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 ^{3}He and ^{21}Ne 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 ^{3}He, ^{21}Ne and ^{38}Ar are not available yet for NWA 5029. Presence of Xe originated from Mars is indicated by the excess ^{129}Xe observed for both meteorites, i.e., the highest ^{129}Xe/^{132}Xe 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 ^{21}Ne/^{22}Ne ratio of 0.7 is clearly lower than the value of 0.8 for NWA 480 [3]. The low ^{21}Ne/^{22}Ne 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. ^{40}Ar/^{36}Ar ratio of 465 (at 1400°C) of NWA 5029 is distinctly lower than 1050 (at 900°C) of NWA 480. ^{84}Kr/^{132}Xe 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 had been ejected form Mars at ~2.5 Ma ago, but separately fell onto the Earth via different obits 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”.

References: [1] Connolly H.C.Jr. et al. 2007. Meteoritical Bulletin No. 93, *Meteoritics & Planetary Science* 43:571-632. [2] Mikouchi T. and Barrat J.A. 2009. *Meteoritics & Planetary Science* 44:A143. [3] Mathew K.J. et al. 2003. *Earth and Planetary Science Letters* 214:27-42. [4] Garrisson D.H. et al. 1995. *Meteoritics* 30:738-747.