

Adaptations to chronic hypoxia in deep-sea hydrothermal vents invertebrates

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Deep-sea hydrothermal vents are oases of life in the otherwise biomass-poor abyssal depths. This high vent biomass is however composed of relatively few species, likely a result of the challenging conditions that are the rule in this environment. Among the limiting factors, low environmental oxygen (hypoxia) is an important parameter for all aerobic organisms in general and for metazoans in particular. In addition to being overall low, the oxygen concentration is also highly variable in time and space. We investigated the adaptations to hypoxia in an array of invertebrates (crustacea, polychaetes, gastropods) from various vent areas.

In annelids, the extraction of oxygen from the environment is facilitated by the development of large gills, with reduced diffusion distances. This trend is not observed in shrimp but there is then an increased ventilatory capacity in the vent species compared to shallow water ones.

All species that depend on hydrothermal vents also show a high concentration of oxygen binding proteins in their body fluids, and these respiratory pigments exhibit a high affinity for oxygen. This property facilitates the diffusion of oxygen, especially in a hypoxic environment. This high affinity is usually compensated by a pronounced normal Bohr effect that decreases the affinity near the metabolically active tissues (local drop of pH due to the production and release of CO₂).

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