Cosmic-ray exposure records of lunar meteorites studied from spallogenic and neutron-captured products

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Most lunar meteorites are known to have complicated cosmic-ray exposure (CRE) records on the Moon and in space [1]. Spallogenic products like ^{10}Be, ^{26}Al, ^{36}Cl, and ^{41}Ca, and neutron-captured products like ^{150}Sm and ^{158}Gd are useful for characterizing the CRE records of extraterrestrial materials. There are many reports on spallogenic short-lived radionuclides of lunar meteorites [e.g., 2,3], while there are few on their neutron-captured products [4,5]. A combination of short-lived radionuclides with stable isotopic shifts may provide the detailed estimation of the CRE records of lunar meteorites on the Moon and in space.

In this study, eleven lunar meteorites, NWA 479, NWA 482, NWA 2995, NWA 2996, NWA 3163, NWA 4734, NWA 4932, NWA 5000, Dhofar 081, Dhofar 910, Dhofar 911, whose spallogenic products were already reported, were used to obtain additionally new information on the CRE records from their Sm and Gd isotopic data.

30-50 mg of each sample was completely decomposed by mixed acid of HF - $HClO_4$. After then, the residue was redissolved in 1 mL of 1.7 M HCl. The sample solution was divided into two portions: Approximately 90% of the solution was used for conventional resin chemistry to separate Sm and some other rare earth elements (REE) for their isotopic analyses by a thermal ionization mass spectrometer, and the another 10% of the solution was used for the determination of the elemental abundances of REE by an ICP-MS.

The burial depths on the Moon, CRE duration, and neutron fluences for the eleven samples were estimated from the combination of the data given by spallogenic and neutron-captured products.

[1] Nishiizumi et al. (1996) *MAPS*, **31,** 893-896. [2] Nishiizumi and Caffee (2001) LPSC, XXXII, #2101. [3] Nishiizumi et al. (2004) LPSC XXXV, #1130. [4] Welten et al. (2013) LPSC, XXXXIV, #2933. [5] Hidaka et al. (2017) *AJ*, **153,** 274 (7pp).