COSMIC-RAY EXPOSURE HISTORIES OF GAS-RICH BRECCIATED METEORITES. H. Hidaka[1] and S. Yoneda[2]. [1]Department of Earth and Planetary Systems Science, Hiroshima University, Higashi-Hiroshima 739-8526, Japan. E-mail: hidaka@hiroshima-u.ac.jp. [2]Department of Science and Engineering, National Museum of Nature and Science, Tokyo 169-0073, Japan.

Introduction: Isotopic shifts in $^{150}Sm/^{149}Sm$ and $^{158}Gd/^{157}Gd$ caused by neutron capture effects are useful indicators to characterize the interaction of cosmic rays with planetary materials in space, because ^{149}Sm and ^{157}Gd have very large thermal neutron capture cross sections. A recent neutron capture study of the Sm and Gd isotopes of Pesyanoe also shows significant variations of neutron fluences in six different phases of a small meteorite fragment, starting with the early irradiation before compaction of the parent body [1]. In this study, Sm and Gd isotopic analyses of gas-rich brecciated meteorites other than aubrites were performed to find a possible contribution of the irradiation from the early Sun.

Samples and Experiments: Two samples of gas-rich meteorites, NWA801 (CR2), and Kapoeta (howardite), and two brecciated meteorites, Zag (H3-5) and Cook011 (L3-5), were used in this study. Zag consists of light-colored H6 clast and gray H3-4 matrix. In addition to a whole rock sample (Zag #1), 200 mg of clast (Zag #2) and matrix (Zag #3) were individually separated from a main fragment, and used for the Sm and Gd isotopic study. In the case of Kapoeta, a sequential acid-leaching experiment was carried out on the whole rock of Kapoeta, where 200 mg of the powdered sample was leached by 5 mL of 2 M HCl (Kapoeta #2), and aqua regia (Kapoeta #3) in succession. The residue (Kapoeta #4) was finally decomposed by HF + $HClO_4$ with heat. Conventional ion exchange techniques using two column procedures were carried out to chemically separate Sm and Gd for individual fractions [2].

A Micro-mass VG 54-30 thermal ionization mass spectrometer equipped with seven Faraday cup collectors was used for the isotopic measurements of Sm and Gd.

Results and Discussion: Isotopic shifts of Sm and Gd greater than the analytical uncertainties (2σ of the mean) were observed in Kapoeta #2, Kapoeta #3, Zag #1, Zag #2, NWA801 and Cook011, which correspond to the neutron fluences ranging from 0.76×10^{15} to 9.0×10^{15} n cm^{-2}. Interestingly, the neutron fluences of the chemical separates from Kapoeta (Kapoeta #2, #3 and #4) show a large variation from $<0.21 \times 10^{15}$ ncm^{-2} (detection limit) to $(9.0 \pm 0.6) \times 10^{15}$ ncm^{-2}, although that from the whole rock sample (Kapoeta #1) does not show clear evidence of neutron capture over the detection limit ($<0.72 \times 10^{15}$ ncm^{-2}). The data suggest the existence of heterogeneous alien materials having much larger irradiation records than the matrix component in Kapoeta. Zag also shows heterogeneous isotopic shifts on Sm and Gd caused by mixed irradiation records between irradiated and non-irradiated materials. Our Sm and Gd isotopic data from Zag #2 and #3 are consistent with the CRE ages [3].

References: [1] Hidaka H. et al. 2006. *Geochim. Cosmochim. Acta* 70:3449-3456. [2] Hidaka H. and Yoneda S. 2007. *Geochim. Cosmochim. Acta* 71:1074-1086. [3] Whitby et al. 2000. *Science* 288: 1819-1821.