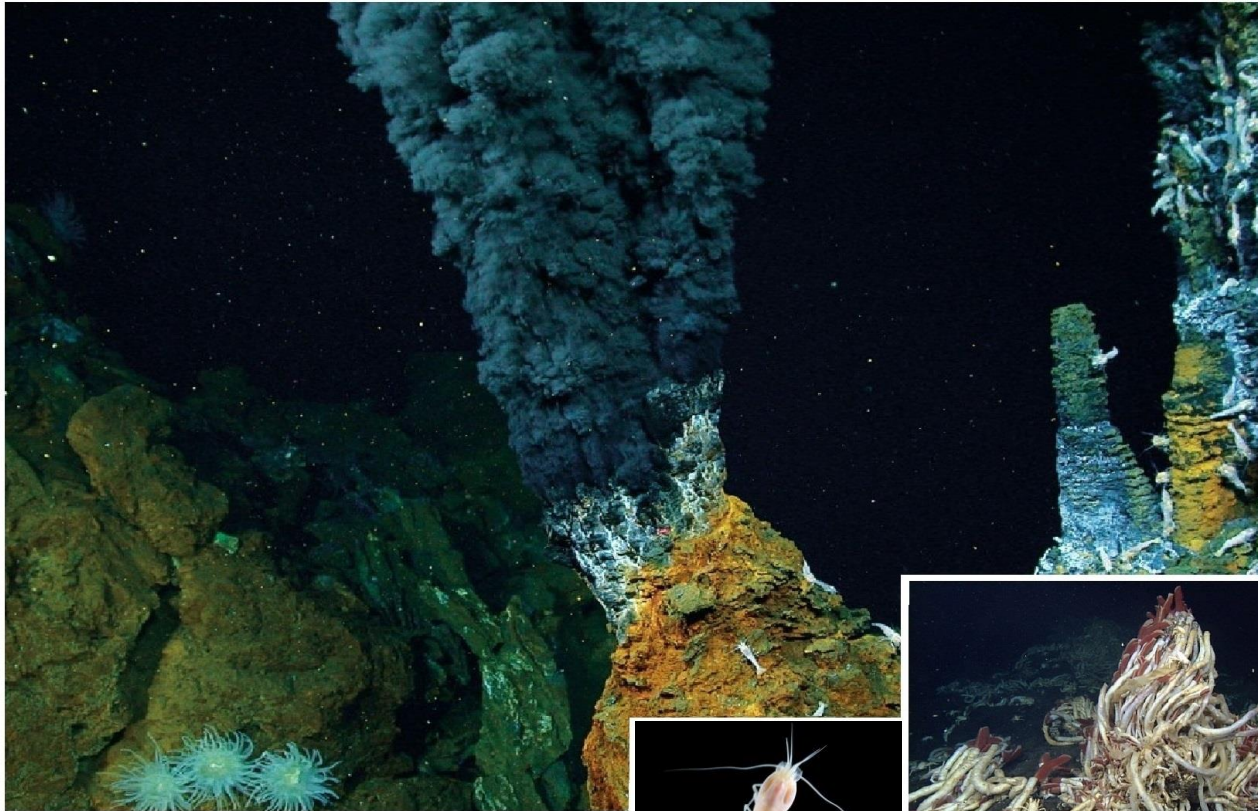


Extremophile, an organism that is tolerant to environmental extremes and that has evolved to grow optimally under one or more of these extreme conditions, hence the suffix *phile*, meaning "one who loves." - Encyclopaedia Britannica

Hydrothermal vents are 400-deg C radioactive pressure cookers located in the total blackness of the ocean floor, but ancient bacteria thrive here, drawing energy from sulphur instead of oxygen and supporting a community of other extremophile organisms.



Tubeworm



Vent shrimp



Polyextremophile *Tardigrades*, also known as water bears, can survive in multiple environments that we would consider unliveable, Tardigrades are generally less than half a millimeter long, and they can live without water or food for 120 years; withstand pressures six times higher than those found in oceans; survive temperatures just above absolute zero and above boiling point; withstand radiation levels hundreds of times higher than humans can handle; and they can even survive the vacuum of space.

Lichens are a symbiotic relationship between a species of fungus and a species of photosynthetic bacterium or alga. They have the ability to bounce back from prolonged periods of desiccation, withering into a dormant state when water isn't available, then coming back to life once they're moistened again. Lichens possess hair-like strands called *rhizines* that penetrate, and anchor them, to rock, eventually creating soil. It's possible they could even be transplanted to carefully selected places on the surface of Mars.



According to the *panspermia* hypothesis, life on Earth may well have evolved from extremophile *Archaeobacteria* that arrived here from interstellar space. If this is the case, then life on Earth has now come full circle, except that the latest extremophile to arrive (evolve) on this planet no longer needs to wait for slow genetic evolution to diversify as separate species adapted for various conditions. In principle, this **adaptive extremophile** can use technology to survive, or even thrive, on any frontier. Is it fair then that we should use this advantage to compete for the habitats of species that are not extremophiles?