and tectonics. Laboratory includes techniques of structural analysis, recognition, and interpretation of structures on geologic maps, and construction of interpretive cross sections. (F)

GEOL 3123 Introductory Field Geology 3 Credit Hours
Prerequisite: 2224, 3114, and 3223 or 3233, or permission (completed laboratory). Techniques of geologic fieldwork including: measuring stratigraphic sections, airphoto analysis, mapping, total station, writing reports. Course includes 10-12 field days in Oklahoma (during weekends) and a weekly laboratory. Students will be charged transportation costs. (Sp)

GEOL 3223 Igneous and Metamorphic Petrology 3 Credit Hours
Prerequisite: 2224 or permission. Laboratory included. Field trip; students will be charged transportation costs. Generation, emplacement and crystallization of magma; phase chemistry; principles of igneous rock classification; the relationship of magma types to geologic setting. Principles of metamorphic petrology; phase chemistry and metamorphic reactions; concepts of metamorphic grade, P-T regimes and relationships to geologic environments; concepts of protoliths and provenance. Laboratory study of the textures, structures and mineral assemblages of igneous and metamorphic rocks utilizing hand specimens and thin sections. Laboratory. (Sp)

GEOL 3233 Sedimentary Petrology and Sedimentology 3 Credit Hours
Prerequisite: 2224 or permission. Laboratory included. Field trip; students will be charged transportation costs. Origin, evolution and interpretation of sedimentary rocks with an emphasis on terrigenous systems; interpretation of mineralogy, textures and structures of terrigenous clastic and carbonate rocks in hand specimen and thin section. Laboratory. (Sp)

GEOL 3333 Geowriting 3 Credit Hours
Prerequisite: English 1113 and English 1213 or Expository Writing 1213. Provides student with the information and skills needed to effectively communicate as professional geoscientists. Students will actively engage in writing and scientific communication exercises through in-class activities, weekly assignments, and semester-long projects. Substitutes for English 3153. (alt. F)

GEOL 3440 Mentored Research Experience 3 Credit Hours
0 to 3 hours. Prerequisites: ENGL 1113 or equivalent, and permission of instructor. May be repeated; maximum credit 12 hours. For the inquisitive student to apply the scholarly processes of the discipline to a research or creative project under the mentorship of a faculty member. Student and instructor should complete an Undergraduate Research & Creative Projects (URCP) Mentoring Agreement and file it with the URCP office. Not for honors credit. (F, Sp, Su)

GEOL 3513 Fundamentals of Invertebrate Paleontology 3 Credit Hours
Prerequisite: GEOL 1114 or GEOL 1024 or BIOL 1114 or permission of instructor. Fossil preservation and bias in the fossil record. Ontogeny and growth of invertebrates. Interpretation of the life habits of fossil organisms, with case histories from invertebrates and vertebrates. Speciation and macroevolution. Paleoecology of marine communities. Mass extinctions in the fossil record. Biostratigraphy. Laboratory covers classification, morphology and ecology of the major invertebrate fossil groups. Laboratory (F)

GEOL 3633 Introduction to Oceanography 3 Credit Hours
General survey of the scientific framework of the four specializations of the oceanographic study - biological, chemical, geological/geophysical and physical oceanography. Applications of ocean research to social and economic problems; interrelations between the ocean disciplines and other fields of study. (Sp) [II-NL] .

GEOL 3960 Honors Reading 1-3 Credit Hours
1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. Consists of topics designated by the instructor in keeping with the student's major program. Covers topics not usually presented in the regular courses. (F, Sp, Su)

GEOL 3970 Honors Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. Subjects covered vary. Deals with concepts not usually treated in regular courses. (Irreg.)

GEOL 3980 Honors Research 1-3 Credit Hours
1 to 3 hours. Prerequisite: Admission to Honors Program. May be repeated; maximum credit six hours. Will provide an opportunity for the gifted Honors candidate to work at a special project in the student's field. (F, Sp, Su)

GEOL 3990 Independent Study 1-3 Credit Hours
1 to 3 hours. Prerequisite: permission of instructor and junior standing. May be repeated once with change of content. Independent study may be arranged to study a subject not available through regular course offerings. (F, Sp, Su)

GEOL 4001 Colloquium Series 1 Credit Hour
Prerequisite: Departmental Permission. May be repeated for credit, maximum credit 9 hours. Departmental seminar series which will host a new guest lecturer, faculty member or student presenter each week. These lectures will provide greater exposure to scholarly work within the field of Geology and Geophysics, along with providing a platform for discussion and department interaction. All department scholarship students are required to enroll in this course each semester. (F, Sp)

GEOL 4106 Digital Geologic Methods 6 Credit Hours
Prerequisite: GEOL 3123; senior standing or departmental permission. This six-week online synchronous course covers a range of tectonic and lithologic processes on Earth and other planetary bodies. Students will become proficient in remote field techniques to create geologic maps, cross-sections, and stratigraphic columns. Students will create cohesive narratives of field areas, and understand the different driving forces of tectonics, volcanism, and sedimentation in current and ancient environments. (Su)

GEOL 4113 Depositional Systems and Stratigraphy 3 Credit Hours
(Slashlisted with GEOL 5113) Prerequisite: GEOL 3233, and GEOL 3114 or concurrent enrollment. Basic stratigraphic principles as well as reconstruction of ancient depositional systems. The controls (climatic, tectonic, eustatic) on deposition of stratigraphic sequences, stratigraphic completeness, biostratigraphy, magnetostratigraphy, and sequence stratigraphy. Field trip; students will be charged transportation costs. Laboratory. No student may earn credit for both 4113 and 5113. (F)

GEOL 4133 Petroleum Geology for Geoscientists 3 Credit Hours
Prerequisite: GEOL 3233 and GEOL 3114, majors only. Addresses the origin and distribution of conventional and unconventional petroleum resources, the petroleum system, source rocks, traps and seals, reservoir rock properties, and exploration and development methods. (F)

GEOL 4136 Field Geology 6 Credit Hours
Prerequisite: 3123; senior standing or permission. A six-week summer course held at the Oklahoma Geology Camp at Canon City, Colorado. Applications of field techniques, including use of aerial photographs, construction of geological maps and geophysical methods, to the recognition and interpretation of geologic phenomena. (Su) [V] .

