NOBLE GASES IN THE HAMLET METEORITE (LL4).

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Introduction: Heavy noble gases in primitive meteorites are contained in a very small portion of meteorites. This phase, Q for quintessence, is most likely carbonaceous [1, 2]. However, the exact nature of Q remains enigmatic. In continued effort to better understand Q [3-6], we carried out noble gas studies of the Hamlet meteorite (LL4), both for a bulk sample and an HF-HCl residue.

Experimental: The total of 3.47 g of the meteorite was processed at Washington University in St. Louis, USA. It was alternately treated with HF-HCl and HCl to dissolve silicates. Elemental sulfur was removed with CS_2. The residue comprised 1.11% of the starting material. Noble gases were analyzed using the VG5400 at Osaka University, Japan. The temperatures for step-wise heating were 600, 800, 1000, 1200, 1400, and 1600°C for both samples.

Results and Discussion: The ^{84}Kr and ^{132}Xe concentrations in the bulk sample are 1.24×10^{-9} and 1.40×10^{-9} cm^3STP/g, respectively. They are 2.2 and 2.8 times higher than those of the same meteorite by Alaerts et al. [7]. Helium-4, ^{22}Ne and ^{36}Ar concentrations are comparable in the two studies, indicating Q is more abundant in our bulk sample.

The ^{132}Xe concentration of the HF-HCl residue is 9.24×10^{-8} cm^3STP/g, indicating that Q was enriched 66 times from the bulk sample. The mass balance calculation indicates that 73 percent of the Xe in the bulk sample remains in the HF-HCl residue. The Xe isotopic composition of the HF-HCl residue indicates that the Xe is essentially Xe-Q and that no diamond was in the residue.

The Ne in the bulk sample is dominated by cosmogenic Ne: the ^{20}Ne/^{22}Ne and ^{21}Ne/^{22}Ne ratios of the total are 0.812 ± 0.004 and 0.866 ± 0.003, respectively. The residue, although all silicates were removed, still contains a large amount of cosmogenic Ne (2.467 ± 0.017 and 0.6576 ± 0.006, respectively), indicating that it contains a significant amount of oxides. In order to determine the ^{20}Ne/^{22}Ne ratio of Hamlet Ne-Q, we assumed 0.029 as the ^{21}Ne/^{22}Ne ratio of Hamlet Ne-Q because ^{21}Ne/^{22}Ne ratios of Ne-Q from many meteorites are known to be ~ 0.029 [4, 8]. The ^{20}Ne/^{22}Ne of Hamlet Ne-Q was determined to be 11.0 ± 0.5. ^{20}Ne/^{22}Ne ratios of Ne-Q vary in different meteorites: they can be divided into two groups [8, 9]. The first group has ^{20}Ne/^{22}Ne ratios of 10.11 ± 0.04, including Ne-Q from Lancé (CO3.5), and Cold Bokkeveld (CM2), and the second group has those of 10.57 $\pm$ 0.19, including Ne-Q from Allende (CV3), Chainpur (LL3.4), Grosnaja (CV3) and Murchison (CM2) [8]. Hamlet Ne-Q obviously falls into the second group.

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