

Morphology of pyrite in particulate matter from shallow submarine hydrothermal vents

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ABSTRACT

Here we present the first study of pyrite textures observed in particulate matter from an active shallow submarine vent site, which is characterized by large spatial and temporal variations in the physico-chemical conditions caused by a combination of geochemical processes and microbial activity. Morphologic characterization of pyrite crystals from suspended particulate matter in the discharged fluid of a shallow submarine vent system near Punta Mita, Nayarit, Mexico, showed diverse crystal morphologies and aggregates; well-defined framboids are only observed within the deposits of fine-layered calcite (calcareous tuff) formed around the vents, whereas particulate matter contains diverse pyrite crystal forms as globular, cubic, octahedral, and pyritohedral but no framboids. Available sulfur isotopic data indicate that pyrite is formed as a consequence of microbial sulfate reduction in a hydrothermal reducing environment.

The results of our study in a natural system provide evidence of the effect of variations in key parameters, such as redox state, on the pyrite morphologies and framboid size distribution, and support the conclusions of numerous studies that have attempted to explain pyrite crystallization processes that generate different morphologies as a result of large variations in the physico-chemical conditions.

Keywords: Suspended particulate matter, crystal morphology, framboids, sulfides, chemosynthesis