GEOL 4143 Petroleum Geology for Business Majors 3 Credit Hours
Prerequisite: 1104 or 1114. The integration of several fields of geology with geochemistry, geophysics, and engineering to provide an overview of the science and technology used in the exploration for and development of oil and natural gas fields. Briefly covers historical development of petroleum geology, amount and location of the world's major oil and gas reserves, and future potential for conventional and non-conventional hydrocarbon resources. (F)

GEOL 4204 Vertebrate Paleobiology 4 Credit Hours
(Slashlisted with GEOL 5204; Crosslisted with BIOL 4204) Prerequisite: BIOL 1114 and 1121, or 1124, or 1134, or permission of instructor. Systematics, relationships, zoogeography and evolutionary morphology of the major groups of vertebrates. Field trips. Laboratory. No student may earn credit for both 4204 and 5204. (Sp)

GEOL 4223 Principles of Geochemistry (Slashlisted with 5223) 3 Credit Hours
Prerequisite: 2224, Chemistry 1315, and 1415. Experience with calculus recommended. Overview of major topics in geochemistry, emphasizing thermodynamics and kinetics within the context of natural systems. Additional topics will include nucleosynthesis and cosmochemistry, bulk Earth geochemistry, chemistry and bonding of natural materials, solutions and mineral solubility, redox processes, interfacial geochemistry, and isotope geochemistry. No student may earn credit for both 4223 and 5223. Laboratory (Alt. Sp)

GEOL G4233 Subsurface Methods 3 Credit Hours
Prerequisite: junior standing or permission of instructor/department. Concepts and methods of subsurface geoscience data analysis, modeling, and interpretation. Data integration (core, well logs, 3-D seismic, outcrops) to evaluate, map, model, and interpret subsurface geological characteristics and formation property heterogeneity. Application to subsurface reservoirs and aquifers related to energy (oil, gas, geothermal, hydrogen), water, and CO2 storage. (Fall) (F)

GEOL 4373 History of Geology 3 Credit Hours
Prerequisite: junior standing. History of science and the scientific method with an emphasis on geology. Greek science, scholasticism, Copernican revolution Francis Bacon, principle of uniformity, evolution, continental drift, climate, progress. Discussion of writings by Plato, Geike, Kuhn, Popper, Chamberlin, Gilbert, Hubbert and others. No student may earn credit for both 4373 and 5373. (F) [IV-WC] .

GEOL 4513 Evolutionary Paleobiology 3 Credit Hours
(Slashlisted with GEOL 5513) Prerequisite: GEOL 3513; MATH 2423 or MATH 2924; or permission of instructor. Advanced course on biological evolution emphasizing mathematical and computational approaches to the fossil record. Biodiversity through time, origination and extinction dynamics; Models of trait evolution (Brownian motion, Ornstein Uhlenbeck processes, and beyond), Markov processes; Phylogeny inference, parsimony, likelihood, and Bayesian approaches; Paleobiological contributions to understanding major features of evolution and the history of life, punctuated equilibrium, levels of selection. No student may earn credit for both 4513 and 5513. (Irreg.)

GEOL 4533 Earth's Past Climate 3 Credit Hours
(Slashlisted with GEOL 5533; Crosslisted with METR 4533) Prerequisite: senior or graduate standing, or permission of instructor. Explores earth's climate system, controls on climate change, and evolution of climate history through geologic time as deciphered from climate proxies. No student may earn credit for both 4533 and 5533. (F)

GEOL 4553 Paleoecology 3 Credit Hours
(Slashlisted with GEOL 5553) Prerequisite: GEOL 3513 or instructor permission. Over millions of years, the interactions of organisms with each other and with their changing environments have had a profound effect on the history of Earth and life. This course will focus on modern and ancient ecological processes, how they scale over geological timescales, and how fossil data are collected, analyzed, and synthesized to address paleoecological questions. Laboratory work included. No student may earn credit for both 4553 and 5553. (Sp)

GEOL 4613 Soil Genesis 3 Credit Hours
(Slashlisted with GEOL 5613) Prerequisite: GEOL 1114 or Instructor/Department Permission. This course focuses on the formation and morphology of soils - otherwise known as the field of pedology. Pedologists research the processes that generate different soils across and within landscapes. We apply this knowledge to understand the development of landforms, biogeochemical reactions across space and time, and the distribution of plant and animal species in the biosphere. No student may earn credit for both 4613 and 5613. (F)

GEOL G4633 Hydrogeology 3 Credit Hours
Prerequisite: MATH 2924 or MATH 2443, PHYS 2524, senior standing in geology, or permission of instructor. Darcy's law, Hubbert's fluid potential, equations of groundwater flow. Physical properties of geologic materials and fluids. Free convection, compaction- and gravity-driven flow. Role of fluids in geologic phenomena, including mineralization, metamorphism, hydrocarbon migration, sedimentary diagenesis, faulting and earthquakes, paleomagnetism. Application of geologic and geophysical techniques to fluid flow problems. (F)

GEOL 4663 Biogeochemistry of the Critical Zone 3 Credit Hours
(Slashlisted with GEOL 5663) Prerequisite: GEOL 1114 or Instructor/Department Permission. This course serves as a survey of the field of biogeochemistry through the lens of critical zone science. Biogeochemistry is the study of the fluxes and transformations of energy, water, carbon, nutrients, and other elements within and through the biosphere; critical zone science encompasses integrative works that study the near-surface interactions between rock, soil, air, water, and biota. No student may earn credit for both 4663 and 5663. (F)

GEOL 4923 Pegmatites 3 Credit Hours
(Slashlisted with GEOL 5923) Prerequisite: GEOL 3223, CHEM 1415, and permission of instructor. Granitic pegmatites are the most complex rocks on earth. Class instructs students in the use of scientific methods, including historical background, working hypotheses, analytical methods, experimental test, and theory as they are utilized in solving the origins of pegmatites. No student may earn credit for both 4923 and 5923. (Sp)

GEOL 4960 Directed Readings 1-4 Credit Hours
1 to 4 hours. Prerequisite: good standing in University; permission of instructor and dean. May be repeated; maximum credit four hours. Designed for upper-division students who need opportunity to study a specific problem in greater depth than formal course content permits. (Irreg.)

