

Tracing Redox Histories of Ancient Marine Shales: Insights from Proterozoic Deposits of Central India and the North Australian Craton.

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Our understanding of ocean redox characteristics during the mid-Proterozoic (1.8 to 0.8 Ga) remains limited, largely due to the significant challenges in establishing the spatial and temporal redox patterns of the era due to the scarcity of well-preserved, well-dated rocks from shallow and deep marine settings. The Paleoproterozoic – Mesoproterozoic Basins of Australia and India host sedimentary sequences that have mostly remained undeformed and unmetamorphosed, making them valuable archives for reconstructing global Earth system dynamics within the heterogeneously oxygenated Proterozoic world. These basins, once tectonically linked during the supercontinent Nuna's assembly (ca. 1600–1300 Ma), share a similar deposition history. Using their shale sequences, we intend to address the longstanding question of how varied the oxygen levels across similar time scales were.

This study systematically combines SEM mineral mapping, geochemical signatures, and in situ Rb-Sr dating of these shales. First, comes petrographically differentiating the various clay origins within the shales of the Limbunya Group (Birrindudu Basin, Northern Australia) and Semri Group (Vindhyan Basin, Central India) making use of their particle morphology and textural relationships. These shales are found to be rich in early diagenetic - authigenic illites, potentially preserving the paleo seawater signature and in principle, the trace elements within these shales should record information about complex redox structures. After scanning for detrital contamination or secondary alteration we analyse these shales for selected trace elements (V, Cr, Mo, Co, Ni, Cu, Th, U, B/Ga), including the REE to get insights regarding the paleoredox and paleosalinity conditions.

Through a comparative study of these geologically similar yet geographically separated Proterozoic basins, we seek to elucidate the mid-Proterozoic ocean's redox structure and paleoclimate. These findings will contribute to a more nuanced understanding of the oxygenation landscape in the Proterozoic seas, recorded in the trace element signatures of shales from the Birrindudu and Vindhyan basins.