

Geochemical energy sources for microbial primary production in the environment of hydrothermal vent shrimps

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At deep-sea hydrothermal vents, dense invertebrate communities prevail along chemoclines, where the relaxation of redox-disequilibria sustains energetically the chemolithoautotrophic microbial CO₂-fixation. At the Mid-Atlantic Ridge (MAR), dense swarms of *Rimicaris exoculata* shrimps assemble along the turbulent mixing interface between hydrothermal fluid and oxygenated seawater. This behaviour was suggested to provide ideal conditions for the growth of an abundant microbial epiflora that colonises the shrimps' branchial cavity. Sulphide has long been considered as the prime electron donor used by these epibionts. Recently, the oxidation of iron has been suggested as an alternative energy-acquisition-pathway at the iron-rich Rainbow site. During this study, the fluid conditions along the mixing gradient were modelled for two chemically contrasted MAR vent fields, Rainbow and TAG. Further on, the energy yielded from different oxidative pathways (e.g.: oxidation of sulphide- iron II- and methane by oxygen), that is available to chemolithoautotrophic primary producers, was computed and quantitatively compared. At TAG, sulphide oxidation was confirmed to be the most favourable pathway in terms of energy release. By contrast, an original biogeochemical context is suggested for Rainbow, where conspicuously higher energy could be obtained from iron oxidation. Here, the conversion of methane appears to be a second potential energy source, while sulphide oxidation contributes insignificantly to the overall energy budget. At each site, the narrow thermal range of the shrimp environment lies close or just below the temperature at which maximum energy is available from the dominant source. Although this could be further constrained by physiological requirements. The optimisation of chemical conditions may thus occur through active shrimp positioning in the mixing gradient.

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