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From Titan's chemistry and exobiology to Titan's astrobiology

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When the IDS proposal « Titan's chemistry and exobiology » was submitted to ESA 25 years ago, in the frame of what will become the Cassini-Huygens mission, Titan was already seen as a quite interesting planetary object in the solar system for Exobiology. Several organic compounds of prebiotic interest were identified in its atmosphere, which was thus was expected to be chemically very active, especially in term of organic processes. Atmospheric aerosols seemed to play a key role in this chemistry. Moreover, the presence of an internal aqueous ocean, compatible with life was suspected. A few years later, when astrobiology was (re)invented, Titan became one of the most interesting planetary target for this new (but very similar to exobiology) field.

With the Cassini-Huygens mission, the exo/astrobiological interest of Titan has become more and more important. However, the mission has been providing a vision of Titan quite different from what it was supposed. Its atmospheric organic chemistry is very complex and starts in much higher zones than it was believed before, involving high molecular weight species in the ionosphere. Titan's surface appears to be far from homogeneous: instead of been covered by a global methane-ethane ocean, it is very diversified, with dunes, lakes, bright and dark areas, impact and volcanic craters with potential cryovolcanic activity. These various geological areas are continuously feeded by atmospheric aerosols, which represent an important step in the complexity of Titan's organic chemistry, but probably not the final one. Indeed, after being deposited on the surface, in the potential cryovolvanic zones, these particles may react with water ice and form compounds of exo/astrobiological interest, such as amino acids, purine and pyrimidine bases. Moreover, The Cassini-Huygens data strongly support the potential presence of an internal water ocean, which becomes less and less hypothetical and of great interest for exobiology.

These various exobiological aspects of Titan, revealed from Cassini-Huygens observations, especially from the data of the Huygens instruments, coupled to laboratory works, both experimental simulations and modeling, will be quickely reviewed and summarized.

References : Raulin, F. (2008), Astrobiology and habitability of Titan, Space Science Reviews 135 (1-4), 37-48 ; Raulin, F. et al. (2012), Prebiotic-like chemistry on Titan. Chemical Society Reviews. 41, 5380-5393

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