GEOL G4970 Seminar 3 Credit Hours
1 to 3 hours. Prerequisite: permission. May be repeated; maximum credit nine hours. (F, Sp)

GEOL 4983 Senior Thesis in Geology 3 Credit Hours
Prerequisite: senior standing with a major in geology and permission. May not be repeated. Individual research of a geological topic selected by the student in consultation with the instructor. The project may involve fieldwork, theoretical analysis, computer modeling, and/or data analysis and interpretation, culminating in a written thesis. (F, Sp, Su)

GEOL 4990 Independent Study 1-3 Credit Hours
1 to 3 hours. Prerequisite: three courses in general area to be studied; permission of instructor and department. May be repeated; maximum credit nine hours. Contracted independent study for topics not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (F, Sp, Su)

GEOL 5001 Topics in Geosciences 1 Credit Hour
Prerequisite: Graduate standing or departmental permission. This course is a broad survey of general concepts in the geosciences, delivered at an advanced level. Students will read the professional scientific literature, participate in class discussions, and complete short writings related to readings and their own research. (F)

GEOL 5003 Diagenesis 3 Credit Hours
Prerequisite: 26 hours of geology or geophysics or permission.
Origin and interpretation of diagenetic features of sedimentary rocks, including porosity, permeability, fluid flow, compaction and cementation. Geochemical approaches are stressed. Laboratory. (Irreg.)

GEOL 5010 Paleomagnetism/Diagenesis Seminar 1-2 Credit Hours
Prerequisite: Senior or graduate standing; GPHY 5364 suggested.
Seminar includes presentations by the professor on research topics as well as presentations by students on papers they read. In addition, each student will also make at least one presentation on their research. Also, students will work through a self-instruction lab with the microscopes. Focuses on recognizing diagenetic features that are important for paleomagnetism. May be taken for a total of six credit hours. (F, Sp)

GEOL 5020 Sedimentology and Stratigraphy Seminar 1-3 Credit Hours
Prerequisite: graduate standing. May be repeated with change of content; maximum credit twelve hours. Directed seminar on selected aspects of sedimentology and stratigraphy. (F, Sp)

GEOL 5041 Critical Geosciences Seminar 1 Credit Hour
Prerequisite: Graduate standing and permission of instructor. Directed seminar on knowledge and inquiry, profession and practice, and careers associated with 'Critical Geosciences,' including but not limited to biogeochemistry and geophysics of planetary critical zones and critical mineral/energy resources. 1 hour/week. (F, Sp)

GEOL 5051 Organic Geochemistry Seminar 1 Credit Hour
Prerequisite: Graduate Standing or Departmental Permission.
This seminar course engages students in examining advanced research in Organic Geochemistry, with a focus on key topics such as paleoceanography, paleoclimate, and biogeochemical cycles across ancient and modern environments. Through interactive, in-class discussions and critical analyses, students will refine their scholarly expertise while developing practical skills essential for success in both academic and industry career paths. (F, Sp)

GEOL 5061 Topics in Critical Zone Science 1 Credit Hour
Prerequisite: Graduate Standing or Department/Instructor Permission.
In this seminar-style class we will explore recent advances in the field of critical zone science. Critical zone science integrates the earth sciences to study the near-surface interactions between rock, water, soil, air, and biota. Therefore, we will read and discuss research articles that use such a systems-based approach to answer questions related to an array of topics. (F, Sp.) (F, Sp)

GEOL 5113 Depositional Systems and Stratigraphy 3 Credit Hours
(Slashlisted with GEOL 4113) Prerequisite: Graduate Standing, GEOL 3233, and GEOL 3114 or equivalent. Basic stratigraphic principles as well as reconstruction of ancient depositional systems. The controls (climatic, tectonic, eustatic) on deposition of stratigraphic sequences, stratigraphic completeness, biostratigraphy, magnetostratigraphy, and sequence stratigraphy. Field trip; students will be charged transportation costs. No student may earn credit for both 4113 and 5113. Laboratory. (F)

GEOL 5173 Clastic Facies 3 Credit Hours
Prerequisite: 3233 or 4113 or equivalent. Bedforms, sedimentary structures, flow regime, intrinsic versus extrinsic controls on sedimentation, ancient depositional environments and depositional models (alluvial fan, fluvial, deltaic, lacustrine, eolian, shelf, etc.). (F)

GEOL 5204 Vertebrate Paleobiology 4 Credit Hours
(Slashlisted with GEOL 4204) Prerequisite: graduate standing and permission of instructor. Systematics, relationships, zoogeography, and evolutionary morphology of the major groups of vertebrates. Field trips. Laboratory. No student may earn credit for both 4204 and 5204. (Sp)

GEOL 5223 Principles of Geochemistry (Slashlisted with 4223) 3 Credit Hours
Prerequisite: graduate standing or permission of instructor. Overview of major topics in geochemistry, emphasizing thermodynamics and kinetics within the context of natural systems. Additional topics will include nucleosynthesis and cosmochemistry, bulk Earth geochemistry, chemistry and bonding of natural materials, solutions and mineral solubility, redox processes, interfacial geochemistry, and isotope geochemistry. No student may earn credit for both 4223 and 5223. Laboratory (Alt. Sp)

GEOL 5343 Stable Isotope Geochemistry 3 Credit Hours
Prerequisite: Chemistry 1315, 1415; senior or graduate standing. Focuses on the stable isotopes of light elements (C, H, O, N, S) in the various processes that have resulted in their redistribution over geologic time. (Alt. F)

GEOL 5353 Carbonates and Sequence Stratigraphy 3 Credit Hours
Prerequisite: Senior undergraduate or graduate standing and permission of instructor. Sedimentology, sequence stratigraphy, paleo-climate, and reservoir attributes of Paleozoic carbonates (and associated eolian, fluvial and deep-water siliciclastics) of the classic Permian basin region. A highlight is a major field trip to world-class exposures in the Sacraments (NM) and Guadalupe (TX) mountains. (Irreg.)

