A PRELIMINARY SEARCH FOR PRESOLAR GRAINS IN A NEW ACID RESIDUE OF THE TAGISH LAKE METEORITE. M. Jadhav[1], P. Haenecour[2], S. Amari[3], J. Davidson[4], and T.J. Zega[2,5]. [1]Department of Physics, University of Louisiana at Lafayette, Lafayette, LA 70504. Email: manavi.jadhav@louisiana.edu. [2]Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85721, [3]Laboratory for Space Sciences, Washington University in St. Louis, St. Louis, MO 63130, [4]Center for Meteorite Studies, Arizona State University, Tempe, AZ 85287, [5]Department of Materials Science and Engineering, University of Arizona, Tucson, AZ 85721.

Introduction: Tagish Lake is a unique primitive meteorite, classified as an ungrouped C2 whose isotopic properties lie between those of CM and CI chondrites [1]. Grady et al. [2] performed stepped-combustion experiments that predict Tagish Lake contains carbonaceous presolar grains and, a possibility that, it is richer in presolar graphite grains, compared to other chondrites (based on measured δ^{15}N and δ^{13}C values). Some presolar grain species have been found during *in-situ* studies of Tagish Lake [3, 4]. Recently, Riebe et al. [5] determined presolar SiC grain abundances in Tagish Lake by noble gas analyses and NanoSIMS ion imaging and found the SiC abundances determined by both methods to be within the range observed in other primitive chondrites [6]. In the present study, we report a search for candidate presolar grains from a new acid residue of Tagish Lake.

Sample preparation and analytical methods: A slurp gun extract of matrix material from the Tagish Lake meteorite was obtained from the University of Calgary collection. Thirty-four grams of this material was subjected to the Amari et al. [7] separation treatment that was successful in isolating carbonaceous presolar grains from Murchison [8] and Orgueil [9]. Unlike these previous separations, we were unable to obtain a clean colloidal separate of nanodiamonds after the oxidation treatment by $Cr_20_7^{-2}$ [7] indicating that part of the insoluble organic matter (IOM) still remained and that the make-up of the IOM was different from that of Murchison and Orgueil. Tagish Lake IOM is known to have a large aromatic component compared to Orgueil, Murchison, and Allende [10], which could explain why part of the IOM was impossible to dissolve, thus, rendering the colloidal and density separation procedures very difficult to carry out. Numerous chemical attempts, which were subsequently made to reduce the IOM to facilitate the separation of presolar grains, were not successful. For this study, a very small amount of the colloidal separate, which should have been enriched in nanodiamonds, was added to <1 ml of isopropanol. We used a mortar and pestle and placed the container in an ultrasonicator bath to break down large aggregates of the sample. Less than 20 μl of this solution was deposited on a Cu transmission electron microscope (TEM) grid supporting a lacey C film.

A manual search for presolar grain candidates was carried out with a Hitachi SU9000 30kV Scanning and Transmission Electron Microscope (SEM/STEM) at the University of Arizona. The SU9000 is equipped with secondary electron (SE), STEM bright-field (BF-STEM), and STEM annular dark-field (ADF-STEM) detectors, an Oxford Instruments X-Max 100LE energy-dispersive x-ray spectrometer (EDS), and a Hitachi electron energy-loss spectrometer (EELS). We obtained SE, BF, and DF images, as well as EDS and EELS spectra for the IOM and candidate presolar grains.

Results and discussion: EDS maps of the IOM indicate C-rich regions with Mg-, Al-, Si-, Cr-rich inclusions and/or grains (e.g. Fig. 1). The IOM on the mount was not electron transparent in most locations but we were successful in obtaining EELS spectra in a few regions that were thin enough (Fig. 2). The energy-loss near-edge structure (ELNES) of the IOM shows character similar to amorphous C, graphite, and diamond. The π* and σ* peaks are similar to amorphous

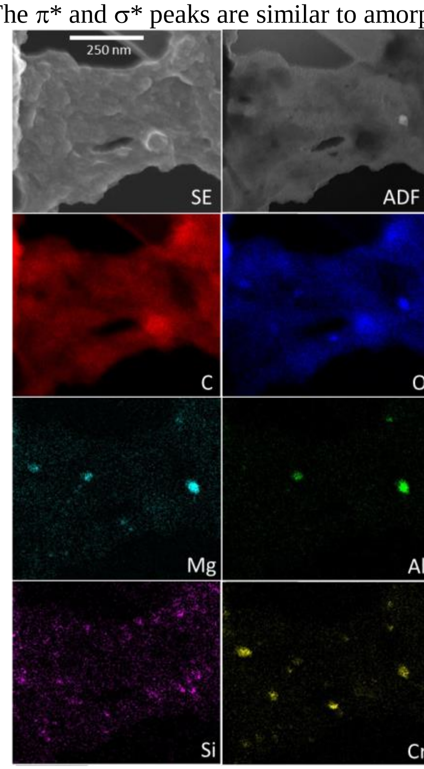

Figure 1: SE, ADF-STEM images and EDS elemental maps of Tagish Lake IOM.

