

Isotopic and elemental studies at a 50 nm scale with the NanoSIMS

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The NanoSIMS is a revolutionary new type of ion microprobe with a wide range of applications in areas like biology, material science and geochemistry. The first commercial NanoSIMS was installed in St. Louis in December 2000 and has since been used for a large number of microanalytical studies of extraterrestrial materials that would not have been possible with any other instrument. The most important features of the NanoSIMS are a primary beam diameter at the sample of less than 50 nm, a very high secondary ion transmission – even at high mass resolution – and the capability of measuring several secondary ion signals simultaneously.

One of the most fascinating aspects of the work with the NanoSIMS is that it can be used as a complement to the transmission electron microscope (TEM). Previous generations of ion microprobes could determine the isotopic compositions of micrometer-sized (and larger) sample components, but it was not possible to determine the mineralogical context of the observed features due to differences in size scales and sample mounting requirements. With the NanoSIMS it is not only possible to measure isotopes at a spatial resolution that comes close to that of the TEM, but it is possible to do so directly in TEM sections, without any modifications to the sample itself. A sample can first be characterized in the TEM and then be transferred to the NanoSIMS for raster imaging SIMS analysis. It is thus possible to directly correlate isotopic and mineralogical information of a sample and its sub-components on a scale of 50 nm. This combination of two powerful microanalytical techniques may become one of the strongest tools for the investigation of extraterrestrial materials.

References:

See <http://presolar.wustl.edu/nanosims/> for more detailed information about the St. Louis NanoSIMS.