

EarthScope Student Geochronology Research and Training Program Laboratory Plan

DRI Soil Characterization and Quaternary Pedology Laboratory

Jan. 20, 2021

Lab Overview

The cosmogenic sample preparation facility at DRI is located within the DRI Soil Characterization and Quaternary Pedology Lab. The lab consists of a range of facilities for complete physical and chemical characterization of soils and sediments, and for separation and isolation of ^{10}Be , ^{26}Al , and ^{36}Cl from bulk soil, sediment, or rock samples for measurement by accelerator mass spectrometry (AMS). Equipment includes HF-handling facilities for sample etching and dissolution, an inductively coupled plasma optical emission spectrometer (ICP-OES) for pre-dissolution sample assays, pipettes, balances, MilliQ water supply, a centrifuge, laminar flow HF-safe fume hoods, hot plates, an oxidation furnace, AMS cathodes and a cathode press, and sufficient lab-ware supplies for processing multiple batches of ~10 samples. Appropriate isotope carriers and quartz standards, acid and base solutions, resins for ion exchange chromatography, and Nb powder for oxide cathode packing are also provided. Rock crushing, milling, sieving, and magnetic and feldspar separation facilities are also available in the Soil Characterization Lab at DRI should students' home institutions not be equipped for the initial mineral separation steps.

Expected Time Frame

Maximum batch size is typically 10 samples, plus a standard and a blank. Students should be prepared to visit for ~1-2 weeks for their first batch of samples. AMS measurements are performed at outside AMS facilities such as the Lawrence Livermore National Laboratory Center for Accelerator Mass Spectrometry (LLNL-CAMS) and the Purdue Rare Isotope Measurement (PRIME) Laboratory and therefore are not part of the processing procedure learned by students at DRI.

The processing steps students will learn are:

- Quartz purity testing
- Carrier mass addition and sample dissolution
- Ion exchange chromatography
- Sample precipitation and oxidation
- Nb mixing and cathode pressing

Analytical Costs

Sample processing costs are \$557 per ^{10}Be sample and \$467 per ^{36}Cl sample. Costs for AMS measurements are additional and need to be arranged for by the visitor with the AMS laboratory. Students can arrange to visit these labs to learn measurement techniques. We can facilitate communication, but visitors must make their own arrangements to pay for AMS analyses and conduct visits.

Preparation for Visiting

Students should communicate with Dr. Brad Sion (brad.sion@dri.edu) regarding their mineral separation needs well in advance of their arrival. Although DRI does host mineral separation facilities, these procedures are time consuming and are most cost effectively accomplished prior to arrival at DRI. Ideally, students should arrive with pure quartz or feldspar separates, having conducted appropriate mineral separation procedures (i.e., density separation or froth floatation) ahead of time.

Laboratory Staff

Visitors will work primarily with Dr. Brad Sion and Janelle Bustarde. Sion is a research faculty at DRI and manages the cosmogenic sample preparation laboratory. He will collaborate on student projects and assist with data interpretation and publication. Bustarde is a laboratory technician and carries out the day-to-day operations of the laboratory.

Data Processing and Interpretation

After AMS measurements are received, students will be guided through the basic calculation required to convert AMS ratios to nuclide concentrations, including the proper methods for propagating errors. Students will be introduced to the commonly used surface exposure age calculators used for surface clasts and depth profile sampling. Instruction in age interpretations will vary with the application, nuclide and type of geologic feature sampled.

Laboratory Availability

Students should schedule their visit to the DRI cosmogenic preparation facility 1-2 months ahead of their intended arrival date.

Contact Information

All questions regarding laboratory facilities and capabilities should be directed to Dr. Brad Sion (brad.sion@dri.edu).