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次世代高分解能 LA-ICP 質量分析法による地球化学研究の新展開
High Resolution Imaging Mass Spectrometry using Laser Ablation-ICPMS Techinique : multifaced tool in Earth and Bioscienc

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As a result of its continuous development, LA-ICP-MS provides ever more precise elemental and isotopic data. Enhancements in elemental sensitivity achieved for ICP-MS, together with newly developed dual or triplicated-ion detection system (combination of multiplier ion counting and a charge integration-Faraday collectors), provides flexible multi-element determinations for both the trace- and major-elements in the samples. Moreover, fast-mass scanning protocol achieved by the ion deflector devices, equipped on a magnetic sector, have led to successive improvements in the precision of isotope ratio measurements. The ICP-MS technique is likely to become a method of choice for many geochemists because it is much more versatile and user friendly and efficient method for elemental and isotopic analyses of trace elements.

Many geologists and geochemists are increasingly interested in processes in rocks that operate at the microscopic scale such as zoning or metamorphic recrystallizations. These processes have implications for the larger scale behavior of the Earth and new technique for chemical and isotopic measurements at the um-scale need to be developed. The combination of laser ablation sample introduction technique and ICP-mass spectrometry (LA-ICPMS) has now become a fast and accurate method of in-situ trace-elements and isotopic analysis for solid geochemical and biochemical samples [1]. Laser ablation utilizing UV-light ? with a frequency-quintupled (213 nm) Nd:YAG laser, Ti:S femtosecond lasers equipped with THG devices (260 nm) or an ArF Excimer laser (193 nm) ? offers reduced elemental fractionation during ablation and better spatial resolution with a small ablation pit size, and is now the most widely used system for LA-ICP-MS. The progresses in the LA-ICPMS technique are well demonstrated in the precision and accuracy of the U-Pb age data for zircons. We are now trying to measure the U-Pb age data for zircons from smaller ablation pit sizes (2-5 um). For zircons with U contents of higher than 100 ug/g, we can measure U-Pb ages from zircons with the ablation pit size of smaller than 5 um. Moreover, 2-dimensional mapping (imaging mass spectrometry) for trace-elements can be made with a ablation pit size of 2 um. The resulting analytical-spatial resolution achieved in this study was better than 5um, and this is almost comparable to the conventional ion microprobe technique. It should be noted that the spatial resolution achieved by the LA-ICPMS technique can be improved by the new generation laser optics. In fact, ablation pit size of smaller than 1um could be achieved by the near field optics. Moreover, it should be noted that the laser ablation was made under the atmospheric pressure. This suggests that in-situ elemental and isotopic analyses can be made on a wet samples including cell or fluid samples (biochemical samples). With high-sensitivity ICP-MS instrument with new generation laser ablation technique, the LA-ICPMS technique has immediate potential as a reconnaissance method and given increasing improvement in instrumentation will in the future produce data comparable or even better quality to ion probes of nano-SIMS type.

References
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