TAGISH LAKE: BULK CHEMISTRY AND TERRESTRIAL ALTERATION. J. M. Friedrich[1], S. F. Wolf[2], H.-P. Voss[1] [1]Department of Cosmochemistry, Max-Planck-Institut für Chemistry D-55128, Mainz, Germany [2]Department of Chemistry, Indiana State University, Terre Haute, IN, 47809 USA.

Introduction: The Tagish Lake carbonaceous chondrite has been the focus of much attention since its isotopic, trace element, and mineralogic properties demonstrate a unique history [1-5]. We have analyzed both pristine and disturbed Tagish Lake samples for 12 major and minor elements by ICPMS and ICPOES. When combined with data collected earlier [1], this brings the total number of elements quantified in identical aliquots of these samples to 61. Herein, we discuss relationships among major, minor, and trace elements within Tagish Lake and among other carbonaceous chondrites. Additionally, we discuss the significant effects of terrestrial alteration exhibited by Tagish Lake samples gathered from ice and snow.

Method and Results: To further investigate Tagish Lake chemistry, we quantified 12 major and minor elements (Na, Mg, Al, P, K, Ca, Ti, Cr, Mn, Fe, Co, Ni) in aliquots of the same dissolved samples analyzed by Friedrich *et al.* 2002. [1]. To ensure the highest analytical accuracy and detect any possible bias, we analyzed each of the above elements by both ICPMS and ICPOES. For ICPMS, we used an external calibration and drift correction method similar to that used for trace elements [1,6-8]. Quantification by ICPOES was performed with well-tested external calibration or standard addition methods.

Two types of Tagish Lake samples were collected by others [3]. As described in [1], one pristine and two disturbed samples were obtained for trace element analysis. The “pristine” sample was collected almost immediately after the fall. The two disaggregated “disturbed” samples were in contact with ice and snow for months before collection. Here, we discuss minor and major element contents in the same three samples as analyzed in [1].

Three elements in our suite (Ti, Mn, Co) are available for comparison with values from [1]: agreement is excellent (≤ 4% difference) in all cases.

Discussion: *Tagish Lake bulk chemistry.* Our results concur with earlier bulk chemical analyses of Tagish Lake. We will limit our discussion here to analyses of the pristine sample. Our determined Al/Mn and Ca/Mn (atom ratio) values of 15.1 and 10.3 respectively suggests assignment to the CM group [9]. However, as noted before [1,3,5], trace element contents naturally rule out this assignment. Moreover, our Cr normalized moderately volatile Na, P, and K values clearly distinguish pristine Tagish Lake from the Murchison (CM2) chondrite –which was analyzed in the same analytical run to minimize bias.

Terrestrial alteration of disturbed samples. Friedrich *et al.* 2002 [1]., noted a difference in the trace element content between pristine and disturbed Tagish Lake samples. In each of the two disturbed samples, 25 refractory lithophiles, 8 refractory siderophiles, and 18 moderately volatile to highly thermally labile were enriched compared to the contents of pristine Tagish Lake. They hypothesized that loss of some major, water-soluble phase(s) were responsible for these observed differences. Our results identify a number of the components responsible. In Figure 1, we show greatly and mildly disturbed Tagish Lake elemental contents normalized to pristine values. In both disturbed samples 8 elements (Mg, Al, Ti, Cr, Mn, Fe, Co, Ni) are enriched relative to the pristine sample. Three others (Na, K, and P) suggest a loss, especially in the greatly disturbed sample. Interestingly, on a weight-normalized basis, Ca is nearly identical in all three samples.

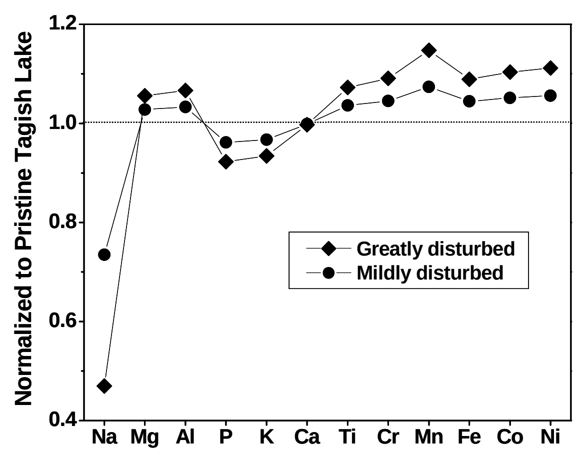

Figure 1: Comparison of minor and major element contents of two disturbed Tagish Lake samples by normalizing to the pristine sample. Statistical comparison of the pristine and greatly disturbed samples show highly significant terrestrial alteration (see text).

Statistical treatments comparing the pristine and greatly disturbed samples show a significant ($\alpha < 0.05$) enrichment of 8 elements (Mg, Al , Ti, Cr, Mn, Fe, Co, Ni). Two others (Na and K) are statistically lower. Chemically similar Rb and Cs are both enriched in disturbed samples [1]. A slight intra-replicate compositional heterogeneity exhibited by P in the pristine sample clouds the issue statistically, but it too may be lower. Preliminary analyses of sulfur in these samples suggest it (or a compound containing it) may also play a role in the observed differences.

Conclusions: We have analyzed 12 minor and major elements in three aliquots of the Tagish Lake meteorite bringing the total number of elements analyzed in identical aliquots of the same sample to 61. Refractory bulk elemental data for our pristine sample concurs with previous results: i.e. suggesting an affinity to the CM chondrite clan. However, moderately volatile Na, K, and P and trace element contents rule out this classification.

Data for two disturbed samples shows that these samples' residence in the ice and snow caused terrestrial alteration. Na, K, and P are all depleted in the greatly disturbed sample suggestive of aqueous dissolution. Future studies should consider this when drawing cosmochemical conclusions from data gathered from disturbed samples.

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