MAGIC Laboratory
MicroAnalytical Geochemistry & Isotope Characterization

MAGIC (MicroAnalytical Geochemistry and Isotope Characterization) Laboratory at the University of Maine
AGeS^3 Participating Laboratory

Laboratory Facilities and Operation The MAGIC Lab provides opportunities for students to generate geochronologic and trace element information utilizing laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). Primary applications include:

1. U-Th-Pb and REE analyses of detrital and magmatic zircon,

2. U-Th-Pb and REE analyses of titanite and monazite, and

3. Rb-Sr *in situ* analyses of micas.

Researchers are welcome to come to the lab to generate their data so that they learn the theory and methods of U-Pb and Rb-Sr geochronology, and become familiar with the strengths and weaknesses of their data. In some cases we can accommodate students for zircon separation sample processing, though users are encouraged to bring mineral separates prepared elsewhere. Many of the analyses we do are done *in situ*, and users are welcome to come and use the imaging facilities to characterize their samples. MAGIC Lab facilities include:

– sample preparation lab (rock crusher, shatterbox, Wilfley table)

– mineral separation lab (heavy liquids, Franz magnetic separator, Wig-L-Bug)

– picking microscope, mounting materials, and reference materials for preparing mounts

– Zeiss AxioImager M2.m polarizing light microscope with motorized XYZ stage for mount imaging, including in reflected light

– SEM laboratory for sample imaging/analysis, which includes a *Tescan Vega-II XMU* (for SE and BSE imaging), as well as Gatan ChromaCL full color and Tescan panchromatic cathodoluminescence (CL) imaging systems

– Electron Probe laboratory for major element characterization, housing a *Cameca SX-100* electron microprobe equipped with 4 dual, large-area crystal spectrometers, a 4-crystal light element spectrometer, and a Rontec energy dispersive spectrometer.

– Agilent 8900 ICP-MS/MS. This instrument is used for U-Th-Pb geochronology and for trace element and rare-earth element analyses.

– Elemental Scientific Lasers NWR193UC laser ablation system equipped with a TV3 fast washout laser ablation cell. This system can be set up for spot analyses and high speed imaging

Time Frame As most of our work is done *in situ*, typically visitors will arrive with samples already characterized (imaging, major element analyses, etc). If this activities are going to be done at the University of Maine, extra time should be allotted for before IPC-MS analyses on a case by case basis. A member of the MAGIC Lab will set up the instruments for the analyses in question, and typically the first day is spent making sure that samples are adequately prepared, and running reference materials appropriate to the project. Users are trained to pick their laser spots, and once they are comfortable are generally allowed to choose laser spot locations on their own. A MAGIC Lab member will monitor users as they learn to navigate the laser software independently, and will help to get analytical runs set up for data acquisition. Once the operator is comfortable with data acquisition, the minder checks on instrument performance and data quality as needed.

U-Pb dates are typically generated at a rate of ~70 analyses per hour, whereas Rb-Sr dates are typically generated at ~50 analysses per hour. Data analysis is done using the iolite4 software under the supervision of Dr. Cruz-Uribe and her lab group. Iolite4 is available in the lab, and users are able to evaluate data quality, reduce data, make data tables and plots, and discuss their interpretations during their visit. Researchers are encouraged to work with Dr. Cruz-Uribe to prepare data and interpretations for publication. The MAGIC Lab is run in a very collaborative way, and most projects are approached as a collaboration due to the need for method development and somewhat complex data processing associated with Rb-Sr analyses and many times U-Pb in titanite and monazite.

Costs The UMaine MAGIC Lab is a cost recovery center. Current rates for internal users and those funded by NSF grants are $125/hr for LA-ICP-MS analyses and $50/sample for sample preparation (including cutting, mounting, grinding, polishing). Please refer to the MAGIC Lab website for current rates, as these rates can change over time. Visitor accommodations can be made at the new on-campus hotel (https://hotelursa.com/), or at nearby hotels and airbnbs. The MAGIC Lab is happy to make recommendations or arrange for university rates at the Hotel Ursa and Black Bear Inn.

Activities prior to a visit The required activities before a visit depend strongly on the home institution and available facilities, and the type of project. Each project should be discussed with Dr. Cruz-Uribe in order to make an analytical plan that fits the needs of the project.

Laboratory staff Lab training and operations are run by Dr. Alicia Cruz-Uribe and her graduate students. Students will work with Dr. Cruz-Uribe and her students on data interpretation and preparation of materials for publication.

Data reduction and interpretation – see above.

Waiting time for lab usage Visits can generally be accommodated within 1–2 months, depending on the time of year.

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