GEOL 5363 Carbonate Geology 3 Credit Hours
Prerequisite: 26 hours of geology and geophysics, or permission.
Students will be charged field trip costs. Petrology and petrography of modern and ancient chemical rocks, the reconstruction of their physical/chemical depositional and diagenetic environments in time and space; applied interpretation of cores, petrophysical logs, and seismic; five-day field trip to the Florida Keys. (Irreg.)

GEOL 5413 Paleobotany 3 Credit Hours
Prerequisite: permission of instructor. Introduction to the fossil record of terrestrial plants from algae to flowering plants. Lectures will address anatomy, morphology, taphonomy and paleoecology, including climate and plant-animal interactions. Laboratories will put lecture topics into practice using fossil plants from the Oklahoma Museum of Natural History collection and from fieldwork. Field trips. No student may earn credit for both 4413 and 5413. Laboratory. (Sp, even-numbered years)

GEOL 5443 Formation Damage 3 Credit Hours
(Crosslisted with P E and G E 5443) Prerequisite: Graduate standing. This course presents an overview of main mechanisms of formation damage (mechanical, chemical, thermal, and biological) occurring during subsurface applications, including but not limited to primary and enhanced hydrocarbon production, CO2 storage, and geothermal processes. Existing theories explaining the process and methods to mitigate the formation damage will be discussed. (Irreg.)

GEOL 5503 Clay Mineralogy 3 Credit Hours
Prerequisite: Graduate Standing or Permission of Instructor. Theoretical fundamentals, methods of investigation, and applications of clay mineral structure and reactivity. Students are required to complete a hands-on original project applying methods and concepts from the course to their research.

GEOL 5513 Evolutionary Paleobiology 3 Credit Hours
(Slashlisted with GEOL 4513) Prerequisite: graduate standing or instructor permission. Advanced course on biological evolution emphasizing mathematical and computational approaches to the fossil record. Biodiversity through time, origination and extinction dynamics; Models of trait evolution (Brownian motion, Ornstein Uhlenbeck processes, and beyond), Markov processes; Phylogeny inference, parsimony, likelihood, and Bayesian approaches; Paleobiological contributions to understanding major features of evolution and the history of life, punctuated equilibrium, levels of selection. No student may earn credit for both 4513 and 5513. (Irreg.)

GEOL 5533 Earth's Past Climate 3 Credit Hours
(Slashlisted with GEOL 4533; Crosslisted with METR 5533) Prerequisite: senior or graduate standing, or permission of instructor. Explores earth's climate system, controls on climate change, and evolution of climate history through geologic time as deciphered from climate proxies. No student may earn credit for both 4533 and 5533. (F)

GEOL 5543 Minerals and the Environment 3 Credit Hours
Prerequisite: Graduate standing or permission of instructor. Explores the bonding and reactivity of common environmental minerals, as well as laboratory methods in environmental mineral analysis, including diffraction, microscopy, and spectroscopy. (F)

GEOL 5553 Paleoecology 3 Credit Hours
(Slashlisted with GEOL 4553) Prerequisite: Graduate Standing. Over millions of years, the interactions of organisms with each other and with their changing environments have had a profound effect on the history of Earth and life. This course will focus on modern and ancient ecological processes, how they scale over geological timescales, and how fossil data are collected, analyzed, and synthesized to address paleoecological questions. Laboratory work included. No student may earn credit for both 4553 and 5553. (F)

GEOL 5613 Soil Genesis 3 Credit Hours
(Slashlisted with GEOL 4613) Prerequisite: Graduate standing or Instructor/Department Permission. This course focuses on the formation and morphology of soils - otherwise known as the field of pedology. Pedologists research the processes that generate different soils across and within landscapes. We apply this knowledge to understand the development of landforms, biogeochemical reactions across space and time, and the distribution of plant and animal species in the biosphere. No student may earn credit for both 4613 and 5613. (F)

GEOL 5633 Field Methods in Hydrogeology 3 Credit Hours
Prerequisite: GEOL 4633 and senior standing or graduate standing in Geology, Civil Engineering, Geography & Environmental Sustainability, or Environmental Science, or permission of instructor. This course provides students with a hands-on introduction to commonly used field methods in hydrogeology. Some aspects of surface hydrology will also be covered. Field-focused exercises in well installation, slug testing, aquifer testing, water sampling (organic and inorganic constituents), in-situ measurement of water quality parameters, surface water discharge measurement techniques, and geophysical methods are covered. (F)

GEOL 5663 Biogeochemistry of the Critical Zone 3 Credit Hours
(Slashlisted with GEOL 4663) Prerequisite: Graduate Standing or Instructor/Department Permission. This course serves as a survey of the field of biogeochemistry through the lens of critical zone science. Biogeochemistry is the study of the fluxes and transformations of energy, water, carbon, nutrients, and other elements within and through the biosphere; critical zone science encompasses integrative works that study the near-surface interactions between rock, soil, air, water, and biota. No student may earn credit for both 4663 and 5663. (F)

GEOL 5733 Sedimentation and Tectonics 3 Credit Hours
Prerequisite: Graduate standing or permission of instructor. Provides a basic understanding of the coupling between tectonics and sedimentation, including how the composition, geometry, and stacking of sedimentary deposits are influenced by spatial and temporal changes in tectonics. Course content is delivered through a series of basic lectures outlining fundamental concepts, followed by discussion-based analyses of primary literature that highlights fundamental couplings between sedimentation and tectonics. (F)

GEOL 5813 Basin Analysis for Oil and Gas 3 Credit Hours
Prerequisite: permission. Development of exploration guidelines to oil and gas (origin, migration, accumulation) based on regional tectonic styles and related time and place associations of structure, sedimentation, heat history and fluid pressures. Laboratory. (F)

GEOL 5923 Pegmatites 3 Credit Hours
(Slashlisted with GEOL 4923) Prerequisite: GEOL 3223, CHEM 1415, and permission of instructor. Granitic pegmatites are the most complex rocks on earth. Class instructs students in the use of scientific methods, including historical background, working hypotheses, analytical methods, experimental test, and theory as they are utilized in solving the origins of pegmatites. No student may earn credit for both 4923 and 5923. (Sp)

