CONTROL ID: 2242026

TITLE: Organic chemistry on planetary satellites around the gas giants and implications for habitability

ABSTRACT BODY:

Abstract Body: The icy satellites of the outer solar system present a variety of chemical compositions where initial complements of ices, minerals, and elements provided during formation have been subjected to various internal and external processes. Additional material has been gained via cometary and meteoritic infall, transfer of material between satellites and magnetospheric interactions. Exchanges also occur between the surface and the interior. Organic compounds have been detected on several of our Solar System's satellites around the gas giant planets, each with unique characteristics as to organic chemistry. Jupiter's Europa, Ganymede and Callisto show evidence of undersurface layers of liquid water that offer potentially interesting environments for organic synthesis. Spectra obtained by Galileo's NIMS show absorption bands indicative of C-H and C≡N organic compounds. Potential organics on the large Galilean moons include CO2, carbonic acid and different kinds of carbonates, hydrocarbons and nitriles. Saturn's Titan is a chemical factory, where the mother molecules N2 (at about 95%), CH4 (at 1.5-5%) and H2 (at 0.1%) produce a host of hydrocarbons and nitriles. The Cassini-Huygens mission has shown Titan to be indeed very rich in organic molecules, which are formed in the upper atmosphere and then deposited on the surface. Some of these species are of prebiotic importance, such as C6H6, HC3N and HCN. Titan's surface displays unique geomorphological features while it probably overlies an internal liquid water ocean. The organic deposits, if in contact with the underground liquid water could undergo an aqueous chemistry that could replicate aspects of life's origins. Enceladus, a smaller moon of Saturn, ejects large amounts of water and organics in the space from plumes located in its southern pole. The implied requirement for liquid water reservoirs under its surface, significantly broadens the diversity of solar system environments which could be habitable worlds.

References: [1] Coustenis, A., Tokano, T., Burger, M. H., et al., 2010. Space Sci. Rev. 153, 155-184. [2] Coustenis and Encrenaz, 2013, CUP, ISBN: 9781107026179.

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