Petrographic and geochemical characterization of a chondrule-like object preserved in an Antarctic micrometeorite

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We report the discovery of a pristine chondrule-like object in a scoriaceous meteorite recovered from the Sør Rondane Mountains, East Antarctica. A preliminary study using a JEOL JSM-IT 300 scanning electron microscope, coupled to an energy dispersive spectrometer (SEM-EDS), at the Vrije Universiteit Brussel indicates that i) the chondrule-like object has a minimum diameter size of ~187 µm, which is broadly analoguous to chondrules found in CM, CO, H and EH chondrites [1]; ii) the chondrule-like object displays a radial pyroxene texture and is readily delineated from the surrounding micrometeorite ground mass. This is emphasized by the presence of microscopic olivine and magnetite crystals at the outer edge of the chondrule-like object. This suggests that it served as a nucleation point for crystallization of secondary mineral phases during atmospheric deceleration and heating. Hence, this object likely represents an original feature of the micrometeoroid; iii) the mineralogical content of the chondrule-like object is mainly composed of low-Ca pyroxene with interstitial glass, some smaller nodules of Fe-Ni metal and a local cluster of chromite grains.

The surrounding micrometeorite material displays a micro-porphyritic olivine texture which contains a single nodule of Fe sulfide, vesicles, and a number of relict mineral grains that survived atmospheric entry. The latter are predominantly composed of forsterite-rich olivine, although several relict grains of low-Ca pyroxene (i.e., enstatite-rich end-members) are observed as well.

The objective of this study is twofold: i) analyze the major element and triple-oxygen isotope composition of the chondrule-like object, and the relict mineral phases to specify the nature of the precursor material, and ii) discuss the overall rarity of chondrules in micrometeorites.

References: [1] Scott E. R. and Krot A. N., 2003 Chondrites and their components; In: Meteorites, Comets and Planets (ed.) Davis A. M., Elsevier, 1 143–200.