Department of Geology
Seminar Series

Secondary Ion Mass Spectrometry (SIMS): A Versatile Technique for the Study of Geologic Materials

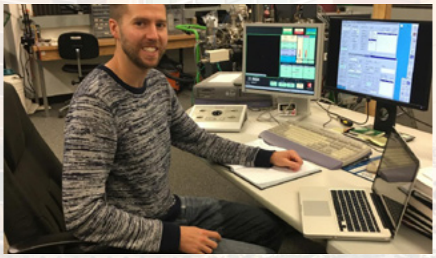
Location:
Science 408

Thursday,
October 7
1:00 pm

Ryan Sharpe

Department of Earth Sciences
University of Manitoba

In the past 50+ years, the SIMS technique has emerged as the most powerful tool for high spatial resolution geochemical analyses.



Ryan Sharpe is the SIMS Lab Manager in the Department of Geological Sciences at the University of Manitoba.

Geology@smu.ca

Saint Mary's University
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Ryan Sharpe, Department of Earth Sciences, University of Manitoba

Secondary Ion Mass Spectrometry (SIMS): A Versatile Technique for the Study of Geologic Materials

Abstract

Secondary Ion Mass Spectrometry (SIMS) was first pioneered in the 1960s. The original SIMS instruments were developed independently by groups from NASA and the University of Paris-Sud. During analysis by SIMS a solid sample is bombarded by a high energy primary ion beam, bombardment causes atoms from the sample to be ejected (and ionized) from the sample surface. These "secondary ions" are measured in the mass spectrometer portion of the instrument and represent the chemistry of the sample.

The field of SIMS has progressed over the past 50+ years to the point where the SIMS technique has emerged as the most powerful tool for high spatial resolution geochemical analyses. Currently, large radius SIMS instruments report precisions for stable isotopes that rival that of the more traditional techniques (0.1-0.2‰). Whereas, small radius SIMS have slightly higher precision (0.3-0.8‰) for many stable isotope systems (e.g. 34S/32S, 18O/16O). Typical spatial resolutions for large and small radius instruments are around 1-5µm and 10-20µm, respectively.

The versatility of the SIMS technique is evidenced by the vast amount of chemical information that can be gleaned from a single analytical spot just a few microns in diameter. Stable isotope ratios (e.g. 2H/1H, 11B/10B, 18O/16O) can be used to determine the source reservoir, the temperature of precipitation, and history of alteration in complex mineral systems. Radiogenic isotope ratios can be used for geochronology of a wide variety of minerals (e.g. zircon, monazite, uraninite) which divulge not just the crystallization age, but in some cases, retain evidence of multiple past fluid events in an area.

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