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The adsorption of biomolecules on mineral surfaces and possible implications for the origin of life

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The adsorption of nucleic acid bases, nucleosides and nucleotides on

mineral surfaces has long been assumed to be related to the origins of life. It is reported that prebiotic molecules, including purines, sugars and amino acids could have been synthesized on the primitive earth. As RNA is able to act as both information container and catalyst, the so called RNA world hypothesis was proposed which suggests RNA is the first living polymer capable of self-replication and catalysing peptide formation on the primitive earth. Clay minerals have also been suggested as both catalyst and repository in the earliest stages of the origin of life. With the addition of montmorillonite, RNA oligomers have been synthesized up to 55 monomers long and even some artificial cells (vesicles) have been formed in the presence of certain minerals. These minerals would have helped to gather prebiotic molecules from the primitive ocean, protect them from hydrolysis and even participate in further reactions. The adsorption isotherms of those biomolecules onto the surfaces of crystalline graphite were determined in the present work by frontal analysis HPLC (high performance liquid chromatography). These indicate that purines (adenine and guanine) have more adsorption onto graphite surfaces than pyrimidines (thymine and cytosine). The adsorption of pyrimidines increases at lower temperatures. The adsorption of adenine and its derivatives onto graphite is in the sequence Adenine>AMP>ADP>ATP. Interactions between these biomolecules and minerals were also investigated by FTIR (Fourier transform infrared spectroscopy) to investigate the changes both of the mineral surfaces and the biomolecules when the adsorption takes place and to investigate possible further reaction after adsorption.