BARIUM ISOTOPIC COMPOSITION OF CHONDRULES IN THE SAYAMA METEORITE

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Introduction: Barium is one of promising elements to address the details of nucleosynthesis and presolar grain formation of the solar system. Previous studies on the Ba isotopic compositions of carbonaceous chondrites provide useful information of the contributions of s-process, r-process and n-process (neutron burst) nucleosynthetic components [1-4]. In addition, ^{135}Ba isotopic abundance may be affected by decay from presently extinct ^{135}Cs isotope ($t_{1/2}$=2.3 Ma), which can be used for Cs-Ba geochronological application. In this study, Ba isotopic composition of chondrules from the Sayama meteorite was determined to search for ^{135}Cs isotope in the early solar system. It is known that the Sayama meteorite (CM2) shows the extensive signature for aqueous alteration on the meteorite parent body [5,6].

Experiments: The sample contains chondrules sized 200 to 600 μm diameter, and interestingly, most anhydrous silicates in the chondrules found in Sayama are replaced to phyllosilicates, which reveal evidence for highly aqueous alteration. 8 chondrules were collected from 0.2 g of the fragment, and leached by 1mL of 0.1 M acetic acid (hereafter fraction#1), 0.1 M HCl (#2), 2 M HCl (#3), and aqua regia (#4), successively. The residue (#5) was finally decomposed by HF-$HClO_4$ with heat. Ba fraction from each leachate was chemically separated using a conventional cation exchange method [2]. The Ba fraction was divided into two portions; one for the determination of isotopic composition by TIMS, and another for the determination of elemental abundances of Cs and Ba by ICP-MS.

Results and discussion: The Ba isotopic data of acid leachates sometimes show variable ^{135}Ba excesses correlated with ^{137}Ba excesses, suggesting the presence of independent nucleosynthetic components for s- and r-processes in the solar system. The Ba isotopic data of fractions #1 and #2 reveal negative isotopic anomalies of ^{135}Ba correlated with ^{137}Ba, suggesting enrichment of s-isotopes due to addition of presolar materials. These data are consistent with previous results from acid leachates of Sayama bulk sample. On the other hand, fractions #4 and #5 show isotopic excess of only ^{135}Ba (ε=+14.8 ± 8.9, and +18.4 ± 4.1, respectively) possibly due to ^{135}Cs decay.

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