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research highlights

ENCELADUS

Deep implications for H_2

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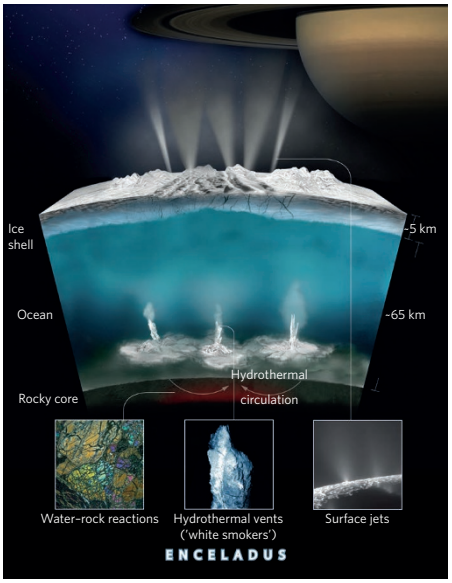

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Even as the Cassini spacecraft prepares for its swan song, it is sending us back important data. In its final flyby of Enceladus, Saturn's fountain-like moon, Cassini's mass spectrometer detected the presence of molecular hydrogen as it flew through a plume. Normally, this would not be particularly unusual, since hydrogen can sometimes be produced in the instrument itself. However, during this particular flyby the instrument was put into a mode to drastically reduce this possibility, because it was purposefully looking for hydrogen in the ejecta. Indeed, hydrogen was found to be as abundant as other trace volatiles (CO_2, CH_4 and NH_3) in the water-rich plume. J. Hunter Waite and collaborators have written in *Science* about an intriguing explanation for this finding.

In the regions near terrestrial hydrothermal vents, certain iron-bearing minerals react with water, releasing bubbles of molecular hydrogen gas. On Enceladus, there have already been tantalizing hints of rock-mediated chemical reactions and hydrothermal activity (see for instance H.-W. Hsu *et al. Nature* **519,** 207–210; 2015), and laboratory simulations of such a system (Y. Sekine *et al. Nat. Commun*. **6,** 8604; 2015) have predicted molecular hydrogen as a by-product. Cassini was commanded into a deep dive through plume material, and the opportunity was taken to test this prediction. Waite *et al.* report the results, asserting that the hydrogen detected in the plume is additional supporting evidence for hydrothermal vents at the base of Enceladus's subsurface ocean.

This is positive news for those thinking about extraterrestrial life in the Solar System. A reaction called methanogenesis creates methane from aqueous CO_2 and hydrothermally generated H_2 in the Earth's oceans. It is employed by primitive microorganisms called chemolithotrophs, which use the chemical energy that the process liberates to survive. With this new development, Enceladus has jumped to the top of the list of best possible sites for extraterrestrial life, but unfortunately firm evidence of such life forms is not due to come in the near future. After Cassini burns up in Saturn's atmosphere, no probes are planned to visit the Kronian system for decades.

Paul Woods