Geophysical Research Abstracts
Vol. 16, EGU2014-14561, 2014
EGU General Assembly 2014

Enceladus as a hydrothermal water world

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The composition of both salty ice grains and nanometer-sized stream particles emitted from Enceladus and measured by Cassini-CDA require require liquid water as a source. Moreover, they provide strong geochemical constraints for their origin inside the active moon. Most stream particles are composed of silica, a unique indicator as nano-silica would only form under quite specific conditions. With high probability on-going or geological recent hydrothermal activity at Enceladus is required to generate these particles. Inferred reaction temperatures at Enceladus ocean floor lie between 100 and 350 °C in a slightly alkaline environment (pH 7.5 – 10.5). The inferred high temperatures at great depth might require heat sources other than tides alone, such as remaining primordial heat and/or serpentinization of a probably porous rocky core.

Long-term laboratory experiments were carried out to simulate the conditions at the Enceladus rock/water interface using the constraints derived from CDA measurements. These experiments allow insights into a rock/water chemistry which severely constrains the formation history of the moon and substantially enhances its astrobiological potential. Together with recent results from other Cassini instruments a conclusive picture of Enceladus as an active water world seems to be in reach.