Rosetta's big day in the sun

August 14 2015

This series of images of Comet 67P/Churyumov–Gerasimenko was captured by Rosetta's OSIRIS narrow-angle camera on 12 August 2015, just a few hours before the comet reached the closest point to the Sun along its 6.5-year orbit, or perihelion. The image at left was taken at 14:07 GMT, the middle image at 17:35 GMT, and the final image at 23:31 GMT. The images were taken from a distance of about 330 km from the comet. The comet's activity, at its peak intensity around perihelion and in the weeks that follow, is clearly visible in these spectacular images. In particular, a significant outburst can be seen in the image captured at 17:35 GMT. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

ESA's Rosetta today witnessed Comet 67P/Churyumov–Gerasimenko making its closest approach to the sun. The exact moment of perihelion occurred at 02:03 GMT this morning when the comet came within 186 million km of the sun.

In the year that has passed since Rosetta arrived, the comet has travelled some 750 million kilometres along its orbit towards the sun, the increasing solar radiation heating up the nucleus and causing its frozen ices to escape as gas and stream out into space at an ever greater rate. These gases, and the dust particles that they drag along, build up the comet's atmosphere – coma – and tail.

The activity reaches its peak intensity around perihelion and in the weeks that follow – and is clearly visible in the spectacular images returned by the spacecraft in the last months. One image taken by Rosetta's navigation camera was acquired at 01:04 GMT, just an hour before the moment of perihelion, from a distance of around 327 km.

The scientific camera is also taking images today – the most recent available image was taken at 23:31 GMT on 12 August, just a few hours before perihelion. The comet's activity is clearly seen in the images, with a multitude of jets stemming from the nucleus, including one outburst captured in an image taken at 17:35 GMT yesterday.

"Activity will remain high like this for many weeks, and we're certainly looking forward to seeing how many more jets and outburst events we catch in the act, as we have already witnessed in the last few weeks," says Nicolas Altobelli, acting Rosetta project scientist.

Rosetta's measurements suggest the comet is spewing up to 300 kg of water vapour – roughly the equivalent of two bathtubs – every second. This is a thousand times more than was observed this time last year when Rosetta first approached the comet. Then, it recorded an outflow rate of just 300 g per second, equivalent to two small glasses of water.

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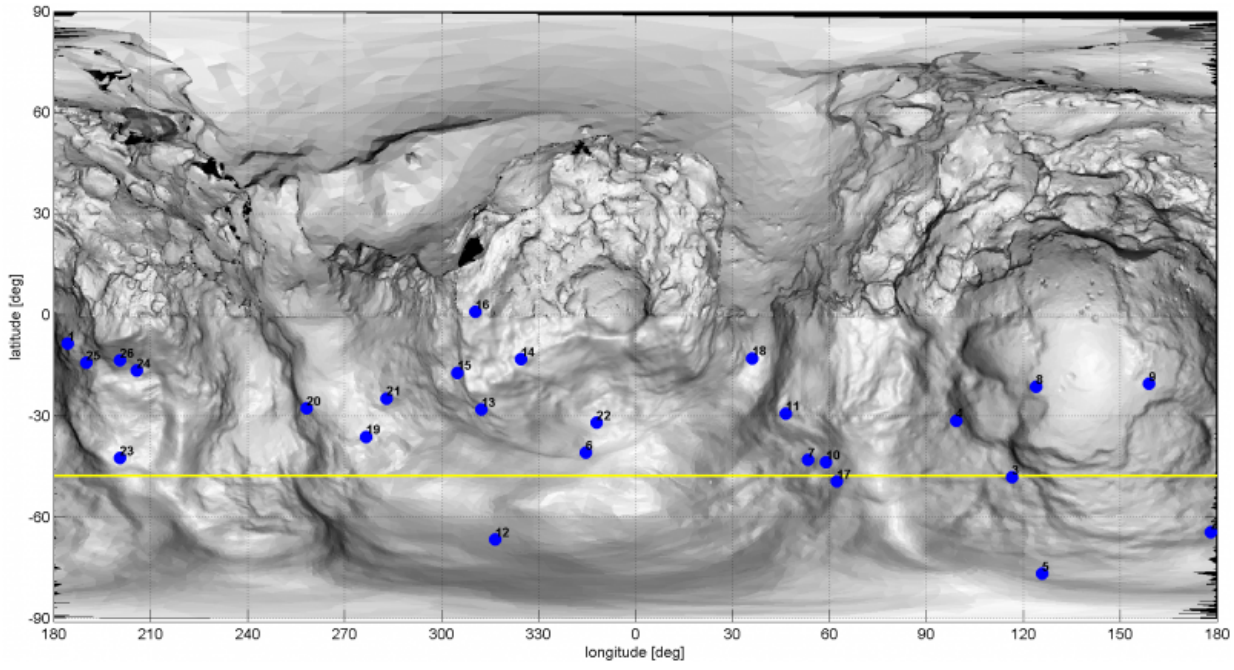
Along with gas, the nucleus is also estimated to be shedding up to 1000 kg of dust per second, creating dangerous working conditions for Rosetta.

