LUNAR METEORITE SAU 300 – NOBLE GAS RECORD.

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Sayh al Uhaymir 300 (SaU 300) is a polymict crystalline impact-melt breccia dominated by feldspathic components with small HMS contribution [1, 2]. Here we discuss the noble gas record of SaU 300. Noble gas components have been separated according [3] and production rates are calculated on composition [2] according [4].

A chip weighing 100.9 mg from SaU 300 has been measured for noble gases at the Laboratory for Earthquake Chemistry, Univ. of Tokyo by a stepwise heating method: 600, 800, 1000, 1200 and 1800°C.

It showed a maximum release at 1000°C, whereas other noble gases were mostly released at 1800°C. At the 600 and 800°C, Ne isotopic ratios are interpreted as a mixture between terrestrial atmospheric and cosmogenic components, but at the higher temperatures trace amount of SEP-Ne, [^{20}Ne] ~1.5×10^{-7} cm^{3}STP/g, was recognized as the plots on a SEP-cosmogenic mixing line. Solar wind Ne as indicated in [5] could not be identified. Cosmogenic ^{3}He, ^{21}Ne and ^{38}Ar concentrations are 0.3, 0.70, 1.5×10^{-8} cm^{3}STP/g, reflecting CREA of 0.2, 3.1 and 9.5 Myr respectively. An adoption of ^{3}He and ^{21}Ne to T38 reflect a He/Ne loss ratio of 1.5 that is moderate above their atomic radii ratio of 1.2. The resulting cosmogenic ^{21}Ne/^{38}Ar ratio meets P21/P38 of 1.45. Measured concentrations of radiogenic ^{4}He and ^{40}Ar are respectively 220 and 1400 $\times10^{-8}$ cm^{3}STP/g. Adopting the concentrations of U (0.22 ppm), Th (0.46 ppm) and K (510 ppm), U/Th-He and K-Ar ages were calculated as 0.055 and 2.9 Gyr, respectively. The much younger U/Th-He age should have been resulted by strong He-loss dominantly during the ejection event. On the basis of the above mentioned CREA He adoption the U/Th-He age move to 2.4 Gyr which is in moderate agreement with the K-Ar-age of SaU 300. Because the radiogenic ^{40}Ar should have been lost partly at the impact events too, real crystallisation age must be older than the calculated K-Ar age.

These observations are consistent from the petrological features interpreted impact events [1, 2]: most of noble gases had been lost by crater-forming impact > 60 GPa on the Moon about 3 Gyr ago, and trace amounts of noble gases strongly retained in some minerals and lithic fragments remain in this meteorite. The noble gas release profile suggests that the temperature was about 1200°C. From the above discussion, the cosmogenic ^{21}Ne and ^{38}Ar should be partly products by cosmic-ray irradiation on the lunar surface for nearly 10 Myr prior to the main impact event. Regolith breccias generally trap solar wind (SW) and solar energetic particles (SEP). By the ejecting impact heating, less energetic SW-particles have been removed. Accordingly, the measured concentration of cosmogenic ^{3}He and its production rate of 1.7 $\times10^{-8}$ cm^{3}STP/g/Myr gives an upper limit on a transit time of SaU 300 from the Moon to the Earth as 0.2 Myr.

References: [1] Hudgins J. A. et al. 2007. *Meteorit. Planet. Sci. 42*:1763-1779. [2] Hsu W. et al. 2008. *Meteorit. Planet. Sci. 43*:1363–1381. [3] Eugster O. et al. 2000. *Meteorit. Planet. Sci. 35*:1177-1181. [4] Eugster O. et al. 1995. *Geochim. Cosmochim. Acta 59*: 177-199 [5] Lorenzetti S. et al. 2005. *Meteorit. Planet. Sci.* 40: 315-327.