A CLOSE-UP LOOK AT COMET 67P: THE ROLIS EXPERIMENT

Stefano Mottola[1] and the ROLIS Team, [1]DLR German Aerospace Center
Rutherfordstr. 2, 12489 Berlin, Germany, EMail: stefano.mottola@dlr.de

The ROLIS instrument – the descent and close-up camera onboard Philae – acquired near-field multispectral images of the surface of 67P at a resolution better than 1 mm/pixel. During descent, it also captured a sequence of images with a maximum resolution of 1 cm/pixel with the intent of providing context for the close-up imagery and aiding in the identification of the landing site. The malfunction of the Philae anchoring system, however, resulted in a rebound of the lander, which caused the descent images and the close-up images to be acquired at two different locations. This gave us the unplanned opportunity to explore two different sites.

Among the most significant insights provided by ROLIS is the evidence that even at scales of 1cm/pixel the cometary surface at the Agilkia touchdown site appears of granular nature and no fine "dust" deposits are present. Within the region observed by ROLIS (a square of 70 m in size), two well distinct types of terrain are observed: a smooth one and a rough one. The frequency-size distribution of the particles in the smooth terrain is well described by a power law with an index that matches with surprising accuracy the power law distribution observed by the OSIRIS and GIADA instruments for small particles traveling in the coma [1,2]. This observation, together with the identification of aeolian erosion features around a large boulder present in the ROLIS field, reinforces the notion that the regions in the comet's Northern hemisphere are subject to particle airfall, as first proposed by Thomas et al, [3]. The observed aeolian features are explained by abrasion of a pre-existing sandbed as a consequence of particle airfall [4].

The multispectral close-up images acquired at Abydos, the final landing site, reveal a completely different terrain texture. No individual particles are seen down to a resolution of 0.3 mm/pixel. The surface appears cracked, with the cracks occasionally defining plates with typical sizes in the range of decimeters. The edges of the plates have usually a higher reflectance (up to 40% brighter) than the top layer, suggesting the presence of a refractory crust and an underlying softer layer [5].

References: [1] Rotundi A. et al. (2015) Science, 347, aaa3905. [2] Pajola M. et al. (2016) MNRAS, submitted. [3] Thomas N. et al. (2015) Science, 347, aaa0440. [4] Mottola S. et al. (2015) Science, 349, aab0232. [5] Schroeder et al. 2016 Icarus, submitted.