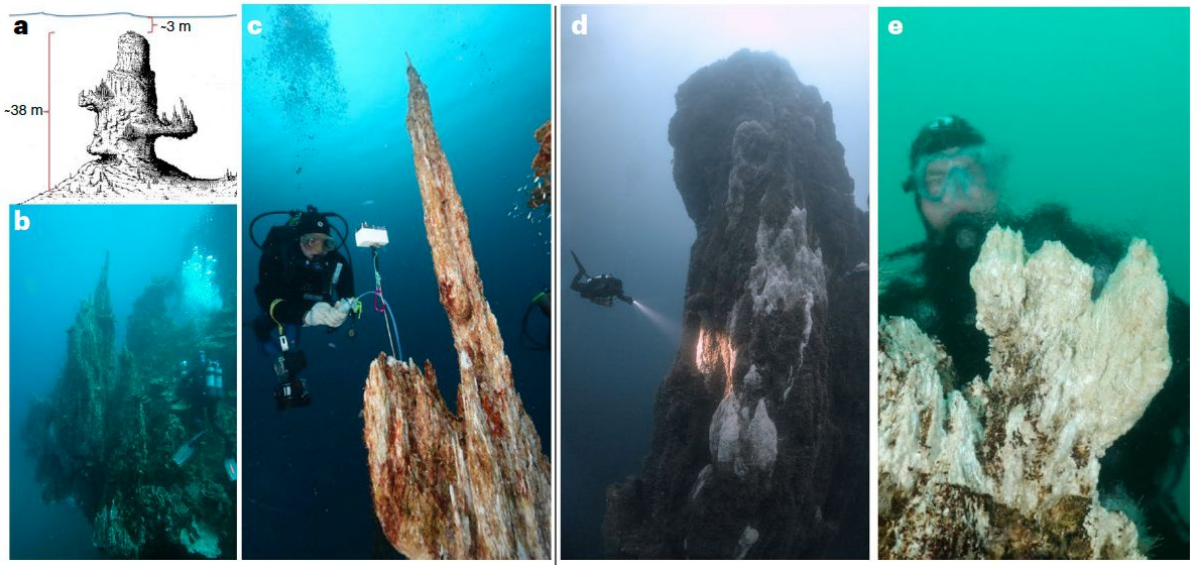
Shallow-sea alkaline hydrothermal vents are favorable environments for prebiotic chemistry on early Earth and potentially other planets

SCIENTIFIC QUESTION: Where did life first arise and thrive on early Earth? Studies have traditionally focused on three environments: 1) bottom of the ocean hydrothermal vents, 2) within the bulk water of the ocean itself, and 3) surface pools. Each of these three environments have major problems with driving prebiotic chemical reactions which are thought to lead to modern biochemistry. However, a site that could combine all three environments could overcome issues with any one type of site and provide access to a much larger suite of prebiotic chemical reactions. Do such sites exist on modern Earth, and were they likely to exist on prebiotic Earth? This study investigates the chemistry and life present at two similar locations, supporting current studies on prebiotic chemistry, and supporting future planetary missions that may investigate similar sites.

SITE CHARACTERISTICS: Shallow-sea alkaline hydrothermal vents. Two field sites:



Prony Hydrothermal Field, New Caledonia | *Strytan Hydrothermal Field, Iceland*

CONCLUSIONS: These shallow-sea alkaline hydrothermal vents did show chemical reactions which support the **"best of both worlds"** for facilitating prebiotic chemistry. They have many of the favorable characteristics of deep-sea and land hydrothermal vents, including (1) bubbles, (2) nutrient-rich detritus from land, (3) agitation from waves and storms, (4) light, and (5) tides. This leads to a chemically diverse setting that can support many of the proposed reactions needed to form the first organism on the early Earth and potentially other planets, like Mars.

Barge, Laura M., and Roy E. Price. Nature Geoscience 15.12 (**2022**): 976-981.

Illustration and text adapted from Barge and Price 2022 by Trent Thomas & Bradley Burcar ***@LifeDetection***