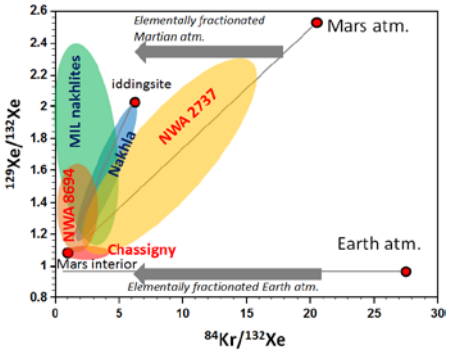
**GENETIC RELATIONSHIP BETWEEN MARTIAN CHASSIGNITES AND NAKHLITES REVEALED FROM NOBLE GASES.** K. Nagao[1], J. Park[2,3,4], J. Choi[1], J. M. Baek[1], M. K. Haba[5], T. Mikouchi[6], M. E. Zolensky[7], G. F. Herzog[3], C. Park[1], J. I. Lee[1], and M. J. Lee[1], [1]Korea Polar Res. Inst. (KOPRI), Yeonsu-gu, Incheon 21990, Rep. of Korea (nagao@kopri.re.kr), [2]Kingsborough Comm. Coll., Brooklyn, NY 11235, USA, [3]Dept. Chem. & Chem. Biol., Rutgers Univ. of Piscataway, NJ 08854, USA, [4]Amer. Muse. of Natural History (AMNH), NY 10024, USA, [5]Dept. of Earth & Planet. Sci., Tokyo Inst. of Technology, Meguro-ku, Tokyo 152-8551, Japan, [6]Univ. Museum, Univ. of Tokyo, Tokyo 113-0033, Japan, [7]ARES, NASA Johnson Space Center, Houston, TX 77058, USA.

**Introduction:** The group called Martian meteorites comprises shergottites, nakhlites, chassignites, ALH 84001 orthopyroxenite, and NWA 7034 and its pairs. They are thought to come from Mars. The nakhlites and chassignites show similar cosmic-ray exposure (CRE) ages of 11-12 Ma, although their petrologic characteristics are very different. Both nakhlites and chassignites indicate similar cooling rates, and would have cooled in identical scale of igneous bodies [e.g., 1, 2]. However, relationship between nakhlites and chassignites is still unclear: They might have been ejected at the same time by coincidental impacts that occurred at different places on Mars or by a single impact that excavated both nakhlites and chassignites from a relatively small area. Based on noble gas data obtained in our laboratory we propose that the chassignites and nakhlites were located within a relatively narrow area from which launch took place. If both chassignites and nakhlites were ejected by a single impact, they provide a geological/petrological profile in the area where both pyroxene-rich lava (nakhlites) and dunite-rich rocks (chassignites) are located close to Martian surface.

**Samples:** Three chassignites (Chassigny, NWA 2737, NWA 8694), Nakhla, and four MIL nakhlites were analyzed either as total melts (TM) or by heating in n steps (nSH): Chassigny (49.1 mg 8SH), NWA 2737 (109.3 mg 6SH; 221.9 mg 13SH; 210.7 mg 16SH; 27.9 mg TM; 26.3 mg TM), NWA 8694 (31.47 mg 9SH; 5.44 mg TM), Nakhla (126.4 mg 8SH; 13.6 mg TM), MIL 03346 (87.5 mg 15SH; 35.2 mg TM), MIL 090030 (43.7 mg 9SH; 4.75 mg 16SH), MIL 090032 (44.3 mg 9SH; 5.18 mg 17SH), and MIL 090136 (49.0 mg 9SH; 5.16 mg 17SH).

**Results and Discussion:** Average CRE ages based on cosmogenic $^{3}$He, $^{21}$Ne and $^{38}$Ar for nakhlites and chassignites calculated following the methods by [3, 4] are 11.5 ± 0.7 and 12.3 ± 3.6 Ma, respectively. The older age range with larger uncertainties for chassignites is mainly due to higher and lower ages yielded from $^{3}$He and $^{38}$Ar, respectively. It was already reported that $^{3}$He yields consistently higher ages for Chassigny [5]. Both ages for nakhlites and chassignites, however, overlap within experimental uncertainties, and also with most of ages reported [e.g., 5, 6, 7, 8]. In plot of $^{129}$Xe/$^{132}$Xe versus $^{84}$Kr/$^{132}$Xe (see figure) Martian meteorites are shown to contain several noble gas components of different origins, i.e., Martian interior (Chassigny), Martian atmosphere (Impact glasses in shergottites), elementally fractionated Martian atmosphere (aqueously altered minerals such as iddingsite), and elementally fractionated Earth atmospheric contamination [e.g., 5, 9, 10, 11]. The three chassignites show wide variation, different from each other. Data for NWA 2737 plot along a mixing line between Martian interior and atmosphere, suggesting a presence of shock-implanted Martian atmosphere, consistent with the heavily shocked nature of this meteorite. The third chassignite NWA 8694, however, shows important trend suggesting a presence of both Chassigny-like and MIL-nakhlite-like noble gases. The characteristic trend for MIL, heavier fractionation than that for iddingsite, is different from those for other nakhlites [12, 13, 14]. The similar trends observed for NWA 8694 and MIL nakhlites suggest that both rocks were affected by aqueous alteration while exposed to surface fluids containing extremely fractionated Martian atmospheric noble gases.




The identical CRE ages and characteristic noble gas compositions observed for both MIL nakhlites and NWA 8694 chassignite strongly support that both nakhlites and chassignites are launch-paired Martian meteorites.

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