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Comet lander's location still eludes scientists

Search intensifies as researchers try to determine if Philae can recharge its batteries.

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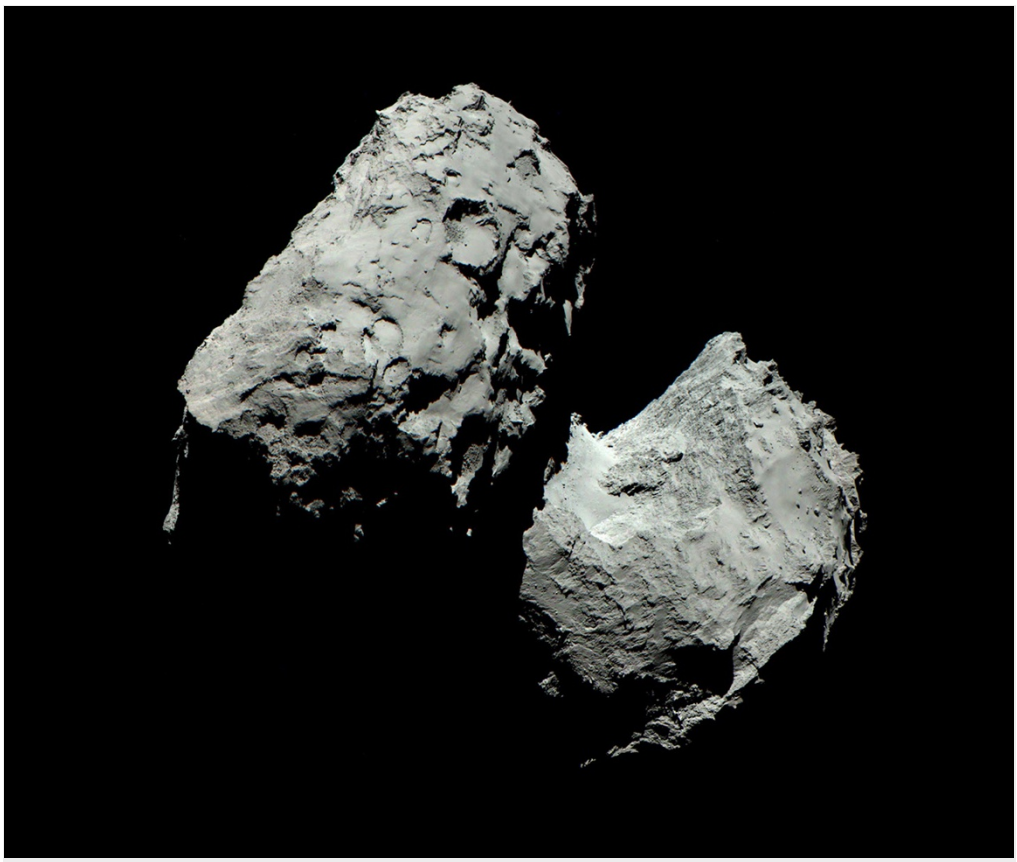

ESA/Rosetta/MPS for OSIRIS Team

The Philae spacecraft is somewhere on Comet 67P (shown here in August).

More than a month after the Philae spacecraft bounced to the surface of Comet 67P/Churyumov–Gerasimenko, European Space Agency (ESA) scientists have still not been able to figure out where it came to rest.

The probe landed off-kilter on 12 November. Knowing where Philae now lies is crucial to understanding whether enough sunlight will reach its solar panels to recharge and awaken the dormant lander. The angle of sunlight will change in the coming months as the comet approaches the Sun.

Jean-Pierre Bibring, a planetary scientist at the Institut d'Astrophysique Spatiale in Orsay, France, and chief scientist for the lander, is confident that Philae will awaken early next year, perhaps sometime between February and April. But he conceded that this estimate relied on exactly where the lander is. "The only question is the site," he said on 17 December at a meeting of the American Geophysical Union (AGU) in San Francisco, California.

