PRELIMINARY DATA ON THE SYNTHESIS OF ANALOGUE OF ORGANIC MATTER FROM CARBONACEOUS CHONDRITE.

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Carbonaceous chondrites are known to contain relics of the most primitive organic matter in the Solar system. Two types of organic matter are commonly distinguished in these meteorites, based on their solubility in organic solvents, the insoluble organic fraction (IOM) being the most abundant. The IOM from various carbonaceous chondrites has been studied to decipher their formation pathway and the chemical alterations they have undergone after their formation. The most extensively studied IOMs are those isolated from Murchison and Orgueil which chemical structure was investigated using a large array of approaches. This led to propose a molecular model for the IOM chemical structure and a synthesis pathway for the hydrocarbon backbone[1]. This pathway is based on the relationship between the aromatic moieties of the macromolecular structure and their aliphatic linkages.

The aim of the present study is to test experimentally this pathway. To this end, we submitted short aliphatic compounds to a plasma discharge under vacuum at temperature around 70 °C for 1 H. 15% of this precursor were converted into OM among which 85% is insoluble. After having ruled out any potential contamination through the use of labeled precursor and molecular analysis of the synthesized compounds, the chemical structure of the IOM could be confidently investigated.

Solid state ^{13}C nuclear magnetic resonance showed that both aliphatic and aromatic carbons contribute to the IOM in a 52/48 ratio. High resolution transmission electron microscopy observations and image analysis pointed to a low level of organization of the polyaromatic moieties of the IOM. Molecular information was reached through pyrolysis which released small and substituted aromatic products. The nature of aliphatic linkages was investigated using ruthenium tetroxide oxidation, which yielded short chain compounds.

Taken together, the aforementioned data point to strong similarities between the synthesized IOM and the hydrocarbon skeleton of Murchison IOM. These results strongly support the proposed synthetic pathway for meteorite IOM.

[1] Derenne S. and Robert F. 2010. Meteoritics & Planetary Science 4: 1461-1475.