

# Geological Sciences

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*Master of Arts  
Master of Science in Geological Sciences  
Doctor of Philosophy*

## For More Information

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## Facilities for Graduate Work

Austin provides an ideal base from which to conduct research projects in all aspects of geological science. The University's central Texas location gives students ready access to exposures of Phanerozoic siliciclastic and carbonate strata and Precambrian igneous and metamorphic basement rocks. The presence of a karst aquifer beneath the city of Austin allows students to study issues related to urbanization, the demand for water, and contamination. Field-intensive studies for master's and doctoral degrees are continually in progress in Texas and in many other states. Field research is currently being conducted on every continent and ocean basin.

Analytical facilities are comprehensive and up-to-date. The electron-microbeam laboratory houses a JEOL JXA-8200 electron microprobe with five wavelength-dispersive spectrometers and an energy-dispersive spectrometer, as well as a Phillips/FEI XL30 environmental scanning electron microscope and a JEOL T330A scanning electron microscope, both of which are equipped for energy-dispersive chemical analysis, cathodoluminescence imaging and spectroscopy, and orientational analysis using electron backscatter diffraction. Two inductively coupled plasma mass spectrometers are available for elemental and isotopic analysis of diverse geologic materials: a Micromass magnetic-sector multicollection device with nine Faraday cups, a Daly ion-counting channel, and three ion-counting channeltrons; and an Agilent quadrupole device. Both instruments can be interfaced with a Merchantek 213-nm-wavelength laser-ablation unit for spatially resolved analysis. These instruments are complemented by a Finnigan-MAT 261 thermal ionization mass spectrometer with seven Faraday cups and one ion-counting channel. Ultraclean laboratories support preparation of samples for rubidium-strontium, uranium-lead, U-series disequilibrium dating, samarium-neodymium, and other isotopic analysis. Additional geochemical instrumentation includes two VG gas-source mass spectrometers for hydrogen, oxygen, nitrogen, and carbon stable-isotope analysis, and a Micromass Multiprep automated preparation system for water and carbonate analyses.

The Department of Geological Sciences houses a dual high-resolution X-ray computed tomographic scanner used for nondestructive three-dimensional visualization and analysis of the internal structure of geologic samples; a Siemens D500 X-ray diffractometer with Datascan automation software and JADE pattern analysis; and a paleomagnetic laboratory with a shielded room, 2G cryogenic magnetometer, Bartington susceptibility meter, and ASC impulse magnetizer. Special microscopy facilities incorporate an Edge R400 real-time high-resolution three-dimensional light microscope; a USGS-type gas-flow fluid inclusion stage; and a Technosyn luminoscope. Among additional facilities are

a 1-m × 1.5-m × 10-m flume for sediment transport studies and an experimental petrology laboratory containing hydrothermal pressure apparatus and one-atmosphere gas-mixing furnaces.

Geophysical research employs portable multichannel seismographs with vertical and three-component geophones; a ground-penetrating radar system; a LaCoste-Romberg gravimeter; an airborne Optech LIDAR system for fine-scale topographic mapping; an Optech ILRIS tripod-mounted laser scanning system for very-high-resolution outcrop topography; five portable broadband Guralp seismographs for teleseismic studies; two Vibroseis seismic sources, for both low- and high-frequency three-axis shaking; 10 dual-frequency geodetic-quality GPS receivers with choke-ring antennas; portable field magnetometers; and an aerogeophysical instrument package (radar, gravity, LIDAR, magnetometers) most often used in Antarctica. A field site south of San Antonio is available for calibration and testing of seismic instruments and techniques. Graduate students are frequent members of scientific crews on vessels of the University-National Oceanographic Laboratory System and of other nations, and students regularly conduct fieldwork in Antarctica using National Science Foundation Polar Programs facilities.

Facilities for data processing, data interpretation, and numerical simulation are extensive. There are multiple workstation clusters with Sun and SGI hardware, as well as Windows and Macintosh systems. Most major commercial software packages for seismic data processing and interpretation are available, along with software for GIS, potential field, synthetic aperture radar, and other applications.

