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Amino Acids Adsorption to Mineral Surfaces: Basis for Prebiotic Molecule Accumulation Studied at Nanoscale

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Introduction: In the study of origin of life, selective accumulation of abiotically synthesized amino acids to a high enough concentration for the subsequent creation of functional peptides and proteins has been regarded as a very important but least understood step. It is often discussed that certain mineral surfaces played a role in adsorbing amino acids selectively for further polymerization reactions [1]. Adsorption of amino acids to various mineral surfaces or to lipid vesicles has been proposed and studied both experimentally and theoretically but more solid knowledge about this process is expected to be established [2,3].

Experiment: In the present study, the single molecule force spectroscopy technique based on atomic force microscopy (AFM) was used to verify the binding-interaction of several amino acids to pyrite and other mineral surfaces. Amino acid molecules were covalently crosslinked to an AFM probe and their unbinding event from the mineral surface was investigated.

Resutlts and Discussion: Our results clearly indicated the ionic nature of the single molecular adsorption/desorption reaction on the pyrite substrate. Changes in the local reaction environment may have influenced the binding reaction in addition to surface properties of pyrite as investigated by Raman spectroscopy and other surface science related techniques [4].

References:

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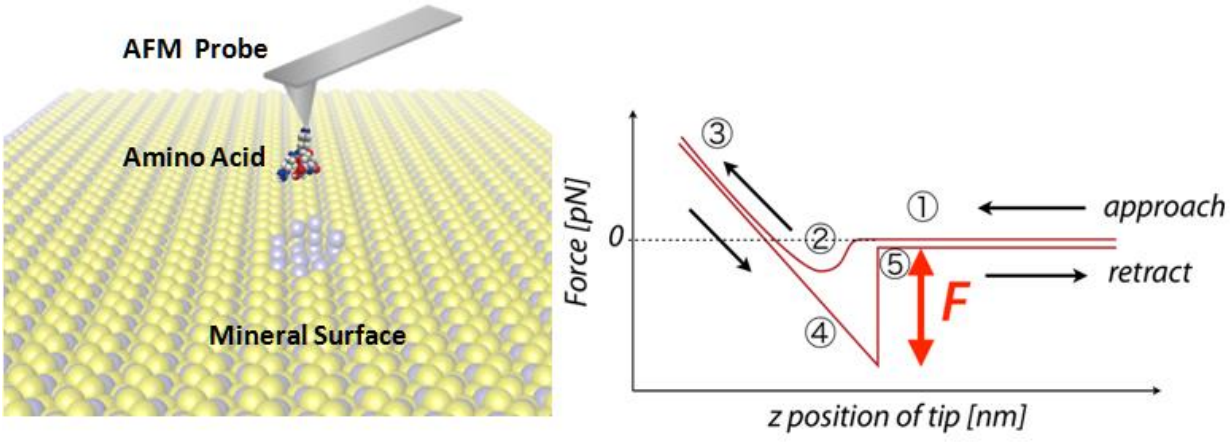

Figure 1. Schematic presentation of general principle of this work based on single molecule force measurements of AFM .