PRESOLAR GRAINS IN THE TAGISH LAKE METEORITE.

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Introduction: Different types of presolar grains have been identified in primitive meteorites [1]. Tagish Lake is a unique primitive carbonaceous chondrite and the first representative of the CI2 group. It has a fine-grained matrix with olivine-rich aggregates, sparse chondrules, altered CAIs, magnetite, and Ca-Mg-Fe-Mn carbonates (indicating aqueous alteration) [2]. Stepped combustion experiments [2, 3] indicate the presence of presolar grains (SiC, diamonds). From these measurements the matrix-normalized abundance of presolar SiC was estimated to be 8 ppm [3]. In order to explore the inventory of presolar grains in Tagish Lake in more detail we will present here new data from an in-situ search of presolar grains (oxides, silicates, carbonaceous grains) in a polished thin section of Tagish Lake with the NanoSIMS.

Experimental: The NanoSIMS was used in multicollection mode to map two different regions of the fine-grained matrix for two sets of measurements: (i) A search for presolar oxides/silicates ($^{16,17,18}O$, ^{28}Si, $^{27}Al^{16}O$) and (ii) a search for presolar carbonaceous grains ($^{12,13}C$, $^{26,27}CN$, ^{28}Si). A < 1 pA Cs^+ primary ion beam, ~100 nm in size, was used to raster (256 x 256 pixels) areas of 15 x 15 μm^2. Each measurement lasted for about one hour and consisted of 4 image layers. A total area of 29,250 μm^2 was mapped for the search of presolar oxide and silicate grains, and 5,400 μm^2 for the search of presolar carbonaceous grains.

Results and Discussion: One presolar silicate grain of ~350 nm was found, representing an abundance of ~4 ppm of matrix material in Tagish Lake. Although statistics is limited, this is compatible with the abundances inferred for ordinary chondrites [4] but much lower than that observed in the carbonaceous chondrite Acfer 094 [5, 6]. According to the O-isotopic composition ($\delta^{17}O$ = 70 ± 140 ‰, $\delta^{18}O$ = 640 ± 80 ‰), the grain belongs to the rare group 4 of oxide grains [7]. Both high metallicity AGB stars and type II supernovae are considered potential sources for the grains of this group [7, 8].

Preliminary inspection of the C and N data reveals the presence of a presolar C-rich grain, probably SiC, with $\delta^{13}C$ = 450 ± 80 ‰ and $\delta^{15}N$ = -310 ± 130 ‰ and size of ~250 nm, representing an abundance of 12 ppm of the matrix material. In addition we observed areas with ^{15}N-enrichments ($\delta^{15}N$ of up to 600 ‰), possibly representing molecular cloud material. A similar observation was made by [9] for chondritic organic matter.

Although the relatively low abundance of presolar silicates may be the result of aqueous alteration, the presence of different presolar minerals confirms the primitive nature of Tagish Lake.

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