CONTROL ID: 2558016

TITLE: Sulfides and refractory organic matter at the surface of 67P/Churyumov-Gerasimenko: evidence from VIRTIS data and laboratory measurements

ABSTRACT BODY:
Abstract (2,250 Maximum Characters): From Aug. 2014 to Sept. 2016, Rosetta has been orbiting comet 67P and has obtained informations on the origin and evolution of comets. The imaging spectrometer VIRTIS collected reflectance spectra of the surface within the range 0.25-5.1 µm that revealed a low albedo and a homogeneous surface (Capaccioni et al., 2015; Ciarniello et al., 2015). The spectra are also characterized by red slopes in the visible and in the near infrared. These properties have been interpreted to be due to the presence of an organic polyaromatic material mixed with opaque minerals, presumably troilite-like sulfides according to the composition of presumed cometary grains (Quirico et al., 2016).

In order to test this proposition, we have run a series of experimental measurements of granular mixtures of an analog of cometary polyaromatic organic matter (an immature coal) and different sulfides (pyrite, pyrrhotite and troilite). Bi-directional reflectance spectra were obtained at IPAG in the range 0.4-4 µm and under a range of viewing geometries. For the first time we are performing measurements on materials with sub-micrometer grains relevant to what is expected for cometary grains. Produced with a planetary grinder operating on colloidal solutions, these grains were characterized with SEM, X-ray diffraction and an electronic microprobe.

The experiment confirms that the low albedo in the near infrared is controlled by the abundance of pyrrhotite or troilite, while pyrite is not a viable candidate. These sulfides also account very well for the red slopes in the visible and the near infrared ranges. Excellent match with VIRTIS spectra is obtained for coal+pyrrhotite mixtures with a pyrrhotite abundance ranging from 30 to 50 wt%. Although the cometary grains composition include silicates and other organic compounds (see IDPs and Wild2 samples analysis), these results offer another interpretation of the reddish nature of some small bodies' surfaces, which has been interpreted so far as the presence of red organics or the consequence of space weathering. Finally, the suggestion that sulfides are major contributors to 67P dust might be generalized to other cometary nuclei that have similar VNIR spectra, as well as to P & D type asteroids.

CURRENT * CATEGORY: 67P/Churyumov-Gerasimenko

CURRENT : None

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