

NOBLE GASES IN TAGISH LAKE. Monica M. Grady¹, A.B.Verchovsky², I.A.Franchi², I.P.Wright² and C.T.Pillinger², ¹Dept. of Mineralogy, The Natural History Museum, Cromwell Road, London SW7 5BD, UK (mmg@nhm.ac.uk), ²PSSRI, The Open University, Walton Hall, Milton Keynes MK7 6AA, UK.

Introduction: Tagish Lake has been classified as a CI2 chondrite [1] with an interstellar grain abundance enhanced over that of CI1 and CM2 chondrites [2]. Noble gases have been used as markers for the presence of exotic, presolar grains in chondritic meteorites: Xe-HL (nanodiamonds) and Xe-s/Ne-E (SiC). We have measured ⁴He, Ne, Ar and Xe in whole-rock Tagish Lake, and an orthophosphoric acid-resistant residue, in an effort to define more precisely the relative abundances of the different presolar components present, and to verify whether or not the meteorite has an enhanced complement of presolar diamonds. For comparison, whole-rock samples of Orgueil and Murchison have also been analysed using the same experimental procedure.

Experimental: a 4.400 mg chip of whole-rock Tagish Lake, and a 1.327 mg powder from the H₃PO₄-resistant residue (remaining from carbonate analysis) were separately combusted in narrow temperature increments from room temperature to 1200°C. Gases were analysed on the Finesse multiple mass spectrometer system [3]. Nitrogen data acquired simultaneously have been reported earlier [2].

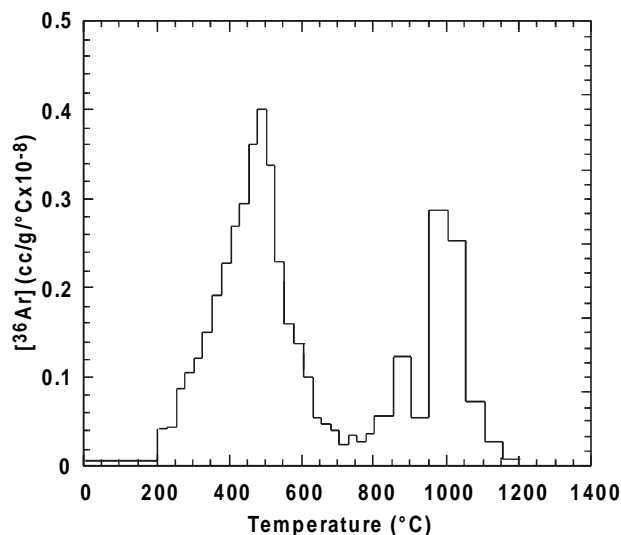
Results: (i) *whole-rock data.* The release of ³⁶Ar with temperature in whole-rock Tagish Lake is shown in the Figure. The [³⁶Ar] total is ~ 135 x 10⁻⁸ cm⁻³g⁻¹ STP, an amount similar to that in CI and CM chondrites. There are clearly 2, and possibly 3, discrete argon components. The first, accounting for almost 60% of the total ³⁶Ar, has a broad release temperature, between 200 and 600°C, with ³⁸Ar/³⁶Ar ~ 0.19. A small quantity of ⁴He was released across this temperature range, but Ne yield was close to blank levels. Above 800°C, just over 30% of the total ³⁶Ar was liberated, again with ³⁸Ar/³⁶Ar ~ 0.19. This component was accompanied by [²⁰Ne] ~ 250 x 10⁻⁸ cm⁻³g⁻¹ STP and [⁴He] ~ 4 x 10⁻⁵ cm⁻³g⁻¹ STP. Based on comparisons with other carbonaceous chondrites, it is likely that the lower temperature component is mainly from combustion of Q, the planetary noble gas-carrier, whilst the higher temperature release is a mixture of planetary, solar and exotic noble gases. The low amounts of gas released at the highest temperatures of the experiment preclude calculation of an exposure age from cosmogenic ²¹Ne. However, from the low abundance of cosmogenic nuclides, it can be inferred that the exposure age is fairly low.

(ii) *Acid residue data.* Approximately 20% of the ³⁶Ar was lost from Tagish Lake during dissolution: [³⁶Ar] ~ 108 x 10⁻⁸ cm⁻³g⁻¹ STP. The higher temperature component has disappeared, confirming probable identification as gas trapped or implanted into silicates. The remaining ³⁶Ar combusts across a narrow temperature interval, 300 - 400°C. It has ³⁸Ar/³⁶Ar ~ 0.21, and is accompanied by Xe with ¹³⁶Xe/¹³²Xe between 0.3 and 0.5, and ¹³⁴Xe/¹³²Xe between 0.4 and 0.5. Total [¹³²Xe] ~ 0.39 x 10⁻⁸ cm⁻³g⁻¹ STP (relative to whole-rock). This is a lower amount than was reported by Nakamura et al. [4]. It is likely that these are noble gas components associated with the presolar diamond, and are a mixture of Xe-P1 (Q-Xe), Xe-HL, Xe-P3, and possibly Xe-P6 [5].

Summary: the data acquired so far have not yet confirmed our findings that Tagish Lake is highly enriched in

presolar components. Tagish Lake certainly contains planetary type noble gases, plus Ar-P3, Xe-P3 and Xe-HL.

Figure: Argon in whole-rock Tagish Lake



References: [1] Brown P. et al. (2000). *Science* 290, 320-325; [2] Grady M. M. et al. (2001). *32nd LPSC* CD#1733; [3] Verchovsky A. B. et al. (1997). *Meteoritics* 32, A321; [4] Nakamura T. et al. (2001). *32nd LPSC* CD#1621; [5] Huss G. R. and Lewis R.S. (1994). *Meteoritics* 29, 791-810.