STOCHASTIC PREBIOTIC CHEMISTRY IN REALISTIC GEOLOGICAL SYSTEMS Avinash Vicholous Dass[1], Keyron Hickman-Lewis[1,2], André Brack[1], Terence P. Kee[3], Frances Westall[1]. [1]CNRS Centre de Biophysique Moléculaire, Orléans, France (avinash.dass@cnrs-orleans.fr); [2]Università di Bologna, Italy, [3]School of Chemistry, Universty of Leeds, UK.

Introduction: We aim to introduce a "stochastic approach" to origins of life research. We would like to present a rationale to a "stochastic approach" to prebiotic chemistry, which is not radical, but emphasizes the fact that the early Earth was never a perfect chemical laboratory for organic reactions, and thus prebiotic chemistry must embrace realistic geological scenarios. Multiple such geological scenarios have been proposed, though most hypotheses suffer from rarity of opportunity. The interaction of stochastic prebiotic chemistry with compositionally heterogeneous rocks (and thus their mineral surfaces) brings with herent heterogeneity of chemical systems[1-2].

Our approach is a stochastic geochemical one, since the heterogeneity within the mineral phase will ultimately lead to heterogeneity within the chemical phase. Dealing with such systems is inevitable in order to understand the origins of life and it opens up fresh avenues for origins of life scientists to explore. We consider organo-mineral interactions, uniting aspects of prebiotic chemistry and geology, to be an especially promising way forward[3]. However, we aim here to advance current approaches by advocating a methodology involving chemical systems and their stochastic reactivity on heterogeneous geological surfaces *i.e.* volcanic rocks. This models the origins of life as a continuity of chemical reactions in an analogue to the early Earth (Hadean) environment.

Past experiments have often focussed on very restricted scenarios involving the interaction of a single mineral phase with organic molecules, an experimental setup which does not accurately mimic the conditions of the early Earth as determined by the geological record. It is clear that numerous chemical species, mineral surfaces and phases must have been present in a range of environmental conditions[2].

'Stochastic' approach: Synthetic routes to the production of complex prebiotic molecules are generally too 'controlled' to accurately represent a natural scenario, and we thus advocate a 'hands-free' approach, in which mixtures of multiple molecules, and a heterogeneous geological substrate, are permitted to react and complexify without human intervention[3]. Such a varied chemical system must have been active on the Hadean Earth, thus playing a key role in the origin of life.

The interaction of stochastic prebiotic chemistry with compositionally heterogeneous rocks brings along a higher level of complexity in addition to the inherent heterogeneity of chemical systems, however, it provides what we believe to be the most faithful and relavent representation of early Earth conditions which may be recreated in experiments.

References:

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