CONTROL ID: 2256053

TITLE: Water and organics in interplanetary dust particles

ABSTRACT BODY:

Abstract Body: Interplanetary dust particles (IDPs) and larger micrometeorites (MMs) impinge on the upper atmosphere where they decelerate at ~90 km altitude and settle to the Earth's surface. Comets and asteroids are the major sources and the flux, 30,000–40,000 tons/yr, is comparable to the mass of larger meteorites impacting the Earth's surface. The sedimentary record suggests that the flux was much higher on the early Earth. The chondritic porous (CP) subset of IDPs together with their larger counterparts, ultracarbonaceous micrometeorites (UCMMs), appear to be unique among known meteoritic materials in that they are composed almost exclusively of anhydrous minerals, some of them contain >> 50% organic carbon by volume as well as the highest abundances of presolar silicate grains including GEMS. D/H and ^{15}N abundances implicate the Oort Cloud or presolar molecular cloud as likely sources of the organic carbon. Prior to atmospheric entry, IDPs and MMs spend ~10^4-10^5 year lifetimes in solar orbit where their surfaces develop amorphous space weathered rims from exposure to the solar wind (SW). Similar rims are observed on lunar soil grains and on asteroid Itokawa regolith grains. Using valence electron energy-loss spectroscopy (VEELS) we have detected radiolytic water in the rims on IDPs formed by the interaction of solar wind protons with oxygen in silicate minerals. Therefore, IDPs and MMs continuously deliver both water and organics to the earth and other terrestrial planets. The interaction of protons with oxygen-rich minerals to form water is a universal process.

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PRESENTATION TYPE: Oral