Highly siderophile element and Re-Os isotope compositions of the 3.5 Ga Tomka Iron Formation, Daitari Greenstone Belt, India

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Banded iron formations (BIFs) are Precambrian sedimentary rocks that are the product of chemical precipitation from seawater diagenetic, and metamorphic processes. Their abundance reach a maximum at around 2.4 Ga and appear to correlate with the Paleoproterozoic rise of atmospheric oxygen (Great Oxidation Event) with the subsequent change from anoxic to oxic conditions in the shallow parts of the ancient oceans. BIFs may thus represent robust archives, traced by rare earth elements and Yttrium (REY) and the Sm-Nd isotope system (Viehmann et al. 2015b) for the physico-chemical evolution of early Earth's atmosphere and oceans.

Following earlier studies that applied the redox-sensitive highly siderophile element (HSE) abundances and the Re-Os isotopes system to the Neoarchean Temagami BIF (Schulz et al. 2021) and the Neoproterozoic Urucum BIF ((Prost 2023), we investigate the application of these geochemical tools to a BIF of the Paleoarchean Daitari Greenstone Belt, Singhbhum Craton, India. This multiproxy approach has the potential to record the influence of different source contributions to the BIF forming seawater column (i.e., continental vs. hydrothermal vs. possibly meteoritic). Analyses were conducted using the laboratory and thermal ionization mass spectrometry facilities at the GeoIsotope Core Facility of the Department of Lithospheric Research at the University of Vienna and (for isotope dilution concentration measurements of selected HSEs) in cooperation with the mass spectrometry facilities at the Freie Universität Berlin.

The Tomka, as well as any other, BIF can only serve as a geochemical seawater archive if devoid of detrital contamination and pristine (i.e., devoid of diagenetic, metamorphic, and hydrothermal overprints). The Tomka BIF is a promising candidate to preserve primary seawater signatures, because it was only subjected to greenschist-facies metamorphism, whereas other old iron formations (e.g., Isua BIF) almost exclusively underwent higher grade metamorphism (Nutman et al. 2017; Jodder et al. 2023).

A comparison between literature data for immobile elements such as Zr, and fluid mobile elements, such as Sr (Bau & Möller, 1993; Kamber et al. 2004; Viehmann et al. 2015a, 2016), in combination with the $^{187}Os/^{188}Os$ ratios reported in this study for the Daitari BIF layers (chert-, magnetite- and mineralogically mixed layers) might indicate only minor syn- and postdepositional disturbances. Accordingly, most of the analyzed samples have a weak linear correlation in the $^{187}Os/^{188}Os$ vs. $^{187}Re/^{188}Os$ diagram and scatter around a ~3.5 Ga reference isochron. The $^{187}Os/^{188}Os$ ratios range from mantle-like values of ~0.14 to more radiogenic values up to ~0.41 (which is still significantly less radiogenic than the present-day upper continental crust with a value of ~1.4; Peucker-Ehrenbrink & Jahn 2001). Iridium

contents of the analyzed samples are exclusively crust-like at ~0.03 ppb, thus excluding any extraterrestrial component, while Os concentrations (mostly ranging between 0.1 and 0.3 ppb) can be as high as 1 ppb. More data, including Pt, Ru and Pd concentrations, will be presented at the conference.

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