Interplanetary dust collected in the comet Grigg-Skjellerup dust stream

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Interplanetary dust particles (IDPs) are among the most primitive solar system materials available for analysis, and some are considered more pristine than returned comet Wild 2 dust [1]. Their provenance is generally unknown, but a cometary origin for some is likely [2]. The increased probability to sample dust from comet Grigg-Skjellerup during Earth's passage through its dust stream [3] provides the rare opportunity to link IDPs to a known parent body.

Indeed some IDPs from this particular dust collection are the most primitive yet analyzed [4, 5]. This is evidenced by their extremely high presolar silicate abundance, and their large D/H and $^{15}N/^{14}N$ ratios, associated with interstellar organic material. Moreover, Raman characteristics of the organic matter indicate its highly disordered and thermally unprocessed nature.

To better characterize these extraordinary IDPs, we extracted D-, ^{15}N- and presolar grain-rich material, as identified by secondary ion mass-spectrometry, by *in situ* focused ion beam liftout, and analyzed two sections by X-ray absorption near-edge structure spectroscopy (XANES) and transmission electron microscopy (TEM).

XANES revealed localized Ca signatures spatially associated with D- and ^{15}N-rich organic matter. Some Ca is attributed to Ca-rich pyroxene. However, XANES also revealed the presence of carbonate. The fine-grained porous nature of this IDP suggests that it is anhydrous [2], so the observation of carbonate, in association with unequilibrated interstellar organic matter, may support the suggestion of direct carbonate condensation in the solar nebula [6], rather than (local) aqueous alteration on the cometary parent body [7]. In agreement with our findings, carbonate has been found occasionally in anhydrous IDPs and comets [7].

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Mineral weathering in a deep volcaniclastic saprolite, Luquillo Mountains, Puerto Rico

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Mineral weathering in the critical zone directly impacts the availability of many important soil nutrients. As part of the USGS Water Energy and Biogeochemical Budgets (WEBB) program and the Critical Zone Exploration Network, we are investigating mineral nutrient distributions and fluxes in depth profiles (to 16 m) at five sites in the Bisley 1 catchment in the Luquillo Mountains of Puerto Rico.

The Bisley 1 catchment contains thick saprolites developed on marine bedded, andesitic, volcaniclastic bedrock. To date, data collected as functions of depth include bulk density, moisture, mineralogy, bulk chemistry of the solid material, pore space gas concentrations (O_2 and CO_2), and the chemistry and Mg isotopic composition of the pore waters.

Preliminary findings indicate that the saprolite is highly weathered and is depleted in primary minerals (except quartz) and Na, Ca, Mg with respect to bedrock collected from the Bisley 1 stream. Inverse relationships between Si and Ti or Zr indicate that Ti and Zr are not conserved during weathering. Increasing solid and pore water Mg concentrations with depth likely indicate the weathering of a Mg-containing mineral within the saprolite profile.