Titan's Surface Organics Surpass Hydrocarbons on Earth

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Overview

In this article, you will experience both facts and fiction.

On the one hand, you will be presented with the raw facts about Titan, a moon devoid of organic life but abundant in hydrocarbons like methane, ethane, and coal, while simultaneously members of the scientific community promote the idea that the source for hydrocarbons is organic life.

Source & Date

Jet Propulsion Laboratory
California Institute of Technology

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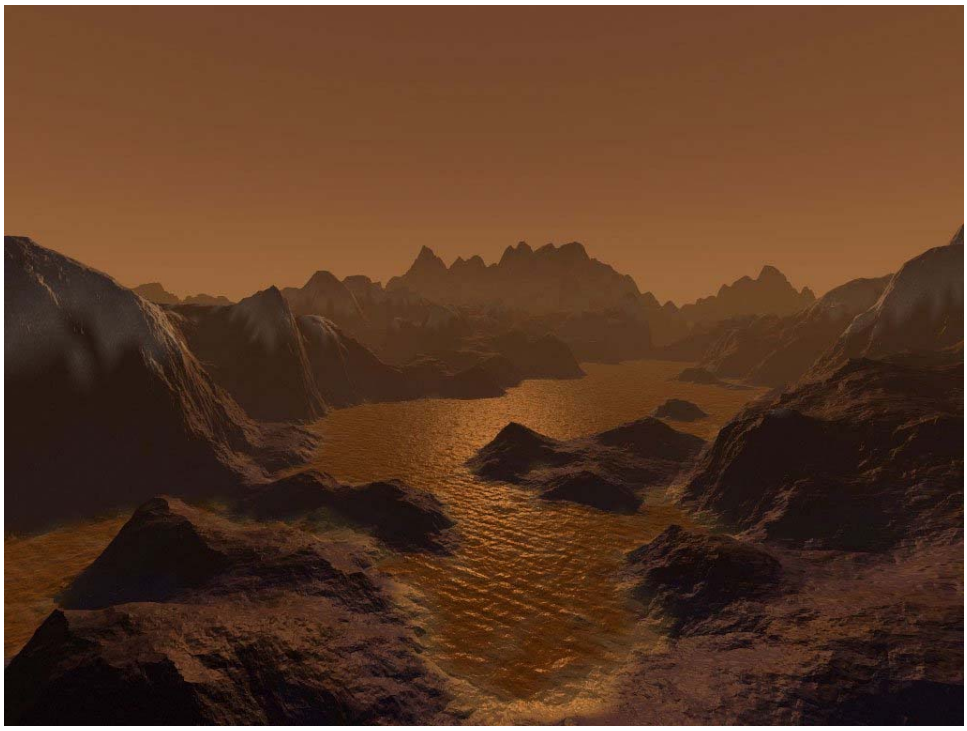
Titan's Surface Images

The lakes in these images taken by the Cassini mission are filled with liquid hydrocarbons and cover the surface of Titan, Saturn's largest moon, which has a temperature of minus 290 degrees Fahrenheit.



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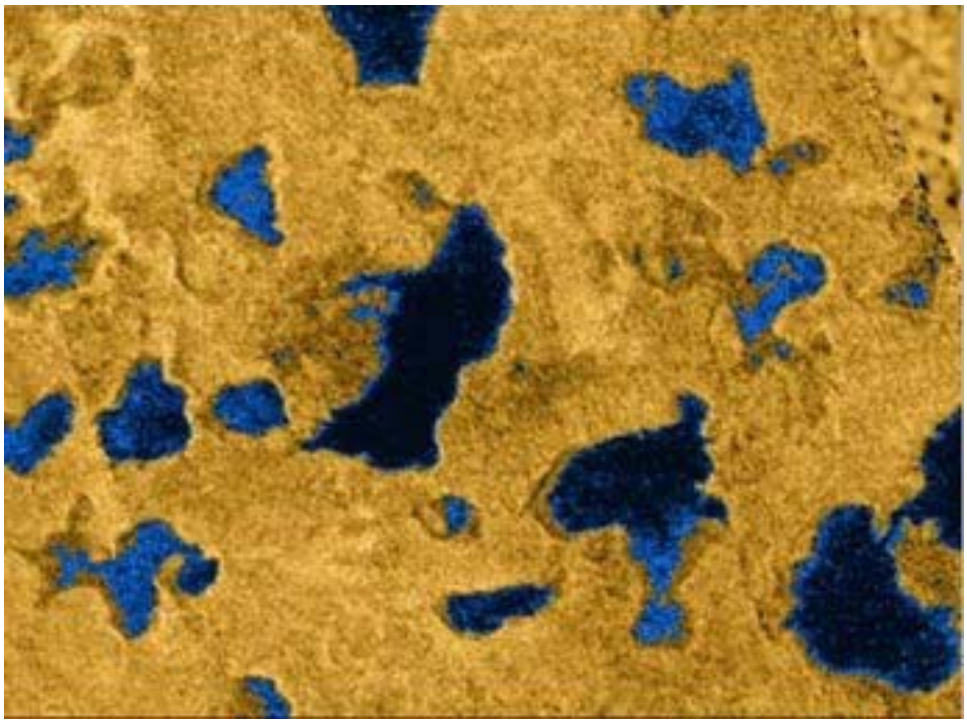

Titan has hundreds of times more hydrocarbons than Earth

Saturn's moon Titan has hundreds of times more liquid hydrocarbons than all the known oil and natural gas reserves on Earth, according to new data from NASA's Cassini spacecraft.

