COMPARISON BETWEEN THE BOUND AND FREE CARBOXYLIC ACIDS IN THE MURCHISON METEORITE

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Preliminary work has detected bound organic acids within the Murchison meteorite organic macromolecule. A HF/HCl residue from a sample of Murchison meteorite was subjected to online thermochemolysis. Thermally assisted hydrolysis and methylation (thermochemolysis) using tetramethylammonium hydroxide (TMAH) results in the cleaving of ether and ester bonds and methylation of the released products. Temperatures employed (280 °C) are below those required for pyrolytic cracking of organic material. Thus thermochemolysis is an excellent method for determining oxygen bound moieties within organic macromolecules such as that in the Murchison meteorite.

The most abundant compound released by thermochemolysis was benzoic acid and other abundant compounds include methyl and dimethyl benzoic acids together with methoxy benzoic acids. Short chain dicarboxylic acids (C_{4-8}) were also released from the macromolecule similar to those observed in solvent extracts of the same meteorite. Other compounds detected include fluoranone, methoxymethylsulfanylbenezenes and dimethylsulfone as well as aromatic hydrocarbons. The distribution of the C_1 and C_2 benzoic acids (BA) contain all possible structural isomers (except the ethyl BA). The most abundant isomers include 3,4-dimethylbenzoic acid (DMBA), 3,5-DMBA, 2,6-DMBA and phenylacetic acid. TMAH liberates hydrocarbons that are not observed during thermal desorption at 280 °C and must represent non-covalently bound occluded molecules within the organic framework.

The distribution of bound acids has been compared to the distribution of the 'free' carboxylic acids in Murchison. Although benzoic acids are present in the free fraction the saturated α,ω-dicarboxylic acids are much more abundant. The relationship between the free and the bound acids will be discussed as well as potential origins and the astrobiological implications.