TRAPPED NOBLE GASES IN THE ISHEYEVO CH/CB CHONDRITE. D. Nakashima[1,2], S. P. Schwenzer[1,3], U. Ott[1], and M. A. Ivanova[4]. [1]Max-Planck-Institut für Chemie, J.-J.-Becher-Weg 27, D-55128 Mainz, Germany. [2]Laboratory for Earthquake Chemistry, Graduate School of Science, University of Tokyo, Hongo 7-3-1, Tokyo 113-0033, Japan (naka@eqchem.s.u-tokyo.ac.jp). [3]Lunar and Planetary Institute, 3600 Bay Area Boulevard, Houston, TX 77058-1113, USA. [4]Vernadsky Institute of Geochemistry and Analytical Chemistry, Kosygin St. 19, Moscow 119991, Russia.

Introduction: The recently discovered meteorite Isheyevo contains two lithologies: relatively metal-rich CB like (~ 70 vol% FeNi metal content) and metal-poor CH like (< 20 vol% FeNi metal content) [1], and for this reason the meteorite is expected to provide a clue for genetic relationship between CH and CB chondrites. Metal-rich CH and CB chondrites are characterized by isotopically heavy nitrogen [e.g., 2], where the metallic phases tend to contain isotopically heavier nitrogen than the silicate phases [2]. The same holds for Isheyevo [3]. Bulk noble gas analysis has shown that Isheyevo contains solar noble gases as well as Ar-rich noble gases [4], which is also characteristic for CH and CB chondrites [e.g., 5]. Here we report results of noble gas analyses of metallic and silicate phases, and discuss differences between the trapped noble gas signatures.

Results and Discussion: Isotopic ratios of He and Ne in both fractions are dominated by solar and cosmogenic components. The presence of solar noble gases indicates that the constituent materials of Isheyevo experienced solar wind irradiation. It has been suggested that chondrules and metal grains in the CB chondrites formed from a melt-vapor produced during a giant impact event [6]. Solar wind noble gas acquisition must have occurred after such a giant impact, since otherwise volatile elements such as noble gases would have been effectively lost.

The $(^{4}He/^{20}Ne)_{Solar}$ ratios of the metallic phases are higher than those of the silicate phases (Table 1), indicating solar noble gases to be better-retained in the metallic phases than in the silicate phases. On the other hand, the $(^{20}Ne/^{36}Ar)_{Trapped}$ ratios of the metallic phases are lower than those of the silicate phases (Table 1). There are two possible explanations for low $(^{20}Ne/^{36}Ar)_{Trapped}$ ratios: preferential loss of solar ^{20}Ne and enrichment of ^{36}Ar. If solar ^{20}Ne were lost, solar ^{4}He would have been lost even more strongly and the $(^{4}He/^{20}Ne)_{Solar}$ ratios of the metallic phases would be lower than those of the silicate phases. Thus, the low $(^{20}Ne/^{36}Ar)_{Trapped}$ ratios of the metallic phases are better explained by enrichment of ^{36}Ar.

Subtracting solar ^{36}Ar assuming the $(^{20}Ne/^{36}Ar)_{Solar}$ ratios of the metallic phases to be in the range 27.7 to 47 (the former is the highest ratio of silicate phases, the latter is the ratio in the solar wind [7]), results in $(^{36}Ar/^{132}Xe)_{Primordial}$ ratios for the metallic phases between 396 and 586. This is above the Q range (50 - 100; [8]), but in the range of Ar-rich gases (200 - 2800; [e.g., 9]). Thus, the enrichment of ^{36}Ar in metallic phases is most likely derived from Ar-rich noble gases.

