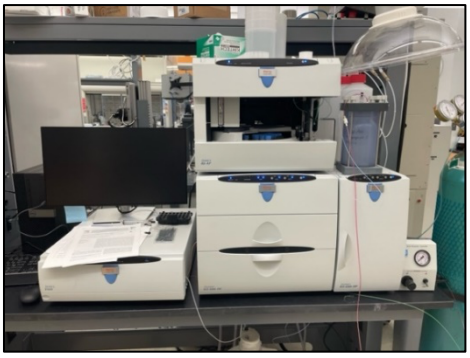
Geo-technology Laboratory (GTL) Instrumentation/Equipment

School of Energy Resources – Center for Economic Geology Research

Energy Innovation Center (EIC) #277

University of Wyoming – Laramie, WY 82071

The School of Energy Resources' (SER) Center for Economic Geology Research (CEGR) provides access to facilities and equipment for both researchers and students. The primary CEGR facility is located in Energy Innovation Center (EIC) Room #277 and houses a suite of sample preparation equipment and analytical instrumentation useful for a variety of scientific methods. In addition to the equipment/instrumentation listed below, the CEGR facility is also fully outfitted with supporting laboratory tools such as weighing balances and hot plates/stirrers. For questions and to schedule facilities training/access, please contact Tyler Brown (tbrown46@uwyo.edu) and Cole Messa (cmessa@uwyo.edu). Facilities access is contingent upon completion of laboratory safety training and laboratory personnel availability, but accommodations to facilitate access will be made as soon as possible. SER values collaboration and promotion of its shared facilities. To ensure that EIC #277 remains useable for future researchers, strict adherence to laboratory protocols is required. Failure to follow laboratory protocols could result in access being revoked. Scheduling is based on a first come, first served basis.

Instruments/Equipment	
Dionex ICS-6000 HPIC System • Highly configurable and modular Thermo Scientific Dionex ICS-6000 HPIC ion chromatography (IC) system • Outfitted with a Dionex ICS-Series VWD/UV-Vis absorbance detector • Can address a range of IC applications, from 2-D IC for trace-level analysis to high-performance anion-exchange chromatography with pulsed amperometric detection (HPAE-PAD) for complex carbohydrate analysis • Offers both high pressure and capillary ion exchange chromatography capabilities • Operates at up to 5000 psi	 Dionex ICS-6000 HPIC System in the GTL at the University of Wyoming's School of Energy Resources.

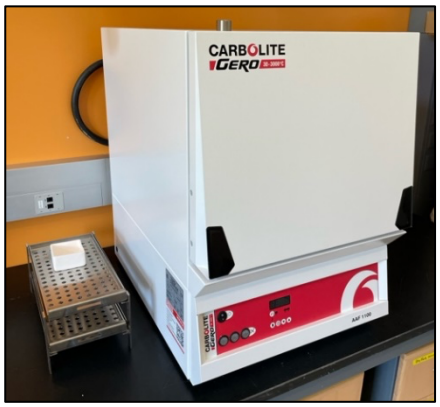
Dionex ASE 350 Accelerated Solvent Extractor

- For use with *Dionex ICS-6000 HPIC System*
- Extraction, filtration and clean-up of compounds from solid and semisolid samples
- Accommodates sample sizes of 1-100g and allows unattended extraction of up to 24 samples
- Uses 50-90% less solvent compared to other solvent extraction methods
- Supports acid and alkaline sample matrices and solvents

Dionex ASE350 in the GTL at the University of Wyoming's School of Energy Resources.

Carbolite Gero AAF Ashing Furnace

- Vented furnace that can ash samples at up to 1100°C
- Ramp to set-point and process timer
- Ideal for ashing foods, plastics, coal and other hydrocarbon materials
- Two tier sampling tray, sample loading handle, and 16 square crucibles ensure safe handling and maximum sample throughput



Carbolite Gero Ashing Furnace in the GTL at the University of Wyoming's School of Energy Resources.

Spex 8000M Ball Mill

- A high-energy ball mill used to grind, pulverize, or mix samples to analytical fineness
- Grinds samples ranging from 0.2 – 10 g
- Sample vial is shaken in complex motion which develops strong intra-vial G-forces
- Capable of pulverizing the toughest rocks, slags and ceramics in minutes

Spex 8000M Ball Mill in the GTL at the University of Wyoming's School of Energy Resources.

