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Cassini scientists observe evidence for water geysers on Saturn's moon Enceladus

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The US-European spacecraft Cassini has obtained images and spectral measurements from the South Pole of Saturn's moon Enceladus showing what appears to be geysers of liquid water erupting from the surface. The news, published in a pair of articles in the 10 March issue of the US journal 'Science', was announced by researchers including team members from the German Aerospace Center.



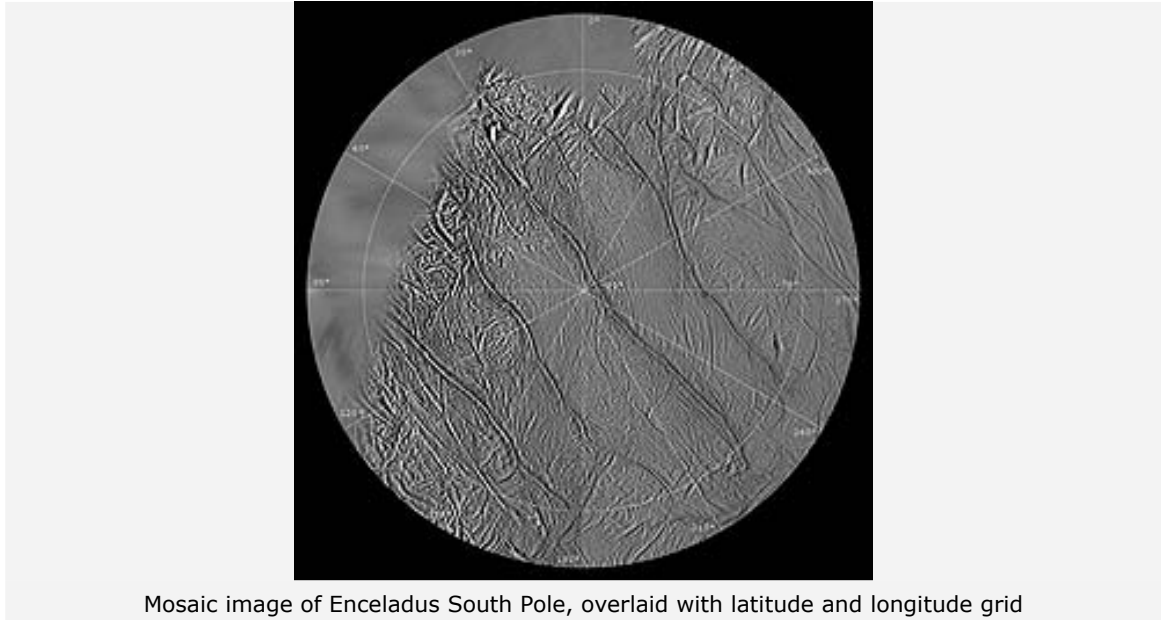
Cassini mosaic image of the South Pole of Saturn's moon Enceladus

The geysers appear to spout water up to 490 kilometres high into the neighbouring space around Enceladus. The reservoirs that supply the water are possibly only a few metres below the icy surface of the small, 500-km diameter moon. Similar to well-known water geysers on Earth, such as those in America's Yellowstone National Park, these alien geysers spray water droplets over a wide area at the South Pole of this geologically-active Saturn satellite; however, on Enceladus, the water droplets immediately freeze.

During Cassini's November fly-by of Enceladus, the camera system imaged fine jets of particles being ejected from the South Pole, which could be seen travelling far into space. "In data taken at the same time by Cassini's imaging spectrometers, we see that the geochemical composition of the South Pole is different and above all more complex than that on the rest of the moon's surface," says Dr Ralf Jaumann of DLR's Institute of Planetary Research in Berlin and member of the VIMS spectrometer (Visible and Infrared Imaging Spectrometer) team for Cassini. "Beside pure, crystalline and amorphous water ice, there is also carbon dioxide and organic molecules. This is a very clear indication that the moon is still geologically active in this area." Investigations into the composition and physical characteristics of the Enceladean surface are headed by Robert Brown of the Lunar and Planetary Laboratory, University of Arizona, Tucson, USA.

Dr Thomas Roatsch of the DLR Institute of Planetary Research, an author of one of the scientific articles published by Cassini's ISS (Imaging Science Subsystem) team, calculated a composite image map of the icy moon for the Cassini camera team based on data gathered during fly-bys in February, March

and July 2005. The image map serves as the basis for the geological mapping of the moon. "A series of rolling, parallel break structures are immediately noticeable in our picture mosaics of the South Pole. It is probably from these trenches, referred to by scientists as 'tiger stripes', that the water is discharged under high pressure, as the spectrometer data show remarkable variations here." The DLR team produces picture mosaics and maps as well as impact crater statistics used to determine the age of several of Saturn moons in cooperation with Professor Gerhard Neukum of the Freien Universität Berlin (Free University of Berlin), also a member of the Cassini camera team.



Roland Wagner is also from the DLR Institute of Planetary Research. A co-author of the aforementioned article, which was published by a team led by Dr Carolyn Porco of the Space Science Institute, Boulder, Colorado, USA, he was involved in ascertaining the age of the moon's surface. "In comparison to the rest of the surface of Enceladus, the South Pole area is very much younger," explains the scientist, adding: "based on the low presence of impact craters, we surmise that the regions between the 'tiger stripes' are clearly younger than one million years -- a geologically extremely recent age." Since other areas on Enceladus are at least in part very much older, the moon seems to have been geologically active for at least four million million years.

In fact, at a distance of nearly one-and-a-half-billion kilometres from the Sun, it is too cold for Saturn's moons -- particularly one as small as Enceladus -- to harbour liquid water below their icy surfaces. In the case of Enceladus, only one energy source could conceivably allow ice to melt and develop a reservoir of water. Tidal forces similar to those acting on Saturnian moons such as Mimas, Tethys and Dione could produce warmth in the moon's interior due to reciprocal forces exerted by Saturn and neighbouring moons.

On the other hand, with only a 500-km diameter, Enceladus is too small to generate interior heat in the usual ways such as, for example, the radioactive decay of elements. Radioactive decay produces warmth inside Earth and also in the larger satellites of the outer Solar System.

Enceladus is not the first body in the outer Solar System where water is suspected to exist beneath the surface. Through data gathered in the 1990s by the spacecraft Galileo, this was also found to be the case for Jupiter's moon Europa and probably also for Ganymede. But in contrast to these bodies, water on Enceladus appears to be spouting from the 'tiger stripes' immediately below the surface. Scientists do not consider it impossible that the water-bearing layers of the icy moons of Jupiter and Saturn could harbour forms of organic life.

Contact

Dr.rer.nat. Thomas Roatsch

German Aerospace Center
Institute of Planetary Research, Planetary Geology
E-Mail: Thomas.Roatsch@dlr.de

Elke Heinemann

German Aerospace Center (DLR)
Corporate Communications, Online Communication - DLR Web Portal
Tel: +49 2203 601-2867

Fax: +49 2203 601-3249
E-Mail: elke.heinemann@dlr.de

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