Xe isotopic ratios of the silicate phases are distributed around Xe-Q, whereas those of the metallic phases are close to those of Xe-subsolar (between Xe-Q and solar wind). Assuming that Xe in the metallic phases is a mixture of Xe-Q and solar wind (rather than subsolar), the implied $(^{20}Ne/^{132}Xe)_{Solar}$ ratios of the metallic phases are much lower than in the solar wind [7] implying some 99 % loss of solar ^{20}Ne. Solar ^{4}He should have been lost even more than solar Ne, so the $(^{4}He/^{20}Ne)_{Solar}$ ratios would be expected to be lowered, contrary to observation. Thus, rather than as a mixture of Xe-Q and solar wind, Xe in the metallic phases is regarded as predominantly Xe-subsolar.

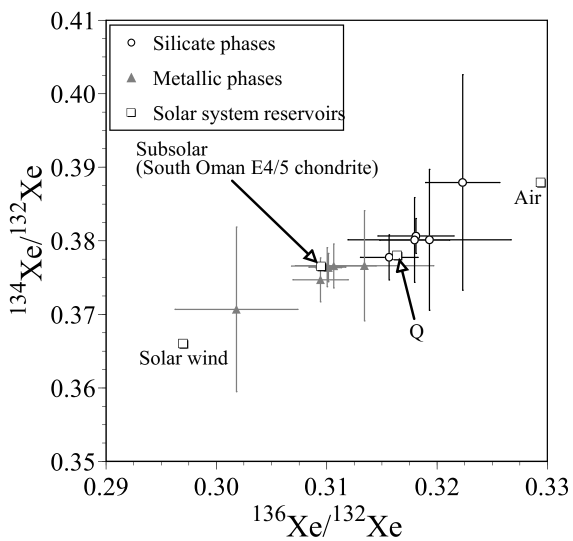

Fig. 1: Xe three isotope diagram. Xe isotopic ratios of Q, subsolar, solar wind, and air are from [8-11].

Only the metallic phases appear to contain Ar-rich noble gases associated with subsolar-like Xe. This may be due to higher retentivity of Ar-rich noble gases in metallic phases than in silicate phases, like in the case of solar noble gases, i.e., Ar-rich noble gases may have been lost from the silicate phases during parent body processes. However Isheyevo is less altered (A. N. Krot, personal communication) than the Bencubbin CB chondrite where both metallic and silicate phases contain Ar-rich noble gases associated with subsolar-like Xe [5]. It thus appears that selective acquisition of Ar-rich noble gases by the metallic phases of Isheyevo is more likely than loss from the silicate phases during parent body processes.

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Table 1. Solar ^{20}Ne concentrations and elemental ratios of trapped noble gases in the silicate and metallic phases of Isheyevo

	Mass mg	Solar ^{20}Ne 10^{-6}cm^3/g	$(^{4}He/^{20}Ne)_{Solar}$	$(^{20}Ne/^{36}Ar)_{Trapped}$	$(^{36}Ar/^{132}Xe)_{Trapped}$	$(^{84}Kr/^{132}Xe)_{Trapped}$
Silicate phases	0.61	6.67	149 ± 5	13.6 ± 0.9	795 ± 297	2.09 ± 0.81
	2.55	6.99	153 ± 4	13.0 ± 0.6	743 ± 76	1.97 ± 0.20
	1.87	7.12	146 ± 4	14.1 ± 0.6	730 ± 88	1.92 ± 0.23
	0.69	5.57	138 ± 5	15.0 ± 0.9	782 ± 320	2.19 ± 0.93
	31.91	6.70	169 ± 4	27.7 ± 0.9	310 ± 7	1.93 ± 0.05
Metallic phases	0.53	6.29	384 ± 5	10.2 ± 1.8	750 ± 379	2.53 ± 1.24
	11.14	3.92	419 ± 6	9.4 ± 0.3	635 ± 56	2.10 ± 0.18
	11.64	3.71	457 ± 11	9.5 ± 0.4	634 ± 59	2.13 ± 0.19
	2.57	6.60	337 ± 22	12.0 ± 1.1	700 ± 100	2.02 ± 0.26
	2.31	3.56	452 ± 10	7.1 ± 0.3	660 ± 25	2.01 ± 0.10
	30.18	2.77	380 ± 11	3.6 ± 0.1	1207 ± 14	1.89 ± 0.01