GEOL 5960 Directed Readings 1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing and permission of department. May be repeated; maximum credit twelve hours. Directed readings and/or literature reviews under the direction of a faculty member. (F, Sp, Su)

GEOL 5970 Special Topics/Seminar 3 Credit Hours
1 to 3 hours. Prerequisite: Graduate standing or permission of instructor. May be repeated; maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)

GEOL 5980 Research for Master's Thesis 2-9 Credit Hours
Variable enrollment, two to nine hours; maximum credit applicable toward degree, four hours. (F, Sp, Su)

GEOL 5990 Special Studies 1-3 Credit Hours
1 to 3 hours. Prerequisite: permission. May be repeated; maximum credit nine hours. Advanced special studies in geological problems. May include directed reading in geology, fieldwork, laboratory research or preparation of reports. (F, Sp, Su)

GEOL 6103 Petroleum Geochemistry 3 Credit Hours
Prerequisite: graduate standing in geology or chemistry. An introduction to the basic concepts of petroleum geochemistry and their role in exploration. Includes the biomarker concept, pyrolysis techniques, isotopes in petroleum exploration, basin modeling and kinetic studies, organic petrography and detailed studies of a number of case histories. (Irreg.)

GEOL 6113 Organic Geochemistry 3 Credit Hours
Prerequisite: graduate standing or instructor permission. This course will introduce basic concepts, methods, and hot topics of Organic Geochemistry with a focus on lipid biomarkers, the molecular fossils that are commonly studied for tracing the metabolic activities of once living organisms and reconstructing past climates.

GEOL 6633 Aqueous Geochemical Modeling 3 Credit Hours
Prerequisite: Graduate standing in geology, civil engineering, environmental science, or other program with permission of instructor, and GEOL 5223/4223. Provides an interactive platform to improve our understanding of complex biogeochemical reactions and processes in natural systems. Course will cover the mathematical and thermodynamic basis for widely used geochemical modeling programs including PHREEQC, Visual MINTEQ, and Geochemists Work Bench (GWB). Various types of modeling approaches will be explored using geochemical data representative of real work applications. (Sp)

GEOL 6950 Research 1-4 Credit Hours
1 to 4 hours. Prerequisite: graduate standing and permission of faculty supervisor. May be repeated with change of content; maximum credit twelve hours. Individual research in various areas of geology. (F, Sp, Su)

GEOL 6960 Directed Readings 1-6 Credit Hours
1 to 6 hours. Prerequisite: graduate standing and permission of faculty supervisor. May be repeated; maximum credit six hours. Supervised reading at an advanced graduate level. (F, Sp, Su)

GEOL 6970 Seminar 4 Credit Hours
1 to 4 hours. Prerequisite: graduate standing and permission of faculty supervisor. May be repeated with change of subject matter; maximum credit 20 hours. Directed seminar on selected aspects of geologic knowledge and inquiry. (F, Sp, Su)

GEOL 6980 Research for Doctoral Dissertation 2-16 Credit Hours
2 to 16 hours. Prerequisite: Graduate standing and permission of instructor; may be repeated. Directed research culminating in the completion of the doctoral dissertation. (F, Sp, Su)

GEOL 6990 Independent Study 1-3 Credit Hours
1 to 3 hours. Prerequisite: Graduate standing and permission of instructor. May be repeated; maximum credit nine hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)

GPHY 1103 Adventures in Geophysics 3 Credit Hours
The field of applied near-surface geophysics will be introduced within the broader scope of the geophysical sciences. Key geophysical techniques and tools will be covered through exploration of existing case studies involving fields such as archaeology, law enforcement and ground water resources. There will also be opportunities for 'hands on' experience with high-tech geophysical tools. (Sp) [II-NS].

GPHY 2013 Frontiers of Geophysics 3 Credit Hours
Prerequisite: GEOL 1114 or co-enrollment. Introduction to the basic theories, methods, and modern applications of geophysics. This sampler course will address topics such as, but not limited to: seismology, deep earth geophysics, remote sensing, reflection seismology, computational geophysics, and machine learning. (Sp)

GPHY 3013 Data Analysis in Geoscience 3 Credit Hours
Prerequisite: GEOL 1114, and MATH 2924 or MATH 2423. This course introduces theories and techniques in data analysis and their applications in the Earth and Environmental Sciences, with examples demonstrated in MatLab. Topics include data visualization, probability theory, linear models, periodicity detection, filtering, correlation, interpolation, approximations, and hypothesis testing. (Sp)

GPHY 3423 Introductory Petroleum Geology and Geophysics 3 Credit Hours
Prerequisite: GEOL 1114, MATH 2924 or MATH 2423, PHYS 2514, and GEOL 3003. Fundamentals of the utilization of geological and geophysical data in the exploration for and development of petroleum reserves. Fundamental principles, geological and geophysical data acquisition, processing and interpretation. (F)

GPHY 3440 Mentored Research Experience 3 Credit Hours
0 to 3 hours. Prerequisites: ENGL 1113 or equivalent, and permission of instructor. May be repeated; maximum credit 12 hours. For the inquisitive student to apply the scholarly processes of the discipline to a research or creative project under the mentorship of a faculty member. Student and instructor should complete an Undergraduate Research & Creative Projects (URCP) Mentoring Agreement and file it with the URCP office. Not for honors credit. (F, Sp, Su)

GPHY 3960 Honors Reading 1-3 Credit Hours
1 to 3 hours. Prerequisite: Admission to Honors Program. May be repeated; maximum credit six hours. Consists of topics designated by the instructor in keeping with the student's major program. The topics will cover materials not usually presented in the regular courses. (F, Sp, Su)

GPHY 3970 Honors Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. Subjects covered vary. Deals with concepts not usually treated in regular courses. (Irreg.)

