12. Organic Geochemistry Lab

The Organic Geochemistry Lab has been developed to study hydrocarbon chemistry and source-rock properties. The lab's capabilities include identification and quantification of 18 gas components; oil extraction from organic-rich shales; liquid hydrocarbon identification and quantification with GCMS; analysis of source rocks, including surface area, pore volume, and pore-size distribution; and high-temperature, high-pressure rock/brine interaction experiments.

Existing Equipment: Lab equipment includes a custom-built, high-pressure, pure gas adsorption/desorption system, an Agilent 7890A gas chromatograph, a custom rock-crusher sample cell and Spex sample prep 800M mixer/mill for use with GC system, a Shimadzu GCMS-QP2010S gas chromatograph/mass spectrometer, a Foss Soxtec 2043 extraction unit, and a Quantachrome Autosorb iQ-MP physisorption analyzer capable of monitoring pores from 0.35 to 300 nm in diameter.

Contact: Dr. Tongwei Zhang; phone: 512-232-1496,
e-mail: tongwei.zhang@beg.utexas.edu

13. Porosity, Permeability, and Pore-Scale Processes (P^4) Lab

The P^4 Lab, which is still under development, was established with a general focus on multiscale characterization of pore-system and fluid-flow processes in tight formation, including mudrock and tight carbonates. Laboratory and pore-scale imaging techniques are applied to macro-scopic rock-property measurements and microscale pore network/fluid-flow characterization, respectively.

Existing Equipment: Lab equipment includes a CoreLab UltraPore-200, a CoreLab SMP-300, a NextGen 3D Laser Scanner, a Hassler Core Holder, an Enerpac Manual Hydraulic Pump, a vacuum oven, and stainless steel sieves.

Contact: Dr. Sheng Peng; phone: 512-232-7619,
e-mail: sheng.peng@beg.utexas.edu

14. Rock Mechanics Lab

The Rock Mechanics Lab uses a new triaxial load frame to collect static and dynamic elastic rock properties at confining and pore pressures up to 140 MPa and temperatures up to 150°C. The triaxial test allows accurate measurement of parameters such as unconfined compressive strength (UCS), yield strength, Young's modulus, Poisson's ratio, and ultrasonic properties including compressional and shear velocity.

Existing Equipment: Lab equipment includes a GCTS RTR-1000 Rapid Triaxial Rock Testing System, Core Lab Profile Permeameter, Olson Instruments NDE-360 Pulse Velocity System, and a Proceq Equotip Portable Hardness Tester.

Contact: Donnie Brooks; phone: 512-471-2403,
e-mail: donnie.brooks@beg.utexas.edu

15. Scanning Electron Microscope (SEM) Lab

The SEM Lab provides micro- to nanoscale SEM imaging and chemical analysis of various rock types. The lab is critical to a diverse range of funded research projects in the areas of reservoir characterization, fracture measurements and interpretation, and unconventional resources.

Existing Equipment: A newly acquired Zeiss Sigma High Vacuum Field Emission SEM is devoted to generation of large-area, high-resolution, automated image mosaics for fracture-scaling studies. An older Nova NanoSEM field-emission unit is devoted to high-resolution SE, BSE, CL, and X-ray mapping for fine-grained rocks. The lab also has two ion beam milling systems (Leica TIC 3X and Leica TIC020) that are used to create extremely flat rock surfaces for high-resolution SEM imaging.

Contact: Dr. Jiemin Lu; phone: 512-475-9525, e-mail: jiemin.lu@beg.utexas.edu

16. Sedimentary Analysis Lab

The Sedimentary Analysis Lab houses instru-mentation and facilities for treating rocks and sediments for XRD, microscopic, and other analyses. The lab provides the ability to make randomly oriented rock powders using methods of wet grounding and spray drying for XRD quantitative analysis.

Existing Equipment: For quantitative XRD sample preparation, there is a ball mill, a McCrone MicroNising Mill for wet grinding and mixing, and a spray dryer. A sonicator is used for disintegrating rock samples, and a high-speed centrifuge is used for separating clay minerals. A vacuum pump and a filtering system are used for making oriented clay films.

