Iodine, xenon and the Q process.

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The Q component has a distinct xenon isotopic signature [1]. This can be derived by mass fractionation favouring the heavy isotopes from the solar xenon composition, modified by the addition of presolar Xe-HL and excess ^{129}Xe from the decay of ^{129}I (half life 16 Myr) [2] [3]. We identify a Q-Process that traps xenon into carbon-rich material, introducing this characteristic mass fractionation.

Nanodiamond-rich residues prepared from primitive meteorites contain a planetary xenon component designated Xe-P3 [4]. It appears to have been produced from a parent reservoir, the extent of mass fractionation suggesting the Q-Process ^{129}Xe from decay of ^{129}I is also present. The parent reservoir from which Xe-P3 was trapped was depleted in s-process xenon relative to the solar composition [2] [3].

We thus have samples from two distinct environments in which xenon was trapped by the Q-process. In each case it seems that iodine was trapped alongside xenon, and that trapping of iodine was more efficent than trapping of xenon (trapped I/Xe ratios were high enough for decay of ^{129}I to modify the xenon isotopic signature). This observation has the potential to provide a new constraint both on the carrier phase itself and on the trapping process and, possibly, to constrain the date of the last loss of xenon from Phase Q. I-Xe data from Xe-P3 has already been reported [5].

There is a striking dichotomy between ("solar") Q-Xe, trapped in an oxidisable carrier, and ("presolar") Xe-P3, trapped in a carrier that survives strong oxidation. We have suggested that preparation of nanodiamond-rich residues preferentially preserves grains that sample Q-process events further back into galactic history [3]. The s-process deficit is then a natural consequence of galactic chemical evolution. To explain the difference in carriers we now suggest that the carriers of Xe-P3 were originally identical to those of Q-Xe, and that processing in the interstellar medium transformed them into the P3 host [e.g. 6]. This would naturally explain the observations and predicts that processing in the ISM can produce one from the other.

[1] Busemann *et al.* (2000) *Meteorit. Planet Sci.* **53**, 949-973. [2] Gilmour (2010) *Geochim. Cosmochim. Acta* **74**, 380-393. [3] Crowther & Gilmour (2013) *Geochim. Cosmochim. Acta* **123**, 17-34. [4] Huss & Lewis (1994) *Meteoritics* **29**, 791-810 [5] Gilmour (2009) *LPSC XL*, Abstract #**1603**. [6] Stroud et al. (2011) *Astrophys. J. Lett.* **738**, L27.