GPHY 3980 Honors Research 1-3 Credit Hours
1 to 3 hours. Prerequisite: Admission to Honors Program. May be repeated; maximum credit six hours. Will provide an opportunity for the gifted Honors candidate to work at a special project in the student's field. (F, Sp, Su)

GPHY 3990 Independent Study 1-3 Credit Hours
1 to 3 hours. Prerequisite: permission of instructor and junior standing. May be repeated once with change of content. Independent study may be arranged to study a subject not available through regular course offerings. (F, Sp, Su)

GPHY 4133 Colorado Field Geophysics 3 Credit Hours
Prerequisite: 4113; Geology 3123; or permission of instructor. Students become familiar with field methods in geophysics and apply principles of geophysical methods to survey design, data acquisition, data processing, and interpretation. Students plan geophysical surveys, collect field geophysical data in small groups, interpret the acquired datasets in terms of earth structure, and learn about the tectonics and structure of the front range of the Rocky Mountains. Field course is taught at the OU field camp near Canon City, Colorado, and is predominantly field based. Three-week field experience required. (Su) [V].

GPHY 4153 Fractures, Faults, and Earthquakes 3 Credit Hours
(Slashlisted with GPHY 5153) Prerequisite: Junior Standing or permission of instructor. This course provides an introduction to the principles of fracturing, brittle faulting and earthquake mechanics. We will examine content including: brittle failure, fractures, fluid-flow and hydrothermal alteration, the state of stress in Earth's crust, borehole interpretation of fractures and faults, fault rocks and structures, the strength, rheology, and friction of faults, the seismic cycle, and scientific drilling. No student may earn credit for both 4153 and 5153. (Irreg.)

GPHY 4413 Global Geophysics 3 Credit Hours
(Slashlisted with GPHY 5413) Prerequisite: GEOL 3114 or concurrent enrollment; MATH 2924 or 2423; PHYS 2514; or permission of instructor. Introduces geophysical concepts about the solid Earth, the structure and physical properties of Earth's shallow subsurface and deep interior, active tectonic processes and geological hazards on Earth, and the use of geophysical methods to study structure, processes, and resources. No student may earn credit for both 4413 and 5413. (F)

GPHY G4553 Introduction to Seismology 3 Credit Hours
Prerequisite: MATH 2924 or 2423, and PHYS 2514; or permission of instructor. This course presents an overview of seismology to introduce students to the fundamentals of seismic wave, quantitative data analyses, and the utilization of seismic wave for the study of earthquakes and the Earth's interior structure. Students will gain hand-on experiences with real data analysis. Course is appropriate for upper-class undergraduates and graduate students. (Sp)

GPHY G4874 Seismic Exploration 4 Credit Hours
Prerequisite: PHYS 2524; MATH 2433 or MATH 2924 or concurrent enrollment. Lectures, projects, and laboratory/problem sessions covering theory and advanced methods of reflection seismic methods and applications to energy exploration, carbon capture, paleosedimentation and paleotectonics. (F)

GPHY 4953 Senior Thesis in Geophysics 3 Credit Hours
Prerequisite: senior standing with a major in geophysics and permission. May not be repeated. Individual research of a geophysical topic selected by the student in consultation with the instructor. The project may involve fieldwork, theoretical analysis, computer modeling, and/or data analysis and interpretation, culminating in a written thesis. (F, Sp, Su) [V].

GPHY 4960 Directed Readings 1-4 Credit Hours
1 to 4 hours. Prerequisite: good standing in University; permission of instructor and dean. May be repeated; maximum credit four hours. Designed for upper-division students who need opportunity to study a specific problem in greater depth than formal course content permits. (Irreg.)

GPHY G4970 Seminar 3 Credit Hours
1 to 3 hours. Prerequisite: permission of instructor. May be repeated with change of content; maximum credit nine hours. (F, Sp)

GPHY 4990 Independent Study 1-3 Credit Hours
1 to 3 hours. Prerequisite: three courses in general area to be studied; permission of instructor and department. May be repeated; maximum credit nine hours. Contracted independent study for topics not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (F, Sp, Su)

GPHY 5011 AASPI Seminar 1 Credit Hour
Prerequisite: Graduate Standing or Department/Instructor Permission. This 1-credit Attribute-Assisted Seismic Processing & Interpretation (AASPI) seminar is designed to cultivate a dynamic environment where students develop essential research skills, foster collaboration, acquire proficiency in coding and programming, and refine oral and written communication abilities. (F, Sp)

GPHY 5021 Geophysical Journal Seminar 1 Credit Hour
Prerequisite: Graduate Standing or Instructor Permission. This seminar course involves undergraduate and graduate students in selecting, reviewing, and discussing frontier research papers in geophysics about the solid Earth system and problems related to geo-hazards, energy, and the environment. Students will share research progress and discuss important topics for career development. (F, Sp)

GPHY 5023 Computational Geophysics 3 Credit Hours
Prerequisite: Graduate standing or permission of instructor. This course introduces concepts and practices in numerical modeling in geophysics, including the formulation of finite-difference and finite-element methods and their applications in problems of heat and fluid flow, deformation, and wave propagation. Students learn to program numerical methods in MATLAB or Python, use open-source software, and discuss topics about computational methods in seismology, geomechanics, and geodynamics. (F, Sp)

GPHY 5031 Near-Surface Geophysics Seminar 1 Credit Hour
Prerequisite: Graduate Standing or Instructor Permission. In this course, we will discuss the latest scientific research and learn about new approaches for studying near-surface problems. We will also learn how to develop a proposal and how to review papers. At the end, students should be able to analyze and review scientific geophysical articles. Additionally, students should be able to prepare presentations based on the articles discussed. (F, Sp)

GPHY 5153 Fractures, Faults, and Earthquakes 3 Credit Hours
(Slashlisted with GPHY 4153) Prerequisite: Graduate Standing or permission of instructor. This course provides an introduction to the principles of fracturing, brittle faulting and earthquake mechanics. We will examine content including: brittle failure, fractures, fluid-flow and hydrothermal alteration, the state of stress in Earth's crust, borehole interpretation of fractures and faults, fault rocks and structures, the strength, rheology, and friction of faults, the seismic cycle, and scientific drilling. No student may earn credit for both 4153 and 5153. (Irreg.)

GPHY 5203 Near-Surface Geophysics 3 Credit Hours
Prerequisite: graduate Standing or instructor permission. Near-surface geophysics is a branch of geophysics that deals with a zone that spans within a few 100s of meters of the Earth's surface. In near-surface geophysics, we use methods such as seismic refraction and electrical resistivity to address environmental, engineering (civil), forensic, archaeological and mineral exploration issues. There is a required Field Research project as part of this course.

