Geophysical Research Abstracts, Vol. 8, 09423, 2006
SRef-ID: 1607-7962/gra/EGU06-A-09423
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Modern stromatolites from Lagoa Vermelha, Brazil: An analogue for benthos microbial associations on the early Earth

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Stromatolites are laminated organo-sedimentary structures shaped by microbial activity. These laminated structures represent possibly the oldest record of life and provide the main source of information on the evolution of the early benthos, which has inhabited the shallow seafloor since the Archean. Recent studies conducted on modern Bahamian stromatolites have shown that lamination structures are a product of symbiotic processes in well-developed microcosms. Here, we report on the first recognized occurrence of microbiolite stromatolitic structures, associated with Ca-dolomite, growing in a hypersaline coastal lagoon, Lagoa Vermelha, near Rio de Janeiro, Brazil. Mineralogical and geochemical characteristics of these living stromatolites indicate the presence of a diverse symbiotic association resulting in calicification. The balance between precipitation and dissolution is controlled by biogeochemical gradients within the uppermost living microbial mat, as well as the environmental conditions, such as high salinity.

SEM and geomicrobiological studies provide information about the biomineralization processes and associated metabolic mechanisms, such as photosynthesis, aerobic respiration, sulfate reduction, methanogenesis, sulfide oxidation and fermentation. Despite the high diversity detected in the microbial mat, the stable carbon isotope data measured in the biominerals only reflect contributions from photosynthesis and sulfate reduction. These modern examples reveal the existence of very complex microcosms involved in the formation of the biomineral laminations leading to lithification. These communities may be representative of early benthos associations involved in Archean

stromatolite formation.