University of Wyoming U-Pb geochronology AGeS2 lab profile

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Specialties:

1) CA-ID-TIMS high-precision U-Pb zircon dating for magmatism, metamorphism, volcanism
2) ID-TIMS U-Pb dating of baddeleyite (mafic magmatism), titanite (magmatism, deformation, metamorphism), apatite (450°C cooling ages, thermal histories), epidote (deformation, metamorphism, mineralization).
3) In-situ SIMS U-Pb dating of baddeleyite and zircon (mafic magmatism, especially when grains are too small to physically separate, metamorphism, alteration, shock metamorphism).
4) U isotopic compositions for redox reactions and biologic tracing
5) Pb isotopic compositions from waters, whole rocks, feldspars for environmental monitoring, crustal evolution, petrogenesis.
6) mineral separations for LA-ICP or SIMS/SHRIIMP analyses at external labs.

Laboratory facilities:

1) crushing and mineral separation facilities for concentrating zircon, baddeleyite (≥50 microns), titanite, apatite, micas, feldspar from magmatic, metamorphic, sedimentary rocks and volcanic/ash deposits.
   - jaw crusher, cyclone z chain mill, disc mill
   - ultrasonic defloculation system for bentonites and tonsteins
   - Wilfley water shaker table
   - barrier-style isodynamic magnetic separator
   - heavy liquid density purification
2) picking and imaging laboratory for final grain selection
3) Class 100, metal-free, clean lab for low Pb-blank dissolutions and ion exchange purifications
4) Micromass Sector 54 thermal ionization mass spectrometer (TIMS) with Daly-photomultiplier.
5) access to electron microprobe and scanning electron microscope for element mapping, mineral identification, back-scattered electron and cathodoluminescent imaging.

Time Frame for student visits and projects:

The actual timeframes and durations of student visits will vary depending on the nature of the projects. It is strongly recommended that each student or adviser contact Dr. Chamberlain in the early stages of planning the project to discuss the scientific goals and strategies so that appropriate methods and a realistic timeframe can be determined.

With that caveat, a 3-4 week visit is generally sufficient for dating 2-3 samples by mineral separation CATIMS or ID-TIMS methods. This includes one week for mineral separations, one week for clean lab dissolutions and chemistry, and one week for mass spectrometry and data reduction. More samples require more time. There is a 55-hour annealing step in the CATIMS method which poses a potential bottle-neck and delay but

there are usually many other tasks that can fill that time. It is also possible to split the work into two or more visits.

For in-situ SIMS dating of micro-baddeleyite and zircon (3 to 20 micron grains) there are a number of steps that require planning and prior work depending on the resources at the student's home institution. A 3-4 day visit is recommended at a minimum for consultation and experience with many of the steps, but the whole process of preparing samples and producing in-situ SIMS dates will take 6-12 months.

Lab costs and expenses:
Rock crushing and mineral separation involves a number of expendables plus time for training. The student should budget $200 for the first sample and $40 for each subsequent sample.

Clean room and mass spectrometry costs are combined to $500 per analysis with a minimum of 4 analyses per date, so $2000 per date generally. Some samples are complex and may require more than 4 analyses to complete. No additional charges will be incurred if samples require more than 4 analyses however.

The costs for in-situ SIMS dating and U and Pb isotopic analyses are quite variable depending on the application and samples. Early contact with Dr. Chamberlain is essential to determine a budget for those projects.

Preparations for a student visit:
1) early communication with Dr. Chamberlain to discuss sample selection and goals
2) mineral separations if the student's institution has the necessary labs and expertise, if not, then budget time and funds for mineral separations at UW.
3) for in-situ dating, student needs to arrive with polished thin sections and possibly some preliminary assessments of the samples' zirconium content and mineralogy. Early communication with Dr. Chamberlain is critical.

UW Staff:
Dr. Chamberlain will oversee the student directly for most of the project steps. Some aspects may also be directed by one of Dr. Chamberlain's assistants as appropriate.
Dr. Chamberlain is the principal contact: kchamber@uwyo.edu, (307)766-2914.

Data reduction and interpretation:
Data reduction generally occurs during and immediately after mass spectrometry and will be overseen by Dr. Chamberlain. Preparation of final figures and tables can be done off-site by the student with readily available software, but all tables and figures must be reviewed by Dr. Chamberlain prior to presentation and publication to ensure data quality. It is anticipated that Dr. Chamberlain will generally be a co-author on all abstracts and journal publications that result from the research.

Access and waiting time:
Lab use and availability varies at UW depending on the number of ongoing projects; early contact with Dr. Chamberlain is encouraged. In general, student projects can be accommodated within a few months, but need to be coordinated with other lab use.