Sr, Ba and REE isotopic studies of eucrites

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Most eucrites have basaltic composition and represent lava flows or shallow intrusions from a differentiated parent body, possibly asteroid 4 Vesta. Chronological information of eucrites provide important constraints of the evolutional history of the eucrite parent body (EPB). Although many isotopic studies have been conducted by several kinds of geochronometers using decay systems with long-lived and short-lived radioisotopes to understand the processes of accretion, core formation, mantle differentiation, and the formation of primary basalts on the EPB [1-4], the exact time-scales for eucrites petrogenesis are still unclear.

In this study, systematic isotopic analyses of Sr, Ba, Ce, Nd, Sm and Gd were performed on eight eucrites for better understanding of differentiation on the EPB. ^{87}Sr, ^{138}Ce, ^{142}Nd, and ^{143}Nd include radiogenic components, and their isotopic variations correlate with Rb/Sr, La/Ce and Sm/Nd elemental ratios, respectively. 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. ^{135}Ba and ^{137}Ba 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. However, in case of eucrites, there are no isotopic variations of all Ba isotopes. Sm and Gd isotopic compositions of the eucrites show the variations of ^{149}Sm- ^{150}Sm and ^{157}Gd- ^{158}Gd caused by neutron capture reactions due to cosmic rays irradiation. These Sm and Gd isotopic shifts correspond to the neutron fluences ranging from 3.2 to 6.1x10^{15} n cm^{-2}. Systematic isotopic data obtained in this study provide a hint to understand the evolution processes of differentiated meteorites.

[1] Lugmair and Shukolyukov (1998) *GCA* **62,** 2863-2886. [2] Misawa *et al* (2005) *GCA* **69,** 5847-5861. [3]Srinivasan *et al* (2007) *Science* **317,** 345-347. [4] Quitté *et al* (2011) *GCA* **75,** 7698-7706.