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Prebiotic vesicle formation from primordial lipids.

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Understanding the origins of protocells is a fundamental challenge for prebiotic chemistry, biophysics, and astrobiology. One plausible scenario suggests that in early Earth, the ocean was covered by a thin layer of hydrocarbons, known as an "oil slick". The resulting hydrocarbons may have undergone photo-oxidation due to exposure to ultraviolet (UV) light, forming amphiphilic compounds such as fatty acids (primordial lipids), alcohols, aldehydes, and ketones. But how did these fatty acids function as "proto-lipids," and what mechanisms led to their vesicle formation? These primordial lipids would have formed stable vesicles, now considered to be structures that serve as models for protocells.

In this study, we compare the vesicle formation under two different preparations: via phase emulsion transfer through the oil-water interface to mimic the scenario of the early earth and via the well-known “thin film hydration method”.

We evaluated the potential effects of various environmental variables, such as ionic strength to mimic the salinity of the early ocean, on the self-assembly of prebiotic vesicles by describing their structure and morphology using Cryo-TEM.

Our findings provide insights into the influence of oil-water interfaces on prebiotic compartmentalization, offering new perspectives on both the origins of life and environmental remediation strategies for modern oil pollution.