SULFUR COMPOUNDS DETECTED BY XANES IN MURCHISON AND ALLENDE.

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Introduction: The speciation of sulfur and relative contents of the sulfur-bearing phases in carbonaceous chondrites is critical to understand the nature and extent of post accretion processes that affected the matrices of these chondrites in the early solar system. Both the reduced and oxidized forms of sulfur have been identified in carbonaceous chondrites [1, 2]. Sulfide minerals are ubiquitous in chondrites, while the occurrence of sulfate minerals typically indicates aqueous alteration in the asteroid parent bodies [3]. Here the chemical structure of the sulfur-bearing species in insoluble organic matter extracted from two carbonaceous chondrites, Murchison and Allende are investigated. The insoluble organic matter (IOM), primarily in the matrix of the meteorites is more susceptible to aqueous alteration, and can be a more sensitive indicator of this alteration process than the minerals.

Methods: Insoluble organic matter extracted from CM chondrite Murchison and CV chondrite Allende were investigated by sulfur K-edge XANES. Samples were deposited as a monolayer on S-free polyimide tape (Kapton) and analyzed under a He atmosphere using a passivated implanted planar silicon (PIPS) fluorescence detector. Energy calibration was performed between each set of sample scans using the maximum of the first peak of sodium thiosulfate, assigned to 2.47202keV. The meteoritic IOM was hydrothermally treated at 300°C temperature and 100MPa pressure for 6 days, and subsequently studied using XANES.

Results & Discussion: Examination of the spectra of the IOM reveals that the sulfur speciation in Murchison and Allende is variable. Murchison's insoluble organic matter contains K-edge peaks of elemental S, alkyl disulfides and thiols, as well as thioesters. The hydrothermally treated Murchison sample has additional peak at 2.474keV and additional small peak at 2.476keV indicating the presence of sulfur heterocycles dibenzothiophene and thianthrene. Murchison is rich in thiophene rings, which have been previously identified by [4]. The IOM extracted from Allende and its hydrothermally treated counterpart show similar spectral characteristics, and they show presence of elemental S, alkyl disulfides and thiols with a peak at 2.743keV and sulfones peak at 2.48keV. While both meteorites are known to be rich in amino acids [5], the S-containing amino acids cysteine and methionine were not observed. The presence of the highly oxidized, i.e., sulfate functional group was not observed. Implications of this data will be discussed.

References: [1] Orthous-Daunay F. –R., Quirico E., Lemelle L., Beck P., deAndrade V., Simionovici A. and Derenne S. 2010. *Earth and Planetary Science letters* 300: 321−328. [2] Cooper G. W., Thiemens M. H., Jackson T. L., Chang S. 1997. *Science* 277: 1072−1074. [3] Burgess R., Wright I. P. and Pillinger C. T. 1991. *Meteoritics*26: 55−64. [4] Remusat L., Derenne S., Robert F., and Knicker H. 2005. *Geochimica et Cosmochimica Acta* 69: 3919−3932. [5] Cronin J. R. and Moore C. 1971. *Science* 172: 1327−1329.

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