Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.24558

Iron isotope compositions of ~2.45 Ga Pronto Paleosol, Canada

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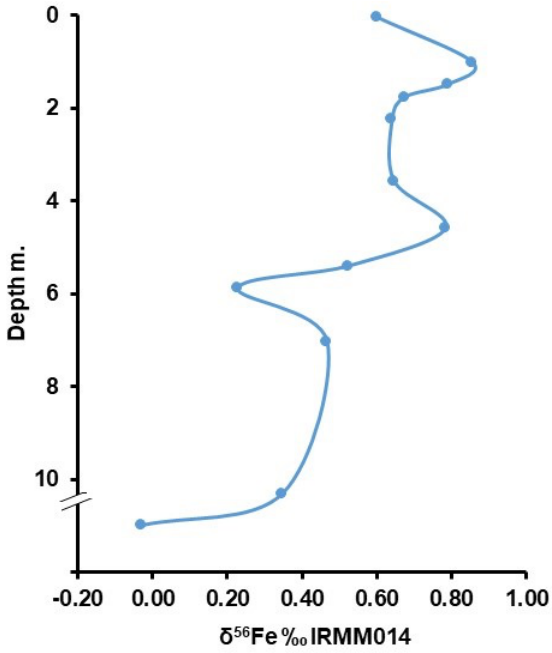
The 2.45 Ga Pronto profile is among the most extensively studied Precambrian paleosols. The Pronto paleosol is developed under low atmospheric oxygen conditions as indicated by the low iron contents and presence of Ce phosphate minerals such as rabdophane [1]. The Pronto paleosols are developed on Late Archean granites and overlain by the basal Matinenda Formation of the Paleoproterozoic Huronian Supergroup between 2.475 and 2.440 Ga [2]. Iron isotope compositions (δ^{56}Fe ‰ IRMM014) of Precambrian paleosols are sensitive to Fe retention or loss as the lighter Fe isotopes dissolve and leave, and the remaining Fe is enriched with ^{56}Fe. We report δ^{56}Fe values of eleven Pronto paleosol samples and one underlying parent granite sample. We have analyzed the Fe isotope compositions using Nu HR MC-ICP-MS at CSIR-NGRI, using pseudo high resolution with a resolution power of >4500 and the standard-sample bracketing technique. The IRMM014 standard yielded a precision of ±0.085 ‰ (1 σ). The external precisions on the analyzed samples are within ±0.1 ‰ (1 σ). The geostandards IF-G and BCR-2 analyzed yielded accurate δ^{56}Fe values of 0.65±0.08 ‰ and 0.05±0.07 ‰.

The parent granite sample has a δ^{56}Fe value of 0.03 ‰. All the paleosols have wide-ranging positive values from 0.23 to 0.85 ‰ (Fig. 1). The paleosol samples from the top of the profile belonging to the sericite zone show the highest δ^{56}Fe values. Those close to parent granite in the lower chlorite zone have moderate enrichment in ^{56}Fe. Remarkably, the stratigraphically equivalent and basalt-derived 2.45 Ga Cooper Lake paleosol profile also shows a similar pattern of ^{56}Fe isotope enrichment in the upper sericite zone. The Fe contents in granite-derived paleosols do not help derive information about the Fe retention on an isovolumetric basis because of low concentrations and parent rock heterogeneity; the δ^{56}Fe values are very effective in deducing the redox conditions.



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