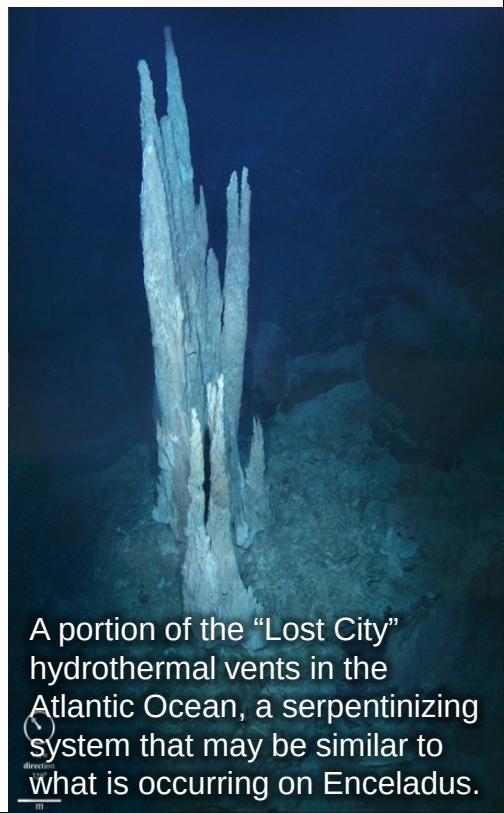
How Friendly Is Enceladus' Ocean to Life?


Tufa towers in Mono Lake, CA.

New data from the Cassini spacecraft have been used to model the ocean water on Enceladus to estimate the pH of its ocean, answering a fundamental question in determining whether Saturn's icy moon Enceladus could support life.

- Mass spectra observations of the plume gas made from the Cosmic Dust Analyzer (CDA) onboard the Cassini spacecraft indicate that the ocean is a sodium-chloride-carbonate solution with an alkaline pH of ~11-12.
- The dominance of NaCl is similar to oceans on the Earth, but the dissolved Na_2CO_3 concentrations mean that the ocean composition is similar to that of soda lakes on Earth (e.g., Mono Lake in California).
- The alkaline pH results from serpentinization, a geochemical process in which iron- and/or magnesium-rich rocks interact with water to produce hydrogen, a geochemical fuel that can support both abiotic and biological synthesis of organic molecules such as those that have been detected in Enceladus' plume from Cassini.
- Serpentinization has happened in many places throughout the solar system, but it is not known whether serpentinization is taking place on Enceladus today, or whether Enceladus' rocky core has been completely altered by past hydrothermal activity.
- The detection of native hydrogen gas in the plume today would indicate current serpentinization, and thus a source of energy for possible life.

Glein, et al. 2016.Geochimica et Cosmochimica Acta


A portion of the "Lost City" hydrothermal vents in the Atlantic Ocean, a serpentinizing system that may be similar to what is occurring on Enceladus.