Fisher Scientific Model 664 Drying Oven

- Used for drying, curing and heating samples involved in laboratory applications
- Adjustable temperature up to >500°F
- Gravity convection ensures consistent and uniform heating
- Spacious interior and three drying trays/grates accommodate larger volume samples or multiple samples
- User-friendly interface allows for easy temperature setting

Model 664 Drying Oven in the GTL at the University of Wyoming's School of Energy Resources.

Humboldt Motorized Sieve Shaker

- Used for consistent particle separation for particle size analysis of a wide ranges of material types and sizes
- Ideal for accurate particle size determinations of soils, sand, and aggregates
- Can be used with 8", 10" and 12" sieves
- Can handle up to eleven 8" sieves, seven 10" sieves, seven 12" full-height sieves, nineteen half-height 8" sieves or thirteen half-height 12" sieves
- 1/4 hp motor with a 30-minute timer

Motorized Sieve Shaker in the GTL at the University of Wyoming's School of Energy Resources.

Diamond Core Drilling & Cutting System

- Used for precision drilling and cutting of hard materials such as rocks, ceramics, metals, and composites during sample preparation
- System includes a high-powered drill and saw equipped with diamond-tipped bits/blades

Diamond Core Drilling & Cutting System in the GTL at the University of Wyoming's School of Energy Resources.

Barnstead Smart2Pure Water Purification System

- Converts tap water to ASTM ultrapure Type 1 water
- Fitted with an internal 6L tank and vent filter, RO/pretreatment cartridge, ultrapure polisher cartridge, sterile 0.2 µm filter, pressure regulator, UV lamp and UF filter
- Variable speeds to control fluid flow

In-lab picture coming soon.

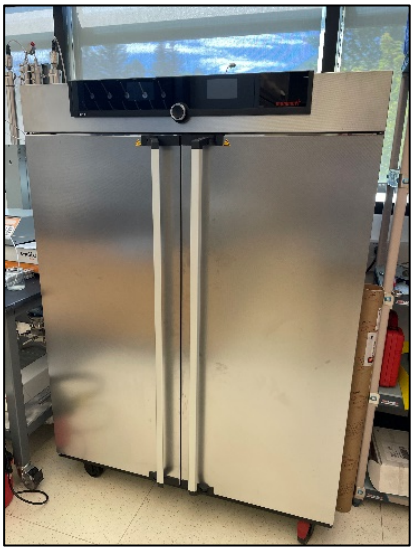
Particulate Systems High-Pressure Volumetric Analyzer (HPVA II)

- Uses static volumetric method to obtain high-pressure adsorption and desorption isotherms utilizing gases such as hydrogen, methane, and carbon dioxide
- Can analyze a variety of materials, including MOFs, zeolites, and microporous carbons
- Useful for investigating concepts related to hydrogen storage, carbon dioxide sequestration, fuel cells and batteries, and hydrocarbon traps
- Pressure range: high vacuum to 100/200 bar
- Temperature range: cryogenic to 500°C
- Fully automated analysis
- Handles typical adsorbates such as nitrogen, hydrogen, methane, argon, oxygen, and carbon dioxide

HPVAII system in the GTL at the University of Wyoming's School of Energy Resources.

Memmert Core Flooding System

- Replicates dynamic interaction between fluids and geological formations under conditions resembling those found in natural reservoirs
- Consists of a core holder, pumps for injecting fluids at controlled pressures and flow rates, pressure sensors to monitor fluid pressures, and systems for collecting and analyzing effluent fluids
- Useful for investigating aspects of fluid permeability, assessing reservoir characteristics, testing enhanced oil recovery techniques, and optimizing production strategies



Core Flooding System in the GTL at the University of Wyoming's School of Energy Resources.

Zeiss Axio Observer AX10 Microscope

- Versatile research-grade instrument renowned for its optical clarity and advanced imaging capabilities
- Features a modular design with a wide range of objective lenses and contrast methods
- Allows for high-resolution observation and analysis of biological samples, materials, and live cells

Zeiss Axio Observer AX10 Microscope in the GTL at the University of Wyoming's School of Energy Resources.

