

Adsorption of nucleotides onto ferromagnesian phyllosilicates: Significance for the origin of Life

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The concentration of prebiotic organic building blocks may have promoted the formation of biopolymers in the environment of the early Earth. We therefore studied the adsorption of RNA and DNA monomers on minerals that were abundant in the early Earth environment as the result of aqueous or hydrothermal alteration of the primitive seafloor. We focused our study on swelling clays (nontronite, montmorillonite) and non-swelling phyllosilicates (pyrophyllite, chlorite, lizardite, chrysotile). In a first reference study [1], adsorption experiments were carried out under standard (P,T) conditions and controlled pH. Therefore, the latter study is also relevant to the preservation of nucleic acids in Fe-Mg-rich terrestrial and Martian soils. In a second step, the role of hydrothermal conditions has been tested.

We found that DNA monomers adsorb much more strongly than RNA monomers, and that any monomer containing the G nucleobase adsorbed more strongly than one containing the C nucleobase. We could also infer that all nucleotides behave as homologous molecules in regard to their adsorption onto the studied mineral surfaces. Their adsorption is best explained by a single mechanism that will be presented.

We could therefore propose that Fe-Mg rich phyllo-silicates tightly bind nucleotides and concentrate them up to 1000 times the solution concentration upon saturation. The concentration effect may be enhanced by hydrothermal conditions over a range of (P,T) conditions that is currently under refinement. Nontronites have the most favorable behavior and could have helped to the concentration and polymerization of nucleotides under primitive Earth-like conditions.

[1] Pedreira-Segade *et al.* (2016) *Geochim. Cosmochim. Acta*, **176**, 81-95.