The reconstruction of microbial habitats during Mesoproterozoic stromatolite formation

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Ancient stromatolites mainly consist of authigenic carbonate which may have formed within living microbial mats and, hence, provide unique archives of local physico-biogeochemical conditions within the mats and of the prevailing water chemistry of the paleo-depositional environment. In this study we report trace element and Cd isotope data of individual mesobands of Late Mesoproterozoic domal stromatolites and conophyta from the Paranoá Group (Brazil).

Carbonate leachates of domal stromatolites show rather flat shale-normalized REY patterns (subscript SN) with slightly positive Y_{SN} anomalies indicating that the carbonate was formed in a very restricted environment dominated by terrigenous REY from the continental hinterland. In contrast, conical *conophyta* with typical seawater-like REY_{SN} patterns formed in a milieu dominated by open ocean seawater. The lack of positive Eu_{SN} anomalies suggests that the (sea)water present at both locations was not significantly influenced by high-temperature, hydrothermal fluids, while negative Ce_{SN} anomalies indicate slightly oxidizing conditions in the atmosphere-hydrosphere system during the Late Mesoproterozoic.

In combination with redox-sensitive trace elements such as Ce, Mn and U, the additional analysed $\varepsilon^{112/110}Cd$ values can be used to clearly distinguish between two carbonate endmembers that formed at the seawater-microbial mat interface and the interior of the ancient microbial mat, respectively. Hence, the geochemical reconstruction of stromatolite environment suggests that REY geochemistry in stromatolite-associated carbonate is a reliable proxy to reconstruct the physico-chemical conditions in Precambrian microbial habitats and further highlights Cd isotopes as novel geochemical proxy to gather unique insights into microbial habitats and element cycling on Early Earth.