

Bacteria construct zebra architecture

TAZAKI, K.

Department of Earth Sciences, Faculty of Science, Kanazawa University, Kanazawa, Ishikawa 920-1192, Japan.

Microbial architectures in the form of banded zebra patterns have been found as periodic Fe-Mn precipitates in living biomats from Satsuma-Iwo Jima, southern Kyushu, Japan. Electron microscopic observation shows that fibrous and bacillus type bacteria construct a zebra architecture through biomineralization on or in the cell. A living microbial fumarolic ferro-manganese precipitate growing in the seawater around an active volcanic island explains the mechanism of banded formation. Biological processes form the elemental zebra pattern, with periodic distribution of bacterial cells filled with Mn and Fe in each layer of the architecture. Fibrous bacteria are sometimes mineralized with goethite, ferrihydrite, siderite and buserite microcrystals, coated with granular mucoid substances.

Mucoid substances (polysaccharides) of iron bacteria may act as active support for adhesion of iron hydroxides. This results in condensations of iron hydroxides as colloidal particles coated with granular mucoid substances. Bacteria respond to their specific microenvironmental conditions. This direct observation suggests that the formation of zebra architecture on the porous rock surfaces requires not only a narrow set of physical or chemical conditions, but also bacterial biomineralization. In the biomats, bacteria have established certain symbiotic associations.