EarthScope Student Geochronology Research and Training Program Laboratory Plan
NSF/UVM Community Cosmogenic Facility
Updated November 2019

*****The AGeS program limits the number of proposals to four per facility; accordingly, we will need to choose only the four which fit best our capabilities and expertise. If you wish to work with us (and we hope you do!), we require a pre-proposal at least one month before the AGeS submission deadline. We will then pick the four pre-proposals that most closely align with our mission and ask for full proposals at that time******

Laboratory Overview

We are a hands-on, community and learning-centered laboratory funded by the National Science Foundation and housed at University of Vermont. We host student, faculty, and staff visitors of all experience levels to process samples for cosmogenic nuclide analysis, learn laboratory methods, collaborate, and work with a community of colleagues from around the world.

The Community Cosmogenic Facility (CCF) is equipped to isolate both the *in situ* and meteoric cosmogenic nuclide ^{10}Be from soils, rock and sediment for measurement by accelerator mass spectrometry (AMS). We can also process samples for ^{26}Al, produce low blank ^{10}Be carrier, purify quartz, and test quartz purity.

For meteoric samples, equipment includes HF- and Perchloric acid-handling facilities, Pt crucibles, MilliQ water supply, balances, hot plates, pipettes, laminar-flow HF-safe fume hoods, ovens, a fluxing stand, a torch, Pt-tipped tongs, plastic forceps and rods, a centrifuge, tubes and beakers and sufficient labware for processing 14 samples each week along with an associated blank and internal standard.

For *in situ* samples, equipment includes HF- and Perchloric acid-handling facilities, teflon labware, MilliQ water supply, balances, hot plates, pipettes, column chromatography set-ups, laminar-flow HF-safe fume hoods, ovens, a centrifuge, tubes and beakers, and sufficient labware for processing 10 samples each week along with an associated blank and internal standard.

For both of the above, appropriate isotope carriers, acid and base solutions, and Nb for oxide cathode packing are also provided. Rock crushing, milling, sieving and magnetic and density separation facilities are available, should students' home institutions not be equipped for the initial mineral separation steps.

Timeframe

Each batch of samples takes a week of hands-on work, not counting initial preparation steps (quartz purification for *in situ* samples, powdering for meteoric samples). Visitors can purify quartz at the CCF if needed, a process that can take from several to numerous weeks depending on the number of samples and sample lithology. We can provide a more definitive schedule once we have details about your project.

AMS measurements are performed at outside AMS facilities including Lawrence Livermore National Laboratory's Center for Accelerator Mass Spectrometry (LLNL-CAMS) and Purdue Rare Isotope Measurement (PRIME) Laboratory. Students can arrange to visit these labs in order to learn measurement techniques. We can facilitate communication, but visitors must make their own arrangements to pay for AMS analyses.

For *in situ* sample preparation, the processing steps visitors can learn are:

- Magnetic separation
- Sample etching to purify quartz
- Quartz purity testing
- Carrier mass addition and sample dissolution
- Ion exchange chromatography
- Sample precipitation and oxidation
- Nb mixing and cathode pressing

For meteoric sample preparation, the processing steps visitors will learn are:

- Sample powdering
- Massing and carrier addition
- Fluxing
- Purification
- Yield testing
- Sample precipitation and oxidation
- Nb mixing and cathode pressing

Costs

Because of funding from the National Science Foundation, all training, mentoring, and collaboration are covered by our grant. Visitors pay only for laboratory consumables. Costs (which may evolve slightly in future fiscal years) are $35-65/sample for quartz purification (depending on sample type and lithology), $225/sample for *in situ* extraction, and $185/sample for meteoric extraction.

Costs for AMS measurements are additional and need to be arranged for by the visitor with the AMS laboratory.

Pre-Proposal

As noted above, we ask all interested AGeS applicants to submit a pre-proposal to us no later than **one month before the AGeS deadline**. The pre-proposal should include the "Collaborative Project Inquiry Form" available on our website, as well as a short email describing your project and why you want to visit the CCF. We will review all pre-proposals within several days and will choose which four (the number specified by the AGeS program that we are allowed to support) align most closely with our capabilities and expertise.

Please note that we will not be able to support your proposal unless we receive a pre-proposal by the specified deadline. If we are not able to support your proposal, we can make recommendations about which other cosmogenic nuclide laboratory might be a good fit. We can also host you outside the AGeS program which is something we do all the time! We have about 20 visitor each year working in our labs.

Preparation for Visiting

Further information is available on our website, www.uvm.edu/cosmolab (click on Visitor Information in the left-hand menu, then select Sample Processing Visit). Please read through the information provided, then send the Project Inquiry Form to get started.

Due to significant demand for laboratory time, we ask visitors to contact us as early as possible. We often book several months to 6+ months in advance.

Laboratory Staff

Visitors will work primarily with Dr. Lee Corbett, who is a Research Scientist at University of Vermont and runs the day-to-day operations of the laboratory as facility manager. She is funded by the National Science Foundation to oversee the facility, conduct visitor training, and collaborate on visitor projects.

Visitors will also work with Dr. Paul Bierman, a Professor at University of Vermont and the director of the CCF. He will collaborate on visitor projects and assist with data interpretation and publication.

Data Reduction and Interpretation

After AMS measurements are received, visitors will be guided through the basic calculations required to convert AMS ratios to nuclide concentrations, including the proper methods for propagating errors. Visitors will be introduced to the commonly used surface exposure age calculators used for surface exposure age estimates including bedrock and clasts and depth profile sampling as well as erosion rate estimates from river sediment and outcrops. Instruction in nuclide interpretations will vary with the application, nuclide and type of geologic feature sampled. We work with visitors to help them prepare abstracts for meetings and manuscripts for publication ensuring data quality, reporting and interpretation meet community standards.

Contact Information

All questions regarding laboratory facilities and capabilities should be directed to both Dr. Paul Bierman (Paul.Bierman@uvm.edu) and Dr. Lee Corbett (Ashley.Corbett@uvm.edu). Additional information is also available on our website, www.uvm.edu/cosmolab. To see our daily operations and visitors working in the laboratory, follow our Facebook (“NSF/UVM Community Cosmogenic Facility”) and Instagram (“uvmcosmolab”) pages.