

## **EarthScope Student Geochronology Research and Training Program Laboratory Overview**

### **University of Cincinnati Fission Track Laboratory**

**9/22/14**

#### ***Lab Description***

The University of Cincinnati fission track (FT) laboratory includes all of the facilities required to prepare and analyze minerals for FT thermochronology. Equipment includes a motorized microscope (Zeiss AxioImager M2M) equipped with a digital camera and motorized x-y-stage that are connected with a computer and operated by the Autoscan software. This system allows you to analyze fission tracks by either looking through the microscope or on the computer screen. The calibrated digital camera allows analyzing grains, measure surfaces, track lengths, and angles, store images including stacked images, which can be analyzed on any computer.

The lab is also equipped with a STRUERS polishing machine, heat plates and oven for zircon mounting and etching, a lathe for mount cutting, and two stereomicroscopes for preparing the mineral separate. The lab is set up for FT dating of the minerals apatite and zircon using the external detector method. We also regularly conduct zircon FT and U/Pb double dating on samples. The student should contact the lab manager to discuss details on the procedure for this.

#### ***Expected Time Frame***

Students who want to conduct FT dating need to visit the UC FT lab twice. During the first visit the student will learn how to mount, grind, polish and etch the samples to prepare them for neutron irradiation. Students should expect to spend one week for the first visit. The second visit will be after the samples returned from the reactor facility. During this second visit the student will first analyze standard material to learn fission track dating and determine their personal fission track calibration factor. After that the analysis of the unknown samples will be conducted. Depending on the number of samples and if length measurements will be done or not, students should expect to spend a minimum of 4–6 weeks visiting our lab. Because the calibration is taking a large amount of time, it is generally recommended that students will analyze a minimum of 10 samples.

Due to restrictions on clean lab and radiation safety, students will not participate in the unpacking of the irradiation. Those steps will be handled by lab staff, and are covered in the per sample fee.

The basic steps that the student will learn and perform during and after the visit are as follows:

First visit:

- Mounting mineral grains in epoxy resin or Teflon.
- Grinding and polishing mineral mounts to expose internal mineral surfaces.
- Slicing sample disc using a mini-lathe.
- Etching minerals to reveal fission tracks.
- Checking fossil track density and estimating neutron flux for irradiation.
- Covering samples with muscovite external detectors.
- Prepare and pack samples for neutron irradiation.

Second visit:

- Identifying FT in minerals and crystallographic orientation under the microscope.
- Counting FT on age standards and unknown samples, external detectors and U-dosimeter glass.
- Calculating the zeta-calibration factor based on the age standard data.
- Calculating fission track ages and errors.
- Identifying and measuring confined tracks, kinetic parameters.
- Interpret and/or model data.

### ***Analytical Costs***

Students should budget for a \$500 training fee, and an additional \$300 for each apatite sample and \$450 for each zircon sample. These prices include all consumables and supplies, use of equipment, and training. This price is per sample and you can measure as many grains you have.

### ***Preparation for Visit***

Students should arrive at UC with pure mineral separates. Rocks need to be crushed, pulverized, and run through hydrodynamic, heavy liquid, and magnetic separation steps so that they are left with a dense, non-magnetic fraction, preferably a vial of apatite or zircon. Students who do not have access to mineral separation facilities should contact A to Z Inc., a commercial outfit many thermochronology labs regularly work with. Mineral separation can take substantial time, and students should make sure to check with A to Z prior to scheduling a lab visit. Please note, you need a larger amount of grains, preferred are hundreds, for FT dating and particularly for detrital zircon dating (thousand of grains). Please contact Eva Enkelmann to seek advises for sampling and mineral separation.

### ***Data Processing and Interpretation***

While in the lab students will learn how to process and reduce all of the data they have collected. This includes calculation of zeta factor, neutron flux dosimeter, fission track age and uncertainties. In addition, students will be shown the basics of how to use a thermal modeling program to better understand the significance of their results. Eva Enkelmann will continue to be available to consult with the students through email and/or videoconferencing until they are satisfied that they understand the results.

### ***Expected Lab Availability***

In most situations, students may schedule time in the UC FT lab with 2 months lead time.

### ***Contacts***

If you are interested in acquiring FT data in our lab, or would like to discuss potential collaborations, please contact: Eva Enkelmann [eva.enkelmann@uc.edu](mailto:eva.enkelmann@uc.edu)