NASA Astrobiology Institute

Guiding Life Detection Through Discovery of Hyperdiverse Hydrothermal Communities

Background | Geologically active planets generate chemical disequilibrium among the lithosphere, hydrosphere, and atmosphere and maintain conditions that can support life. This phenomenon is acutely expressed in hot springs.

Discovery | A hot spring in Yellowstone National Park was shown to exhibit extreme chemical disequilibrium due to mixing of reduced volcanic gases with oxidized surface water. Genomic data indicate that the "buffet" of chemical nutrients in this spring supports a hyperdiverse microbial community that represent over half of the known archaeal and bacterial lineages (blue in image at right), including a preponderance of early evolving organisms. These lineages are adapted to use volcanic gases to support their energy metabolism.

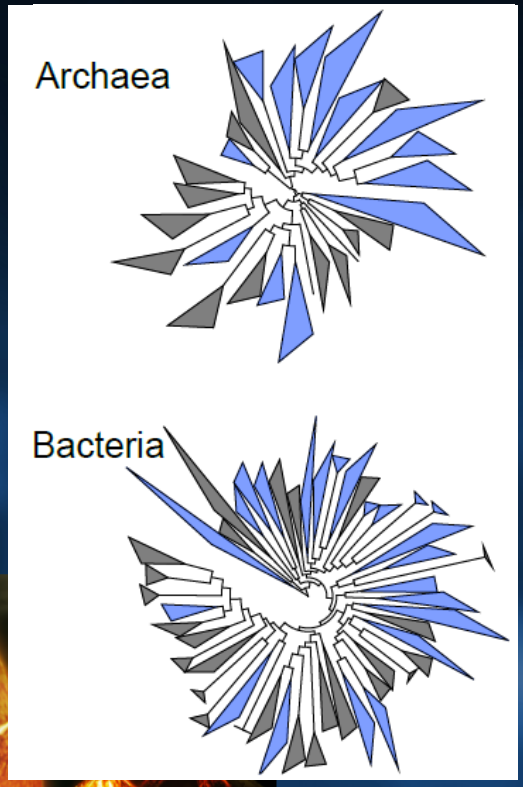

Image credit: University of Colorado Boulder

Innovation and Impact | This study demonstrates the central role of fluid mixing in generating and maintaining extensive microbial diversity in early Earth analog environments. Given the strong relationship between biodiversity and productivity, this finding can better constrain targets in the search for evidence of life on other geologically active planetary bodies.

Image credit:Tim Bertelink

E. Boyd et al. (2019). Nature Communications.