Enceladus Water Geyers Full of *Organic* Chemicals

"A completely unexpected surprise is that the chemistry of Enceladus, what's coming out from inside, resembles that of a comet. To have primordial material coming out from inside a Saturn moon raises many questions on the formation of the Saturn system." - Hunter Waite, a Principal Investigator, Cassini Mission

On Wednesday, March 12, 2008, NASA's Cassini spacecraft flew along the south pole of Enceladus to sample water-ice, dust and gas in the geyser plumes that erupt there. This was the first of four Cassini flybys of Enceladus planned for 2008, the second coming in August. Image 2007 by Cassini-Huygens spacecraft.

March 30, 2008 Pasadena, California - NASA reported this week:

> NASA's Cassini spacecraft tasted and sampled a surprising organic brew erupting in geyser-like fashion from Saturn's moon Enceladus during a close flyby on March 12. Scientists are amazed that this tiny moon is so active, "hot" and brimming with water vapor and organic chemicals.
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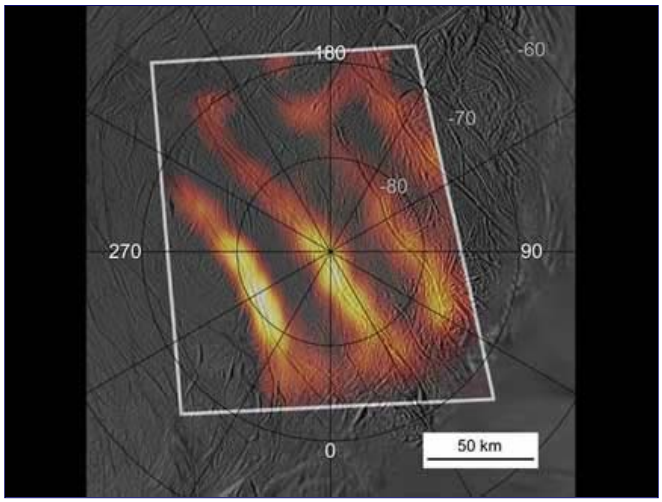
> New heat maps of the surface show higher temperatures than previously known in the south polar region, with hot tracks running the length of giant fissures. Additionally, scientists say the organics "taste and smell" like some of those found in a comet. The jets themselves harmlessly peppered Cassini, exerting measurable torque on the spacecraft, and providing an indirect measure of the plume density.



Heat radiating from the entire length of 150 kilometer (95 mile)-long fractures is seen in this best-yet heat map of the active south polar region of Saturn's ice moon Enceladus. Heat map credit: NASA/JPL/GSFC/SwRI/SSI.

The warmest parts of the fractures tend to lie on locations of the plume jets identified in earlier images, shown in the annotated version with yellow stars. The measurements were obtained by the Cassini spacecraft's Composite Infrared Spectrometer from the spacecraft's close flyby of the moon on March 12, 2008.

Remarkably high temperatures, at least 180 Kelvin (minus 135 degrees Fahrenheit) were registered along the brightest fracture, named Damascus Sulcus, in the lower left portion of the image. For comparison, surface temperatures elsewhere in the south polar region of Enceladus are below 72 Kelvin (minus 330 degrees Fahrenheit).

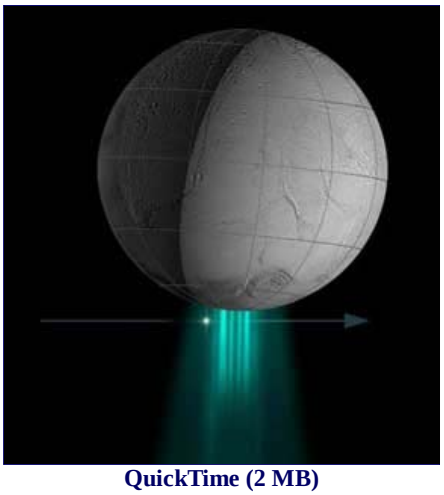
Heat is escaping from Enceladus' interior along these warm fractures, dubbed "tiger stripes," which are also the source of the geysers that erupt from the polar region. The infrared radiation was mapped at wavelengths between 12 and 16 microns. The infrared data, shown in false color, are superimposed on a grayscale image mosaic of the south pole obtained by Cassini's cameras on July 14, 2005, during the previous close Enceladus flyby. Numbers on the map indicate latitude and longitude.

