Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.28253

Geochemical and Fe-Zn-Nd isotopic constraints on the origin of the ~2.8 Ga Ntem Complex banded iron formation (BIF), NW Congo Craton

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Banded iron formations (BIFs) are Precambrian Fe- and Si-rich chemical marine sedimentary rocks and constitute an important geological archive for the understanding of early Earth processes. However, the sources and the depositional settings of the Archean and Paleoproterozoic BIFs remain controversial[1]. Here, we present rare earth element-yttrium (REE + Y) and Zn-Fe-Nd isotope data from 2.8-billion-year-old Mezesse and Mbalam banded iron formation within the Ntem Complex, south Cameroon. Mezesses BIFs show low a REE content (∑REE <10 ppm), positive Eu and negative Ce anomalies with superchondritic Y/Ho value (21.66 – 35.71), and have relative heterogeneous δ^{56}Fe values of −0.16 ‰ to +0.81 ‰ (average δ^{56}Fe = +0.35 ± 0.06 ‰ 2SD). The δ^{66}Zn ≈ +0.53 ±0.02‰ (2SD). This suggests derivation from a hydrothermal source and enriched $\varepsilon Nd_{(initial)}$ values from −13.83 to −5.03 reflect contributions from a continental component. The Mbalam BIFs display relative enrichment of HREE, positive Eu anomalies (average = 2.49) and depleted $\varepsilon Nd_{(initial)}$ (average ≈ + 6.9) and δ^{56}Fe (average = +0.40 ± 0.05 ‰ 2SD) signatures, but low sedimentary δ^{66}Zn values (− 0.77 to + 0.16 ‰, average = − 0.39 ± 0.03 ‰ 2SD) below the lithospheric mantle Zn isotopic signature(+0.18 ± 0.04 ‰ 2SD) [2]. These geochemical and Zn-Fe-Nd isotopic data suggest that significant amounts of iron in Mbalam BIFs likely derived from oceanic crust, following hydrothermal fluid alteration by seawater percolation in deep basins. Collectively, we observe a source heterogeneity for the major components of ~2.8 Ga banded iron formations in the Ntem Complex.

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