TAGISH LAKE: A SPECIAL NEW TYPE 2 CARBONACEOUS CHONDRITE FALL. M. E. Zolensky[1], M. M. Grady[2], R. N. Clayton[3], T. K. Mayeda[3], A. R. Hildebrand[4], P.G. Brown[5], and J.L. Brook[6], [1]Mail Code SN2, NASA Johnson Space Center, Houston TX 77058, USA (michael.e.zolensky1@jsc.nasa.gov), [2]Natural History Museum, London, UK, [3]University of Chicago, Chicago IL 60637, USA, [4]University of Calgary, Calgary AB T2N 1N4, Canada, [5]University of Western Ontario, London, Ontario N6A 3K7, Canada, [6]Atlin, British Columbia, VOW IAO, Canada.

Fall: A brilliant fireball followed by loud detonations was widely observed over the Yukon Territory and northern British Columbia on January 18, 2000. The fireball was also detected by satellites in Earth orbit. JLB recovered several dozen meteorites totaling ~1 kg on the ice of Taku Arm, Tagish Lake, on January 25 and 26. All but one of these initial samples have been kept frozen. Between April 20 and May 8, ~500 additional specimens were located on and in the now melting ice: these specimens are weathered to varying degrees by residence in melt-water and are currently being thawed under controlled conditions. The meteorite has been named “Tagish Lake.”

Petrography and Mineralogy: Thus far we have examined one section of the January recovered Tagish Lake by electron microprobe. The chondrite is a brecciated, matrix supported mixture of olivine-rich aggregates, a few chondrules (<1 mm), altered CAI (up to 2 mm), magnetite framboids, and individual grains of olivine, Ca-Mg-Fe-Mn carbonates (very abundant), magnetite (very abundant) and Fe-Ni sulfides. Some of the chondrules and the majority of aggregates sport fine-grained, sulfide-rich rims; all show evidence of aqueous alteration. The CAI has the sinuous texture typical of CMs [1,2], but is almost completely altered to phyllosilicates, predominantly Mg-rich serpentine (in contrast to CM chondrites where altered CAI usually consist of Fe-rich serpentine and diopside [2,3]). Sulfides (pyrrhotite and magnetite) are far less abundant than in most CM or CI chondrites, and magnetite is far more abundant than in most CMs [1]; in many places magnetite can be observed replacing sulfides. The carbonates exhibit a remarkable compositional variation, including end-member Ca carbonate as well as siderite and magnesite, and intermediate compositions; these Mg and Fe-rich compositions are not found in other C chondrites [2]. Some carbonates have Mn contents up to 1 wt%. Olivine has the compositional range Fa_{0-29} (PMD = 2%) with a peak at Fa1; pyroxene is Fs_{1-7} (PMD = 2%), with a peak at Fs_2. The meteorite shock stage is S1, typical for C chondrites.

Based solely upon the microprobe data, the matrix consists mainly of phyllosilicates, probably intergrown serpentine and saponite (this requires verification by TEM examination). Since the meteorite consists mainly of matrix, this meteorite must have a very high water content.

Bulk C content, as determined by mass spectrometry, is 5.4 wt.%, with $\delta^{13}C$ = 24.3‰. Oxygen isotopes or two samples are: $\delta^{18}O$ = 17.95 and 19.01‰, $\delta^{17}O$ = 8.30 and 9.16‰, respectively; this composition lies within the field of CI chondrites, but also very near that occupied by such naturally-heated meteorites as Y 82162 and Y 86720 [4] (which have unclear affinities, but may include heated CIs) [5].

Classification and Alteration History: Although the meteorite resembles CMs petrographically, and CIs compositionally, it exhibits interesting differences from both chondrite classes. The range of carbonate compositions is far more extensive in Tagish Lake than in CM2 or CI1 chondrites. Sulfides appear to be less abundant than in these chondrites; in particular the coarse-grained sulfides present in CIs and all of the naturally-heated C chondrites [1,5] are absent in Tagish Lake. Magnetite in Tagish Lake resembles CIs in type and abundance, certainly not CM2s. The presence of chondrules and CAI precludes classification as CI1, and better matches the CM2s. The high C content and O isotope composition best resembles CIs [4,6]. The O isotope composition is also similar to naturally-heated C chondrites [4], however there are also significant differences from these as well. There is no evidence of parent asteroid heating beyond that necessary to form phyllosilicates, carbonates, sulfides and magnetite (25°–150ºC) [1].

Tagish Lake is obviously something new, but exactly how does it fit in the current architecture of C chondrites? We observe that this meteorite has experienced extensive aqueous alteration, as well as consecutive sulfidation and oxidation events. At some point abundant carbonates formed; we do not see significant quantities of sulfates. Although definitive classification is impossible until a complete bulk composition is available, we suggest CI2. This would make Tagish Lake the precursor lithology to CI1 and possibly such naturally-heated chondrites as Y 82162. In any case, the availability of a type 2 carbonaceous chondrite fall maintained in a frozen state will permit many investigations that were previously impossible to perform.

References: [1] Zolensky et al. (1993) *GCA, 57,* 3123–3148. [2] Zolensky et al. (1997) *GCA, 61,* 5099–5115. [3] MacPherson and Davis (1994) *GCA, 58,* 5599–5625. [4] Clayton and Mayeda (1993) *Annu. Rev. Earth Planet. Sci., 21,* 115–149. [5] Lipschutz et al. (1999) *Antarct. Meteorite Res., 12,* 57–80. [6] Grady et al. (1988) *GCA, 52,* 2855–2866.