What Life in Volcanic Environments Tells Us About the Emergence of Life and Life Elsewhere

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Life on Earth is now known to inhabit environments that were once considered inhospitable to life. These environments include the areas in, on, around, and near volcanoes, which often have elevated temperatures, and extremes of pH and the composition of other chemical species. Studying the so-called extreme conditions associated with volcanic environments and the life that inhabits them helps us understand how these conditions allow microorganisms to not only survive, but to thrive. Volcanic environments have also been suggested as likely locations for the emergence of life on the early Earth, and the organisms that inhabit volcanic and hydrothermal systems provide substantial information about the nature of early life. In addition, we see evidence and infer the existence in our Solar System for volcanic areas on other celestial bodies (such as the planet Mars and moons Europa and Enceladus). The presence of analogous volcanic processes on other worlds hints at the possibility that life may have also arisen outside of Earth. We will explore what geology and microbiology tell us about the nature of life in volcanic areas, what this means for the processes that lead to life on Earth, and the implications for life elsewhere in our Solar System.