Effects of Galactic Cosmic Rays on the surface of transneptunians objets, implication for ultra-carbonaceous Antarctic micrometeorites

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Meteorites and interplanetary dust particles provide constraints on the formation and evolution of organic matter in the young solar system. Micrometeorites recovered from Antarctic snow provide a unique source of pristine interplanetary particles, which underwent a minimal weathering at atmospheric entry and during their stay at cold temperature in the snow. A few percent are characterized by a very large carbon content with at least 50% in volume, much higher than the value found in meteorites, the Ultra-Carbonaceous Antarctic MicroMeteorites (UCAMMs). The UCAMMs organic matter exhibits extreme deuterium excesses and is unusually nitrogen-rich [1,2].

Several scenarios have been proposed for the formation of the N-rich organic matter observed in UCAMMs, suggesting that these particles come from a parent body beyond the nitrogen snow line in the outer solar system [3]. We experimentally evaluate the scenario involving high-energy irradiation of icy bodies subsurface orbiting at large heliocentric distances by irradiating N_2-CH_4 ices with swift heavy ions provided by the GANIL facility. Chemical evolution was monitored by Fourier transform infrared spectroscopy during low temperature irradiation and slow warming up to room temperature. The infrared spectra of the final solid residues present striking similarities with that of UCAMMs [4].

References:

[1] Duprat J. et al. 2010. *Science* 328: 742-745
[2] Dobrica E. 2008. *Meteoritics & Planetary Science* 43: A38
[3] Dartois E. 2013. *Icarus* 224: 243-252
[4] Augé B. 2016. *Astronomy & Astrophysics* 592: A99