INFRARED SPECTROSCOPY OF MULTIPLE SAMPLES FROM THE ALMAHATA SITTA METEORITE.

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Introduction: On 7 October 2008, the asteroid 2008 TC3 entered the Earth's atmosphere, exploded at 37 km altitude, and created a strewn field of stones, now known as the Almahata Sitta meteorite, in the Sudan desert. Preliminary analysis of one stone showed it to be a unique polymict ureilite [1]. Here we report on 39 mid-infrared transmission spectra taken from 26 different stones collected from the strewn field.

Samples and Measurement Techniques: Typical sample sizes obtained were in the 5–10 mg range, and samples were prepared for infrared (IR) spectral measurements using standard KBr pellet techniques [2]. Care was taken to ensure that selected samples were representative of the material available and free from contaminants and fusion crust. IR spectra were taken from 7000-450 cm^{-1} at a resolution of 1 cm^{-1} using a Bio-Rad Excalibur Fourier transform infrared spectrometer equipped with a Globar source, a KBr beamsplitter, and a liquid nitrogen-cooled mercury-cadmium-telluride detector.

Results: The ureilite spectra show a number of absorption bands including a complex feature centered near 1000 cm-1 (10 μm) due to Si–O stretching vibrations. The profiles of the silicate features fall along a mixing line with endmembers represented by Mg-rich olivines and pyroxenes, and no evidence is seen for the presence of phyllosilicates. The relative abundances of olivine and pyroxene show substantial variation from sample to sample and sometimes differ between multiple samples taken from the same stone. Analysis of a mass-normalized coaddition of all ureilite spectra presented here yields an olivine:pyroxene ratio of 74:26, a value that falls in the middle of the range inferred from the infrared spectra of other ureilites [2]. Both the predominance of olivine and the variable olivine-to-pyroxene ratio are consistent with the known composition and heterogeneity of other ureilites. Variations in the colors of the KBr pellets and the intensities of the silicate feature relative to sample mass indicate a significant and variable contribution from additional materials having no strong absorption bands, most likely graphitized carbon, diamonds, and/or metal.

Conclusions: The 4000–450 cm^{-1} (2.5–22.2 μm) IR spectra of 39 samples taken from 26 different stones from the Almahata Sitta meteorite show a strong complex absorption feature centered near 1000 cm^{-1} (10 μm) attributed to Si–O stretching vibrations due to mixtures of olivines and pyroxenes. Mineral blends span the entire range from nearly pure olivine to nearly pure pyroxene. The mass weighted average spectrum of all the ureilite samples yields an olivine:pyroxene ratio of 74:26. The predominance of olivine and the variable olivine-to-pyroxene ratio (both within and between stones) are consistent with the known composition and heterogeneity of other ureilites. Infrared-neutral material is also present – likely graphitized carbon, diamond, and/or metals.

A more detailed description of these results is scheduled to appear soon in *MAPS* [3].

References: [1] Jenniskens P., et al., 2009, *Nature* 458:485–488. [2] Sandford, S. A., 1993, *Meteoritics* 28:579-585. [3] Sandford, S. A., et al., *MAPS*, in press.