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Insights into early mantle processes from coupled ^{182}W-^{142}Nd isotope systematics of igneous rocks from the Singhbhum Craton

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The understanding of early mantle differentiation processes on Earth as inferred from long and short-lived isotope decay series of ancient cratonic rocks remains controversial partly due to the scarcity of well-preserved, exposed rocks from Precambrian shields. Challenges related to post-emplacement metamorphism and alteration that affect the primary isotope compositions of rocks can be overcome by powerful tools such as the short-lived ^{182}Hf-^{182}W, ^{146}Sm-^{142}Nd isotope systems that only record radiogenic ingrowth within the Hadean Eon whereas younger parent/daughter fractionation no longer affects their isotope composition. However, W can be fluid-mobile in open systems hence posing a challenge in obtaining primary W abundances of ancient rocks. This can be initially tested by examination of W concentrations of rocks relative to their respective, immobile element concentrations (ratios of W/Th, W/Ta, W/Nb; [1]).

In this study, we present high-precision measurements of ^{182}W/^{184}W and ^{142}Nd/^{144}Nd isotope compositions via MC-ICP-MS ([2], [3]) of ultramafic, mafic and felsic rocks from the Singhbhum Craton, India. On a global perspective, the Singhbhum rocks are not well characterized in terms of multi-dimensional short-lived isotopic data (e.g., [4]). The emplacement ages of rock samples collected from different parts of the craton range from 3.5 to 1.6 Ga, covering spatial and temporal heterogeneities. Due to the susceptibility of W to second-stage fluid-rock interactions, the rock samples that were chosen for our study were initially tested for mobility of W by trace element measurements using ICP-MS with a focus on precise High Field Strength Element concentrations (<6% uncertainty). These samples generally have mantle-like canonical values and TTGs have canonical to sub-canonical values (W/Th = 0.04-0.24; [1]), thereby ensuring to analyse only these samples that carry pristine ^{182}W isotope compositions. This dataset can give first-hand evidence on early mantle differentiation of the Singhbhum Craton and insights on mantle heterogeneity and contributions of late veneer.

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[3] Hasenstab-Dübeler et al. (2022), **Chem. Geo.** *614*
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