Thermal analyses of biocarbonates as part of the search for traces of life on Mars

A. PERRON[1,2], F. STALPORT[2], S. DERENNE[3], C. ANQUETIL[3], S. BORENSZTAJN[1], S. NOWAK[4], A. CHEVILLOT-BIRAUD[5], P. BURCKEL[1], L. LECOURT[1], B. MENEZ[1]

[1] Université de Paris, Institut de physique du globe de Paris, perron@ipgp.fr

[2] Laboratoire Interuniversitaire des Systèmes Atmosphériques CNRS UMR 7583.UPEC, Université de Paris.

[3] Milieux environnementaux, transferts et interactions dans les hydrosystèmes et les sols UMR 7619 METIS: Sorbonne Université, Paris.

[4] Plateforme RX, UFR Chimie Université de Paris

[5] ITODYS : Université Paris Diderot, CNRS (UMR 7086)

The search for organic compounds on Mars is currently the main strategy to highlight a potential extinct or extant life on this planet. However, the Martian environmental conditions (e.g. radiations, high level of oxidants) can lead to their degradation. An alternative method to detect clues of life is to search for the presence of biominerals, probably more resistant in this environment. The objective is therefore to be able to distinguish bio- and organo-minerals from their abiotic counterparts by using instruments that can carry out *in situ* measurements on Mars. Differential thermal analysis (DTA) coupled with gas chromatography and mass spectrometry (GC-MS) share similarities with space instruments dedicated to *in situ* analyses on Mars, such as SAM (Sample Analysis at Mars) aboard the rover Curiosity or MOMA (Mars Organics Molecule Analyser) from the ExoMars 2020 mission; The both instruments are gas chromatographs coupled to mass spectrometers. Several space missions revealed the presence of carbonates at the surface of Mars. Carbonates are abundant minerals in the Earth's rock record that were mostly formed by biological activity, both by biologically controlled mineralization and biologically induced mineralization. DTA analyses show differences of more than 20°C in phase transition temperatures between natural or laboratory biocarbonates and abiotic carbonates. Additional analyses by pyrolysis-GC-MS reveal in biocarbonates a wide variety of organic fragments characteristic of organic matter with a biological origin. Thus, DTA-GC-MS would have the potential to discriminate biocarbonates from abiotic carbonates and would lead to a better understanding of the physico-chemical properties of these minerals. This approach may eventually be used for the search for possible records of life on Mars.

Indicative keywords: Microbiology, Sun and Solar system