This new view shows that at least three of the south polar fractures are active along almost their full lengths--the fourth one, on the right, was only partially covered by this scan. The level of activity varies greatly along the fractures. The warmest parts of the fractures tend to lie on locations of the plume jets identified in earlier images. The main "tiger stripe" fractures are not the only sources of heat, however; additional warm spots are seen in the upper right part of the scan. The warm regions are probably concentrated within less than a few hundred meters (a few hundred yards) of the fractures, and their apparent width in this image results from the relatively low resolution of the infrared data.

This map was made by scanning the south pole during the period from 16 to 37 minutes after closest approach to Enceladus, at a distance between 14,000 and 32,000 kilometers (about 8,700 and 20,000 miles) as Cassini rapidly receded from its close (50-kilometer or 32-mile) flyby.

"A completely unexpected surprise is that the chemistry of Enceladus, what's coming out from inside, resembles that of a comet," said Hunter Waite, principal investigator for the Cassini Ion and Neutral Mass Spectrometer at the Southwest Research Institute in San Antonio. "To have primordial material coming out from inside a Saturn moon raises many questions on the formation of the Saturn system."

"Enceladus is by no means a comet. Comets have tails and orbit the sun, and Enceladus' activity is powered by internal heat while comet activity is powered by sunlight. Enceladus' brew is like carbonated water with an essence of natural gas," said Waite.



QuickTime (2 MB)

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New structure, density and composition measurements of Enceladus' water plume were obtained when the Cassini spacecraft's Ultraviolet Imaging Spectrograph observed the star zeta Orionis pass behind the plume Oct. 24, 2007, as seen in this animation.
The Ion and Neutral Mass Spectrometer saw a much higher density of volatile gases, water vapor, carbon dioxide and carbon monoxide, as well as organic materials, some 20 times denser than expected. This dramatic increase in density was evident as the spacecraft flew over the area of the plumes.

New high-resolution heat maps of the south pole by Cassini's Composite Infrared Spectrometer show that the so-called tiger stripes, giant fissures that are the source of the geysers, are warm along almost their entire lengths, and reveal other warm fissures nearby. These more precise new measurements reveal temperatures of at least minus 93 degrees Celsius (minus 135 Fahrenheit.) That is 17 degrees Celsius (63 degrees Fahrenheit) warmer than previously seen and 93 degrees Celsius (200 degrees Fahrenheit) warmer than other regions of the moon. The warmest regions along the tiger stripes correspond to two of the jet locations seen in Cassini images.

"These spectacular new data will really help us understand what powers the geysers. The surprisingly high temperatures make it more likely that there's liquid water not far below the surface," said John Spencer, Cassini scientist on the Composite Infrared Spectrometer team at the Southwest Research Institute in Boulder, Colo.

Previous ultraviolet observations showed four jet sources, matching the locations of the plumes seen in previous images. This indicates that gas in the plume blasts off the surface into space, blending to form the larger plume.

Images from previous observations show individual jets and mark places from which they emanate. New images show how hot spot fractures are related to other surface features. In future imaging observations, scientists hope to see individual plume sources and investigate differences among fractures.

"Enceladus has got warmth, water and organic chemicals, some of the essential building blocks needed for life," said Dennis Matson, Cassini project scientist at NASA's Jet Propulsion Laboratory in Pasadena, Calif. "We have quite a recipe for life on our hands, but we have yet to find the final ingredient, liquid water, but Enceladus is only whetting our appetites for more."

At closest approach, Cassini was only 30 miles from Enceladus. When it flew through the plumes it was 120 miles from the moon's surface. Cassini's next flyby of Enceladus is in August.

Blue-veined Enceladus,
one of 57 moons of Saturn (as of 2007 count).

More Information:

For further information about Saturn and its moons, please see related Earthfiles reports below in the **Earthfiles Archive**:

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