ORIGIN OF THE SOLUBLE ORGANIC COMPOUNDS FROM MARTIAN REGOLITH BRECCIA NWA 7533 BY ORBITRAP SPECTROMETRY.

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Introduction: The first study of soluble organic matter (SOM) from Murchison by ultra-high resolution MS has revealed outstanding molecular density [1]. Orbitrap technique helped relate this molecular complexity to chemical processes [2], [3]. A significant fraction of Murchison compounds are saturated chains bearing a few N and O atoms and showing complexity consistent with interstellar grains surface chemistry [4].

We propose to use the SOM diversity as a proxy of synthesis and transformation processes occurring in the solar system. We applied the same methodology to the NWA7533 Martian regolith meteorite which samples the early crust brecciated by impacts and contains up to 5% exogenous CI-like material [5], [6]. The comparison of its SOM to Murchison's will bring several clues to the maturation processes on Mars surface.

Method: Twice 30 milligrams of ground NWA7533 were used for this study. First batch was soaked in Methanol/Toluene (1:2) solvents for maceration during 48h. The second batch was first macerated with water for 1 week then with Methanol/Toluene. Glassware was washed in Ethanol with caustic soda and baked at 250°C for 12 hours. Mass spectra were acquired with a Thermo LTQ Orbitrap XL at its highest resolving power, coupled with Electrospay ionization (ESI) source, in several range or beyond, both for protoned cations and deprotonated anions.

Results: In general, the Martian extracts produce simpler mass spectra than chondritic extracts. Considering only the cations, the molecular density is four times lower (~500 compound vs ~2000 in Murchison in the 150-500 m/z range). Each Martian extract shows an organic mass distribution consistent with a single step synthesis or transformation process. Extracts are unlikely to be mixtures of several components.

Polymeric patterns in the NWA7533 are simple. Only CH_2, C_2H_2 and C_2H_4O patterns seem to be responsible of the molecular complexity. Heteroatomic pattern is the major difference between chondritic and Martian SOM. Another major difference is the absence of nitrogen in any cations observed whereas it was a key feature in Murchison. We will discuss the hypothesis of a chondritic organic material delivery that would have been modified through solar irradiation and impact heat on the Mars surface.

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