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MICROFLUIDIC: A TOOL TO UNDERSTAND THE INTERACTION BETWEEN MINERALS AND PREBIOTIC MOLECULES ON EARTH AND BEYOND

Abstract

Every chemical reaction requires energy. Energy is essential for the breaking and formations of bonds, ultimately leading to the formation of new chemical compounds. The onset of life on Earth unfolded through a series of chemical reactions, marking a transition from inorganic chemistry to biochemistry and subsequently to organic chemistry. Yet, the precise nature of the energy source that facilitated these crucial reactions remains unclear, along with the mechanisms governing it.

This project investigates the interactions between hydrothermal vent minerals and prebiotic molecules to gain insights into the origins of life on Earth, with future applications to study possible life formation on other planets through mineral and molecules interactions. This study addresses two key questions: (1) whether ancient forms of cells (protocells) formed at the border or within the interlayers of hydrothermal vent minerals, and (2) whether pH gradients within hydrothermal vents served as an energy promoter, enabling reaction coupling prior to the presence of adenosine triphosphate (ATP), which is the modern biological energy source. To investigate these questions, a laboratory microfluidic system has been developed to replicate the vent mineral structures and surrounding conditions, facilitating investigations into prebiotic chemistry and the potential formation of protocells. By analysing the interactions between fatty acid molecules (plausible protocell candidates) and mineral interlayers within this system, this study could shed light on fundamental processes such as protocell formation, chemical reactions, and the potential interactions between protocells.