EPSC Abstracts
Vol. 10, EPSC2015-527, 2015
European Planetary Science Congress 2015

Understanding Rosetta's measurements through laboratory experiments

Diana Laufer and Akiva Bar-Nun
Department of Geosciences, Tel-Aviv University, Tel-Aviv, Israel, (dianal@post.tau.ac.il/ Fax:+97236409282)

Abstract

The Rosetta spacecraft the Philae lander provide an unprecedented opportunity to follow the evolution of surface and the growing activity of the comet 67P/Churyumov-Gerasimenko. In this study we will present an explanation of the observed surface features on the comet nucleus, as derived from our laboratory experimental results, such as gas/water ratios, surface features as craters, boulders, active areas and smooth terrains, due to ice sublimation and evolution of gases from the interior of the nucleus.

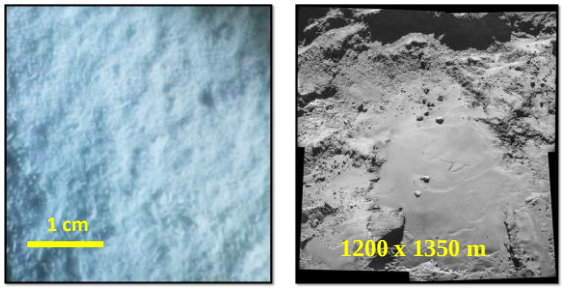
1. Introduction

Our experimental studies on "cometary" gas laden amorphous ice can explain the direct measurements of the Rosetta spacecraft the Philae lander. The ice grains are ejected together with gas jets from the ice, forming on the surface craters and smooth areas as found in the direct observations. Our experimental results on the gas/water ratios, density, thermal conductivity and mechanical strength are similar with the in situ results of comet 67P/ C-G.

1.1 Surface of the nucleus

The surface of the comet shows complex active processes such as craters, boulders, smooth areas.

In our experiments, upon heating from above, two types of ices were observed with different properties: on the surface -smooth water ice layers – compacted and denser and gas laden ices - very porous.



Copyright ESA/Rosetta/NAVCAM

Figure 1: Ejected ice grains cover the surface forming smooth areas as observed in different regions of the comet [1].

1.2 Cometary Activity

Most of the activity of the nucleus of the comet 67P is coming out from the transition region between the small and the large lobe, where, emanating jets and craters were observed [2]. From our experiments, jets are formed when an underneath pocket of gas explode carrying with it water vapor and ice grains, forming on the surface of the ice holes (craters) and cracks. The micron size distribution fit the Rosetta's direct observation [3].

2. Summary and Conclusions

Our experiment fit the direct observations on the comet 67P/Churyumov-Gerasimenko and the results from pervious missions to different comets. These results can explain also direct observations of the activity of distant comets [4].

Acknowledgements

The authors acknowledge support from the Israel Ministry of Science, Technology and Space through the Israel Space Agency.

References

[1] Laufer, D., et al. 2013. Icarus Vol. 222, pp. 73-80.

[2] Sierks, H., et al. 2015. Science, Vol. 347, aaa1044.

[3] Bentley, M. et al. EGU 2015.EGU 12-17 April 2015, Vienna, 2015.

[4] Meech, K.J., et. Al, Icarus, Vol. 201,pp. 719-739, 2009.