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The role of minerals surfaces in prebiotic chemistry and planetary exploration

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Mineral substrates are essential in prebiotic chemistry field and play a crucial role for the preservation of molecules on planetary exploration, thus the chemistry behind the interaction between organic molecules and mineral surfaces has been object of interest for astrobiology in the last years. Therefore, deeper understanding about the guidelines that govern molecular adsorption on surfaces and chemical species were most favorable for the development of prebiotic chemistry and catalysis on mineral surfaces at the origin of Life. To this end, we study and characterize the adsorption processes and chemical reactivity of molecules on mineral surfaces, using advanced surface characterization techniques. A second objective is to study the role of mineral surfaces in catalyzing the formation of prebiotic organic compounds, as a possible source of energy and catalysts in the early stages of the formation of complex organic molecules. These studies are carried out experimentally in vacuum system: spectroscopies and microscopies on surfaces (SMS) and in the simulation chamber for planetary atmospheres and surfaces (PASC), equipment located at CAB.

Our recent studies have shown that pyrite induce UV-photocatalytic abiotic nitrogen fixation [1], also, pyrite mineral have been studied for testing glycine amino acid surrounding conditions minerals can form diverse surface chemistry patterns, driving the interaction of adsorbed amino acids and small peptides on its surface [2]. Furthermore, we have investigated the suitability single layer of silica nanoparticles with an average size of 200 nm deposited on pristine gold surfaces as a tool for CO_2 recognition at standard Mars low pressures [3] and identifications of spectroscopic fingerprints corresponding to relevant molecular/minerals in Mars environments. These studies contribute to the understanding of molecular chemical reactivity and the role that minerals may have played in prebiotic chemistry and planetary exploration.

Figure 1. Photo of PASC and relevant applications for prebiotic chemistry and planetary exploration.

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