THE PARENT BODIES OF LARGE MICROMETEORITES: AN OXYGEN ISOTOPES APPROACH.

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Introduction: The high-precision measurement of oxygen isotopes by laser fluorination coupled with mass spectrometry is a powerful proxy to the determination of the parent body of micrometeorites [1]. However such measurements require micrometeorites (MMs) with a minimum mass of about 0.3 mg, i.e. a diameter of about 560 µm. In view of the typical size distribution of MMs, such large objects are extremely rare and can be found only in very large MM collection. The dry conditions coupled with the old age of the Atacama Desert make it a very favorable area for the recovery of meteorites [2; 3]. We collected several thousands of MMs from the soil of the Atacama desert, and selected 23 micrometeorites with mass > 250 mg to measure their oxygen isotopes after non-destructive characterization.

Material and methods: Raw soil was samples over a 1 m^2 area, sieved (200-800 µm), and submitted to magnetic separation. MMs were then hand-picked from the magnetic fraction using a binocular microscope. This technique yielded over 2000 magnetic cosmic spherules (CS), lacking the non-magnetic glass CSs. The present study focuses on 23 CSs. The oxygen isotope composition of the CSs will be determined using laser fluorination coupled with mass spectrometry at CEREGE (see [1] for the analytical details). The mass of studied CSs ranges between 250 and 500 µg, so the whole samples will be consumed to analyze their oxygen isotope composition. Therefore the CSs have been characterized prior to the oxygen isotopes measurements by non-destructive techniques. The physical properties of 18 of these CSs were determined by X-ray microtomography (XMT), X-ray diffraction (XRD), and magnetic hysteresis. The physical properties of the 5 remaining CSs are currently being determined.

Results: The physical properties of 18 of these 23 CSs have already been reported in [4]. XMT show that analyzed CSs include mainly cryptocrystalline and barred-olivine subtypes, and one porphyritic olivine showing well-defined skeletal olivine crystals several tens of µm in length. XRD and magnetic hysteresis show that CSs are mainly made of olivine, with minor magnetite grains typically ≤1 µm in size. Pervasive dissolution of olivine resulting from terrestrial weathering is almost non-existent in the studied CSs, thus we assume that weathering products will not affect the oxygen isotope composition of CSs.

Discussion: The aim of the present study is to confirm conclusions from similar studies on MMs from Antarctica (e.g, [1]) by drastically increasing the number of available data and by sampling micrometeorites from a different location and environment, thus exploring possible biases introduced by localized unusual events (e.g., meteorite showers and associated ablation spherules).

References: [1] Suavet et al. 2010. *Earth and Planetary Science Letters* 293:313-320. [2] Gattacceca et al. 2012. *Meteoritics and Planetary Science* 46:1276-1287. [3] Rochette et al. 2009 *Met.Soc. Meeting*, abstract #5038. [4] Kohout et al. 2014. *Meteoritics and Planetary Science* 49:1157–1170.