THEME 1: THE DYNAMIC SOLID

Session 1.3: In-situ investigation of properties and processes

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This session focuses on in-situ studies of properties and processes in Earth materials and their application to important geochemical and geological problems. "In-situ" refers to both the study of properties and the behaviour of rocks and minerals under realistic Earth conditions (e.g. at high temperatures and pressures) and the use of in situ techniques to examine chemical and isotopic variations in the recent and past geological, biogeochemical and cosmochemical record. Examples include in situ investigations of crystal structures, microstructures and phase transformations in minerals, in situ determinations of the dynamical/mechanical properties of rocks and minerals, and small-scale, in situ studies of isotopic and chemical variations in mineral, biological and geological materials to investigate Earth processes.

1.3.11

Ion Microprobe analysis of Rb & Sr isotopes in K-rich minerals: An attempt of radiometric dating

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We report *in situ* measurements of Rb and Sr isotopes in K-rich minerals (muscovite, phlogopite and K-feldspar) using Sensitive High-Resolution Ion MicroProbe (SHRIMP) installed at Hiroshima University.

After the pioneer studies in the 1970s, the application of ion microprobe (secondary ion mass spectrometer) dating of terrestrial rocks has been focused on the U-Pb system. For extraterrestrial materials, ion microprobe dating method was based on extinct nuclides.

Rb-Sr age determination has widely been conducted in order to study the history of the Earth and the Solar System. However, all existing techniques employ chemical treatment of samples to separate Sr from Rb. Although the conventional methods have been succesful, the possibility of *in situ* dating is important when the sample must not be destroyed or their textural context is important. However, it is generally accepted that ion microprobe method is not suitable for Rb-Sr system, since radiogenic ^{87}Sr has a mass number very similar to that of the mother nuclide, ^{87}Rb, and cannot be separated with current technique.

In this study, several grains of the K-rich minerals were extracted from eight granitic rocks with various formation ages and mounted on epoxy-resin disks. A 2 nA mass filtered O_2^- primary beam was used to sputter a 30-µm-diameter flat-bottomed crater and secondary positive ions were extracted by a 10 kV accelerating voltage for mass analysis. A mass resolution of 9300 at 1% peak height was attained to reduce isobaric hydride interferences. The magnet was cyclically peak-stepped from mass 84 (^{84}Sr) to mass 88 (^{88}Sr) including background.

Observed ^{87}A/^{85}A ratios were plotted against ^{88}A/^{85}A ratios for each sample. A least-square fitting was made in the diagram where the inclination and Y-intercept were assigned to initial ^{87}Sr/^{88}Sr and (^{87}Rb + ^{87}Sr*)/^{85}Rb ratios, respectively, where "*" denotes radiogenic. There is a positive correlation between the (^{87}Rb + ^{87}Sr*)/^{85}Rb ratio and formation age of the granitic rock sample, suggesting that *in situ* ^{87}Rb – ^{87}Sr dating may be possible using an ion microprobe method.