Anaerobic sulfur bacteria inducing lithification in modern- and possibly Precambrian stromatolites

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The formation of stromatolites is still a subject of debate. Laminated structures found in sedimentary rocks of the Warrawoona Group, Western Australia (3.5 Ga) provide evidence of possible microbially mediated carbonate layers. Although often implied, the microbial impact on stromatolite accretion can rarely be proven because of the lack of fossilized organisms and geochemical traces. Recent studies performed in an environmental setting considered to be an analogue for the Archean could supply new evidence of participation of specific microorganisms, regarded as "living fossils". Photosynthetic sulfur bacteria are considered to be one of the oldest form of life [1] and are abundantly present in a microbial mat from Lagoa Vermelha, Brazil [2]. Studies on recent living and calcifying stromatolites, artificial anaerobic microbial mats and pure culture experiments show that purple sulphur bacteria may play an important role in the calcification process.

Living stromatolites from Lagoa Vermelha contain distinct high Mg-calcite layers in 6-8 mm sediment depth., although the process of formation remains unclear. Microsensor studies indicate that H_2S oxidation activity occurrs in the absence of oxygen. Biogeochemical modelling suggests that, when microbes form elemental sulphur, a pH shift induces the precipitation of carbonate minerals. Molecular phylogenetic analysis of one bacterial strain from the microbial mat identified a bacterium related to *Ectothiorhodospira sp.*, capable of anaerobically oxidizing H_2S to elemental sulphur (S°). The same metabolism could be confirmed in pure culture experiments. These findings expand our understanding of carbonate biomineralization and stromatolite formation in early anoxic ecosystems.

Conclusion: Even before the evolution of oxygenic photosynthesis, anaerobic sulphur bacteria may have contributed to the formation of carbonates resulting in the well-known stromatolite structures.

References

[1] Schidlowski M., Orig Life (1979) **9**(4):299-311
[2] Vasconcelos et al. (2006) Sed Geol **185**:175-183