

Complex homogenization of the silicate Earth constrained by ^{182}W and ^{142}Nd isotopes in the earliest rock record of the São Francisco Craton, eastern Brazil

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To study the geological processes that operated on early Earth, the application of short-lived radiogenic isotope (e.g. ^{182}W , ^{142}Nd) variations in Archean cratons has increased rapidly in the last decade mainly due to the improvement in analytical protocols, which enable precise measurements down to the lower ppm range. Recently, negative $\mu^{142}\text{Nd}$ compositions were identified in a mobile belt at the border of the São Francisco Craton (SFC; Brazil) [1] indicating the presence of a Hadean/Archean enriched source reservoir, which however contrasts with previously reported non-anomalous $\mu^{142}\text{Nd}$ values of Archean rocks that are within the SFC boundary [2].

In order to unravel this inconsistency, $\mu^{142}\text{Nd}$ and $\mu^{182}\text{W}$ data were acquired in combination with long-lived ^{143}Nd and ^{176}Hf isotopes, from a set of Eo- to Paleoarchean amphibolites, TTG gneisses, granites and a gabbroic rock from different geological units in the northern segment of the SFC. Rocks from the SFC provide a vestige of Hadean and early Archean geodynamic processes, especially regarding the homogenization rate of the silicate Earth via a globally convective mantle. We identified the presence of a long-lasting depleted Hadean component preserved in Archean rocks of the SFC for at least 1.2 Ga, which is characterized by excesses in $\mu^{182}\text{W}$ values, whereas all samples depict $\mu^{142}\text{Nd}$ values similar to that of the modern upper mantle. Interpretations for the positive $\mu^{182}\text{W}$ values range from a disproportional later addition of meteoritic material to the Earth and/or early silicate differentiation and inefficient mixing on a yet not fully convective Earth. The combination of $\mu^{182}\text{W}$ and $\mu^{142}\text{Nd}$ provides additional information for the modeling and interpretation of the processes that operated in the early Earth for another major, yet understudied Archean craton.

[1] Garcia et al. 2023 (GPL); [2] Wainright et al. 2018