Contact: Dr. Jiemin Lu; phone: 512-475-9525, e-mail: jiemin.lu@beg.utexas.edu

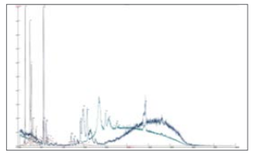
17. Soil Characterization Lab

This lab supports a wide range of soil and soil/water analyses, as well as in situ sensor calibration and near-surface geophysical measurements. Its primary function is to derive saturated and unsaturated hydraulic properties of soils and sediments.

Existing Equipment: Lab equipment includes a Malvern MS-3000 Laser Particle Size Analyzer, Decagon Hyprop System, Decagon KSAT, and Decagon WP4T water potential meters.

Contact: Dr. Todd Caldwell; phone: 512-471-2003,
e-mail: todd.caldwell@beg.utexas.edu

18. Wet Chemistry Lab



The Wet Chemistry Lab provides facilities to perform chemical analyses and research experiments on solid synthetic and natural materials and associated geofluids. The lab is multifunctional, providing space and resources for projects associated with mineral resources, ore-forming fluids, geochemical and petrological modeling, and characterization of materials. This is the only lab at the Pickle Research Campus with a mineral-resource focus; it conducts research on a range of material from rare earth elements, uranium, base metals, gold, and silver to industrial sand, aggregate, and cement products. The lab is outfitted with X-ray fluorescence (XRF) equipment for elemental abundance characterization and high-powered petrographic microscopes with transmitted, reflected, and fluorescence capabilities. The lab also has high-flow chemical hoods and mineral-separation equipment to accommodate a wide variety of whole-rock material and geochemical processing.

Existing Equipment: Lab equipment includes the Nikon SMZ800 stereoscopic microscope and Eclipse LV100POL petrographic microscope equipped with transmitted, reflected, and C-HGFI fluorescence. The lab also has a Thermo Scientific Niton XL3t GOLDD+ XRF analyzer and equipment for mineral sieving, sorting, and general processing. Lab equipment includes the Nikon SMZ800 stereoscopic microscope and Eclipse LV100POL petrographic microscope equipped with transmitted, reflected, and C-HGFI fluorescence. The lab also has a Thermo Scientific Niton XL3t GOLDD+ XRF analyzer and equipment for mineral sieving, sorting, and general processing.

Contact: Dr. Brent A. Elliott; phone: 512-471-1812, e-mail: brent.elliott@beg.utexas.edu
Dr. Seyyed A. Hosseini; phone: 512-471-2360, e-mail: seyyed.hosseini@beg.utexas.edu

Bureau of Economic Geology

Laboratory Facilities and Capabilities

1. Applied Geodynamics Physical Modeling Lab

This lab studies salt tectonic processes using scaled physical models run under a variety of driving forces, including gravity and differential loading, extension, contraction, and strike-slip. Founded in 1989, this is one of the only laboratories in the world whose sole purpose is the study of salt tectonic processes.

Existing Equipment: Three multifunction deformation rigs can accommodate models up to 2 m long and 1.5 m wide. Models are recorded using standard high-resolution digital cameras (Canon Rebel T1i and T2i). In addition, the upper surfaces of the models are recorded using LaVision Strainmaster stereo digital image correlation system (x2), allowing us to track motions and surface strains in 3D. Additional surface monitoring is done by a Basis Surphaser laser scanner.

Contact: Dr. Tim Dooley; phone: 512-475-9565, e-mail: tim.dooley@beg.utexas.edu

2. Core Sawing and Processing

All core sawing and sampling takes place in this lab. Whole cores are slabbed into usable sets, and thin section stubs are cut and sent to labs that create thin section slides for microscopy. Permeability and porosity plugs are cored using a modified drill press machine. Larger saws are available for cutting outcrop samples taken from the field. This lab also has a hydraulic rock splitter and a rock-crusher machine.

Existing Equipment: Lab equipment includes two Husqvarna masonry saws with 14" continuous-rim diamond blades; a Husqvarna masonry saw with 20" slotted diamond blade; a Hillquist trim saw with 10" continuous-rim diamond blade; a Covington 36" blade enclosed saw; a Hillquist Thin Section Machine; a Wilton drill press (Plugger); a hydraulic rock splitter; a "Chipmunk" rock-crusher machine; and additional Plugger and trim saw belonging to the Rock Mechanics Lab.

