

**NEW DEVELOPMENTS AT THE UCLA-NSF NATIONAL ION MICROPROBE FACILITY.** K.D. McKeegan, T.M. Harrison, and M.-C. Liu. Department of Earth, Planetary, and Space Sciences, UCLA, Los Angeles, CA., USA (mckeegan@epss.ucla.edu).

**Introduction:** In late 1992, the nation's first high sensitivity-high resolution ion microprobe was delivered to the UCLA Department of Earth & Space Sciences. This instrument, the first commercial prototype (serial #1) of the ims1200-series, was developed during the previous two years by a team of CAMECA engineers led by Emmanuel de Chambost in collaboration with UCLA scientists Mark Harrison and Kevin McKeegan. Capital costs were financed through grants from the W. M. Keck Foundation (\$1M) and the NSF Instrumentation and Facilities program (\$0.4M), matched by UCLA internal funds (\$0.9M). The prototype instrument required correction of several design flaws, some requiring substantial hardware modifications that have since been incorporated into later instruments (IMS-1270 and IMS-1280). In 1996, we were able to commission the laboratory as a national facility with the support of NSF's Instrumentation and Facilities Program. From the outset, our stated intention has been to create a world-class facility for in situ microscale isotopic analyses of geologic materials and to provide access to its unique capabilities to the broader community to address important problems in earth and planetary science. We have operated continuously as a National Ion Microprobe Facility since that time, hosting ~400 scientists, students, and postdocs for many different types of analyses. By virtue of our role as an NSF National Facility, we have played a significant role in making SIMS technology available to a wide community and in facilitating the research of many young scientists. Over the two decades of facility operation, more than 100 Ph.D. and M.S. theses containing ims 1270 data have been completed – with nearly 3/4 at institutions other than UCLA. Ten of our former students and postdocs took up faculty appointments at leading universities, seven of whom went on to operate their own SIMS laboratories.

In addition to Earth Science, our laboratory has supported work by principal investigators of NASA-sponsored research, including especially the former Cosmochemistry Program, Mars Fundamental Research, Astrobiology, and the GENESIS and STARDUST Discovery missions. Other agencies for which internal or external users have accomplished research on the UCLA IMS-1270 have included the Dept. of Energy, the USGS, California Department of Fish and Wildlife, GSA, National Geographic Society, Sigma XI, UC MEXUS, and the Dept. of Homeland Security.

With \$4M Major Research Instrumentation funding from the NSF Geoscience directorate, along with a commitment of funds from UCLA, we have recently

purchased a new CAMECA large format ion microprobe for which we are developing improved primary ion beam capabilities, based on the new Hyperion-II plasma ion source from Oregon Physics. Coupled with improvements in the multicollector detection system, this new instrument, the CAMECA IMS-1290, will enable new types of investigations and/or significant improvements in our ability to scientifically innovate as well as improve our efficiency in operating a National Ion Microprobe Facility.

**Applications:** Our applications primarily focus on isotopic analyses in geologic samples, with some but significantly less attention spent on trace element and/or secondary ion imaging. We have well established protocols for the routine measurement of U-Th-Pb for geochronology of accessory minerals (such as zircon, baddeleyite, and monazite), and analysis of stable isotope ratios for Li, B, C, N, O, Mg, Si, S, Cl, Ca, Ti, and in some specialized cases, Fe, Ni, and Sr. Some recent applications have included:

- Geochronology and tectonic investigations, e.g., Indo-Asian collision and tectonics of SE Asia; magmatism and tectonism in western North America; plateau and foreland basin evolution in the Central Andes; Circum-Tethyan crustal
- Rates of metamorphic processes and fluid overprinting.
- New detrital accessory mineral tools to constrain orogenic processes and sedimentary provenance
- Experimental investigations of zircon saturation in melts.
- Pre-eruptive processes and timescales of crystallization in crustal magmas and improved eruption chronology through combined disequilibrium and (U-Th)/He dating.
- Investigations of early solar system and planetary processes, including analysis of primitive meteorites, interplanetary dust, STARDUST samples, lunar samples, and martian meteorites.
- Development of “backside” depth profiling for analysis of ultra-shallow (~30 nm) ion implantation profiles with application to solar wind isotopic fractionation determination.
- Measurement of S isotopes in salmon otoliths to assess provenance and environmental impacts on populations.
- Microbiological ecology and paleontology
- Experimental calibration of trace element and isotopic partitioning in carbonates with applications to paleo-environmental proxies.

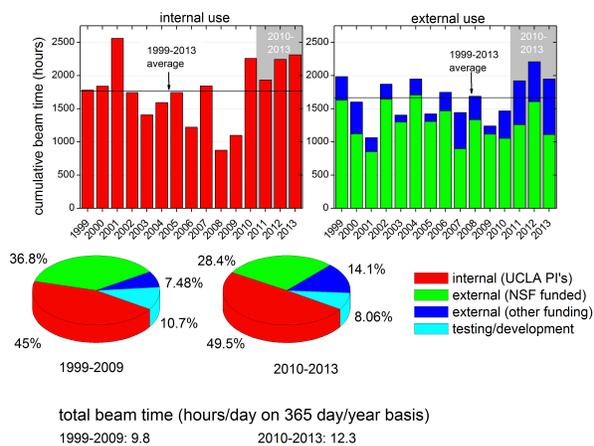
References and further information may be found at the

facility web page: [sims.ess.ucla.edu](http://sims.ess.ucla.edu)

**Facility Usage:** The Facility is utilized by both internal scientists (i.e. the facility PI's and their postdocs and students) and external (visiting) scientists. The long-term average accesses by the latter group is a little more than 40% of the available beam-time. The usage of the IMS-1270 over the last few years has been remarkable: the instrument has been in beam-on mode for a little more than half of the time since 2010 (i.e., more than 12 hours per day on a 365-day annual basis). In the last year, maintenance and repairs on the 25-year-old IMS-1270 has reduced this efficiency, but as the new IMS-1290 comes on line, we anticipate overall greater usage of the National Facility.

innovation and/or provide proof-of-principle for obtaining research funding.

The design and performance of the new IMS-1290 will be described at the conference.



**Management:** Mark Harrison and Kevin McKeegan serve as co-directors of the National Facility and have overall responsibility for its scientific directions. Ming-Chang Liu manages the day-to-day technical operations and he is assisted by postdoctoral scholars and an electronics engineer and apprentice. The core team has a diversity of experience and scientific interests related to SIMS. Collectively, the authors of this abstract have written well over 175 papers on applications of SIMS to the geosciences. McKeegan has 30 years experience in the development and application of the ion microprobe to geo- and cosmochemistry. Harrison is a pioneer in thermochronologic investigations and leads SIMS investigations of the early Earth. Liu has experience with the IMS-1270, IMS-1280 HR2, NanoSIMS, in addition to the new IMS-1290. The Facility has an Advisory Board who offer council on applications, scientific trends and needs, and user-feedback. All users of the Facility pay for instrument time, although some seed projects are undertaken free of charge if, in the judgement of the directors, the project may advance technical