IN SITU INVESTIGATION OF METEORITIC ORGANIC–MINERAL RELATIONSHIPS BY HIGH SPATIAL RESOLUTION INFRARED SPECTROSCOPY.

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Introduction: Carbonaceous chondrites are fragments of either primitive asteroids or comets [1] and contain high concentrations and variety of largely complex and insoluble organic molecules [2], [3]. Understanding how organic compounds are formed in these samples of extraterrestrial matter is important to the question of how life arose on Earth [4]. Relationships between organic matter and mineral species may provide clues to such formation. However, little is known about the spatial distribution and mineralogical relationships of organics in meteorites. Here we report first results of an infrared spectral imaging technique for the investigation of relations of organic molecules with mineral species *in situ* with high spatial resolution

Methods: We utilized synchrotron-based FTIR microspectroscopy. The experiment is installed on the IRENI (Infrared Environmental Imaging) beamline at the Synchrotron Radiation Center (SRC), University of Wisconsin in Madison. With the effective pixel size of 0.54 μm × 0.54 μm, spatial oversampling for all wavelengths across the mid-IR region has been accomplished. This provides spatially resolved images that are diffraction-limited at all wavelengths [5]. Meteorite powders of ~10 μm size were placed on a diamond substrate for micro-FTIR spectroscopy measurements. In addition to spectra, two-dimensional infrared images of individual few-micron grains were collected in the mid-IR.

Results: Recently, we reported preliminary results of organic-mineral correlations in NWA852 (CR2) [6], [7]. We have further investigated NWA852, and successfully obtained spectral as well as spatial information in detail. Additionally, we have employed correlation coefficient model and principal component analyses in order to statistically investigate correlations between characteristic infrared absorption bands that are due to organics and minerals. Results indicate that silicate minerals may be correlated with organics of aliphatic functional groups. Additionally, a negative correlation has been observed between organics and carbonate minerals. Integrated infrared images show that carbonyl-water combination is spatially surrounded by carbonates.

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References:

[1] Leitner J. et al. 2012. *Astrophysical Journal 745,38*. [2] Sephton M. A. et al. 2002. *Natural Product Report* 3:292-311. [3] Kebukawa Y. et al. 2011. *Geochimica et Cosmochimica Acta* 75:3530-3541. [4] Ponnamperuma C. et al. 1982. *Origins of Life and Evolution of the Biosphere* 12:9-40. [5] Hirschmugl C. J. and Gough K. M. 2012. *Applied Spectroscopy* 66:475-491. [6] Yesiltas M. et al. 2013. Abstract #2717. 44th Lunar & Planetary Science Conference. [7] Yesiltas M. et al. 2013. Abstract #99. From Stars to Life.