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Distribution of bacteria and associated minerals in the gill chamber of the vent shrimp *Rimicaris exoculata* and related biogeochemical processes

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The shrimp *Rimicaris exoculata* dominates the megafauna of some mid-Atlantic Ridge (MAR) hydrothermal vent fields. This species harbors a rich bacterial epibiosis inside its gill chamber. At the Rainbow vent field, where iron concentrations in the fluids are particularly high compared to other MAR sites, these epibionts are associated with iron oxide deposits. Cartography of both bacteria and minerals shows the occurrence of three distinct compartments in the gill chamber: (1) the lower pre-branchial chamber, housing bacteria, but devoid of minerals, (2) the "true" branchial chamber that contains the gills and remains free of both bacteria and minerals, and (3) the upper pre-branchial chamber housing the main ectosymbiotic bacterial community and associated mineral deposits. According to our *in situ* chemical and temperature data, abiotic iron oxidation appears to be kinetically inhibited in the shrimp swarms and this would explain the lack of iron oxide deposits in the first two areas. We propose that, in the third area, iron oxidation is microbially promoted, possibly by iron-oxidizers; Indeed, modifications of physico-chemical conditions downstream of the gills would reduce the oxygen content and favor the development of bacterial iron-oxidizers in this Fe^{II}–rich environment. A potential role of such iron-oxidizing symbionts in the shrimp diet is suggested. If confirmed, this symbiosis would appear unique, as most previously studied symbioses at deep-sea vents rely on sulphide or methane oxidation. Further microbiological investigations are still required to confirm this hypothesis, and

to determine if such bacteria - *R. exoculata* association is widespread or specific to the peculiar chemical environment of the Rainbow vent field.