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IRON AND ZINC SULPHIDE MINERALIZATIONS IN ALVINELLA POMPEJANA TUBES: SPECIFIC MINERALOGICAL MARKERS OF BACTERIAL ACTIVITY AT HYDROTHERMAL VENTS?

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The deep-sea hydrothermal environments at mid-oceanic ridges are appropriate for studying biologically induced mineralizations (BIM), since an abundant biomass lives in highly mineralizing environments. In order to sudy BIM in this context, proteinaceous tubes of Alvinella pompejana, a thermophilic polychaete (DESBRUYÈRES et al., 1985; CARY et al., 1998), have been collected with a special experimental device (GAILL et al., 1996; TAYLOR et al., 1999) on active smoker walls at deep-sea vents of the East Pacific Rise. Minerals precipitated within the animal tubes were studied by analytical transmission electron microscopy. The unique sulphide mineral observed within the exoskeleton of the animals is nanocrystalline Zn-Fe suphide, forming typical alignments parallel to the main tube layering. These minerals are closely associated with layers of bacteria present within the tubes and, in some cases, they are observed within bacterial cells. The structure of the nanocrystals is consistent with both blende or wurzite forms, but with some particular space group modifications. We show that these minerals are very different structurally and chemically from the sulphides precipitated inorganically in the hydrothermal environment immediately outside of the living organisms. This makes them interesting as mineralogical biomarkers. Both their particular microstructure and their close association with the bacterial cells present within the proteinaceous tube leave open the possibility that this BIM might indeed correspond to biologically controlled mineralization. In any case, the significance of this Zn-Fe-S BIM or BCM will be discussed with regard to metal detoxification mechanisms by these organisms. Such alignments of nanocrystals might also be searched in fossilized hydrothermal vent systems and used as specific mineralogical markers in paleometabolical studies.

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