ORGANIC AND MINERAL CORRELATIONS IN TAGISH LAKE VIA HIGH SPATIAL RESOLUTION SYNCHROTRON-BASED FTIR MICROSPECTROSCOPY

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Introduction: Meteorites are highly heterogeneous extraterrestrial samples, and contain various molecular compounds such as organics and minerals. Previous laboratory studies provide evidences to suggest that certain minerals may be associated with, and play a role in the formation of specific organic molecules [1,2]. Although conditions in space differ from those in the laboratory, such relationships seem likely in heterogeneous meteorites. These organic-mineral relations and their *in situ* spatial distributions may provide insights on the formation conditions and evolution of organics in the early solar system, and eventually on the formation of life, however these relationships have been very little investigated to date.

Tagish Lake meteorite fell in British Columbia, Canada in 2000. It is a type 2 ungrouped carbonaceous chondrite with affinities to CI and CM chondrites [3,4].

In this work, we studied a total of 13 Tagish Lake grains, which we believe belong to carbonate-rich lithology. Spectral identification of different features were made, and their two-dimensional infrared maps were generated [e.g., 5]. Quantitative statistical correlation analyses was performed in our Tagish Lake datasets in order to understand both inter- as well as intra-grain relationships of organics and minerals.

Methods: FTIR microspectroscopy experiments were performed on 13 Tagish Lake grains at IRENI beamline at the Synchrotron Radiation Center, University of Wisconsin in Madison with high spatial resolution (0.54 x 0.54 μm^2). Using synchrotron radiation as a light source and a Focal Plane Array (FPA) detector, signatures of organics and minerals in the studied meteorite grains were detected and identified. A house-made diamond windows was used as a sample holder for transmission measurements. All samples were kept in sample containers which proved to be non-contaminant for meteorites, and at all times the sample containers were placed away from adhesives, grease, and rubber mats.

Results: Infrared spectra of all Tagish Lake grains show signatures of aliphatics, silicates, carbonates, and water (including both molecular water and silicate-bonded OH). Some grains show clear signatures of sulfates. Spatial distribution of individual chemical components are mapped in the mid-infrared region for all grains. Based on quantitative analyses, we observe a strong correlation between aliphatics, silicates, and water, for which we propose several possible scenarios explaining these relationships. Studied Tagish Lake grains present various CH_2/CH_3 ratios, which is negatively correlated with sulfate abundance in Tagish Lake.

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