The two research components of the Jackson School—the Bureau of Economic Geology and the Institute for Geophysics—are housed in adjoining buildings on the J. J. Pickle Research Campus. The two units contribute the expertise of more than 50 research scientists to the Jackson School. The bureau functions as the state geological survey for Texas and sells many different types of publications to the public. The institute includes the Hockley Seismic Station, located in Hockley, Texas, just north of Houston. The station, part of the IRIS Global Seismic Network, houses a broadband seismometer that collects information on global as well as Texas seismic events.

Reference materials include the 165,000-item Joseph C. and Elizabeth C. Walter Geology Library and Tobin International Map Collection, both located in the John A. and Katherine G. Jackson Geological Sciences Building. Research collections of about one million vertebrate paleontology specimens and about four million nonvertebrate specimens, including a type collection of about five thousand specimens, are housed at the J. J. Pickle Research Campus. The Bureau of Economic Geology maintains three major core storage facilities, containing nearly two million boxes of core and cuttings, mostly from North American sedimentary basins. The bureau also maintains a collection of nearly one million electric logs from Texas oil and gas wells.

Research support is provided by a well-equipped petrographic laboratory with a separate thin-section laboratory for student use, a machine shop, and an electronics shop. The department's staff includes analytical chemists, computer support specialists, a petrographic section technician, a computer graphics specialist, a photographer, and a machinist.

## Areas of Study

Areas of active research in the Department of Geological Sciences include studies in sedimentary depositional systems; hydrogeology; climate systems science; structural geology; marine geology and geophysics; regional tectonics; seismology; paleomagnetism; seismic reflection and refraction; isotope and aqueous geochemistry; sedimentary geochemistry; geomicrobiology; igneous, sedimentary, and metamorphic petrology; high-temperature geochemistry; ore deposits

and industrial mineral resources; and vertebrate and invertebrate paleontology. Cooperative research projects are under way with the Center for Space Research, the Institute for Geophysics, and the Bureau of Economic Geology.

## Graduate Studies Committee

The following faculty members served on the Graduate Studies Committee (GSC) in the spring 2023 semester.

Nathan L Bangs	John C Lassiter
Jay L Banner	Stephen E Laubach
Jaime D Barnes	Luc L Lavier
Thorsten Becker	Jung-Fu Lin
Christopher J Bell	Robert G Loucks
Srinivas V Bettadpur	Christopher Lowery
Donald D Blankenship	Matthew Alan Malkowski
Daniel O Breecker	Rowan Clare Martindale
Meinhard Bayani Cardenas	Ashley Michelle Matheny
Ginny A Catania	Tip Meckel
Elizabeth Jacqueline Catlos	David Mohrig
Jingyi Chen	Claudia I Mora
Julia Allison Clarke	Lorena G Moscardelli
Mark P Cloos	Sharon Mosher
Kerry H Cook	Maria-Aikaterini Nikolinakou
Jacob Aaron Covault	Dev Niyogi
Ian W Dalziel	Yuko M Okumura
Peter Eichhubl	Cornel Olariu
Peter Barry Flemings	Geeta Persad
Sergey B Fomel	Daniella M Rempe
James E Gardner	Timothy B Rowe
John A Goff	Demian M Saffer
Timothy Andrew Goudge	Mrinal K Sen
Stephen P Grand	Timothy Michael Shanahan
Sean S Gulick	Kyle Thomas Spikes
Patrick Heimbach	Daniel Stockli
Marc Andre Hesse	Chenguang Sun
Brian K Horton	Scott W Tinker
Xavier Janson	Nicola Tisato
Joel Peterson Johnson	Harm J Van Avendonk
Melissa Kemp	Zong-Liang Yang
Charles Kerans	Duncan A Young
Richard A Ketcham	Michael Howard Young

## Admission Requirements

The preliminary education of students who intend to become candidates for a graduate degree in geological sciences usually includes coursework in general geology, paleontology, mineralogy, petrology, structural geology, and field geology, as well as physics, chemistry, and calculus. Geophysicists and climatologists are expected to have a sound foundation in both mathematics and physics; paleontologists should include suitable preparation in the comparative morphology and genetics of living organisms. Students without the necessary foundation for advanced study and research may be required to take additional coursework.