

# **$^{87}\text{Sr}/^{86}\text{Sr}$ of apatite as an indicator of magma processes of the granites**

M. TSUBOI<sup>1</sup> AND K. SUZUKI<sup>2</sup>

<sup>1</sup>Department of Chemistry, Kwansei Gakuin University,  
Sanda, Hyogo, 669-1337, Japan; Japan;  
tsuboimot@hotmail.com

<sup>2</sup>Chronological Research Center, Nagoya University,  
Nagoya, 464-8602, Japan; suzuki@nendai.nagoya-u.ac.jp

Apatite is known to contain very little rubidium, and consequently has very low Rb/Sr values. The  $^{87}\text{Sr}/^{86}\text{Sr}$  of apatite should therefore not be significantly affected by  $^{87}\text{Rb}$  decay, and therefore be a good indicator of initial  $^{87}\text{Sr}/^{86}\text{Sr}$  (SrI) values for the sample. This method does not require prior knowledge of the age of plutons or the construction of isochrons [1][2].

In this study, magmatic apatite in samples of three granitic plutons (the Habu Granodiorite, the Inagawa Granite and the Kamihara Tonalite) in the Cretaceous Ryoke Belt, southwestern Japan was examined to reveal the spatial distribution of SrI within the pluton for understanding the detailed magmatic processes.

$^{87}\text{Sr}/^{86}\text{Sr}$  values of apatite in individual samples are uniform and correspond with SrI from the whole-rock mineral isochron. This suggests that  $^{87}\text{Sr}/^{86}\text{Sr}$  of apatite is unlikely to have been modified by uptake of radiogenic strontium during cooling.  $^{87}\text{Sr}/^{86}\text{Sr}$  in apatite seems to represent the  $^{87}\text{Sr}/^{86}\text{Sr}$  in the original magma. All plutons have systematic SrI variations within the pluton (the Habu Granodiorite: SrI=0.7054–0.7074; the Inagawa Granite: SrI=0.7093–0.7108; the Kamihara Tonalite: SrI=0.7070–0.7079). Combining SrI with whole-rock chemistry and field observations, the heterogeneity of initial  $^{87}\text{Sr}/^{86}\text{Sr}$  is caused by (1) the heterogeneity of magma for the Habu Granodiorite, (2) magma-magma mixing for the Inagawa Granite, and (3) assimilation of the country metamorphic rocks for the Kamihara Tonalite. Such SrI heterogeneity can produce spurious Rb-Sr whole-rock age estimates in granitic plutons, even where the true age of a pluton is uniform within measurable error.

Measurement of  $^{87}\text{Sr}/^{86}\text{Sr}$  of apatite is a potentially powerful geochemical tool suited to obtaining high precision direct estimates of the initial  $^{87}\text{Sr}/^{86}\text{Sr}$  ratio in a large number of samples. It provides an independent way of testing the significance of the initial  $^{87}\text{Sr}/^{86}\text{Sr}$  and age derived from an Rb-Sr isochron.

## **References**

- [1] Tsuboi M. and Suzuki K. (2003) *Chem. Geol.* **199**, 189-197.
- [2] Tsuboi M. (2005) *Chem. Geol.* **221**, 157-169.