Recreation of Earth’s ancient hydrothermal vents suggests life could emerge even on ‘hellish worlds’

One theory for how life emerged suggests that it originated in the sea, at alkaline hydrothermal vents. It’s impossible to observe life-in-the-making in hydrothermal vents nowadays, though, as the seabed has drastically changed in the billions of years since. Instead, researchers at NASA’s Jet Propulsion Laboratory have recreated early Earth’s deep-sea conditions in their lab to experimentally verify this theory.

A team of scientists, led by Lauren White, have built a reactor that mimics early Earth’s geological processes at the bottom of the ocean. By mixing CO2 and hydrogen-rich fluids — proxies for early Earth’s acidic ocean waters and alkaline hydrothermal spew — across a reconstruction of an ancient seafloor, the reactor successfully converted CO2 into simple organic molecules.

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These simple organic molecules are a far cry from the complex bio-molecules in our bodies today, but it’s a promising start. More importantly, the results demonstrate that these initial chemical reactions are possible under the harsh conditions of a high temperature, high pressure deep-sea environment on a hellish world.

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If life was kickstarted by Earth’s geological processes, that means life in general may not be a freak accident but perhaps an inevitable outcome, especially on worlds with a similar geology. Mars, Europa, and Enceladus are promising candidates for extraterrestrial life.

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