A series of high-resolution images being downloaded this week from the orbiting Rosetta spacecraft may finally be able to pinpoint Philae's location. "I find it a bit strange that four weeks after landing, we don't have it," says Holger Sierks, a planetary scientist at the Max Planck Institute for Solar System Research in Göttingen, Germany, and chief scientist for the camera on Rosetta that is searching for Philae.

The search continues

That camera, called OSIRIS, looked for Philae on 24 November and again on 6 December. It combed an area measuring 350 metres by 50 metres on the lip of a crater rim where Philae is thought to have come to a stop. The 6 December scan turned up an intriguing glint outside the search area that could have been a reflection from the spacecraft, Sierks says. But the entire region was in shadow at the time, so it is difficult to say what the camera was actually seeing.

OSIRIS tried again on 12, 13 and 14 December, looking at a larger area that includes both the original scan site and the intriguing glint. The data are being downloaded now and could be available in as early as a day or two.

Because sunlight illuminated the area during the most recent search, the team is hopeful that it will see something. “It’s a bit like waiting for Christmas presents,” says Matt Taylor, Rosetta project scientist at ESA.

Philae needs around 15 watts of power to awaken and be able to perform science. Its location on the comet, and the angle at which its solar panels are oriented to the Sun, will determine how long it might take to gather that power. Bibring says that the lander is currently receiving only about four and a half hours of sunlight a day.

Philae’s survival also depends on whether it can withstand the frigid temperatures on Comet 67P. Its instruments are rated to minus 65 °C and can probably survive conditions a bit colder than that, says Bibring: “We are confident we are in an environment to survive until the energy on the solar panels is back to what we need.”

Sneak peak

In the meantime, Rosetta has been sending back its first findings from orbit. At the AGU meeting, the OSIRIS images garnered the most attention for their high-resolution glimpses of the comet’s surface. The OSIRIS team has released only a small amount of its images publicly, holding the rest back for internal analysis — a policy that many external scientists have grumbled about. At a standing-room-only talk, Sierks flicked through a series of dramatic landscapes.

The comet is covered by small pits that seem to have vented gas, and 'boulders' that may be icy blocks in the process of disintegrating. In other areas, fine-grained dust blankets the surface, and large cracks run through the blocky-looking cliffs that dominate much of the comet. There are small terraces that look like stepping stones, one after the other, down the sides of a slope.

Perhaps most strikingly, the sides of some cliffs are peppered with round objects that Sierks dubbed “dinosaur eggs”. They may represent some kind of big pebble, where cometary material has clumped together.

There are so many types of terrain that the OSIRIS team has divvied the landscape up into different sections, each with its own Egyptian-themed name. (The Rosetta mission is named after the Rosetta stone that allowed ancient Egyptian scripts to be deciphered.)

The Imhotep region, for instance, has features that could be underground voids that gave way, says Olivier Groussin of the Laboratoire d’Astrophysique de Marseille in France. “It’s a ruins landscape,” he adds.

Meanwhile, dust collectors aboard Rosetta have captured fluffy bits spraying off the comet. A particle trap caught nearly 2,000 dust grains — many more than expected — over the course of three weeks, says Yves Langevin, a planetary scientist at the Institut d’Astrophysique Spatiale.

Lack of magnetism

Rosetta has also discovered that, unlike Earth rocks, lunar rocks and meteorites, Comet 67P has essentially no magnetism. In this way, it is comparable only to the asteroid Eros. The finding suggests that magnetic forces were not a major factor when the comet condensed out of primordial material in the early Solar System, says Hans-Ulrich Auster of the Technical University of Braunschweig in Germany.

In February, Rosetta will descend to within 10 kilometres of the comet's surface and perform its closest fly-by. After that, the Sun’s heat will cause so much gas and dust to fly off the comet that it will be too dangerous for Rosetta to approach. The mission's goal is to study how the comet's activity changes as it gets closer to the Sun.

Comet 67P will swing past the Sun in August 2015. The Rosetta mission had been scheduled to end in December 2015, but ESA is considering extending it for several months beyond that, Taylor says.