

Systematic isotopic studies of REE, Sr and Ba in eucrites

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The eucrites is meteorites that probably originate from the crust of asteroid 4-Vesta. Cosmochemical and chronological information of eucrites puts important constraints of on the evolutionary history of the eucrite parent body (EPB). In this study, systematic isotopic studies of Sr, Ba, Ce, Nd, Sm and Gd were performed on eight eucrites for better understanding of differentiation on the EPB. ¹³⁸Ce, ¹⁴²Nd, and ¹⁴³Nd include radiogenic components, and their isotopic variations correlate with La/Ce and Sm/Nd elemental ratios, respectively. The results were consistent with the isochron from previous studies (Makishima and Masuda, 1991; Boyet and Carlson, 2005; Andreasen and Sharma, 2007). The Rb-Sr chronometer consisting of ⁸⁷Sr/⁸⁶Sr and Rb/Sr for these eucrites is now in progress. Sm and Gd isotopic compositions of the eucrites showed the isotopic shifts caused by neutron capture reactions due to cosmic rays irradiation. These isotopic shifts correspond to the neutron fluences ranging from 0.28 to $4.05 \times 10^{15} \text{ n cm}^{-2}$, but these are almost consistent with their cosmic-ray exposure ages, suggesting no strong evidence of initial cosmic-ray irradiation on the surface of EPB. Most previous Ba isotopic studies of meteorites focused on the variation of r- and s-process nucleosynthetic components due to additional inputs in the early solar system. ¹³⁵Ba and ¹³⁷Ba isotopes are sensitive to s- and r-process variations, and often have deficits and/or excesses in chemical separates in carbonaceous chondrites due to the existence of presolar grains. In case of eucrites, there are no isotopic variations of all Ba isotopes, but some samples showed the slight excess of radiogenic ¹³⁵Ba probably from ¹³⁵Cs decay. Systematic isotopic data obtained in this study provide a hint to understand the evolution processes of differentiated meteorites. We are now applying this technique for the analyses of cumulate eucrites and diogenites.

Keywords: eucrite, REE, chronology, isotope