NOBLE GASES OF THE BASALTIC SHERGOTTITE NWA 5029: COMPARISON WITH NWA 480

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Introduction: The basaltic shergottite NWA 5029 was discovered in Morocco in 2003 as a small single stone weighing 14.67 g [1]. As the meteorite has mineralogical similarities to NWA 480 and NWA 1460 shergottites, geochemical investigation is required to clarify the possibility of paring for these meteorites [2]. We measured noble gas isotopic composition of NWA 5029 and compared with those reported for NWA 480 [3] to examine the possible paring.

Experimental: Two tips of NWA 5029 were analyzed for noble gases: 27.2 mg by total melting (TM) at 1800°C and 53.7 mg by stepwise heating (SH) at 7 temperature steps from 600 to 1800°C. Noble gases extracted at each temperature were measured on a modified-VG5400(MS-II) at the University of Tokyo.

Result and Discussion: Helium is dominated by cosmogenic component, but other noble gases are affected by contamination from atmospheric noble gases. Cosmogenic 3He and 21Ne concentrations (in 10^-9 cm^3 STP/g) are 45 and 4.7 for the SH and 46 and 5.7 for the TM, respectively. The concentrations are similar to the values of 40 and 4.6 reported for NWA 480 [3], which indicates identical cosmic-ray exposure age of about 2.5 Ma for these meteorites, although concentrations of target elements producing cosmogenic nuclides such as 3He, 21Ne and 38Ar are not available yet for NWA 5029. Presence of Xe originated from Mars is indicated by the excess 129Xe observed for both meteorites, i.e., the highest 129Xe/132Xe ratios of 1.28 and 1.25 were observed at 1400°C for NWA 5029 (SH) and NWA 480 [3], respectively.

In contrast to the similarities noted above, cosmogenic 21Ne/22Ne ratio of 0.7 is clearly lower than the value of 0.8 for NWA 480 [3]. The low 21Ne/22Ne ratio for Martian meteorites is generally attributed to irradiation of solar cosmic-rays [4]. The SH sample is heavily contaminated from atmospheric noble gases compared with the TM one, showing different degree of weathering even in a small scale within the meteorite. NWA 480 is, however, less contaminated by terrestrial heavy noble gases than the NWA 5029 samples. 40Ar/36Ar ratio of 465 (at 1400°C) of NWA 5029 is distinctly lower than 1050 (at 900°C) of NWA 480. 84Kr/132Xe ratios for the two meteorites also show clear difference, i.e., 12-24 and ~4 for NWA 5029 and NWA 480, respectively.

The noble gas compositions described above indicates that these meteorites were ejected from Mars at ~2.5 Ma ago, but separately fell onto the Earth via different orbits from Mars. This conclusion supports the description by Mikouchi and Barrat [2] that “NWA 5029 is probably not paired with NWA 480/1460 although it is likely that they originated from the same igneous body on Mars”.