FINE-GRAINED MINERALOGY OF COMETARY ULTRA-CARBONACEOUS ANTARCTIC MICROMETEORITES.

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Introduction: The CONCORDIA micrometeorite collection recovered from central Antarctic snow contains fluffy, fragile particles [1] among which we identified some UltraCarbonaceous Antarctic Micrometeorites (UCAMMs) [2, 3]. UCAMMs are dominated by up to ~ 80 vol% of carbonaceous material that contains small and complex mineral assemblages [2-4]. Their structure and chemical compositions are reminiscent of the CHON particles detected in comet Halley [5, 6]. We found extreme deuterium anomalies (up to 30 times the solar value) in these UCAMMs [7]. We present here the fine-grained mineralogy of these mineral assemblages by Transmission Electron Microscopy (TEM) in two UCAMMs (DC-06-09-45 and -119), in order to shed light on the formation and evolution of these well preserved particles of potential cometary origin.

Results and discussion: The UCAMM ultrathin sections show the predominance of a homogeneous carbonaceous amorphous-like material containing small pockets of complex mineral assemblages [3, 8]. No organic nanoglobules like those frequently observed in AMMs, carbonaceous chondrites or possibly Stardust samples [9-12] were identified in the UCAMM carbonaceous matter. Crystalline material dominates over glassy phases in the fine-grained mineral assemblages, with grain ranging from a few nanometers to half a micron in size. The dominant mineral phases identified so far are Mg-rich olivines, low-Ca and Mg-rich pyroxenes, Ca-rich pyroxenes (diopside), Fe-Ni sulfides and Fe-Ni metals. The olivine and low-Ca pyroxene compositions range from Fo-En_{100} to Fo-En_{80} with a frequency peak around Fo-En_{90}. Low-Ca pyroxenes are about twice as abundant as olivines. The compositions of Fe-Ni sulfides measured at this scale are comparable to that determined for larger Fe-Ni sulfides in all types of CONCORDIA AMMs [13]. The average major element composition of the fine-grained mineral assemblage is close to that of CI-chondrites.

The olivine and pyroxene compositions of the UCAMM mineral assemblages do not show the pronounced frequency peak at Fo-En_{99} observed in regular AMMs and Comet Wild 2 samples [14-16]. They can be compared to equilibrated assemblages observed in IDPs, of possible cometary origin and interpreted as the result of subsolidus annealing of amorphous precursors, like GEMS grains [17].

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