

ITQIY: II. A SHORT STORY ABOUT ITS NOBLE GASES AND OXYGEN ISOTOPES. A. Patzer¹, D. H. Hill¹, W. V. Boynton¹, L. Franke², L. Schultz² and I. A. Franchi², ¹Lunar and Planetary Laboratory, University of Arizona, Tucson AZ 85721 (apatzer@lpl.arizona.edu), ²Max-Planck-Institut für Chemie, D-55020 Mainz, Germany (schultz@mpch-mainz.mpg.de), ³Planetary Sciences Research Institute, Open University, Walton Hall, Milton Keynes, MK7 6AA, U.K. (I.A.Franchi@open.ac.uk).

Introduction: Itqiy is a unique coarse-grained, metal-rich enstatite meteorite that was recovered from Western Sahara in July 2000 [1,2]. The dominating mineral phase is a low Ca pyroxene that partly resembles EL chondritic enstatite. The other main constituent (about 25 vol%) is kamacite, which shows EH chondritic compositional characteristics. Additionally, a few tiny intergrowths of different sulfides with kamacite were identified. The sulfides are generally similar to those found in enstatite chondrites, but yield distinct elemental abundances that complicate an assignment to either EHs or ELs [1,2].

In order to further explore the genetic relation of Itqiy to enstatite chondrites (E-chondrites), we performed noble gas and oxygen isotope analyses. The noble gas record of E-chondrites leads to two different patterns of trapped heavy noble gases depending on the petrologic type. All E-chondrites of type 4 to 6 contain a mixture of trapped planetary rare gases (Q) and a subsolar component. In contrast to that, most E3-chondrites show a mixture of Q and a so-called sub-Q signature with lower elemental ratios [3].

As to the oxygen isotopic composition of E-chondrites, most samples exhibit relative abundances of ¹⁷O and ¹⁸O close to the terrestrial fractionation line (TFL) [4,5]. However, there appears to be a systematic increase in $\delta^{18}\text{O}$ from both, EHs and ELs of petrologic type 3 to those of type 6. Besides, [4] found good evidence that EHs plot slightly off the TFL on a line of slope 0.66. Their results point to a complex accretion history, parent body evolution, or both.

Results and discussion: *Noble gases.* The noble gas record of Itqiy reveals two interesting features: First, no or hardly any radiogenic component (⁴He, ⁴⁰Ar) is detectable. Second, the meteorite definitely contains subsolar noble gases (fig. 1).

The virtual lack of radiogenic He and Ar is consistent with Itqiy's thermal history. Regarding its texture and mineralogy, a first igneous process that involved slow cooling as well as a later melting event with subsequent quenching occurred. The second event might have been caused by shock [1,2]. Both heating processes are capable of inducing a substantial loss of radiogenic gases. Since their concentrations are still very low or absent, their release must have taken place rather recently and consequently, was probably due to an impact. Another explanation for the low radiogenic Ar amount is the low K content of Itqiy (only 4.1 ppm compared to nearly 900 ppm in E-chondrites).

The subsolar signature detected in Itqiy is typical for E4-6's [3]. Hence, there might exist a connection between heating and trapping of subsolar gases. The finding also supports the idea that Itqiy's parent body formed under similar conditions as E-chondrites and is probably genetically linked to this group [1,2]. Noble gas measurements of mineral fractions are underway to find out more about involved carrier phases.

The ²¹Ne cosmic ray exposure age (T_{21}) of Itqiy is 28.8 Ma. It matches the most common age range of E-chondrites [6]. T_3 (from cosmogenic ³He) is consistent with T_{21} whereas T_{38} (from cosmogenic ³⁸Ar) turned out to be too high. The reason for this is the relatively high trapped ³⁶Ar content, which in turn is related to the subsolar component. Thus, corrections for air and calculating cosmogenic Ar are difficult.

Oxygen isotopes. The isotopic composition of oxygen in Itqiy is similar to that of the aubrites and EH/EL chondrites, but no clear preferential association is observed. If one takes into account the possible terrestrial contamination of E-chondrites, then the oxygen in Itqiy is more like that of the aubrites, but it also plots within errors in the E4-5 data range [4].

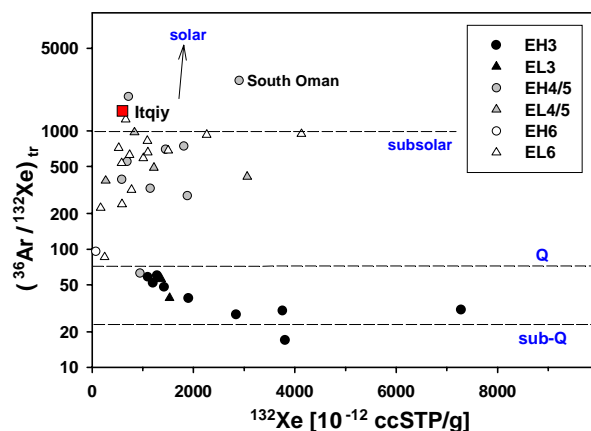


Fig. 1: Trapped heavy noble gases of E-chondrites [3] and Itqiy. Data of South Oman is taken from [7].

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