

The role of nanoconfined water in meteoritic material and on early earth for catalyzing prebiotic syntheses

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Water confined between nanoscale rock cavities or inorganic particles in suspensions behaves fundamentally different compared to bulk water. Anomalous properties arises in terms of water activity, hydrogen bonding network dynamics, dielectric constant, density, flow behavior, reactivity, or the quantum state of protons. The nanofluid properties were influenced by the physics and chemistry of the confining mineral surfaces.

We show that properties of nanoconfined water enable abiotic syntheses of RNA from its building blocks [1]. We used geomaterials that are assumed to have been common on early earth, such as silica glass, meteoritic quinones, and meteorite material itself. Different molecular biology approaches indicate the abiotic synthesis of RNA after adding its building blocks to our samples. Our results suggest that including aqueous nanogeochemistry is important to understand prebiotic chemistry on asteroids and on early earth.

[1] de Herrera, A.G. et al. (2023) Commun. Chem. 6, 69.