Structure, Tectonics, and OU Thermochronology Laboratory

AGeS Student Geochronology Research and Training Program Laboratory Overview

Laboratory Facilities

The Structure, Tectonics, and OU Thermochronology (STOUT) Laboratory is run by Dr. Gilby Jepson. The laboratory is set-up for fission-track (FT) and U-Pb double-dating via the laser ablation method (Hasebe et al., 2004).

- **Mineral Separation:** At STOUT we maintain a Chipmunk Jaw Crusher, a tungsten carbide disk mill, a Jasper Cayon water table, a Franz magnetic separated, and heavy liquids for separation of apatite, zircon, monazite, and titanite.
- **Mounting, polishing, and etching:** We have mounting and polishing equipment for apatite, zircon, and monazite. As well as associated etching protocol and oven for zircon etching.
- **Fission-Track:** The lab is equipped with a Zeiss Axio Imager for sample and grain imaging. Following imaging, FT counting can be performed externally on users or lab computers using Fijjiontrack, an ImageJ plugin for fission-track analysis (https://github.com/gatechtonics/fijjiontrack).
- **Laser Ablation Inductively Coupled Plasma Mass Spectrometry:** At STOUT we utilize a New Wave 213 nm laser ablation (LA) system coupled with a PerkinElmer NexION2000 inductively coupled plasma mass spectrometer (ICP-MS, https://www.ou.edu/core-facilities/mass-spectrometry). The LA-ICP-MS system is set-up to run U-Th-Pb isotopic and concentration analysis plus limited trace element concentrations. We have established methods for apatite, monazite, and zircon U-Th-Pb dating.

Time Frame

At STOUT we follow the Laser Ablation approach to FT analysis. Thus, we do not require irradiation or handling of HF acid. However, FT analysis is still a labour-intensive analytic technique. Time is required to separate, mount, polish, and etch minerals, in addition to training on fission-track analysis. Time estimates are given for basement samples (~20 grains per sample), detrital samples require longer due to higher numbers of grains (~120 grains per sample).

- **Sample preparation:** Mineral separation from rock samples requires ~2 weeks for 10-20 samples. Preparing a batch of 10-20 mineral separates for FT analysis requires 1-2 weeks. As FT etching in zircon can take days, additional time of 1-3 days should be budgeted if using that method.

- **Fission-track analysis:** Training in FT analysis is conducted through three approaches. Firstly, users will be provided access to four one-hour long introductionary lectures into the basics of the FT method and counting fundamentals. Following lectures, users will be required to train on a sub-set of fission-track standard image-sets (McClure Mountain, Fish Canyon Tuff, and Durango). Finally, users will be required to count ~five standard grains per ~20 unknown grains in order to develop a “session-zeta" which will be used to calibrate their final age. In total, training for FT analysis will require ~2-3 weeks. Following training, users may count their unknown samples which, depending on the user, takes ~0.5-1 day per sample.
- **LA-ICP-MS:** Samples are then analysed via LA-ICP-MS for U-Pb isotopic ratios and ^{238}U concentrations. Time on the LA-ICP-MS should be budgeted at ~5 samples per day.

Analytical costs

Costs are budgeted at $250 for each basement FT analysis (~20-30 grains) and $500 for earch detrital sample (~120 grains). The cost includes U-Pb isotopic ratios and limited trace element concentrations. If users would like to undertake their own mineral separation, this requires an additional $100 per sample.

Preparation for visit

Depending on situation students can bring rock samples or previously separated mineral concentrates. Sample purity should be reasonably high, although some leeway can be given as the user will be required to pick the mineral phases. Users will be provided access to four ~1 hour FT training videos which will give a history on the method, as well as some background regarding interpretation and counting.

Laboratory Personnel

Training will be conducted by Gilby Jepson. However, a number of graduate students with experience of FT dating are also available to assist users with any questions.

Data Processing and Interpretation

Users will be taught how to calculate a session-zeta calibration, an FT age using in-house R spreadsheet, and reduce trace element concentrations and U-Th-Pb ratios using Iolite. We can also offer an introduction to inverse thermal history modeling using FT and other low-temperature thermochronologic data using QTQt (Gallagher, 2012).

Scheduling

We ask that inquires are given 2-3 months in advance. We encourage prospective users to contact us beforehand to discuss any project, feasibility, and how best to approach the project.

Contact

Gilby Jepson: gjepson@ou.edu