

MINERALOGY OF INTERPLANETARY DUST PARTICLES FROM THE COMET GIACOBINI-ZINNER DUST STREAM COLLECTIONS.

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Introduction: The Draconid meteor shower, originating from comet 21P/Giacobini-Zinner, is a low-velocity Earth-crossing dust stream that had a peak anticipated flux on Oct. 8, 2012 [1, 2]. In response to this prediction, NASA performed dedicated stratospheric dust collections to target interplanetary dust particles (IDPs) from this comet stream on Oct 15-17, 2012 [3]. Twelve dust particles from this targeted collection were allocated to our coordinated analysis team for studies of noble gas (Univ. Minnesota, Minnesota State Univ.), SXRF and Fe-XANES (SSL Berkeley) and mineralogy/isotopes (JSC). Here we report a mineralogical study of 3 IDPs from the Draconid collection.

Experimental: Dust samples A2 (9x9 um, cluster#1), A4 (8x10 um, cluster#2), and A11 (10x14 um, cluster#3) from collector U2153 were embedded in elemental sulfur and sectioned using ultramicrotomy into 70 nm-thick slices. Microtome thin sections of these particles were examined for mineralogy using a JEOL 2500SE field-emission scanning TEM (FE-STEM). The remaining ~80% unsectioned portions of the particles were reserved for analysis by SXRF/XANES and noble gas extraction.

Results: We did not observe well developed magnetite rims on the surfaces of the mineral grains, suggesting that these samples were not strongly heated during atmospheric entry. Solar flare tracks were not detected in any mineral grains. A2 shows typical characteristics of anhydrous IDPs, including GEMS grains and 20 – 200 nm sized enstatite, forsterite and sulfides bound together by carbonaceous material. Enstatite and forsterite grains contain up to 5 wt% of MnO, typical of LIME (Low-Fe Mn-Enriched) olivines and pyroxenes [3]. A4, on the contrary, is completely dominated by phyllosilicates with 11-13 Å spacing. A11 is dominated by 20-50 nm size spherical Cu sulfide grains together with bigger nodules of kamacitic Fe metal. No silicate crystals or amorphous silicate grains are found in A11.

Particles from these clusters show remarkable mineralogical diversity, yet further analyses are needed to see if the mineralogy is consistent within each cluster. These samples are devoid of solar flare tracks, but have not been strongly heated, consistent with short space exposure ages expected for fresh cometary particles [4]. While A2 has expected attributes of cometary materials, A4 (hydrated) and A11 (metallic/sulfide) do not. Future planned noble gas measurements will provide additional constraints on the space exposure histories of these particles.

References: [1] Campbell-Brown, M.D et al. (2006) *A&A*, 451, 339-344 [2] Bastien, R. et al. (2013) *LPSC* **44**, #1622 [3] Klöck, W., et al. (1989) *Nature* **339**, 126. [4] Messenger S. (2002) *MAPS* **37**, 1491-1505.