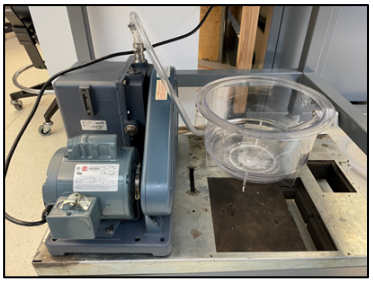
Zeiss Discovery V8 Microscope

- Binocular reflected light microscope with 8:1 zoom range magnification
- Equipped with fiber optic ring light with adjustable brightness
- The selectable click-stops for discrete magnification steps allow you to calibrate pixel sizes in the imaging software ZEN

Zeiss Discovery V8 Microscope in the GTL at the University of Wyoming's School of Energy Resources.

Clear Polycarbonate Vacuum Desiccator

- Removes air and moisture, maintaining dry conditions inside the desiccator to prevent moisture absorption by stored materials



Polycarbonate Vacuum Desiccator in the GTL at the University of Wyoming's School of Energy Resources.

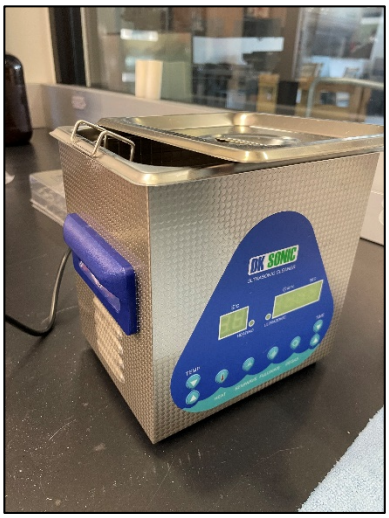
Phase Behavior PVT System

- Aids in the study of the thermo-physical properties of fluids such as phase behavior, density, viscosity, and more under diverse pressure, temperature and volume conditions
- Can examine various fluid types, such as black oil, volatile oil, heavy oil, and gas condensate

Phase Behavior PVT System in the GTL at the University of Wyoming's School of Energy Resources.

DK SONIC Ultrasonic Cleaner

- Provides effective and efficient cleaning of laboratory glassware and instruments
- Features a digital timer
- 0-80ºC temperature range
- 1-99 minutes working tim
- Degassing and degreasing function
- 28KHz for gross rinse or 40KHz for intensive rinse
- Auto stand-by, sleep, and wake-up by one key-press mode



DK SONIC Ultrasonic Cleaner in the GTL at the University of Wyoming's School of Energy Resources.

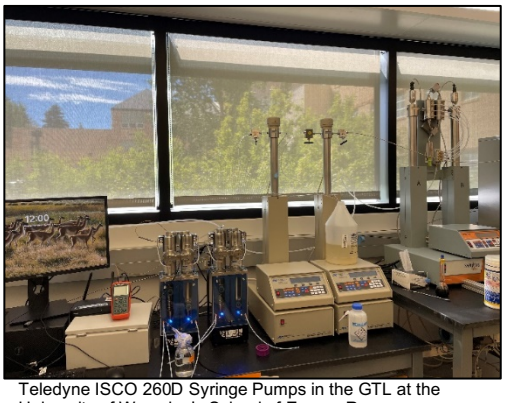
Thermo Scientific Revco FMS High-Performance Lab Refrigerator

- Protects flammable materials, solvents and intermediates
- Meets US Pharmacopeia standards for drug storage and NFPA safety provisions for flammable liquids storage
- Digital display featuring microprocessor control
- Lockable doors, audio and visual alarms

Revco Refrigerator in the GTL at the University of Wyoming's School of Energy Resources.

Teledyne ISCO 260D High Pressure Syringe Pumps

- Used for high pressure applications from deep well core analysis to multi-dimensional capillary LC
- Provides precise, predictable flow and pressure control
- Flow rates range from sub-microliter up to 107 mL/min
- Exceptional low-flow stability at up to 7,500 psi



Teledyne ISCO 260D Syringe Pumps in the GTL at the University of Wyoming's School of Energy Resources.

NER Sonic Pulser

- Ultrasonic pulse velocity test instrument used for investigating aspects of rock mechanics

NER Sonic Pulser in the GTL at the University of Wyoming's School of Energy Resources.

Soxhlet Solvent Extractor

- Used for extracting soluble analytes from a solid sample into an organic solvent

Soxhlet Solvent Extractor in the GTL at the University of Wyoming's School of Energy Resources.