GPHY 5303 Electrical Environmental Geophysics 3 Credit Hours
Prerequisite: graduate Standing or permission of instructor. Introduction to "electrical-based" near-surface geophysical methods and the application of these techniques to environmental and engineering studies. Participation in problems set in class is expected. A minimum of time equivalent to one day of fieldwork will be organized for each student: participation in fieldwork is mandatory as it provides an opportunity to work with the different geophysical methods.

GPHY 5364 Paleomagnetism 4 Credit Hours
Prerequisite: permission. Concerns the magnetic properties of minerals and rocks and the physical and chemical processes which produce them. Laboratory techniques used in investigations are discussed. (F)

GPHY 5413 Global Geophysics 3 Credit Hours
(Slashlisted with GPHY 4413) Prerequisite: Graduate standing or permission of instructor. Introduces geophysical concepts about the solid Earth, the structure and physical properties of Earth's shallow subsurface and deep interior, active tectonic processes and geological hazards on Earth, and the use of geophysical methods to study structure, processes, and resources. No student may earn credit for both 4413 and 5413. (F)

GPHY 5513 3-D Seismic Interpretation 3 Credit Hours
Prerequisite: graduate standing or permission of instructor. Principles of seismic stratigraphy, seismic geomorphology, structural geology, and rock physics to interpret seismic reflection data and associated attributes to delineate faults, fractures, folds, fluvial-deltaic complexes, turbidites, mass transport complexes, karst, and other structural and stratigraphic features of interest. Course is intended for graduate students in geophysics, geology, and petroleum engineering. Laboratory (F)

GPHY 5523 3-D Seismic Processing 3 Credit Hours
Prerequisite: GPHY 4874 or equivalent and MATH 3333. Theory and application of seismic signal analysis to modern 3-D surface seismic surveys including sorting, statics, deconvolution, coherent noise suppression, velocity analysis and migration. At the end of the course, the student will be able to apply appropriate modern work flows to 3-D land data surveys resulting in prestack time migrated images amenable to AVO, attribute, and velocity anisotropy analysis. (Sp)

GPHY 5533 Quantitative Seismic Interpretation 3 Credit Hours
Prerequisite: graduate standing, and GPHY 5513 or current research work in reservoir characterization or simulation. This course is the second part of a two-course sequence on seismic interpretation and will investigate the theoretical foundation and application of tools used in quantitative reservoir characterization. This course is intended for upper level graduate students in geophysics, geology, and petroleum engineering doing research in reservoir imaging, characterization, and simulation. (Sp-even yrs)

GPHY 5613 Introduction to Seismic Stratigraphy 3 Credit Hours
Prerequisite: Physics 2524, Mathematics 3333, or permission. Introduction to the stratigraphic interpretation of reflection seismic data, emphasizing 2-D exploration seismic reflection group analysis. Topics covered include the theory and practice of borehole constrained interpretation, analysis, and mapping of seismic sequences, fault mechanical stratigraphy, chronostratigraphy, seismic facies, relative changes in sea level, and integrated geohistory analysis with emphasis upon providing a foundation for petroleum system analysis. Seismic sections for the analyses are taken from varying tectonic and depositional settings worldwide. (Alt. F)

GPHY 5864 Gravimetric and Magnetic Exploration 4 Credit Hours
Prerequisite: Graduate standing, MATH 2924 or MATH 2433, PHYS 2524, or permission of instructor. Lectures and laboratory/problem sessions covering theory and applications of gravimetric and magnetic exploration. Includes potential theory, filtering, modeling and interpretation. Emphasis is on exploration for minerals, oil and gas. Concepts of geodesy and isostasy are briefly considered. Laboratory. (S.

GPHY 5960 Directed Readings 1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing and permission of department. May be repeated; maximum credit twelve hours. Directed readings and/or literature reviews under the direction of a faculty member. (F, Sp, Su)

GPHY 5970 Special Topics/Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: Graduate standing or permission of instructor. May be repeated; maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)

GPHY 5980 Research for Master's Thesis 2-9 Credit Hours
Variable enrollment, two to nine hours; maximum applicable toward degree, four hours. (F, Sp, Su)

GPHY 5990 Special Studies 1-3 Credit Hours
1 to 3 hours. Prerequisite: permission. May be repeated; maximum credit nine hours. Advanced special studies in geophysical problems. May include directed reading in geophysics, fieldwork, laboratory research or preparation of reports. (F, Sp, Su)

GPHY 6873 Seismic Imaging 3 Credit Hours
Prerequisite: Graduate standing. Seismic imaging is a fundamental tool to understand Earth's structure. This class will focus on various migrations used in exploration geophysics including ray-based and wavefield-based methods. Also, it will cover velocity analyses of the structure such as travel-time tomography and full-waveform inversion. (Sp)

GPHY 6950 Research 1-4 Credit Hours
1 to 4 hours. Prerequisite: graduate standing and permission of faculty supervisor. May be repeated with change of content; maximum credit 12 hours. Individual research in various areas of geophysics. (F, Sp, Su)

GPHY 6960 Directed Readings 1-6 Credit Hours
1 to 6 hours. Prerequisite: graduate standing and permission of faculty supervisor. May be repeated; maximum credit six hours. Supervised reading at an advanced graduate level. (F, Sp, Su)

GPHY 6970 Seminar 1-4 Credit Hours
1 to 4 hours. Prerequisite: graduate standing, permission. May be repeated with change of subject matter; maximum credit twenty hours. Directed seminar on selected aspects of geophysical knowledge and inquiry. (F, Sp)

GPHY 6980 Research for Doctoral Dissertation 2-16 Credit Hours
2 to 16 hours. Prerequisite: Graduate standing and permission of instructor; may be repeated. Directed research culminating in the completion of the doctoral dissertation. (F, Sp, Su)

GPHY 6990 Independent Study 1-3 Credit Hours
1 to 3 hours. Prerequisite: Graduate standing and permission of instructor. May be repeated; maximum credit nine hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)

