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Fully automated open column separation system - "Columnspider I" for efficient preparation of isotope analysis

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Sr, Nd, Pb and Hf isotope ratios are fundamental in our research on the evolution of the Earth's interior and surface. Until recent it was difficult to process rocks with very low concentrations or to target individual minerals in a tiny sample. At IFREE, JAMSTEC we have developed improved analytical methods for high precision analysis of very low concentration and small sized samples. This has expanded the scope of application of isotope analysis on broader variety of rock samples. The number of important samples we want to process has greatly increased. Therefore we must significantly improve the efficiency of the sample analysis and particularly the sample preparation.

Thermal Ionization Mass Spectrometer that includes some level of automation is used for measuring the samples without much labor and with decent speed. However the sample preparation process requires lengthy and labor-heavy pre-treatment compared to the actual measurements. Despite there are other simpler methods for direct sample measurement (laser ablation) the conventional method of separating the target elements using open column chromatography is still valuable and preferred in many cases.

In general, the rock sample preparation for isotope analysis is roughly divided into three steps: 1.Decomposition of the sample; 2.Extraction of the target element; 3.Dilution (MC-ICP-MS) or Loading on filaments (TIMS); All these three stages require cumbersome and lengthy manual labor. The most time-consuming and monotonous processes are found in the case of 2.Extraction of the target element. The possibility for human error is also very high here. Many of the sub-processes are easy to automate and it's relatively easy to simulate human manipulations.

This put the beginning of the project for a pipette robot that JAMSTEC and HOYUTEC CO.LTD. successfully co-developed. The fully automated open column separation system "Columnspider I" can be set up with 10 samples for simultaneous separation and extraction of target elements. By using this equipment we are able to save labor and valuable time and dramatically improve the performance for the preparation of the samples. In the context of the whole process of isotope analysis we expect it to play major role in achieving accurate analysis of increased number of samples. In this presentation I will introduce the features of "Columnspider I" in detail.

Keywords: Fully automated separation system, Open column, Sr,Nd,Pb,Hf isotope, Preparation, Column separation, Pipette robot