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Clays and the Homochirality enigma: probing a prebiotic hypothesis

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Life as we know it is intrinsically linked to the concept of homochirality, where biological building blocks are composed solely of one enantiomer [1]. One of the major enigmas in prebiotic chemistry is understanding how homochirality arose. Since the 1970s, clay minerals have been hypothesized to play a role in enantioselective interactions with amino acids, possibly contributing to the emergence of homochirality [2]. Despite the age of this hypothesis, the role of clays remains unresolved due to conflicting results across various studies [1, 2], largely due to the fact that experiments have not been performed under abiotic Archean conditions. This research revisits and deepens the investigation into the interaction between amino acids and clay minerals, with a particular focus on the conditions under which these interactions occur. Using hypothesized Archean seawater compositions [3-6] and anoxic conditions, we test these interactions at three different pH levels and three different temperatures, monitoring their progress over hours to months. A novel aspect of this study is the direct comparison of results obtained from natural clays and synthetic clays (kaolinite), aiming to resolve past discrepancies, potentially linked to differences in experimental approaches. By doing so, this study seeks to provide a deeper understanding of the role of clays in homochirality formation, contribute to resolving this ongoing debate, and offer valuable insight into the chemical pathways that may have facilitated the origin of life on Earth.

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