Evolution of Prebiotic Peptides in Amphiphilic Environments

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A fundamental problem in many postulated pathways of prebiotic chemistry is the low concentration which is generally expected for interesting reactants in fluid environments. Therefore, a mechanism of selection and accumulation of relevant prebiotic compounds seems to be a crucial condition for further molecular evolution. A very efficient environment for selection and accumulation can be found in the fluid H₂O/scCO₂ continuum circulating in tectonic fault zones. Vesicles which form periodically at a depth of approximately 1 km present a selective trap for amphiphilic molecules, especially for peptides composed of hydrophilic and hydrophobic amino acids in a suitable sequence:

Recent experiments which artificially reproduce these conditions have shown that this mechanism leads to an efficient selection and accumulation of amphiphilic peptides, the latter being formed in-situ in the same environment out of a random mixture of amino acids. The experiments are presently continued in order to follow an evolution process of the incorporated peptides as well as of the vesicles as a whole:

Altogether, the described processes lead to peptide-enriched, stabilized, and potentially functionalized vesicles which form a very potent basis for further developments such as a subsequent RNA-based evolution.