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The JAMSTEC NanoSIMS 50L: Imaging mass spectrometry at the sub-micron scale for meteorite and biology samples
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伊藤 元雄 [1*]
ITO, Motoo[1*]

[1] 海洋研究開発機構　高知コア研究所
[1]Kochi Institute for Core Sample Research, JAMSTEC

On November 4, 2011 the Cameca NanoSIMS 50L ion microprobe was delivered to Kochi Institute for Core Sample Research. The NanoSIMS is *the-state-of-the-art* instrument for microanalysis by a secondary ion mass spectrometry. The strong ability is to analyze extremely small *regions-of-interest* (achieving lateral resolutions down to 50 nm and small sputtering depth) while keeping very high sensitivity at high mass resolution. This derives from the new coaxial optical design of the primary ion sources and secondary ion extraction system, and from a new design of the magnetic sector mass analyzer. The capability of simultaneously measurement up to 7 masses, achieving more precise isotopic ratios from the same small volume, or better ion image superimposition in a imaging mode. This allows the comparison of images of the distribution of different measured isotopes or elements. This ability for imaging with sub-micro meter spatial resolution is very unique to the NanoSIMS and provides a new approach to the analysis of the isotope and/or element distributions in variety of samples. Faraday cups are also installed into the NanoSIMS, enabling to achieve the precision and external reproducibility of isotopic measurements down to the sub-permil level. Therefore, the JAMSTEC NanoSIMS will be the centerpiece of the ion imaging and geomicrobiology laboratories at the Kochi Institute for Core Sample Research and will be used to investigate extraterrestrial, terrestrial and biology samples (e.g., meteorites, oceanic crusts, deep life) explored by a scientific ocean drilling and sample-return missions from extraterrestrial locations opportunities.

The NanoSIMS instrument is in a clean room with class 10,000. Temperature (+- 0.3^{o}C around a magnet) and humidity level (+-2% in the room) are well controlled. Currently the specifications of beam size (Cs+: ˜30 nm, O-: 180 nm) and beam stability in 10 min (Cs+: 0.2 %, O-: 0.7 %) were achieved. We have done with Si and O isotopic measurements using electron multipliers and Faradays cups for Si wafer and quartz, respectively (Table 1).

Some initial results for O and Mg isotopes in meteorites and terrestrial mineral standards, and isotope images of microbiology sample will be shown at the meeting.

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Keywords: NanoSIMS, Ion imaging, sub-micron spatial resolution

Table 1. Reproducibilities of Si and O isotopic measurements.

EMs		16 points (within 1 inch sample)	10 points (5 sample locations)	**FCs**		10 points (within 1 inch sample)	10 points (5 samples locations)
$^{29}Si/^{28}Si$	Si wafer	+- 0.7 permil	+- 0.9 permil	$^{29}Si/^{28}Si$	Si wafer	+- 0.07 permil	+- 0.13 permil
$^{30}Si/^{28}Si$	Si wafer	+- 0.7 permil	+- 1.1 permil	$^{30}Si/^{28}Si$	Si wafer	+- 0.17 permil	+- 0.26 permil
				$^{18}O/^{16}O$	Quartz	+- 0.6 permil	+- 0.5 permil