

Effect of UV Irradiation on the Soluble Organic Matter extract from the Murchison Chondrite.

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Introduction: The Soluble Organic Matter (SOM) consists of thousands of compounds [1], [2]. Their size is in-between the molecules detected in space (tens of atoms) and macromolecules found only in meteorites and can be related to their synthesis process [3], [4]. The carbonaceous chains size distributions is consistent with an interstellar origin. Recent studies reported efficient aliphatic chains growth in hot corinos [5]. An experimental test of this origin would be to expose SOM to photolytic condition and to monitor any chemical change with high resolution MS.

Method: Sixty-five g of Murchison were disaggregated before being macerated in methanol and toluene. Thin films of extract were deposited on sapphire glasses and exposed to UV (115 to 165 nm) deuterium lamps under $\sim 10^{-6}$ Pa vacuum inside the PICACHU apparatus at Hokkaido University. Samples received various fluencies of photons, reaching 1020 photons/cm² in 500 hours of exposure. Chemical modification was checked by high resolution MS before and after exposure with a Thermo LTQ Orbitrap XL, at Univ. Grenoble Alpes.

Results and discussion: Detected ions are in the 150-750 Da range. Cations have an average mass of ~ 350 Da. In this mass range, the Orbitrap resolution is high enough for stoichiometry computation. We interpret the periodicity in mass as a repetition of stoichiometric patterns. Molecules varying only by a given number of CH₂ all exhibit a lognormal distribution. This is characteristic of chains transfer polymerization. After exposure, we observe a lognormal distribution but with significant variations of the distribution parameters.

References: [1]Schmitt-Kopplin P. et al. (2010) Proc. Natl. Acad. Sci. U. S. A., 107, 7 pp. 2763–8.[2]Yamashita Y. and Naraoka H. (2014) Geochem. J., 48 pp. 519–525.[3]Wesslau H. (1956) Makromol. Chem., 20 p. 111.[4]Somogyi Á. et al. (2016) Int. J. Mol. Sci., 17, 439.[5]Belloche A. et al. (2014) Science (80-.), 345, 6204 p. 15841587.