The change of REE patterns from gneiss core in boreholes, Namyangju and Cheongyang area, Korea

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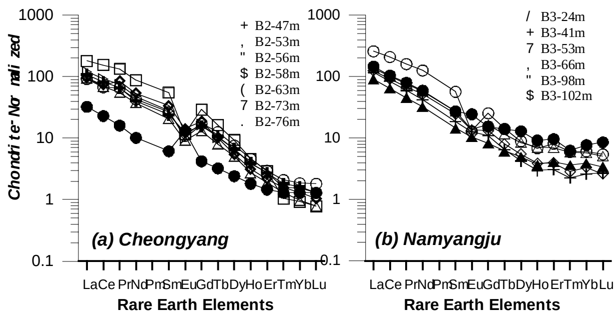
Introduction

An understanding of the geochemistry of potential host rocks is very important for the evaluation of a site for construction of an underground geologic repository requires. Especially, rare earth elements (REE) play an important role for solving various geological problems. In this paper, we discuss the abrupt change of Eu anomaly REE geochemistry from the rock unit in borehole. This change is due to the precipitation of the calcite from paleo-groundwater.

Results and Discussion

Fig. 1 is a chondrite-normalized REE pattern of gneiss core samples from Cheongyang and Namyangju area, Korea, the area of which are located at the SW and middle part of Korea, respectively. Fig. 1 shows an abrupt change of Eu anomaly at specific depth (see solid symbols). This change of Eu anomaly at a specific depth is due to the presence of calcite, which is a secondary mineral in the core samples. The calcite is precipitated as a fracture-filling material due to changes of geochemical environment in paleo-groundwater. The leaching experiment showed that positive Eu anomalies of core samples were due to calcite fraction.

Fig. 1. Chondrite-normalized REE patterns of gneiss core from two areas, Korea (In B2-47, B2 is the hole number, 47m means the depth)



Conclusion

Fracture-filling calcite is one of main products by precipitation from groundwater. Therefore, REE abundance in fracture-filling calcite may provide an important key for understanding the geochemical change of paleo-groundwater environment.

Where is geochronology going? Insights into intracrystalline reactions from alkali feldspars

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The microtextural complexity of alkali feldspars reflects the importance of exsolution, transformation and deuteric/hydrothermal reactions in the history of these minerals. Each process yields a distinctive suite of microtextures that can only be adequately characterised using transmission electron microscopy (TEM). Quantifying the impact of these microtextures on the behaviour of Ar isotopes in Nature and the laboratory is challenging and controversial.

Alkali feldspars formed in igneous and metamorphic rocks possess two classes of microtextures of importance in Ar isotope behaviour. Pristine strain-controlled microtextures form by exsolution during cooling from high temperatures and retain radiogenic Ar. The coarse exsolution lamellae that form microperthites are lined with edge dislocations that produce an interconnected, but ultimately closed, network in three-dimensions. Finer exsolution lamellae that form cryptoperthites are dislocation-free and commonly occur in igneous and metamorphic feldspars and even in 'gem quality' feldspars from pegmatites such as Madagasgar Orthoclase. Deuteric microtextures, called patch perthites, form by fluid-feldspar interaction at relatively low temperatures. These microtextures can act as fast diffusion pathways for radiogenic Ar because they are composed of an irregular mosaic of micrometre-sized dislocation- and micropore-rich subgrains. Our most recent work on authigenic K-feldspar overgrowths from siliciclastic sedimentary rocks shows that despite their pristine appearance in light and SEM images these overgrowths are composed of subgrains and are likely to behave in the same manner as patch perthites.

Owing to their very fine scale intergrowth of retentive and leaky microtextures, detailed characterisation of alkali feldspar grains is a prerequisite for interpreting data from isotopic analyses. How can the current gap between microtextural and isotopic studies be bridged? To date, many of the problems in combining data from these two analytical techniques has been the difficulty of characterising by TEM approximately the same volume of a sample that had been isotopically analysed and *vice versa*. The recent development of Focused Ion Beam (FIB) instruments for the nanotechnology & semiconductor industries offers a solution. These instruments enable micrometre-sized TEM samples to be directly extracted from specific parts grain surfaces. The combination of FIB techniques with high spatial resolution isotope analyses will at last achieve the coupling between TEM-scale microtextural characterisation and isotopic data in a wide variety of minerals.