Faculty

Last Name	First/Middle Name	Middle init.	OU Service start	Title(s), date(s) appointed	Degrees Earned, Schools, Dates Completed
Bedle	Heather		2018	ASSOCIATE PROFESSOR OF GEOSCIENCES, 2024; LISSA AND CY WAGNER PROFESSOR; EDITH KINNEY GAYLORD PREIDENTIAL PROFESSORSHIP, 2024	PhD, Northwestern Univ, 2008; MS, Northwester Univ, 2005; BS, Wake Forest Univ, 1999
Carpenter	Brett	M	2017	BRIAN E. AND SANDRA O'BRIEN PRESIDENIAL PROFESSORSHIP, 2025; WILLARD L. MILLER PROFESSOR, 2023; ASSOCIATE PROFESSOR OF GEOSCIENCES, 2023	PhD, Penn State Univ, 2012; MS, Penn State Univ, 2007; BS, Mansfield Univ of Pennsylvania, 2005
Cole	Selina		2022	ASSISTANT PROFESSOR OF GEOSCIENCES AND ASSISTANT CURATOR, SAM NOBLE MUSEUM, 2022	PhD, The Ohio State Univ, 2017; BS, James Madison Univ, 2012; AA, Danville Community College, 2009
Dulin	Shannon	A	2014	ASSISTANT PROFESSOR OF GEOSCIENCES, 2014; CHRIS J. CHEATWOOD DIRECTOR, BARTELL FIELD CAMP, 2020	PhD, Univ of Oklahoma, 2014; MS, Univ of Oklahoma, 2006; BS, Univ of Oklahoma, 2003
Engel	Michael	H	1982	PROFESSOR OF GEOSCIENCES, 1994; CLYDE BECKER, SR. CHAIR IN GEOLOGY AND GEOPHYSICS, 2009	PhD, Univ of Arizona, 1980; MS, Univ of Arizona, 1976; BA, SUNY at Binghamton, 1973
Filly	Timothy		2021	PROFESSOR, 2021; DIRECTOR OF INSTITUTE FOR RESILIENT ENVIRONMENTAL AND ENERGY SYSTEMS	Ph.D., 1997, The Pennsylvania State Univ; B.S., 1990, Loyola Univ
George	Sarah		2022	ASSISTANT PROFESSOR OF GEOSCIENCES, 2022	PhD, Univ of Texas at Austin, 2019; BA, Wellesley College, 2014
Hodges	Caitlin		2021	ASSISTANT PROFESSOR OF GEOSCIENCES, 2021	Ph.D., 2021 Soil Science and Biogeochemistry – Pennsylvania State Univ; M.S., 2017 Ecology – Univ of Georgia; B.S.E.S. 2014 Water and Soil Resources – Univ of Georgia
Hu	Hao			ASSISTANT PROFESSOR OF GEOSCIENCES, 2024	Ph. D, GEOPHYSICS, INSTITUTE OF GEOLOGY AND GEOPHYSICS, CHINESE ACADEMY OF SCIENCES; B.S, GEOPHYSICS, YUNNAN UNIVERSITY
Jepson	Gilby			ASSISTANT PROFESSOR OF GEOSCIENCES, 2022	Ph. D UNIVERSITY OF ADELAIDE; B.S UNIVERSITY OF ADELAIDE
Jiang	Junle		2020	ASSISTANT PROFESSOR OF GEOSCIENCES, 2020	Ph.D., 2016, Geophysics, California Institute of Technology, USA; Ph.D. minor, 2014, Computational Science and Engineering, California Institute of Technology, USA; M.S., 2011, Geophysics, California Institute of Technology, USA; B.S., 2009, Physics, Peking Univ, China
Lamadrid	Hector		2023	ASSISTANT PROFESSOR OF GEOSCIENCES, 2023	PhD, Virginia Tech, 2016; BS, National University of Mexico, 2005
Liu	Xiaolei		2017	NORMAN R. GELPHMAN PROFESSOR, 2023; ASSOCIATE PROFESSOR OF GEOSCIENCES, 2023	PhD, Univ of Bremen, 2011; MS, Chinese Acad of Sciences, 2007; BS, Shandong Univ, 2003
Lungmus	Jacqueline		2022	ASSISTANT PROFESSOR OF GEOSCIENCES; ASSISTANT CURATOR, SAM NOBLE MUSEUM, 2022	PhD, Univ of Chicago, 2020; MS, Univ of Chicago, 2016
Lupia	Richard	A	1999	FRANK & HENRIETTA SCHULTZ CHAIR, 2020; ASSOCIATE DIRECTOR AND HEAD CURATOR, SAM NOBLE OKLAHOMA MUSEUM OF NATURAL HISTORY, 2005; NORMAN R. GELPHMAN PROFESSOR, 2023; ASSOCIATE PROFESSOR OF GEOSCIENCES, 2005; ASSOCIATE PROFESSOR OF SAM NOBLE OKLAHOMA MUSEUM OF NATURAL HISTORY, 2005	PhD, Univ of Chicago, 1997; MS, Univ of Chicago, 1994; BA, Univ of Pennsylvania, 1991

Pranter	Matthew	J	2013	DIRECTOR, SCHOOL OF GEOSCEICNES AND EBERLY FAMILY CHAIR, 2023; PROFESSOR OF GEOSCIENCES, 2013	PhD, Colorado School of Mines, 1999; MS, Baylor Univ, 1989; BS, Colorado School of Mines, 1996; BS, Oklahoma State Univ, 1987
Soreghan	Gerilyn	S	1996	EDWARD L. MCCOLLOUGH CHAIR, 2023; DAVID L. BOREN PROFESSORSHIP, 2017	PhD, Univ of Arizona, 1992; BS, Univ of California Los Angeles, 1986
Soreghan	Michael	J	2005	JAMES ROY MAXEY CHAIR, 2020; PROFESSOR OF GEOSCIENCES, 2020	PhD, Univ of Arizona, 1994; MS, Univ of Indiana, 1990; BS, Univ of California Los Angeles, 1986
Wright	David		2022	ASSISTANT PROFESSOR OF GEOSCIENCES; ASSISTANT CURATOR, SAM NOBLE MUSEUM, 2022	PhD, The Ohio State Univ, 2016; MS, Ohio Univ, 2012; BS, Univ of Kansas, 2010