In Situ Sample Analysis and Sample Return Exploration from Deep Habitats of the Ocean Worlds

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Disocovery of sub-surface water reservours of icy bodies in the Solar System has revolutionalized a concept of the habitable zone. Now potential deep habitats like Europa and Enceladus have received rigorous exploration mission studies from space agencies, scientists and engineers worldwide. In particular, present icy plumes from the southern polar region of Enceladus, a Saturnian satellite of 500 km in diameter, has yielded chemical composition of the global ocean water containing organics, salts, and minerals implying hydrothermal activities at its sea floor, thanks to the investigations by the Cassini spacecraft.
Together with a new launcher with a great delta V like NASA's SLS rocket soon to be launched in 2018 or so, "Ocean Worlds" exploration is a next logical step for astrobiology-driven robotic space explorations in 2020's to the mid 21st Century. The main scientific objectives are understanding the habilility conditions of these deep habitats and life detection in these "eco systems". To do so, a number of innovative exploration strategies are essential, including life detection instruments, sample collection and analysis methods, as well as planetary protection countermeasures of the collected samples.
In this presentation, we discuss a possible game changing strategy of sample return science for "restricted Earth return" samples, by employing synergy between lessons learned from terrestrial deep sea exploration and sample handling and current developments of next generation sample collection and analysis instruments in deep space missions.

Keywords: Deep Sea Exploration, Subsurface Ocean, Icy Plumes

