NOBLE GASES IN A GIBEON IRON METEORITE FRAGMENT HEAVILY SHIELDED TO COSMIC-RAYS

K. Bajo[1], K. Nagao[1], and M. Honda[2]. [1]Laboratory for Earthquake Chemistry, Graduate School of Science, University of Tokyo, Bunkyo-ku, Tokyo 113-0033, Japan. E-mail: k-bajo@eqchem.s.u-tokyo.ac.jp. [2]Department of Chemistry, Nihon University, Setagaya-ku, Tokyo 156-0045, Japan.

Introduction: Gibeon iron meteorite classified as IVA has been discovered as a large number of fragments in a strewn field in Namibia, Africa. Total weight of the meteorite becomes about 21 tons [1], and its preatmospheric body was estimated to be lager than 3 meters in radius (applying the model calculation from [2] for our data). The scarcity of cosmogenic noble gases may provide us with a chance to investigate primordial component in iron meteorite parent body. We will report noble gas data recently obtained for a plate-shaped sample (about 240 × 170 × 8 mm in size), which shows extraordinary low concentration of cosmogenic noble gas, e.g., ^{3}He $<10^{-12}$ cm^{3}STP/g [3]. This belongs to a group with relatively short cosmic-ray exposure age (~10^7 y) [4]. Our purpose of this study is to investigate the primitive noble gas component in iron meteorite parent body.

Noble gas analysis: Meteorite pieces weighing 90–130 mg each, drilled out from 8 points in the sample plate, were analyzed for noble gases on a modified-VG5400 (MS-III). We used a Mo crucible of which inner wall was coated with zirconium oxide to avoid melting of the crucible by forming alloy with the iron meteorite.

Results and Discussion: Measured ^{3}He/^{4}He ratios were as low as (3-5) × 10^{-4}, which resemble isotopic ratio of "primordial helium". Several cases can be considered for the low ^{3}He/^{4}He; 1) mixing of cosmogenic helium and radiogenic ^{4}He, 2) true primordial helium, and 3) air contamination. Combination of these cases can also be considered. If ^{3}He is totally cosmogenic, cosmogenic ^{3}He was generated as low as (2.2 ± 0.4) × 10^{-13} cm^{3}STP/g in a time spans of 10 My [4]. Concentrations of ^{4}He were in the order of 10^{-9} cm^{3}STP/g, homogeneously distribute in the sample plate. Given that the ^{4}He was produced from U, Th (Th/U = 3) for 4 Ga, concentration of uranium can be estimated as low as 0.5 ppt. Contamination of terrestrial air is improbable, because ^{4}He/^{20}Ne ratios in our sample are >1.3 much larger than the atmospheric value of 0.32 and contamination generally occurs selectively in heavier noble gas.

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