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Role of bioengineering processes in the colonisation of extreme hydrothermal environments

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Deep-sea hydrothermal vents harbour amazingly rich and diverse animal communities in some of the most extreme environments on Earth. These environmental conditions both represent large chemosynthetically-derived energy budgets but also potentially high thermal and chemical stresses for the organisms. Vent organisms have developed a wide range of strategies to face these constraints. The most emblematic of them, the tube-dwelling polychaete *Alvinella pompejana*, colonises hydrothermal smoker walls on the East Pacific Rise. How this organism deals with temperature rising over 100 ˚C, as well as high sulphide and low oxygen levels and acidic pH, in its close surroundings cannot be solely explained by adaptations to thermal and chemical stresses. *A. pompejana* tubes form biogeoassemblages of several centimetre thick within a few weeks on substrates submitted to intense hot fluid flows. Recently, small scale *in situ* pH and temperature profiling has shown that this architecture partitions the vent fluid-seawater interface into chemically and thermally distinct micro-niches. Tube ventilation was shown to exert a control on thermal variability in this environment, potentially facilitating the settlement of less tolerant species. The study of tube properties, furthermore, emphasized the selective transport of hydrogen sulfide through the tube wall. Thermal regulation and continuous supply of electron donor and acceptor to the medium inside *A. pompejana* likely promote mutualistic interactions between the animal and chemoautotrophic primary producers from the abundant microflora observed inside the tube. To better constrain the role of such bio-engineering processes at deep-sea hot vents requires new *in situ* experimental strategies to understand their dynamics, biogeochemical implications and impact in the establishment of biological diversity.