WHAT'S NEW ON THE WIND TAILS ON 67P/CHURYUMOV-GERASIMENKO? D. Tirsch[1], K. A. Otto[1], S. Mottola[1], S. Hviid[1], R. Jaumann[1,2], L. Jorda[3], E. Kührt[1], K.-D. Matz[1], F. Preusker[1]. [1]Institute of Planetary Research, German Aerospace Center (DLR), Rutherfordstrasse 2, 12489 Berlin, Germany, (Daniela.Tirsch@dlr.de); [2]Institute of Geological Sciences, Freie Universität Berlin, Berlin, Germany; [3]Aix-Marseille Université, CNRS, Laboratoire d'Astrophysique de Marseille (LAM), Marseille, France.

Introduction: Aeolian bedforms have been detected on the surface of comet 67P/Churyumov-Gerasimenko (hereafter named 67P) by high resolution image data of the ROLIS descent imager [1] and OSIRIS orbiter camera [2] on-board the Rosetta spacecraft and its lander Philae [e.g. 3, 4, 5]. These bedforms involve dune-like landforms or ripples in the Hapi region as well as elongated deposits of granular material and semicircular depressions around several larger boulders (>5 m) resembling wind tails and moats as known from planets with atmospheres (Figure 1). Due to the similarity in morphology, we use the same terms for these bedfoms on the comet. Such features commonly form by accumulation or erosion by wind on Earth and Mars for example [e.g. 6, 7]. However, wind transport is difficult to explain on 67P and the features are probably of different origin. Nevertheless, they indicate that aeolian-like processes can transport particles across the surface of the nucleus and that this process is particularly effective where it interacts with obstacles such as boulders. Recent studies suggest that they form as a result of abrasion of a sandbed induced by air-fall particles [2, 3, 8].

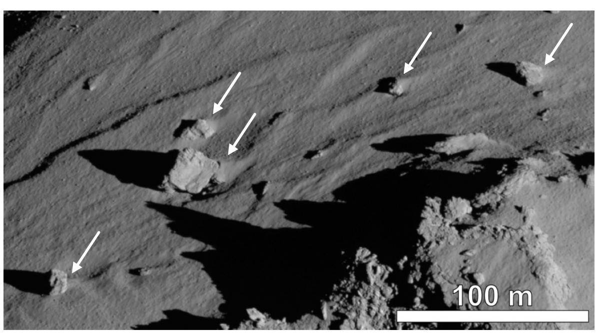

Figure 1: Examples of boulders with wind tails in the Serqet region. The wind tails point towards the upper right of the image and possess a sharp crest along the ridge. *Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA*

In this study, we focus on the wind tails associated with obstacles, classify their appearances and track possible air-fall directions from the shape and direction of the deposits. One aim is to determine the possible source of the air-fall particles assuming that the direction of the wind tails is associated with the direction of the air-fall in the area. We base our analysis on the method described by Mottola et al. [2], which assumes that the boulders were previously covered by particles, which were subsequently eroded by impinging particles from an air-fall stream. We will compare our results with existing models of dust transport on 67P [8, 9] and will test the accordance of the models and our observations.

Methods: We investigated pre-perihelion OSIRIS images with a spatial resolution better than 50 cm/ pixel from the entire sunlit surface of the comet as well as the ROLIS descent imager data from Philae's landing site Agilkia (touch down site 1). We marked and counted all wind-tail morphologies in the image data and projected these images onto a shape model of the nucleus [10] providing a 3-dimensional view of the wind tails' orientation. For each boulder with an associated wind tail we estimated the direction of the deposit from the projected image data by determining two points on the shape model: The first point is located where the wind tail touched the boulder and the second point is where the wind tail merges into the surrounding regolith. The connection between these two points represents the projected wind direction. In combination with the estimated boulder height (estimated to be 1/3-1/2 of the boulder width [4]), we were able to derive a preferred direction of particle in-fall associated with the abrasion of the sandbed as explained in [4].

Results: We found 65 wind tails on the comet's surface, which we divided into 3 morphological classes. Most of them are relatively broad and have a sharp crest along the ridge (Figure 1). Others are broad but have a rounded ridge. A small number of wind tails are elongated and slim. Most of these features are located on the small lobe in the Ma'at region, on the "head" of 67P whereas other areas are depleted (Figure 2). The average boulder size ranges around 13.5 m (±8.4 m) and the average length of the wind tails is around 13.4 m (±13.7 m). We noted a clear correlation of wind tail orientation in a given vicinity indicating a common source of the transport process. For instance, the preferred orientation of the wind tails in the Ma'at region is to the north (Figure 2). Bedforms located in other parts of the comet mostly have a different orientation indicating different source regions of the air-fall stream. The clustering of wind tails at Ma'at is consistent with the findings of [9] suggesting erosion of particles in Ma'at and Ash. In addition, the orientation of the wind tails agrees with the particle transport from south to north of the comet as suggested by [9].

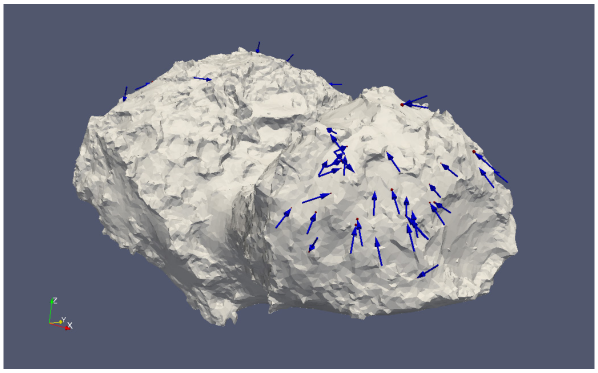

Figure 2: The location and orientation of wind tails (blue arrows) on 67P projected on a shape-model by [10]. Most of these features were found in the Ma'at region with a south to north orientation.

References:

[1] Keller H. U. et al. (2007) *Sp. Sci. Rev*. 128, 433–506. [2] Mottola S. et al. (2007) *Sp. Sci. Rev*. 128, 241-255. [3] Thomas N. et al. (2015) *A&A* 583. [4] Mottola et al. (2015) *Science* 349. [5] Thomas N. et al. (2015) *Science* 347, 0.1126/science.aaa0440. [6] Greeley, R. et al. (2002) *JG*R 107. [7] Greeley R. (1999) JGR 104, E4, 8573-8584. [8] Kramer T. and Noack M. (2015) A&A 813. [9] Lai et al. (2016) *EGU* 2016, #3655. [9] Keller et al. (2017) *ACM* 2017. [10] Presuker et al. (2015) A&A 583.