Contact: Nathan Ivicic; phone: 512-475-9561, e-mail: nathan.ivicic@beg.utexas.edu

3. Experimental Fracture Diagenesis Lab

This lab's experiments focus on quartz cement growth in artificial fractures in single quartz crystals, unconsolidated sand grains, and sandstone. The goal of the lab is to explore the interaction between fracture opening and fracture cement precipitation, as well as growth interactions between host rock and mineral cement and how these interactions affect patterns of fracture aperture and cement textures.

Existing Equipment: The hydrothermal experimental system consists of six externally heated cold-seal pressure vessels with operation temperature and pressure conditions of up to 800°C and 350 MPa (~50 kPsi). The lab is also equipped with a full set of sample preparatory equipment.

Contact: Dr. András Fall; phone: 512-471-8334, e-mail: andras.fall@beg.utexas.edu

4. Fluid Inclusion Microscopy and Microthermometry Lab

This lab provides information on the composition of aqueous and hydrocarbon fluids, temperature and pressure conditions during fluid migration, and conditions and timing of pore and fracture cement growth. Research performed here addresses migration of oil, water, and gas in conventional and unconventional hydrocarbon systems and in geothermal systems.

Existing Equipment: Lab equipment includes an Olympus BX 51 optical microscope, fitted for use with transmitted, reflected, and UV light; a FLUID, Inc.–adapted USGS-type gas flow heating/cooling stage; a Linkam THMSG 600° C programmable heating/cooling stage; and a digital camera. The lab is fully equipped with sample preparatory facilities for doubly-polished thin and thick sections. Synthetic fluid inclusions for inclusion standards and the study of phase behavior of complex fluids can be prepared using the experimental hydrothermal lab setup of the adjacent Experimental Fracture Diagenesis Lab.

Contacts: Dr. Peter Eichhubl; phone: 512-475-8829, e-mail: peter.eichhubl@beg.utexas.edu

Dr. Andras Fall; phone: 512-471-8334, e-mail: andras.fall@beg.utexas.edu

5. Geochemistry Lab

Work in the Geochemistry Lab centers on major elemental analyses of groundwater and formation brines used in hydrogeology investigations. Laboratory-based experiments run between 0 and 150°C, and between 1 and 300 bar of pressure are used to examine water/rock interaction.

Existing Equipment: Lab equipment includes two Dionex ICS-1100 Ion Chromatography systems equipped with an ASAP auto-sampler, and a Thar industries high-pressure/high-temperature autoclave system with supercritical CO_2 pump.

Contact: Dr. Patrick Mickler; phone: 512-232-7125, e-mail: pat.mickler@beg.utexas.edu

6. Hydrology Lab

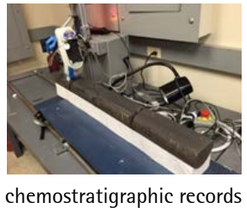
The Hydrology Lab supports a wide range of environmental studies in surface water, groundwater, and unsaturated zone hydrology. The lab has an inventory of field equipment and sampling systems to obtain surface water samples, groundwater samples, and unsaturated zone soil/sediment samples, as well as the equipment and facilities to perform geochemical and physical analyses on these samples.

Existing Equipment: Lab equipment includes a multilevel groundwater well-sampling system, Geoprobe 6620DT, Turner Designs 10-AU-005-CE Field Fluorometer, Durridge RAD7 Radon Detector, and two Dionex ICS-2000 Ion Chromatography systems equipped with an AS50 auto-sampler.

Contacts: Robert Reedy; phone: 512-471-7244, e-mail: bob.reedy@beg.utexas.edu

Dr. Bridget Scanlon; phone: 512-471-8241, e-mail: bridget.scanlon@beg.utexas.edu

7. Inorganic and Stable Isotope Geochemistry Lab

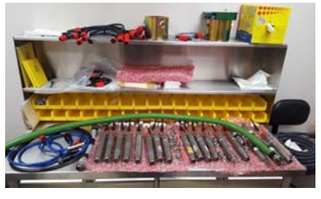


This lab provides rapid, bulk elemental analysis of rock materials—critical for the overall stratigraphic characterization of drill cores. Much of the funded research is focused on generating highly resolved (centimeter-scale) chemostratigraphic records from mudstone and limestone successions.

