IDENTIFICATION OF Q FROM SARATOV (L4).

Sachiko Amari[1], Scott Messenger[2], Simon J. Clemett[3] and Alexander Meshik[1]. [1]Physics Department and The McDonnell Center for the Space Sciences, Washington University, St. Louis, MO 63130, USA. E-mail: sa@physics.wustl.edu. [2]Robert M Walker Laboratory for Space Science, EISD, ARES, NASA Johnson Space Center, Houston, TX 77058, USA. [3]ERC, Inc. / JACOBS, 2224 Bay Area Boulevard, Houston, TX 77023, USA.

Introduction: Heavy noble gases in primitive chondrites are concentrated in a very small portion of meteorites, and the carrier was named Q for quintessence [1]. Q is most likely carbonaceous matter [2, 3] that is readily destroyed by oxidants. However, the exact nature of Q remains enigmatic. In our continuing effort to identify Q [4, 5], we analyzed Q-rich fractions from Saratov (L4) using various types of instruments.

Experimental Results: The separation and noble gas analysis were performed at Washington University as described by Amari and Meshik [6]. The fractions Saratov AO and AP have the highest Xe concentrations among the fractions analyzed, 6.95×10^{-7} and 6.98×10^{-7} cm^3STP/g, respectively. AO and AP were deposited on Au foil and analyzed for organic molecules using microprobe two-step laser mass spectrometry (μ–L^2MS), and C and N isotopic imaging using a NanoSIMS 50L, both at The Johnson Space Center. AO and AP contain aliphatic hydrocarbons, and aromatic hydrocarbons with high-molecular weights, but the amount of organic molecules of AO is 4 to 5 times higher than that of AP. Ammonia (HN_3) (NH_4OH was not used during the separation) is a prominent peak in AO and AP. In the total of two 20×20 μm^2 areas in AO, we found three spots (~0.3 μm) with ^{15}N depletion. The $^{14}N/^{15}N$ ratios of these spots are 424 ± 62, 417 ± 53, 423 ± 65, and are remarkably close to that of the Jupiter (435 ± 57) [7]. The $^{12}C/^{13}C$ ratios of the spots are 123 ± 17, 104 ± 6, and 90 ± 6, respectively. The O^-/C^- and CN^-/C^- ratios are high (1.48 ~ 3.99, and 0.80 ~ 2.80, respectively), indicating they are organic.

Discussion: The affinity of Q and the Q-gases to the primordial component, represented by the composition of Jupiter, has been observed. The $^3He/^4He$ ratio of He-Q, $(1.41 \sim 1.59) \times 10^{-4}$ [8, 9], is very close to the ratio of Jupiter [$(1.66 \pm 0.05) \times 10^{-4}$] [10]. Verchovsky et al. [11] found that Q-gases in CR2 and CR3 chondrites were accompanied by isotopically light N and suggested that Q contained isotopically light N ($\delta^{15}N < -140$ ‰) that might be related to solar N. From the fact that these isotopically anomalous 3 spots have the same $^{14}N/^{15}N$ ratio as that of Jupiter, and are enriched (3 spots in ~400 μm^2) in the Q-rich fraction AO, we concluded that these spots represent Q, and that Q acquired its noble gases in the solar nebula.

References: [1] Lewis R. S. et al. 1975. *Science,* 190:1251-1262. [2] Reynolds J. H. et al. 1978. *Geochim. Cosmochim. Acta,* 42:1775-1797. [3] Ott U. et al. 1981. *Geochim. Cosmochim. Acta,* 45:1751-1788. [4] Matsuda J. et al. 2010. *Meteorit. Planet. Sci.,* 45:361-372. [5] Amari S. et al. 2013. *Astrophys. J.,* 778:37 (39pp). [6] Amari S. and Meshik A. 2015. *Meteorit. Planet. Sci.,* this issue: [7] Owen T. et al. 2001. *Astrophys. J.,* 553:L77-L79. [8] Wieler R. et al. 1991. *Geochim. Cosmochim. Acta,* 55:1709-1722. [9] Busemann H. et al. 2000. *Meteorit. Planet. Sci.,* 35:949-973. [10] Mahaffy P. R. et al. 1998. *Space Sci. Rev.,* 84:251-263.[11] Verchovsky A. B. et al. 2012. *Lunar & Planet. Sci.,* 43:#2645.