Precise REE data open new research horizons

T. TANAKA[1]*

[1] Chrono. Res., ISEE, Nagoya Univ., Nagoya 464-8601 Japan (*correspondence: tanakat@nagoya-u.jp)

A distinguishing feature of Professor Akimasa Masuda's approach to geochemistry is his concept of the "bulk distribution coefficient", which initially seems unusual to geochemists, as we focus on individual mineral phases. Masuda [1] employed isotope dilution with TIMS for REE analysis, and analyzed La with a single filament under low vacuum. This technique is opposite to that commonly aimed; however, it yields precise REE data for meteorites [2]. A quite smooth (sometimes "straight") chondrite-normalized REE pattern is observed for terrestrial [e.g. 3] and lunar samples [4]. This result gives rise to the question of why REE patterns are so smooth when rocks consist of an aggregate of different minerals. In fact, REE patterns are largely determined prior to crystallization of the magma, as indicated by the occurrence of high REEs along grain boundaries [5].

However, more precise data have revealed irregularities in REE patterns such as the "tetrad effect" [6] and the Ce anomaly. Masuda and his students employed the ^{138}La-^{138}Ce [7] and ^{138}La-^{138}Ba [8] isotope decay systems in analyses of geochemistry. A previous study of the Barberton sedimentary rocks employing the La-Ce and Sm-Nd systems revealed that REE patterns with a Ce anomaly form later alteration [9]. Precise REE stable isotope data [10] will allow us to constructδREE pattern like Masuda-Coryell plot in future.

Analyses by ID-TIMS yield precise data for 10 REE, while 14 REE can be measured by ICP-MS [11]. In addition, 14 REE in coral have been measured by ID-ICP-MS [12]. Purified solution was divided into LREE and HREE to eliminate oxide interferences. Ten multi-isotopic REEs were determined by both conventional peak-height comparison and ID. Recovery rates are calculated and applied for mono-isotopic elements.

[1] Masuda (1967) *Geochem. J.* **2**, 111-135. [2] Masuda et al. (1973) *GCA* **37**, 239-248. [3] Shimizu et al. (1981) *Geochem. J.* **15**, 81-93. [4] Masuda et al. (1972) *Proc. 3rd Lunar Sci. Conf.* **2,** 1307-1313. [5] Suzuki (1990) *Geochem. J.* **24,** 57-74. [6] Masuda and Ikeuchi (1979) *Geochem. J.* **13,** 19-22. [7] Tanaka and Masuda (1982) *Nature* **300,** 515-518. [8] Nakai et al. (1986) *Nature* **320,** 433-435. [9] Hayashi et al. (2004) *Precambrian Res.* **135,** 345-357. [10] Wakaki and Tanaka (2012) *Int. Jour. Mass Spec.* **323-324**, 45-54. [11] Hirata et al. (1988) *Anal. Sci.* **4,** 637-647. [12] Tanaka, S-G. Lee, T. Kim, S. Han, H.M. Lee, S.R. Lee and J. I. Lee (in prep).