NOBLE GASES OF THE JINJU (H5) METEORITE FELL ON MARCH 9, 2014, IN KOREA.

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Introduction: A fireball traveling more than 100 km was observed and sonic boom was heard in southern part of Korea on 2014 Mar 9, 20:04 (local time). Four stones, 9 kg (Jinju-1), 4.1 kg (Jinju-2), 0.4 kg, and 20.5 kg were recovered in few days after the fireball observation. The meteorite was classified as H5 ordinary chondrite based on petrological and geochemical investigations [1].

Experimental Methods: Noble gases were measured for two small fragments with masses of 22.1 and 130.5 mg taken from Jinju-1 and a fragment of 49.9 mg from Jinju-2 with Modified-VG5400/MS-III mass spectrometer at the University of Tokyo. Noble gases were extracted by total melting at 1800℃ from the 22.1 g Jinju-1 sample and stepwise heating at 300, 800, 1100, 1400, and 1800℃ from the 130.5 mg Jinju-1 and 49.9 mg Jinju-2. After purification of noble gases, they were separated into He, Ne, Ar, Kr, and Xe fractions, and then each noble gas was introduced into the mass spectrometer. Concentrations of major elements were determined for both Jinju-1 and Jinju-2 with XRF at the Korea Polar Research Institute (KOPRI).

Results and Discussion: Noble gas compositions of both Jinju-1 and Jinju-2 showed no remarkable differences among them, indicating that these fragments were derived from a single preatmospheric body. Low $^{3}He/^{4}He$ ratio of 0.003–0.004 and relatively high concentrations of ^{4}He, $(1.3–1.6) \times 10^{-5}$ $cm^{3}STP/g$, as well as cosmogenic Ne isotope ratios, $^{20}Ne/^{22}Ne$ = 0.83–0.87 and $^{21}Ne/^{22}Ne$ = 0.86–0.88, mean low concentrations of trapped noble gases and relatively short duration of exposure to cosmic-rays for this meteorite. Concentrations of trapped ^{84}Kr and ^{132}Xe are in the range for chondrites of petrologic type 5–6, compatible with the classification of H5 for the Jinju meteorite [1]. Contribution of cosmogenic isotopes to Kr and Xe is negligible. Kr and Xe of atmospheric contamination were mostly released at the heating temperature of 800℃ as shown by the high $^{84}Kr/^{132}Xe$ ratios of 36 and 43 for Jinju-1 and Jinju-2, respectively. Concentrations of radiogenic ^{4}He was calculated by subtracting cosmogenic ^{4}He from the total ^{4}He concentrations with an equation of $^{4}He_{rad} = {}^{4}He_{total} - 5 \times {}^{3}He_{total}$. Measured ^{40}Ar concentrations were assumed as radiogenic ones. Calculated U/Th-He and K-Ar ages are 3.2–4.0 Gy and 3.8–4.0 Gy, respectively, where 42 ppb Th, 12 ppb U [2] and 782 ppm K [3] for average values of H chondrites were used. Cosmic-ray exposure ages based on the cosmogenic ^{3}He, ^{21}Ne and ^{38}Ar concentrations were calculated using the production rates for chondrites [4]. Concordant ages were obtained from ^{3}He, ^{21}Ne and ^{38}Ar, giving an average value is 2.4 My. The gas retention ages and the cosmic-ray exposure ages for Jinju meteorite show negligible preferential loss of He from the meteorite after beginning of retention of radiogenic He and Ar.

References: [1] Meteoritical Bulletin Database. [2] Wasson J. T. and Kallemeyn G. W. 1988. *Philosophical Transactions of the Royal Society of London* A325:535–544: DOI: 10.1098/rsta.1988.0066. [3] Kallemeyn G. W. et al. 1989. *Geochimica et Cosmochimica Acta* 53: 2747–2767. [4] Eugster O. 1988. *Geochimica et Cosmochimica Acta* 52: 1649–1662.