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SATURN DAILY

Titan Offers Clues To Early History Of Earth

Ann Arbor MI (SPX) Dec 01, 2005

Readings from the Huygens probe of the surface and atmosphere around Saturn's largest moon, Titan, give researchers a peek back through time to when and how Earth's atmosphere formed, and how our primitive planet looked before life took a foothold here.

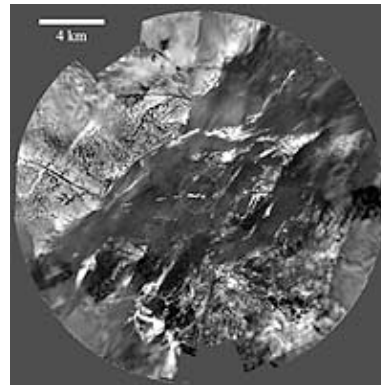
The Huygens space probe, launched from the Cassini spacecraft Dec. 25, 2004, took the first direct measurements of Titan's atmosphere and surface as it parachuted onto the moon on Jan. 14. The instrument that made the measurements, called Gas Chromatograph Mass Spectrometer (GCMS), was built by the Goddard Space Flight Center and the University of Michigan.

The new findings are outlined in the paper, "The Abundances of Constituents of Titan's Atmosphere From the GCMS Instrument on the Huygens Probe," available in the on-line [edition](#) of the journal Nature.

The spectrometer recorded several new and important findings, said Sushil Atreya, U-M professor of atmospheric, oceanic, and space sciences and a member of the team who, together with George Carignan, AOSS Research Scientist Emeritus, helped design the spectrometer, and interpret the readings.

Atreya also directs the Planetary Science Laboratory. The first, and perhaps most significant discovery, is that the spectrometer did not detect the primordial noble gases. Their detection would have signaled that the atmosphere on Titan today is the same as acquired at the time of Titan's formation. Instead, nitrogen on Titan formed from ammonia, which is believed to be the same way nitrogen formed on Earth.

"Titan and Earth have a lot of similarities from the very beginning," Atreya said. "The most important aspect of Titan is that it has an Earth-like atmosphere. No other body in the solar system outside Earth has a massive nitrogen atmosphere. It's like a window into the past of the Earth. It tells us the conditions



Images recorded by the European Space Agency's Huygens probe descent imager/spectral radiometer between 11 and 5 miles (17 and 8 kilometers) were assembled to produce this panoramic mosaic (see larger [image](#)). The probe ground track is indicated as points in white. North is up. Narrow dark linear markings, interpreted as channels, cut through the brighter terrain. The complex channel network implies precipitation (likely as methane "rain") and possibly springs. The circle indicates the outline of the low-altitude panorama shown in [PIA06439](#).

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the way they were when Earth began to form, the way the atmosphere came about."

The spectrometer also discovered that methane is the second most abundant gas on Titan, comprising five percent of the atmospheric volume. Surprisingly, methane was found to play a similar role on Titan as does water in the hydrological cycle on Earth. The spectrometer measurements indicated presence of small amounts of liquid methane mixed in with other surface material; this methane evaporates into the atmosphere and forms clouds (as does water on Earth) and eventually rains back down and completes the cycle.

"It's telling us that Titan's meteorology is somewhat like the meteorology on Earth, except Titan's meteorology is controlled by methane and Earth's is controlled by water," Atreya said.

Another important aspect of Titan is that complex hydrocarbons form in the presence of methane and nitrogen (the two main components of Titan's atmosphere) and the energy from the sun. Reactions can occur here that create complex organic molecules that may be the precursors to life, Atreya said. The spectrometer data provide no indication of life on Titan.

In the cold environment of Titan, the complex organic molecules condense to form the haze that hovers from approximately 16 kilometers to perhaps as high as 700 km above Titan's surface, and obscures the moon's surface from view. In another paper, also available in this issue of Nature, preliminary results on this haze collected by the Aerosol Collector Pyrolyzer (ACP) instrument during Huygen's descent through Titan's atmosphere and analyzed by the GCMS are presented.

"Although it is evident the haze is complex, much work is still required to nail its composition", said Atreya, who is a member of the ACP experiment team also.



Sushil Atreya

The spectrometer also recorded evidence that Titan is geologically active, Atreya said, and it's likely that water-rock reactions occurring within Titan's interior are replenishing the methane destroyed by sunlight in Titan's upper atmosphere.

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Saturn's Moon Titan Looks Like A Primitive Earth

Paris (AFP) Nov 30 - A historic mission to Titan, Saturn's largest moon, has revealed a chemical hell of great complexity which somewhat resembles the forces that helped sculpt the infant Earth, scientists said Wednesday.

In its parachute-braked descent to Titan's surface on January 14, the European Space Agency (ESA) probe Huygens sent back pictures of a world bathed in an orange photochemical smog and a landscape gouged by rivers of methane.

Using an onboard gas analyser that took samples and heated them to 600 C (1,110 F), Huygens found that Titan's clouds are seeded with particles made from complex organic molecules containing carbon and nitrogen.

These compounds are generated in the methane-rich atmosphere and are eventually brought to the surface by wind and rain.

The winds appear to blow in a distinct system of layers, whose speeds range

from 450 kilometers (280 miles) per hour above an altitude of 120 kms (75 miles) to just walking pace at surface level.

The temperature on Titan is -179 C (-290 F) -- so cold that the moon has lakes and rivers of highly flammable, natural gas, the researchers said.

Their analyses were published on Thursday in the British science journal Nature and presented by scientists at ESA headquarters here.

As to where the methane comes from, the likely source is possibly a big store of underground carbon, released by geological activity.

"A similar process may have produced a large reservoir [of methane] on Earth, which brings new hopes for the search for energy sources on our planet," French specialist Francois Raulin told a press conference.

In a review, also carried in Nature, University of Hawaii astronomer Tobias Owen said the overall impression of Titan is of an early Earth that failed to develop any further because it lacked the essential ingredients of light, heat and water.

"Because of its immense distance from the Sun, Titan's development was frozen at a very early stage -- where it will remain until the Sun develops into a red giant star and melts it," said Owen.

Huygens was launched from its mother craft, the US-Italian orbiter Cassini, on December 25, 2004 after a trip of more than seven years.

The probe took two hours, 28 minutes to descend to Titan's surface, where it landed in an area that looked like a dry river or lakebed and had the consistency of loose wet sand.

It survived for another 69 minutes, transmitting data that will be analysed for years, before it fell silent.

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Moffett Field CA (SPX) Nov 04, 2005

Like Earth, Titan has a greenhouse effect. So does Venus, a whopping one, and so does Mars. Venus is the queen of the greenhouse effect. Ninety-nine point nine percent of the energy reaching the surface of Venus is retained by the greenhouse effect. Titan, though, comes in a close second.



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