

Ruthenium isotope evidence for missing late accretion component in the Singhbhum Craton (India) mantle source

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Komatiites from the Singhbhum Craton are characterized by low highly siderophile element (HSE) contents [1], similar to those observed for other Archean komatiites [2]. In the case of Singhbhum, it was suggested that the low HSE contents of the komatiites may not necessarily relate to an HSE-depleted mantle source but instead could be attributed to melting effects from a primitive mantle-like source that is not depleted in HSE [1,3]. Here, we investigate the ruthenium (Ru) isotope composition of 3.5 Ga old ultramafic rocks from the Singhbhum Craton to assess the HSE inventory of their mantle source.

Ruthenium isotopes are a powerful tool for identifying mantle domains that have not received the full complement of late accreted material [4]. This is because the inventory of Ru isotopes on Earth consists of two fractions: one derives from the material added during late accretion, and the other reflects the Earth's mantle composition before the addition of late accreted material. Mantle sources that fully equilibrated with the late accretion component would be indistinguishable from the Ru isotope composition of the modern mantle (with $\epsilon^{100}\text{Ru}=0$). The pre-late veneer Ru isotope composition is distinct from that of the modern mantle and was identified by ^{100}Ru isotope excesses in early Archean ultramafic rocks from SW Greenland [4].

The Ru isotopes of Singhbhum samples display a ^{100}Ru isotope excess of $\epsilon^{100}\text{Ru}=+0.08\pm0.04$ (95% confidence interval) compared to the composition of the modern mantle. The $\epsilon^{100}\text{Ru}$ isotope excess indicates that the Singhbhum mantle source contains a preserved isotopic signature from the pre-late veneer mantle because at 3.5 Ga, it did not yet receive the full complement of late accreted material. This is consistent with low HSE contents observed for Archean komatiites with missing late accretion components in their mantle sources [2].

[1] Zhou et al. (2024) GCA, **390**, 211-231. [2] Maier et al. (2009) Nature, **460**, 620-623. [3] Waterton et al. (2021) GCA, **313**, 214-242. [4] Fischer-Gödde et al. (2020), Nature, **579**, 240-244.