"In recent days, we have been forced to move even further away from the comet. We're currently at a distance of between 325 km and 340 km this week, in a region where Rosetta's startrackers can operate without being confused by excessive dust levels – without them working properly, Rosetta can't position itself in space," comments Sylvain Lodiot, ESA's spacecraft operations manager.

Monitoring the comet's changing environment in the lead up to, during and after perihelion is one of the primary long-term science goals of the mission.



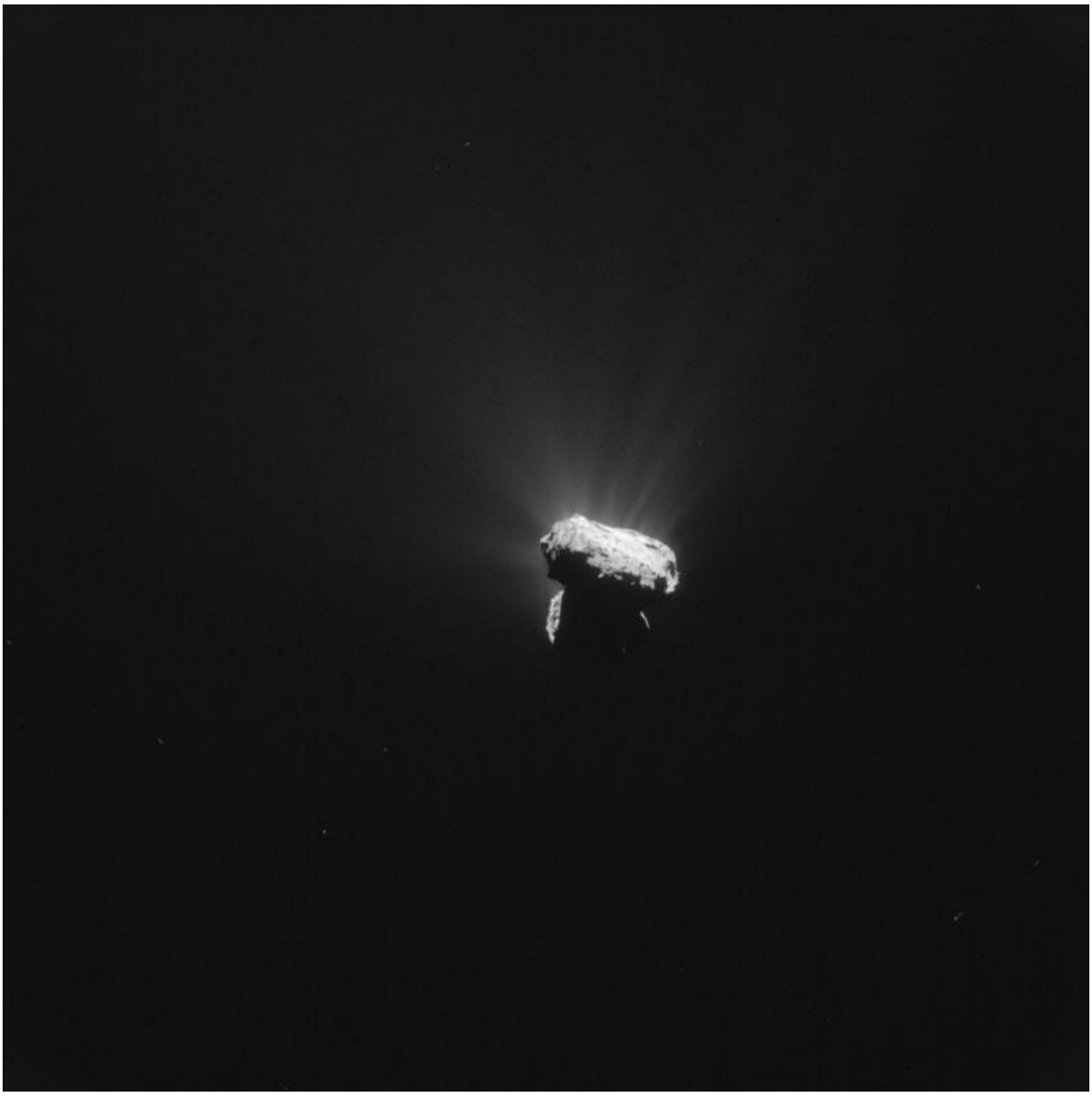
This is a projected map of Comet 67P/Churyumov–Gerasimenko using data from Rosetta's OSIRIS camera. It is based on a cylindrical projection, a procedure that is routinely used to chart the surface of planets, moons and other

(roughly) spherical celestial bodies. The intricate appearance is caused by the unusual, double-lobed shape of this comet: the small lobe is shown at the centre of the map, while portions of the large lobe are shown to the left and right. The blue points refer to possible origins, on the surface of the comet, of some of the dust jets recently observed by OSIRIS. The yellow line indicates the sub-solar line, which traces out the points on the surface where the Sun is directly overhead. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

Over the last few months, seasons on the comet have changed, throwing its southern hemisphere into a short – about 10 month – summer after more than five-and-a-half years in darkness. This has revealed parts of the surface that have previously been cast in shadow during Rosetta's sojourn at the comet, allowing scientists to fill in some of the missing pieces of its regional map.

