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The reconstruction of Mesoproterozoic microbial habitats during stromatolite formation

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Ancient stromatolites mainly consist of authigenic carbonate which partially may have formed within living microbial mats and, hence, provide unique archives of local physico-biogeochemical conditions of the ambient seawater in which the organism thrived. In this study we report trace element data of carbonate leachates from individual mesobands of Late Mesoproterozoic domal stromatolites and conophyta from the Paranoá Group (Brazil) obtained by quadrupol ICP-MS in order to reconstruct the individual paleo-depositional environment.
Concentrations of detritus-related elements (e.g. Hf, Zr, Al) and fluid-mobile elements (e.g., Sr, Mn, Ba), respectively, do not correlate with rare earths and yttrium (REY) in the studied stromatolites, suggesting pristine REY compositions with negligible syn- and post-depositional carbonate alteration.
Rather flat shale-normalized REY patterns (subscribt SN) reveal that domal stromatolites formed in a lagoonal environment dominated by fresh water conditions with occasional seawater influx. In contrast, seawater-like REYSN patterns of conophyta indicate a paleo-milieu dominated by open ocean water masses. The lack of positive EuSN anomalies suggests that ambient (sea)water at both locations was not significantly influenced by high-temperature, hydrothermal fluids, while negative CeSN anomalies indicate locally slightly oxidizing conditions in the atmosphere and hydrosphere system during the Late Mesoproterozoic. Furthermore, up to 25% higher REY concentrations within the stromatolite mesobands relative to ambient carbonate sediment infill highlights REY geochemistry as tracer for biological activity within the stromatolite. Hence, REY geochemistry in stromatolite-associated carbonate is a reliable proxy to reconstruct the physico-chemical conditions in Precambrian microbial habitats.