UVM Noble Gas Geochronology Laboratory
EarthScope Student Geochronology Laboratory Educational Plan

1.) Laboratory Facilities Available

The centerpiece of our facility is a Nu Instruments Noblesse magnetic sector noble gas mass spectrometer with a custom (built in-house) ultrahigh-vacuum extraction line and Santa Cruz Laser Microfurnace diode laser system for step--heating and total-fusion analyses. We also have the capability for in-house sample preparation and mineral separation. These facilities include: 1) access to a departmental rock preparation room containing a jaw crusher, disc grinder, oil and water saws, and a Gemeni table; and 2) a dedicated mineral separation facility, which houses a Nikon AZ100 Multipurpose Zoom Macroscope with a Nikon DS-Fi1--U2 High Resolution Color Digital Camera, a Nikon Labophot Polscope, Frantz Magnetic Barrier mineral separator, fume hoods and heavy liquids separation equipment, binocular hand-picking scopes, and a Mettler-Toledo AB 135-S FACT balance.

2.) Student Time Frame

Students are encouraged to contact us several months in advance to discuss their project, as factors such as number of samples and the expected age will influence scheduling. Sample preparation for irradiation can take up to several weeks, depending on the number and types of rocks selected for analysis and the size of the target mineral separation (coarser-grained rocks can be picked more quickly). In general, approximately five samples per day can be crushed and washed, and after drying overnight approximately two per day can be refined and picked. Because of the nature of $^{40}Ar/^{39}Ar$ analysis, the separated mineral grains need to be specially packaged and sent out to be irradiated, a procedure that can take up to six weeks and is ultimately dependent upon the reactor schedule. Only a few irradiation batches are sent out each year, and these are organized by expected age (which largely determines the duration of the irradiation). After an irradiation batch is returned from the reactor, a series of analyses must take place to determine the sample neutron flux and correction factors for interfering reactions. Once these parameters are determined for a suite of samples, isotopic analyses can be carried out at a rate of about one sample per day.

We encourage students to work with us both on sample preparation and analysis, but if only one trip to UVM can be organized we believe that a student's priority should be to experience a working spectrometer, data collection and analysis. In this case, we would like the student to send relatively pure mineral separates at least 30 days ahead of the expected irradiation shipment to allow for further sample refinement as needed.

3.) Costs and Expenses

Analytical costs are a function of the type of analyses desired and the resolution needed. We will work with students on their budgets based on their

analytical needs, but in general students should expect to budget ~$800 per sample for standard step-heating and/or total fusion experiments. Actual costs are based on hourly rates and therefore will vary depending on the nature of the sample and number of analyses (i.e. 'steps' or total fusions). Students interested in K-feldspar multi-diffusion domain experiments and for detrital analyses should contact the lab to discuss details and pricing.

4.) Student Preparation

The student will need to know the approximate age of the rocks to be dated. This is necessary for proper irradiation of the samples. We encourage students to discuss their sampling strategy with us, including the final selection of material for analysis. This can be accomplished remotely via email, video conferencing, etc. If the student is planning on using our sample preparation facilities (see above), they should have some idea regarding the characteristics of the target mineral they are separating, usually accomplished by thin section observation. If they are sending separates ahead of time for us to finish preparing, they should arrive with a basic knowledge of mass spectrometry and the $^{40}Ar/^{39}Ar$ method; we can provide and/or refer related materials depending on the needs of the student. Further training will be provided during the visit, including laser and radiation safety. Additionally, students should compile all relevant information about their samples to aid in data interpretation and for database submission.

5.) Laboratory Staff

Dr. Laura Webb directs the UVM Noble Gas Geochronology Laboratory, while Daniel Jones, M.Sc., is the full-time lab technician. As such, both will be involved with student training and oversight.

6.) Data Reduction and Analysis

Data is collected and reduced using a combination of Nu Instruments' Noble software and the Berkeley Geochronology Center's ISOPLOT Excel Add-in. We will be available to work with the student on data collection and analysis, as well as interpretation, and will continue to support the student on these fronts as they work towards presentation and publication of data.

7.) Scheduling

Due to scheduling factors related to sample preparation and irradiation described above, please contact us well in advance of your analysis target dates. We will do our best to accommodate students, factoring in deadlines related to conferences, graduation, etc.

8.) Contact

Please contact Dr. Laura Webb (lewebb@uvm.edu) if you would like to obtain $^{40}Ar/^{39}Ar$ analyses, discuss potential collaborations or initiate a learning and training experience in beautiful Vermont.