Existing Equipment: Six Bruker Tracer X-ray fluorescence (XRF) spectrometers are devoted to generating high-quality chemostratigraphic results. An Olympus BTX X-ray diffraction (XRD) unit provides semiquantitative results for establishing sample mineralogy. The ThermoFinnigan Delta V stable isotope ratio mass spectrometer (IRMS) with GasBench and Conflo-IV devices is a workhorse for isotopic studies. Total organic carbon and nitrogen are generated using a Costech ECS-4010 unit, coupled via Conflo-IV to the IRMS.

Contact: Dr. Harry Rowe; phone: 817-505-5819, e-mail: harry.rowe@beg.utexas.edu

8. Marine Seismic Lab

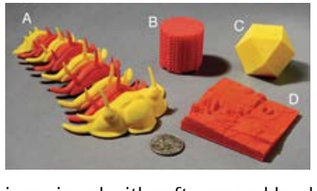


The Marine Seismic Lab houses and develops capability for ultra-high-resolution 3D marine seismic acquisition in the field. The system specializes in meter-scale vertical and horizontal resolution for the upper kilometer beneath the seafloor.

Existing Equipment: The P-Cable seismic acquisition system includes 12 x 25 m, 8-channel streamers, digitizers, SPSU, pneumatic acoustic sources, and supporting equipment.

Contact: Dr. Tip Meckel; phone: 512-471-4306, e-mail: tip.meckel@beg.utexas.edu

9. Micro-Model Lab



The Micro-Model Lab is developed to design and build small-scale, high-resolution porous and nonporous models for fluid-flow analysis and educational topics related to geoscience. The lab is equipped with software and hardware to design high-resolution models, including a 3D printing machine directly connected to computer systems and used to print PLA/ABS materials into the models. Samples created in this lab will be handled and post-processed in the adjacent Wet Sample Rock Chemistry Lab.

Existing Equipment: This new lab currently has no equipment. (Figure courtesy of GeoFabLab, Iowa State University. (A) fossil, (B) reservoir rock, (C) crystal model, and (D) topography print.)

Contact: Dr. Seyyed A. Hosseini; phone: 512-471-2360, e-mail: seyyed.hosseini@beg.utexas.edu

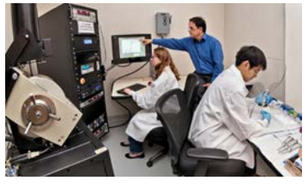
10. Nanogeosciences Lab

The Nanogeosciences Lab uses force spectroscopy tools to study features at the nanoscale. Of primary interest is the force field of fluid molecules or nanoparticles (bare and coated with engineered polymers), as well as pore walls of geological settings such as saline aquifers (CO_2 storage and sequestration) and unconventional shale gas reservoirs (oil and gas flow).

Existing Equipment: The lab is equipped with a state-of-the-art atomic force microscopy (AFM), Zeiss light microscope with high-frequency capture camera, ultraviolet (UV) particle analyzer, packed column transport setup, and computational facilities.

Contact: Dr. Farzam Javadpour; phone: 512-232-8068, e-mail: farzam.javadpour@beg.utexas.edu

11. Nano-Metrology (VSM) Lab



This lab is undertaking an extensive metrology study to compare and catalog magnetic nanoparticles (MNP's) for their usefulness in illuminating waterflood and frac-network imaging. The immediate need is to examine the usefulness of MNP's with high magnetic permeability as passive tracers that will travel in the injected waterflood front and that can be imaged using geophysical tools.

Existing Equipment: The Vibrating Sample Magnetometer (VSM), a high-throughput alternative to a Superconducting Quantum Interference Device (SQUID), is suitable for detailed analysis of magnetic characteristics of nanoparticles, including full hysteresis loop and initial magnetic permeability measurements at a field-intensity range of 0 to -/+1.7 Tesla at a temperature range of -40° C to 800° C.

Contact: Dr. Mohsen Ahmadian; phone: 512-471-2999, e-mail: mohsen.ahmadian@beg.utexas.edu