RESISTANCE, DEGRADATION AND EVOLUTION OF ORGANICS AT THE MARS SURFACE / SUBSURFACE : LABORATORY STUDY OF PHOTOCHEMICAL AND OXIDATIVE PROCESSES WITH THE MOMIE PROGRAM P. Coll[1], A. Noblet[1], F. Stalport[2], C. Szopa[3], H. Cottin[1], Y. Guan[1]
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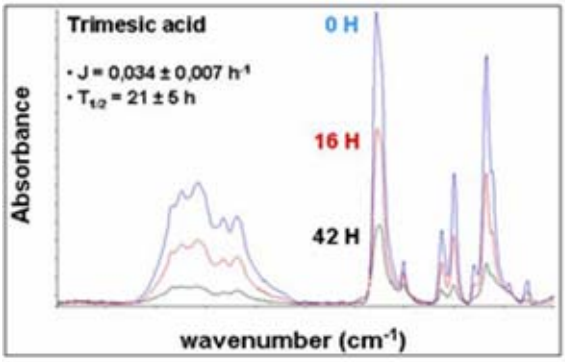
Context: *In situ* exploration of Mars environment to come will have to address the budget of organics at the surface / subsurface [1]. It is well known that exogenous sources (micrometeorites, comets…) brought, and still bring, organics at Mars. Moreover, there are potential endogenous sources (atmospheric synthesis, biological activity) that could have contributed to produce organics at the surface. These molecules, when reaching the surface that will be investigated by space probes, are submitted to harsh environmental conditions.

To support the detection of organics at Mars with space probes, and to determine the processes in which these molecules are implied, it is of primary importance to determine how any kind of organic brought or produced at Mars surface / subsurface can evoluate when submitted to the Mars UV radiation, oxidative processes, cosmic rays impact…

MOMIE program: This program is a laboratory simulation program, and its acronym means Mars Organic Molecules Irradiation & Evolution. It allows submitting any organic molecule (amino acid, carboxylic acid, bio-indicator…) to UV irradiation mimicking those reaching the Mars surface, and/or to any oxidative process that may take place at Mars. Specific analytical in situ devices enables to detect any evolution of the organics tested (products…) and to determine the kinetics data of the observed process, which is necessary for studying the stability of the studied organic at Mars [2].



Variation of the IR spectrum of trimesic acid submitted to UV radiation mimicking theradiation reaching the Mars surface with time

Extension of the work: During the last months the MOMIE program has been extended. We now study samples directly submitted to the real solar UV flux in low Earth orbit, taking benefit of the opportunity to use carriers outside the International Space Station (EXPOSE-E & -R) or Foton automated capsule (BIOPAN 6). These experiments are devoted to confirm the results obtained in laboratory [3].

Samples carrier exposed to the sunlight, onboard the International Space Station (inside the white ellipse).

References:

[1] Coll P. and Stalport F., *Prebiotic Evolution and Astrobiology*, J. Tze-Fei Wong and Antonio Lazcano (Ed), HK, Landes Bioscience Books [2] Stalport F., Coll P., Szopa C., Raulin F. (2008), *Adv. Space Res.* 42, 2014-2018 [3] Cottin H., Coll P., Coscia D. Guan Y.Y., Rivron C., Stalport F., Szopa C., Chaput D., Viso M., Bertrand M., Chabin A., Thirkell L., Westall F., Brack A., *Adv. Space Res.*, 42, 2019-2035