

Stable isotopic compositions of Eu and Sr in igneous rocks

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Stable isotopic composition of light elements, such as C and O, have long been used as a geochemical tracer in geology and geochemistry. Isotope fractionation, caused by both equilibrium and kinetic chemical reactions, generates variation in stable isotopic composition of elements among various geological materials. Recent studies of the stable isotopic composition of heavy elements have demonstrated that the stable isotopes of heavy elements are a useful tool to trace low-temperature geochemical processes (e.g. Beard et al., 2003) as analogous to the traditional stable isotopes of light elements. Theoretical investigation of isotopic fractionation behavior in equilibrium chemical reaction showed that the isotope fractionation factor of an equilibrium isotope exchange reaction is proportional to the relative mass difference between the isotopes of interest and is inversely proportional to the square of the temperature (Begeleisen and Mayer, 1947). Thus, relatively large isotope fractionation is expected for a low-temperature chemical reactions. Natural variations in stable isotopic composition of sediments and sedimentary rocks of low-temperature origin are reported for numbers of heavy elements (Weyer et al., 2008). The isotope effect of high-temperature chemical reactions, on the other hand, is considered to be negligible especially for heavy elements. Homogeneous isotopic composition of igneous rocks are reported for various heavy elements confirming this theoretical expectation. Recently, small variation of Fe isotopic composition is reported for igneous rocks that considered to reflect high-temperature isotope fractionation in magmatic condition (Poitrasson and Freydier, 2005; Heimann et al. 2008; Teng et al., 2008).

We report stable isotopic compositions of Eu and Sr in terrestrial igneous rocks measured by MC-ICP-MS and double-spike TIMS techniques. Variations in stable isotopic composition of both elements is found for some samples. The nature of the isotopic variation of the both elements and the possible isotope fractionation process will be discussed.