

CHARACTERISING PHASE Q AND THE Q-PROCESS WITH IODINE AND XENON.

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The Q component has a distinct xenon isotopic signature [1] that can be derived by mass fractionation favouring the heavy isotopes from the solar xenon composition [2,3]. Q-xenon released from meteorite samples by step etching has slightly variable contributions from presolar Xe-HL and excess ^{129}Xe from the decay of ^{129}I (half life 16 Myr). We identify a Q-Process that traps xenon into carbon-rich material, introducing the characteristic isotopic mass fractionation. The presence of detectable excess $^{129}\text{Xe}^*$ indicates that this process results in I/Xe ratios higher than the average solar system.

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 in this component. The parent reservoir from which Xe-P3 was trapped by the Q-Process 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 efficient 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 on the carrier phase and trapping process and the timing of parent body processing. Data from nanodiamonds show a low $^{129}\text{I}/^{127}\text{I}$ ratio consistent with late degassing of Xe-P3 [2, 5], while intriguing initial results from an I-Xe study of Q-Xe are presented at this meeting [6].

There is a striking dichotomy between Q-Xe, trapped in an oxidisable carrier, and 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. This would naturally explain the observations and makes a testable prediction about the respective carriers; processing in the ISM can produce Xe-P3 carriers from Phase Q.

[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] Holinger *et al* (2015) this meeting.