

Earthscope Graduate Student Geochronology Laboratories

Department of Geological Sciences, University of Florida, Gainesville, FL

Facilities and Logistics The Department of Geological Sciences operates a variety of laboratories with geochronologic applications. These are listed below with primary applications and contacts for each laboratory. An overview of the facilities can be found at web.geology.ufl.edu/Isotope/index_isotope.html, as well as on the home pages of the individuals listed as contacts for each laboratory. Students interested in visiting UFL for geochronologic research should contact the individuals listed for each laboratory well in advance of preparing a proposal. Laboratory personnel will be glad to help you understand the time and financial limits of your proposed project so that you can develop a concise, accurate, and realistic analytical plan. The analytical instrumentation is all housed in the geochemistry wing of Williamson Hall, which makes it feasible, and often desirable, to develop datasets using more than one instrument or application (e.g., U-Pb dating and Lu-Hf isotopic analysis of individual zircons). Williamson Hall is located on the main campus in Gainesville, approximately 100m from the Reitz student union hotel, greatly facilitating campus-lab logistics (except for football weekends!).

1a. Laser ablation, multi-collector ICP-MS for in situ U-Pb geochronology. This instrumentation (Nu Plasma ICP, ASI Nd-Yag laser) is supported by all necessary mineral separation and preparation facilities, including an SEM for imaging (CL and BSE) and x-ray elemental analysis. Prior to analysis of zircon or other phases, minerals (in situ or as grain mounts) must be imaged (CL, BSE, etc.). Typical analytical cost = \$80/hr.

1b. Multi-collector ICP-MS for isotopic analysis. This instrument (Nu Plasma) is also used for measurement of isotopic ratios by both ablation (e.g., Lu-Hf system in zircon) and by solution (e.g., Pb, Nd, and Sr isotopes in whole-rocks and minerals). Elemental concentrations can come from spiked solutions or from elemental analyses conducted separately on the Element-2 multi-resolution ICP-MS (1c) located in the same laboratory. Typical analytical cost = \$65/hr.

1c. Multi-resolution magnetic sector mass spectrometer for trace element analyses. The Element-2 mass spectrometer is used for determination of trace element abundances in whole-rocks and minerals. Samples are prepared in a 1200 sq. ft. clean laboratory (Class-500) equipped with Class-100 laminar flow exhaust hoods for sample preparation. Typical analytical cost = \$25/sample.

ICP Contacts:

Dr. Paul Mueller (pamueller@ufl.edu),

Dr. George Kamenov (kamenov@ufl.edu)

1d. Clean Laboratory. Our class-500 laboratory for sample preparation for both elemental and isotopic analyses is available for visitors. A minimum cost for preparing a solution for trace element analysis from a sufficiently fine powder is \$15/sample. Use of chromatographic columns, spikes (enriched isotope tracer), and ultra-pure reagents for isotopic analyses (e.g., Sm-Nd, Pb-Pb, etc.) will increase the cost per sample.

3. (U-Th)/He laboratory. The UF (U-Th)/He laboratory includes an automated noble gas extraction system for ^4He abundance measurements, Element-2 multi-resolution magnetic sector mass spectrometer for U-Th-Sm concentration measurements (see 1.c), clean laboratory for sample dissolution, and microscopy laboratory for sample preparation (optical and SEM). Apatite and zircon are routinely analyzed, although other minerals can be used upon discussion with Dr. Min. You can apply two different dating techniques (e.g., (U-Th)/He and U/Pb, both of which are available in the department) to a single zircon grain to obtain more complete geo/thermochronologic information. Typical analytical cost = \$70/sample for apatite, \$135/sample for zircon. This rate includes training and lab assistance.

Contact: Dr. Kyle Min (kmin@ufl.edu)

4. Thermal ionization mass spectrometer (multi-collector). Thermal ionization mass spectrometry offers the highest precision for analyses of Sr and Nd isotopes used for geochronologic and tracer applications. Typical analytical cost \$200/sample, excluding wet chemistry and spike.

Contact: Dr. Ellen Martin (eemartin@ufl.edu)

Dr. Ann Heatherington (aheath@ufl.edu)

Learning Experience The laboratories described above routinely host visitors from across campus as well as from other universities. Depending on the application and state of sample preparation, each visitor is provided detailed information (tutorials) on the analytical protocols for their project (sample preparation and analysis), brief introductions to the physical and chemical principles of each instrument, and instruction for use of annotated, off-line software for data reduction and analysis.

Costs Operations in individual laboratories are sustained through the use of dedicated recharge accounts; typical analytical costs are given above. Charges for instrument use are usually based on an hourly rate, and for sample preparation on a per sample basis. In most cases, geochronologic analyses are completed on imaged, separated minerals. In general, sample preparation is likely to be more time-consuming than the actual isotopic measurements, so visitors are encouraged to prepare samples as thoroughly as possible before arriving on-site in order to minimize direct costs (analyses) and indirect costs (e.g., per diem). Visitors are encouraged to contact the lab managers or collaborating faculty regarding their specific project and how to complete it as efficiently as possible. The following costs are provided as a general guide when off-site sample preparation is not possible.

1. Crush and grind the sample sufficiently to separate and physically prepare a trace mineral(s) for analysis (e.g., zircon, titanite, monazite, etc.): \$250
2. Polish and image a plug (grain mount) by CL and/or BSE on the SEM: \$20/hr.
3. Supervision in analysis and data reduction will be by the individual laboratory manager and/or graduate students and faculty working on similar projects at no additional cost.