

CATALYTIC HYDROGENATION OF THE MACROMOLECULAR MATERIAL IN METEORITES.

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Introduction: By far the major organic component in meteorites is a large and relatively complex organic network or macromolecule [1]. The macromolecule is insoluble in common organic solvents and is generally assumed to be completely indigenous owing to its high molecular weight and immobility. However it is this attribute which creates analytical difficulties and repulses straightforward investigations.

In recent years non-degradative techniques such as nuclear magnetic resonance spectroscopy [2,3] and degradative methods such as hydrous pyrolysis [4,5] have provided insights into the make up the macromolecular material. One additional and particularly effective method involves the catalytic addition of hydrogen to the macromolecule to liberate its constituent units [6]. The products of catalytic hydrogenation are highly amenable to analysis by mass spectrometric techniques. Catalytic hydrogenation is highly efficient and has released more bound carbon from the macromolecule than any other thermal degradation technique. This approach has also produced the largest ever aromatic units from the thermal degradation of meteorites and has partly reconciled the disharmony between observations of large interstellar molecules and their smaller meteoritic counterparts [6].

To date, this method has only been applied to the type II Murchison meteorite. New experiments have extended this work to other meteorites of differing petrologic type (types I and III), revealing the potential influence of differing organic source materials and subsequent effects of parent body alteration. Moreover, the previous off-line method has been supplemented by an on-line approach that could provide the opportunity for the analysis of a wider range of meteorites only available in small amounts.

Preliminary data suggest the presence of occluded units within the macromolecular material that may reveal which organic compounds formed first during macromolecule construction before being swamped and immobilised by the forming organic network. Contaminant organic compounds are also occasionally present reflecting the propensity of the macromolecule to retain terrestrial compounds despite previous extraction with organic solvents.

References: [1] Sephton 2002. *Natural Product Reports* 19, 292-311. [2] Gardinier et al. 2000. *Earth and Planetary Science Letters*, 184, 9-21. [3] Cody G.D. et al. 2002. *Geochimica et Cosmochimica Acta*, 66, 1851-1865. [4] Sephton M. A. et al. 1998. *Geochimica et Cosmochimica Acta*. 62, 1821-1828. [5] Sephton M. A. et al. 2000. *Geochimica et Cosmochimica Acta* 64, 321-328. [6] Sephton M. A. et al. 2004. *Geochimica et Cosmochimica Acta*, 68, 1385-1393.