

ORGANIC COMPOUNDS ON THE NUCLEUS OF COMET 67P/CHURYUMOV-GERASIMENKO AS REVEALED BY COSAC MASS SPECTROMETRY

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Abstract: The evolved gas analyzer COMetary SAMpling and Composition experiment (COSAC) aboard the Philae Lander of ESA's Rosetta mission was designed to make unique in situ chemical analyses of nucleus material from comet 67P/Churyumov-Gerasimenko, with an emphasis on organic molecules. Twenty-five minutes after Philae's initial touchdown, the COSAC mass spectrometer took a spectrum in sniffing mode, which displayed an interesting suite of organic compounds. The sampled material is likely to have originated from the dust cloud produced by Philae's first contact with the ground. Analysis of the mass spectrum shows 16 compounds, among them six distinct organic homologous series: alcohols, carbonyls, amines, nitriles, amides and isocyanates. Nearly all the molecules inferred from our data are potential precursors, products, adducts or by-products of each other that can be formed either by surface reactions or by thermal and/or radiation processing of icy surfaces. A relatively abundant nitrogen source, such as NH₃, is required to form the suite of N-bearing species. Several organic compounds have not been identified in comets before or only upper limits have been derived. Overall the identified compounds provide indications of several possible links between interstellar chemistry, cometary organic chemistry and terrestrial prebiotic chemistry. These unique COSAC measurements from a cometary surface provide an unprecedented glimpse into the early origins of our solar system, 4.6 billion years ago.

References: Goesman, F. et al. (2015) Science, submitted