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Colors of comet 67P/Churyumov-Gerasimenko's active pits and their surroundings as seen by OSIRIS on board Rosetta

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The OSIRIS scientific imager (Optical, Spectroscopic, and Infrared Remote Imaging System, Keller et al. 2007) on board ESA's spacecraft Rosetta is an instrument designed to observe the comet nucleus with high spatial resolution, down to a few centimeters per pixel, to provide color information of the surface using its narrow angle camera (NAC) thanks to set of dedicated filters. OSIRIS is successfully observing comet 67P in the spectral range of about 250-1000 nm since Rosetta's arrival to the comet in the summer 2014. The illuminated northern hemisphere of the comet nucleus was mapped with various spatial resolutions (down to 15 cm/px in some regions). Besides the determination of the surface morphology in great details, such high resolution images provided us a mean to unambiguously link some activity in the coma to a series of pits on the nucleus surface (Vincent et al. 2014).

This work focuses on color variations inside and in the vicinity of these active pits. Using filter ratios to limit the effect of topography and illumination conditions, we found that the floor and walls of the pits exhibit the same less red slope of the active Hapi region. We measured a ratio of reflectance (IR)/reflectance (Blue) = 1.8 in the active area and pits while it is 2.1 elsewhere on the nucleus. A full understanding of the compositional implications will require a dedicated investigation, but our preliminary results indicate already that this spectral variation is characteristic of currently active regions on 67P.

Indeed, on a large scale, comet 67P's global spectrum shows a red slope also known from the ground based observations, slightly less red in the most active area (Hapi region) when compared to the average comet surface. Variegation is also found in other places showing activity such as the active pits mentioned above.

The analysis is now extended to the photometrically corrected data set in order to be able to compare observations taken under different illumination conditions. The relevant images acquired between August and December 2014 are reduced using the standard OSIRIS calibration pipeline and then converted to reflectance values (I/F). Analyzed multispectral data is produced by using USGS ISIS3 software. This process includes the sub-pixel image registration, and photometric corrections.

References

Keller, H. U. et al. 2007, Space Sci. Rev., 128, 433
Vincent, J.-B. et al., Science, submitted.