(lacey) carbon although the latter appears to contain some ELNES similar to graphite. The local minimum at 300 eV is subtle but similar to that seen in the diamond spectrum. We note that Zega et al. [11] measured similar ELNES in separates of Tagish Lake IOM, and so the ELNES of the IOM in this study could indicate the presence of nanodiamonds that were not separated from this residue or something intrinsically unique to the IOM in Tagish Lake.

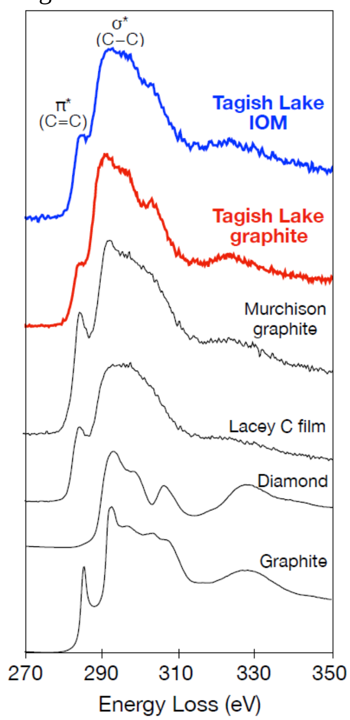

Figure 2: EELS spectra of Tagish Lake IOM (in blue) and a graphitic spherule (in red) from this study compared to the spectra of a Murchison presolar graphite [12], CVD diamond [13], and Madagascar graphite [12].

Within a 150 μm^2 region on the mount (sparsely covered by IOM), we found 10 carbon-rich spherules whose morphologies are identical to the presolar graphite grains from Murchison and Orgueil [e.g. 8, 9]. The grain sizes range from 40 nm to 1.9 μm. One 25 μm carbon spherule was found outside this region. The EDS data on all the 11 grains are dominated by the C-peak. Figure 3 shows typical EDS elemental maps obtained on the C-rich spherules. The ADF-STEM image indicates the presence of multiple inclusions or surface contaminants that are Mg-, Al-, Si-, Cr- (Fig. 3), and Fe-rich (not show in Fig. 3). An EELS spectrum (Fig. 3) obtained on the edge of this grain indicates a graphitic structure with a smaller amorphous content compared to a FIB slice of KFC1b2-303, a presolar graphite from Murchison [12].

Within the same region, EDS data indicate the presence of a 3 μm SiO grain and a 40-50 nm SiC grain.

Future work: We will survey larger areas on this mount and obtain isotopic data for the grains identified here. SIMS data will confirm the presence of presolar graphites and other presolar grain varieties in this acid residue, and allow us to obtain presolar grain abundances for Tagish Lake. We will also continue to explore chemical and physical techniques to separate presolar grains from the IOM of Tagish Lake to facilitate the study of its presolar grain population.

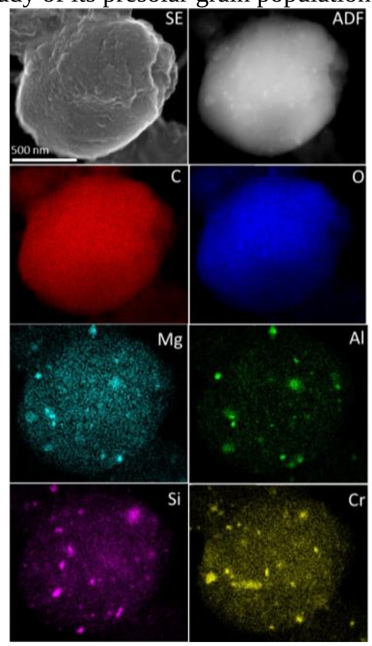

Figure 3: SE, ADF-STEM images and EDS elemental maps of a carbonaceous spherule found in the Tagish Lake acid residue.

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