Hyperthermophilic Biogenesis and Early Biospheric Evolution

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Hyperthermophilic biogenesis and a Last Common Ancestor (LCA) of life is supported by a wide range of recent research [1]. RNA world compatibility with hyperthermophilic biogenesis is supported by the case for highly saline Hadean oceans [2] and experiments demonstrating RNA stability at high temperatures in saline solutions [3]. Likely impact reseeding during the Hadean [4] should have left deeply-rooted mesophiles if they indeed emerged soon after biogenesis. Their apparent absence on molecular phylogenetic trees implies both hyperthermophilic biogenesis and a hot Hadean climate.

The robust anti-correlation of maximum growth temperatures (Tmax) of thermophiles with their rRNA and tRNA phylogenetic distances from the LCA is consistent with the thermophilic Tmax being close to the climatic temperature of each organism at emergence. Drawing on a plausible scenario of hydrothermal biogenesis near the seafloor [5, 6], we propose that a spectrum of Bacterial and Archaeal protocells, including ancestors of extant prokaryotes, emerged simultaneously in the thermal gradient between a hydrothermal source on the seafloor and the ambient climatic oceanic temperature, in Hadean time. A climatic temperature close to 80 deg C in the late Hadean/early Archean is consistent with paleotemperatures derived from oxygen isotopes in marine cherts [2].

This scenario might be tested using insights into phylogenetic trees of RNA molecules. The efficient repair of single and double strand breaks in DNA is apparently a consequence of protocell emergence in both the high temperature and the higher radiation environment of intracellular K40 and C14 decay. Therefore the early accumulation of neutral "clock-like" substitutions is likely driven by this radiation dose as a function of time.

References

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