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# Space Search for Solid O and N-Rich Organic Matter of Prebiotic Interest

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Carbon is 6th in the scale of cosmic elemental abundances. It is a componentof many gas phase molecules in the interstellar medium, from diatomicmolecules like CO to large polyaromatic hydrocarbons (PAHs). Most of theobserved solid carbon in the interstellar medium is in the form of amorphous carbon, graphite, diamond, carbides, and ices. As deduced from infraredobservations, icy grain mantles in dense clouds are mainly composed of H2O, carbon containing molecules (such as CO, CO2, CH3OH, OCN-, OCS, H2CO, HCOOH, CH4), and NH3 or NH4+. While most of the solid carbon in space is not organic, in the sense that it is poor in O and N and a priori not very attractive for prebiotic chemistry, the laboratory residue that results from ultraviolet irradiation of interstellar ice analogs is a refractory organic material, rich in prebiotic organic species or their precursors (carboxylic acids and their ammonium salts, amides, esters, amino acids, . . .). Biologically relevantspecies like amino acids, carboxylic acids, and polyols, were only detected in meteorites. However, at least some comets, like Halley, are rich in organic matter, that remains poorly characterized. In order to promote the search for solid organic matter in interstellar and circumstellar environments, and solar system bodies like comets, we compare the infrared 3.4 micron feature characteristic ofO and N-rich organic residues made from ice photoprocessing, to the same feature in hydrogenated amorphous carbon, like the one observed in the interstellar medium or in the carbon matrix of carbonaceous chondrites. This could help to identify the carbon detected in space by infrared observations, either as a form ofO and N-poor carbonaceous matter, or organic in nature. It can also be useful for laboratory analysis of carbon in cometary and interplanetary dust particles (IDPs) collected by space missions like Stardust, since these particles are too small for analysis with most of the standard techniques, such aschromatography, and infrared spectroscopy is non-destructive. In IDPs, infrared bands due to functional groups characteristic of organic matter, can be difficult to observe because of overlap with features due to carbonates or hydrated silicates, but detection of the 3.4 micron feature is not hindered by the mineral phases of these particles. The use of Raman spectroscopy for laboratory analysis of IDPs is also discussed. It is found that most of the carbon in IDPs, collected in the stratosphere, is present as (hydrogenated) amorphous carbon. However, IDPs collected prior to atmospheric entry heating, like the Stardust samples, might be richer inprebiotic organic matter.