- Titan is approximately one-tenth the size of Earth.

Saturn's orange moon Titan has hundreds of times more liquid hydrocarbons than all the known oil and natural gas reserves on Earth, according to new data from NASA's Cassini spacecraft. The hydrocarbons rain from the sky, collecting in vast deposits that form lakes and dunes. The new findings from the study led by Ralph Lorenz, Cassini radar team member from the Johns Hopkins University Applied Physics Laboratory, Laurel, Md., are reported in the Jan. 29 issue of the Geophysical Research Letters.

"Titan is just covered in carbon-bearing material -- it's a giant factory of organic chemicals," said Lorenz. "This vast carbon inventory is an important window into the geology and climate history of Titan."

- **Organic:** of, relating to, or derived from living organisms
    - Ref: https://www.merriam-webster.com/dictionary/organic

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At a balmy minus 179 degrees Celsius (minus 290 degrees Fahrenheit), Titan is a far cry from Earth. Instead of water, liquid hydrocarbons in the form of methane and ethane are present on the moon's surface, and tholins probably make up its dunes. The term "tholins" was coined by Carl Sagan in 1979 to describe the complex organic molecules at the heart of prebiotic chemistry.

- At minus 290 degrees Fahrenheit, it's safe to assume there has never been organic life on Titan, so where did the abundance of hydrocarbons come from?
- Meanwhile, back here on Earth, we've been taught that hydrocarbons originated from dead dinosaurs and rotting algae.

Cassini has mapped about 20 percent of Titan's surface with radar. Several hundred lakes and seas have been observed, with each of several dozen estimated to contain more hydrocarbon liquid than Earth's oil and gas reserves. The dark dunes that run along the equator contain a volume of organics several hundred times larger than Earth's coal reserves.

- "Dark dunes that run along the equator"—hydrocarbons like coal are present on the surface of Titan, but we have been taught that this type of hydrocarbon is only formed underground and at immense pressures over millions of years.

Proven reserves of natural gas on Earth total 130 billion tons, enough to provide 300 times the amount of energy the entire United States uses annually for residential heating, cooling and lighting. Dozens of Titan's lakes individually have the equivalent of at least this much energy in the form of methane and ethane.

- Natural gas is composed of several gases, with methane making up more than 80%, followed by ethane.

"This global estimate is based mostly on views of the lakes in the northern polar regions. We have assumed the south might be similar, but we really don't yet know how much liquid is there," said Lorenz. Cassini's radar has observed the south polar region only once, and only two small lakes were visible. Future observations of that area are planned during Cassini's proposed extended mission.

Scientists estimated Titan's lake depth by making some general assumptions based on lakes on Earth. They took the average area and depth of lakes on Earth, taking into account the nearby surroundings, like mountains. On Earth, the lake depth is often 10 times less than the height of nearby terrain.

"We also know that some lakes are more than 10 meters or so deep because they

appear literally pitch-black to the radar. If they were shallow we'd see the bottom, and we don't," said Lorenz.

The question of how much liquid is on the surface is an important one because methane is a strong greenhouse gas on Titan as well as on Earth, but there is much more of it on Titan. If all the observed liquid on Titan is methane, it would only last a few million years, because as methane escapes into Titan's atmosphere, it breaks down and escapes into space. If the methane were to run out, Titan could become much colder. Scientists believe that methane might be supplied to the atmosphere by venting from the interior in cryovolcanic eruptions. If so, the amount of methane, and the temperature on Titan, may have fluctuated dramatically in Titan's past.

- Earth is estimated to be 4.5 billion years old.
- If Titan is several billion years old as well, then based on the statements above, there should be very little methane remaining on the moon's surface unless the moon itself is producing the hydrocarbons; if this is true, it would involve a process that's not linked to "organic" sources.
- In the last two sentences above, the sources for the article mention the production of hydrocarbons is so great that they are "venting from the interior in cryovolcanic eruptions."
- Is this a confession or realization by the scientific community as to the true source of hydrocarbons?

"We are carbon-based life, and understanding how far along the chain of complexity towards life that chemistry can go in an environment like Titan will be important in understanding the origins of life throughout the universe," added Lorenz.

- The sources for the article openly admit that there is no life on Titan, nor has there ever been.
- This further bolsters the realization that hydrocarbons do not originate from "organic" sources but are abiotic in nature.

Cassini's next radar flyby of Titan is on Feb. 22, when the radar instrument will observe the Huygens probe landing site.

For images and more information visit: http://www.nasa.gov/cassini and http://saturn.jpl.nasa.gov.

The Cassini-Huygens mission is a cooperative project of NASA, the European Space Agency and the Italian Space Agency. JPL, a division of the California Institute of

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Technology in Pasadena, manages the Cassini-Huygens mission for NASA's Science Mission Directorate, Washington. The Cassini orbiter was designed, developed and assembled at JPL. The radar instrument was built by JPL and the Italian Space Agency, working with team members from the United States and several European countries.

Reference Link

- Ref: https://www.jpl.nasa.gov/news/titans-surface-organics-surpass-oil-reserves-on-earth/