They have now identified four new geological regions on the southern hemisphere, which includes parts of both comet lobes, bringing the total number of regions to 23. The names of the new regions follow the naming convention of Egyptian gods and goddesses adopted for the comet: Anhur, Khonsu, Sobek and Wosret.

The comet's average temperature has also been on the increase. Not long after arriving, surface temperatures of around –70ºC were recorded. By April–May 2015, this had risen to only a few degrees below zero celsius, and now highs of a few tens of degrees above zero are forecast for the next month.



This single frame Rosetta navigation camera image was acquired at 01:04 GMT on 13 August 2015, just one hour before Comet 67P/Churyumov–Gerasimenko reached perihelion – the closest point to the Sun along its 6.5-year orbit. The image was taken around 327 km from the comet. It has a resolution of 28 m/pixel, measures 28.6 km across and was processed to bring out the details of the comet's activity. Credit: ESA/Rosetta/NAVCAM – CC BY-SA IGO 3.0

Meanwhile, astronomers back on Earth have been following the comet's evolution from afar. Rosetta is far too close to the comet to see its growing tail, but images collected over the past few months with telescopes across the world show that it already extends more than 120 000 km.

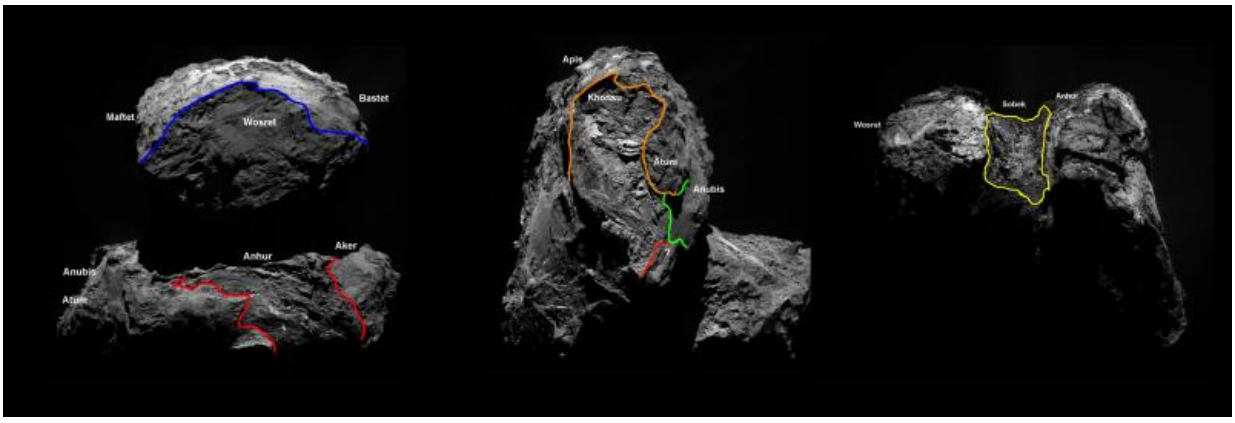
A lop-sided coma, with a notable high-density region away from the main tail, was revealed in various images, including some taken last week from the Gemini-North telescope on Mauna Kea, Hawaii.

"Combining these big-picture views from ground-based telescopes with Rosetta's close-up study of individual jets and outbursts will help us to understand the processes at work on the comet's surface as it approaches the sun," adds Nicolas.

This sequence of images, taken with Rosetta's OSIRIS narrow-angle camera on 30 July 2015, show a boulder-sized object close to the nucleus of Comet 67P/Churyumov–Gerasimenko. The images were captured on 30 July 2015, about 185 km from the comet. The object measures between one and 50 m across; however, the exact size cannot be determined as it depends on its distance to the spacecraft, which cannot be inferred from these images. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

"We aim to go back in much closer again after the activity subsides and make a survey of how the comet has changed. We also continue to hope that Philae will be able to resume its scientific operations on the surface and give us a detailed look at changes which may be occurring immediately surrounding its landing site."

Finally, Patrick Martin, ESA's Rosetta mission manager remarks: "It's exciting to reach the milestone of perihelion, and we look forward to seeing how this amazing comet behaves as we move away from the sun with it over the coming year."



Four new regions, separated by distinct geomorphological boundaries, have been identified on the southern hemisphere of Comet 67P/Churyumov–Gerasimenko. The complex season cycle on the comet means the southern hemisphere – which includes part of both comet lobes – had been undergoing winter for over five years. Around May 2015, seasons on the comet changed, throwing the southern hemisphere into a short – approximately 10 month – summer and revealing parts of the surface that were previously cast in shadow. This allowed scientists to fill in some of the missing pieces of the comet's regional map. Like the 19 regions that had been identified in January 2015, the four new ones are named for Egyptian deities, following the ancient Egyptian theme of the Rosetta mission: Anhur, Khonsu, Sobek and Wosret. Anhur and Khonsu can be found on the underside of the comet's larger lobe, Wosret on the smaller lobe, and Sobek is located on the comet's neck. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

Provided by European Space Agency