July 16-21, 2017 at UC San Diego, CA, USA

Comets and Astrobiology, (re)assessment for comet 67P after ROSETTA

H. Cottin[1], K. Altwegg[2], D. Baklouti[3], A. Bardyn[1,4], C. Briois[4], C. Engrand[5], N. Fray[1], R. Isnard[1,4],L. Le Roy[2], P. Modica[1,4], F. Raulin[1], R. Schulz[6], S. Siljeström[7], L. Thirkell[4]

[(1)] LISA, UMR CNRS 7583, Université Paris Est Créteil et Université Paris Diderot, Institut Pierre Simon Laplace, Avenue du Général de Gaulle, Créteil, France, [(2)] Center for Space and Habitability (CSH), University of Bern, Sidlerstrasse 5, 3012 Bern, Switzerland, (3) Institut d'Astrophysique Spatiale, CNRS / Université Paris Saclay, Bâtiment 121, 91405 Orsay, France, (4) Laboratoire de Physique et Chimie de l'Environnement et de l'Espace, CNRS / Université d'Orléans, 3 Av. de la Recherche Scientifique, 45071 Orléans, France, (5) Centre de Sciences Nucléaires et de Sciences de la Matière, CNRS/IN2P3 – Univ. Paris Sud – UMR 8609, Université Paris-Saclay, Bâtiment 104, 91405 Orsay, France, (6) European Space Agency, Scientific Support Office, Keplerlaan 1, Postbus 299, 2200 AG Noordwijk, The Netherlands. (7) Department of Chemistry, Materials and Surfaces, SP Technical Research Institute of Sweden, Box 857, 501 15 Borås, Sweden.

* herve.cottin@lisa.u-pec.fr

Comets are commonly regarded as objects with a prime astrobiological importance. They are reservoirs of a large amount of material considered as necessary for the origin of life: water and organic molecules. While the measurement of the D/H ratio in the water of comet 67P established in the early stages of the mission that comets such as 67P are probably not a significant source of water on Earth[1], the nature and amount of the volatile organic content of comet 67P is progressively revealed through the complementary measurements of instrument such as ROSINA, COSAC, PTOLEMY[2-4]. The detection of glycine and phosphorous atoms in the atmosphere of the comet have demonstrated the presence of so called “prebiotic” ingredients[5]. However, it takes certainly much more than this to feed the chemical evolution toward the origin of life on a planet.

On the other hand, the COSIMA instrument, analysing the composition of dust particles ejected from the nucleus, has shown that the refractory organic component of those aggregates is found as a macromolecular phase, which bears some similarities with Insoluble Organic Matter detected in carbonaceous chondrites[6]. This organic phase would constitute about half of the mass of the dust particles, hence one of the main form of carbon in the comet.

The form in which carbon has been delivered to the early Earth, and implications for the origin of life, will be discussed with regard to this new inventory of organic matter detected by Rosetta instruments in comet 67P.

References: [1] Altwegg, K., et al., 67P/Churyumov-Gerasimenko, a Jupiter family comet with a high D/H ratio. Science, 2014. 347(6220): p. 1261952., [2] Goesmann, F., et al., Organic compounds on comet 67P/Churyumov-Gerasimenko revealed by COSAC mass spectrometry. Science, 2015. 349(6247). [3] Le Roy, L., et al., Inventory of the volatiles on comet 67P/Churyumov-Gerasimenko from Rosetta/ROSINA. Astronomy and Astrophysics, 2015. 583: p. A1. [4] Wright, I.P., et al., CHO-bearing organic compounds at the surface of 67P/Churyumov-Gerasimenko revealed by Ptolemy. Science, 2015. 349(6247). [5] Altwegg, K., et al., Prebiotic chemicals—amino acid and phosphorus—in the coma of comet 67P/Churyumov-Gerasimenko. Science Advances, 2016. 2(5). [6] Fray, N., et al., High-molecular-weight organic matter in the particles of comet 67P/Churyumov–Gerasimenko. Nature, 2016. 538(7623): p. 72-74.