

EarthScope Student Geochronology Research and Training Program Laboratory Overview

Rutgers University Laser Ablation ICP-MS Facility
http://rci.rutgers.edu/~jav187/LAICPMS_Lab/Welcome.html

Jill VanTongeren, Lab Director

Lab Description

The Rutgers LA-ICP-MS laboratory is equipped with a Photon Machines 193 nm excimer laser ablation system, a Thermo iCapQc quadropole ICPMS, and a Thermo Neptune multicollector mass spectrometer. The LA system can be paired with either the iCapQc for *in situ* analyses of trace elements and U-Pb geochronology or the Neptune multicollector for *in situ* analyses of Sm-Nd and Pb-Pb isotopic systems. The lab has developed standard methods for analyses of silicates (plagioclase, pyroxene, olivine, zircon), phosphates (apatite), oxides (magnetite, ilmenite), biocarbonates (corals, forams, otoliths).

For zircon U-Pb geochronology, the lab maintains a set of 7 published zircon standards ranging in age from 337 Ma to 1065 Ma. Additionally, we routinely analyze an internal laboratory standard of 201 Ma zircon isolated from the nearby Palisades Sill. Replicate analyses on zircon standards and unknowns yields precision of $\pm 2.5\%$ or better. We are currently developing methods for analyzing U-Pb geochronology in monazite and rutile.

The LA-ICP-MS U-Pb zircon geochronology method is commonly used for:

- (1) Preliminary screening of zircons that will later be chosen for more detailed analytical work using CA-ID TIMS
- (2) Age/provenance studies of lithologies in a given field area

Expected Time Frame

The LA-ICP-MS U-Pb zircon method is a very fast way to get a lot of high quality data on a large number of samples. Students should expect to obtain ~200 individual measurements per day of analysis. The total time each student will be expected to schedule for a visit will depend on the number of samples required and the amount of advanced sample preparation. If the student has access to sample preparation (grain mounting and/or polishing) facilities at their home institution, then the total visit duration may be only 1-2 days, depending on sample volume. If the student will need access to the Rutgers sample preparation laboratory, then an additional day must be included in the total visit duration.

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

- (sample preparation, including epoxy mounting and/or grain mounts)
- Load samples into sample holder and laser ablation cell
- Image the samples using the cross-polarized light microscope
- Calibrate the LA signal on the ICP-MS with NIST glass as well as zircon standards
- Setup an analytical protocol for best precision of ^{238}U , ^{235}U , ^{232}Th , ^{208}Pb , ^{207}Pb , ^{206}Pb , ^{204}Pb on zircon standards and unknowns
- Setup an analytical run using basic sample-standard bracketing techniques
- Reduce the data using our easy-to-use Excel macro
- Interpret and/or model the data

Analytical Costs

Our typical lab rates are a \$325 training fee (which covers Argon gas supply during the run and time spent training the student on data reduction and interpretation), plus \$80/hour of analysis for the LA-ICP-MS with the iCapQ mass spectrometer (typical for U-Pb in zircon), and additional \$20/hour is charged for

analyses using the LA on the Neptune multicollector. There is an additional fee of \$100 for the use of the Rutgers Sample Preparation Laboratory for epoxy mounting (see below).

Preparation for Visit

The Rutgers LAICPMS lab has two options for sample holders in the Photon Machines laser ablation cell (also see our website: http://rci.rutgers.edu/~jav187/LAICPMS_Lab/Instrument_Specs.html):

- (1) The first sample holder allows for up to 9 1-inch round samples (thin sections, epoxy mounts, or grain mounts), plus an additional 4 ¼-inch round standards
- (2) 4 standard rectangular thin sections, 3 1-inch round samples and/or standards, and 2 ¼-inch round standards

In order to maximize the amount of sample in the cell (and minimize time spent purging the system during sample exchange), we recommend that the student use the 1st holder option (9, 1-inch rounds).

The student should arrive at Rutgers with picked and cleaned mineral separates for each sample of interest. Zircons can be mounted at Rutgers on glass slides using double-sided tape, or can be mounted in epoxy and polished to reveal core compositions. In the case of epoxy mounting, the student will need to budget one additional day for the visit in order to make the mount and allow it to cure overnight.

The student should contact us prior to proposal submission to discuss the standards available and whether additional standards will be required for the proposed research.

Relevant Laboratory Staff

The Rutgers LA-ICP-MS lab is managed and directed by Professor Jill VanTongeren. Professor VanTongeren and her graduate students will train the students in all of the sample preparation and analytical setup.

Data Processing and Interpretation

After data acquisition, the students will be trained in how to process the raw data for U-Pb geochronology and make all relevant figures for their research. Professor VanTongeren and her graduate students will be available via email or phone to answer any questions regarding data interpretation after the initial visit.

Expected Lab Availability

The student should contact the lab to schedule a visit no less than 1 month prior to desired dates.

Contacts

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