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Mineral matrix complexity during prebiotic evolution

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A key role of clay minerals in the very first steps of biological evolution has long been suggested. Numerous theoretical and experimental evidences suggest that clay minerals could have favoured the synthesis/concentration/protection of precursors of informational molecules as well as genetic polymers such as RNA. Moreover, the presence of mineral compartment is thought to be essential in the evolutionary dynamics of the first replicators.
In this work we have studied the structural and physico-chemical modification of a clay-mineral matrix in the contest of prebiotic evolution. The interaction between organic molecules and clay minerals can modify structural and physical-chemical properties of the matrix itself, thus changing the microenvironment where evolution occurs. For example, organic molecules can promote the aggregation of clay particles to form larger stable aggregates and increase their protection as they do humic substances stabilized in soil aggregates. The increased complexity in mineral matrix could, in turn, provides a new level of support in evolutionary dynamics of prebiotic systems.
Samples of clay mineral (montmorillonite) were subjected to wet/dry cycles to form organo-clay complexes and successively irradiated by UV. The structural and physical chemical properties and interactions of the treated complexes were analyzed by several techniques (SEM, XRD, specific surface, FTIR, porosimetry, cation exchange capacity).
Results achieved were discussed in the context of the origin of life.

Keywords: mineral matrix, clay mineral, compartmentalization, origin of life.