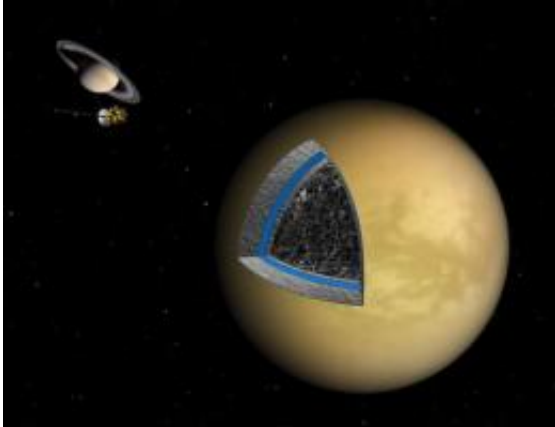


A water ocean on Titan?

May 5 2011, By Charles Q. Choi



This artist's illustration shows the likely interior structure of Saturn's moon Titan. The cool and sluggish interior failed to separate into completely differentiated layers of ice and rock. In addition to the hazy surface of Titan (yellow), the layers in the cutaway show an ice layer starting near the surface (light gray), an internal ocean (blue), another layer of ice (light gray) and the mix of rock and ice in the interior (dark gray). In the background are the Cassini spacecraft and Saturn, not to scale. Credit: NASA/JPL

Oddities in the rotation of Saturn's largest moon Titan might add to growing evidence that it harbors an underground ocean, researchers suggest.

Titan, which is larger than [Mercury](#), is the only world besides [Earth](#) known to have liquid on its surface. Its seas, made of [liquid methane](#) instead of water, have often led to speculation as to whether or not they could host life.

In addition to its seas on its surface, scientists recently also discovered hints that Titan possesses an internal ocean, one of water and [ammonia](#). Using radar to peer through Titan's dense atmosphere, NASA's [Cassini spacecraft](#) found that over time, a number of prominent surface features had shifted from their expected positions by up to 19 miles (30 kilometers), showing that the crust was moving and suggesting that it rested on liquid.

Now Cassini's [gravity](#) and radar observations of Titan have discovered more clues that it might have an underground sea.

Titan apparently has an orbit very similar to our moon's — for instance, it always presents the same face toward its planet.

However, they noted that Titan's axis of rotation was tilted by about 0.3 degrees. This tilt, or obliquity, seems high, given the estimate of Titan's moment of inertia, or its resistance to changes to its rotation.

One implausible reason for these findings is that Titan is a solid body that is denser near the surface than at its center. "This is in contradiction with all we know about others planets and satellites and planetary formation processes," said researcher Rose-Marie Baland, a planetary scientist at the Royal Observatory of Belgium in Brussels.

Another more likely explanation is that Titan is not solid all the way through, but has an icy shell overlying a liquid water ocean, an icy mantle and an icy, rocky core. The research team's models can give a wide range of thicknesses for the liquid ocean, anywhere from three to 265 miles (five to 425 km), as well as for the icy shell, anywhere from 90 to 125 miles (150 to 200 km).



The surface of Titan has some of the largest bodies of liquid ever seen. However, these lakes are composed of hydrocarbons. Scientists believe that oceans of liquid water and ammonia may be contained beneath the surface of the moon. Credit: NASA/JPL

"We found it very exciting to use some measurements that seem in contradiction and to try to reconcile them," Baland said. "It was like putting together pieces of a puzzle."

Still, the case for Titan having an underground ocean is not closed yet. Its [orbit](#) and rotation might also be explained by a recent disturbance, such as a collision with a comet or asteroid.

"Our analysis strengthens the possibility that Titan has a subsurface ocean, but it does not prove it undoubtedly," Baland told *Astrobiology Magazine*. "So there is still work to do."

Since life as we know it needs liquid water, if Titan does have a subsurface water ocean that may increase the chances the moon could harbor alien life.

In the future, Baland noted that she and her colleagues would like to use this method to analyze Jupiter's four largest satellites, the Galilean moons — Io, Europa, Ganymede and Callisto.

"The measurement of the obliquity of Europe or Ganymede could bring additional evidence for subsurface liquid layers," Baland said.

More information: Baland and her colleagues will detail their findings in a forthcoming issue of the journal [Astronomy & Astrophysics](#).

Source: Astrobio.net

Citation: A water ocean on Titan? (2011, May 5) retrieved 2 May 2024 from <https://phys.org/news/2011-05-ocean-titan.html>

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