Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.26059

Archean-like atmospheric and shallow-seawater oxygen content in the late Paleoproterozoic Era: Constraints from molybdenum isotope content of the iron-formation of the Chilpi Group, Bastar Craton, India

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The Chilpi Group of the Bastar Craton, India, preserves chemogenic sediments deposited between 2.1 and 1.8 Ga. Analyses of the geothermometry and oxygen fugacity variations using the mineral chemistry of the rare association of magnetite-greenalite-cronstedtite in the banded iron formation (BIF) in the basin indicate the PO_2 value of 10^{-3} – 10^{-5} times the present atmospheric level (PAL) during the deposition of these rocks. We have measured the Mo concentration and Mo isotope data of BIF samples to validate the results obtained from mineral chemistry. The analytical results of $\delta^{98/95}Mo_{NIST}$ values have a range from –0.2 to 1.2 ‰; a range comparable with the value from sediments deposited below anoxic (ferruginous but not euxinic) condition. The data modelled for adsorption removal of Mo from the modern seawater composition, having $\delta^{98/95}Mo_{NIST}$ value of 2.09 ‰, show a negative offset ($\Delta^{98/95}Mo$) of –0.7 ‰, which falls between –0.6 ‰ of 2.5 Ga BIF and –1.2 ‰ of 1.85 Ga BIF of the world. The results indicate a low $\delta^{98/95}Mo_{NIST}$ value of the paleo-seawater during the late Paleoproterozoic Era, which was the result of a low oxygen content of the atmosphere and shallow sea. The reduced content of Mo, a bio-essential element, in seawater during the late Paleoproterozoic Era and the low atmospheric oxygen levels (between 10^{-3} and 10^{-5} PAL) could be the reasons for the delay in the evolution of eukaryotes.