

Scientist suggests life began in freshwater pond, not the ocean

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(PhysOrg.com) -- For most everyone alive today, it's almost a fundamental fact. Life began in the ocean and evolved into all of the different organisms that exist today. The idea that this could be wrong causes great discomfort, like discovering as an adult that you were adopted as a child. Nonetheless, a team of diverse scientists led by Armen Mulkidjanian is suggesting that very thing; instead of life beginning in deep thermal vents in the ocean, the prevailing view, they say it perhaps instead started in landlocked freshwater pools created by thermal vapor. Their theory is based, as they explain in their paper published in the *Proceedings of the National Academy of Sciences*, mostly on the idea that the sea is just too salty to provide the ideal conditions necessary to spur life into existence.

Mulkidjanian and his colleagues argue that in looking at the way cells are made today, it's hard to imagine they got their start in water that was far saltier than it is now. They point out that cells in all living [organisms](#) have a much higher proportion of potassium to sodium, whereas the [ocean](#) is the reverse. Such high levels of salt would have made it difficult for cells to synthesize proteins, they say, making it extremely difficult for them the form into the molecular machines with strong walls seen today. Such thick walls would not have existed when cells were just starting to form, making it almost impossible for them to get started, grow and mature.

In contrast, they say, the conditions found on land during the time period when life is believed to have started, was likely far more conducive. In addition to the existing pools of fresh water created by the condensation and cooling of geothermal vapor, there were the higher temperatures that are believed to have existed worldwide. In addition, they say that those pools of [water](#), or mud, likely had many of the same ingredients found in modern cells: phosphate ions, zinc, manganese and especially potassium. Thus the newly forming original cells would not have had to work hard to keep out harmful sodium ions. Also, to counter arguments that newly developing [cells](#) on land would be stopped in their tracks by harmful UV radiation from the sun, the team notes that both RNA and DNA have been shown to be stable under such exposure.

Despite the team's compelling arguments, there are likely to be many doubters, and rather than converting most in the scientific community, this new idea is likely to spark debate that will almost certainly continue for many years to come.

More information: Origin of first cells at terrestrial, anoxic geothermal fields, *PNAS*, Published online before print February 13, 2012, [doi:10.1073/pnas.1117774109](https://doi.org/10.1073/pnas.1117774109)

Abstract

All cells contain much more potassium, phosphate, and transition metals than modern (or reconstructed primeval) oceans, lakes, or rivers. Cells maintain ion gradients by using sophisticated, energy-dependent membrane enzymes (membrane pumps) that are embedded in elaborate ion-tight membranes. The first cells could possess neither ion-tight membranes nor membrane pumps, so the concentrations of small inorganic molecules and ions within protocells and in their environment would equilibrate. Hence, the ion composition of modern cells might reflect the inorganic ion composition of the habitats of protocells. We attempted to reconstruct the “hatcheries” of the first cells by combining geochemical analysis with phylogenomic scrutiny of the inorganic ion requirements of universal components of modern cells. These ubiquitous, and by inference primordial, proteins and functional systems show affinity to and functional requirement for K^+ , Zn^{2+} , Mn^{2+} , and phosphate. Thus, protocells must have evolved in habitats with a high K^+/Na^+ ratio and relatively high concentrations of Zn, Mn, and phosphorous compounds. Geochemical reconstruction shows that the ionic composition conducive to the origin of cells could not have existed in marine settings but is compatible with emissions of vapor-dominated zones of inland geothermal systems. Under the anoxic, CO_2 -dominated primordial atmosphere, the chemistry of basins at geothermal fields would resemble the internal milieu of modern cells. The precellular stages of evolution might have transpired in shallow ponds of condensed and cooled geothermal vapor that were lined with porous silicate minerals mixed with metal sulfides and enriched in K^+ , Zn^{2+} , and phosphorous compounds.

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