MICROBIAL COMMUNITIES OF THERMAL ENVIRONMENTS - POSSIBLE ANALOGUES OF EARLY EARTH ECOSYSTEMS?

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The ability of prokaryotes to use inorganic energy substrates and other than oxygen electron acceptors makes them formally independent of modern biosphere where organic matter is the main energy source of non-phtotrophic organisms and the oxygen of photosynthetic origin – the main electron acceptor. However, the majority of lithoautotrophs are quasi-autonomous as their inorganic substrates are the therminal products of anaerobic organic matter destruction; thus their place in the food web is at its end where they bring inot action a short energy cycle. However, in certain habitats, first of all, in those of volcanic origin, inorganic substrates are of abiotic origin, and prokaryotes that can use them producing de novo organic matter, fuel a true autonomous microbial community. Not depending of the light and atmospheric oxygen, anaerobic thermophilic lithoautotrophs can grow at any depth below the surface, thus not being exposed to UV radiation that should destroy all living matter on the surface of Early Earth lacking ozone layer.

Molecular hydrogen could serve as the energy substrate for a wide range of thermophilic lithoautrotrophs with different phylogenetic position (Miroshnichenko, 2011). Another important substrate of thermophilic lithoutotrophs is CO. Anaerobic carboxydotrophy coupled with molecular hydrogen formation from water turned to be a feature of many thermophilic and hyperthermophilic archaea and bacteria (Sokolova et al., 2009). Recenly, a new phylogenetically diverse group of thermophilic prokaryotes was found that grow lithoautotrophically by disproportionation of elemental sulfur when part of sulfur atoms is oxidized to sulfate while the other part is reduced to hydrogen sulfide (Slobodkin et al., 2013).

Small organic molecules formed in hot vents in the course of serpentinization could also fuel autonomous microbial communities (Martin and Russel, 2007). Among them there is formate that could be used by hyperthermophilic archaea of genus *Thermococcus* inhabiting deep-sea vents (Kim et al., 2010). Their activity is supported by the energy of anaerobic formate degradation to carbon dioxide and molecular hydrogen. The energy yield of this reaction previously was considered to be too low for a catablolic process. Genomes of microorganisms capable to CO or formate oxidation coupled with hydrogen production contain similar gene cluster encoding CO- oar formate-dehydrogenase and energy-converting hydrogenase. Thus, these two processes performed by the simpliest enzymatic mechanisms might be considered as possible candidates for the first energy-giving reactions in Earth biosphere.

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