

Archean biogeochemical processes, Dharwar Craton, India: isotopic and geochemical evidences for the early record of life

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In spite of vigorous plate tectonic processes, metamorphism and alteration, the biogenic signatures are well preserved in the sedimentary rocks of Paleo to Mesoproterozoic greenstone belts of Dharwar Craton. The stromatolitic carbonates have varied morphological features and are associated with Fe-Mn deposits and carbonaceous shales. The U-Pb ages of the detrital zircons from the stromatolitic carbonates of Sandur and Chitradurga greenstone belt from the Dharwar Craton range from 3508 ± 29 Ma to 2926 ± 36 Ma and 3426 ± 26 Ma to 2650 ± 38 Ma respectively suggesting Paleo to Neoproterozoic sources.

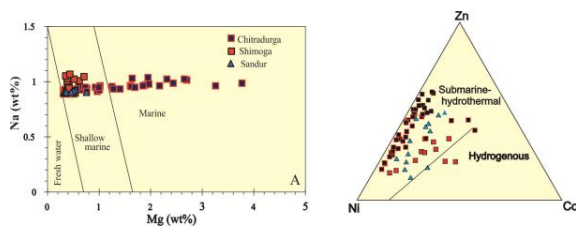


Fig. Marine and hydrothermal signatures in Mn ores

These stromatolites exhibit La, Eu and Gd positive anomalies and MREE/HREE ratios indicative of fluctuating ocean water conditions (oxic/anoxic; acidic/alkaline) and terrigenous/hydrothermal inputs in a volcanically active environment in the Dharwar Craton during the Neoproterozoic times. The Mn ores associated with them also exhibit negative Ce anomalies and shallow marine to marine environment with hydrothermal signatures. The carbonaceous shales from Sandur and Chitradurga display low order negative Ce anomalies with positive Eu anomalies. The negative to positive $\delta^{13}\text{C}$ of the stromatolites indicate local redox and temperature variations in the Archean oceans. The negative $\delta^{18}\text{O}$ endorse fluctuating Archean seawater temperatures ranging from 25° - 75°C with variable influence of hydrothermal input. The Mn formations with predominant hydrothermal signatures and the carbonaceous shales with highly negative $\delta^{13}\text{C}$ are supportive of the Archean biogeochemical processes in the Dharwar Craton.

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