

Spectroscopic observation of native Iron in Late Proterozoic Chaibasa shale, Singhbhum Group, Eastern India

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The origin of native iron has been the subject of much speculation and various theories have been proposed for the origin of native iron ranging from meteoroid impact, deep mantle origin in the stability field of diamonds and through the chemical reaction between magma and carbonaceous. However, in India there were only two reports suggesting the probable occurrence of native iron. The first study surmised the probable existence of native iron in newer dolerites from Singhbhum (Verma and Prasad 1975) based on the thermomagnetic properties of the sample and the other study using magnetic susceptibility and scanning electron microscopy (SEM) to characterize the shales from Chaibasa suggesting the occurrence of native iron in the Precambrian Chaibasa shales (Mazumdar, 2004; Abbt *et al.* 2006), and further they state that native iron has been formed due to the pre 1.6 Ga impact, and preserved for over 1.6 billion years, suggesting the oldest native iron found in the world. The native iron has been characterized unambiguously by measuring the binding energy of native iron Fe⁰ (707 eV) by X-ray photoelectron spectroscopy method, in the shale samples. X-ray diffraction studies reveal the strong well-resolved Bragg peaks at 2.383 (60), 2.112 (40), 2.029 (100), 2.010(100), 1.990 (50), 1.97 (50) Å indicating presence of native iron and cohenite in the sample, suggesting that the native iron is either mantle derived or formed from the ultra high-pressure impact, and supporting the impact event during the Paleo Proterozoic.

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Fe isotope compositions of 2.45 Ga Cooper Lake paleosol

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The Fe isotope compositions of paleosols – buried soils of the past can reveal the redox conditions during weathering. We present here the Fe isotope compositions of the Paleoproterozoic (2.45 Ga) Cooper Lake paleosol developed on the tholeiitic basalt belonging to the Thessalon Formation of the Huronian Supergroup. Utsunomiya *et al.* (2003) have earlier shown that the Fe(II), Fe(III) variations in this paleosol profile indicate anoxic weathering. The paleosol samples of both chlorite and sericite zone have $\delta^{56}\text{Fe}$ values ranging from 0.39 to 0.68 ‰ (IRMM 014) being enriched in ⁵⁶Fe when compared to the parent rock that has a value of 0.30 ‰. The $\delta^{56}\text{Fe}$ values of the Cooper Lake paleosol samples show a good correlation with the retention fraction of Fe (Fe_R) in each of these samples calculated on the isovolumetric basis using Ti contents (Fig. 1). The progressive enrichment in $\delta^{56}\text{Fe}$ values from bottom to top of the profile indicate that lighter isotopes have left the system during anoxic weathering leading to the enrichment of heavy one in paleosol samples. Also large spread in $\delta^{56}\text{Fe}$ values suggests that substantial amount of Fe must have been lost corroborating the Fe_R value of 0.4 obtained for this paleosol. Further, the $\delta^{56}\text{Fe}$ values of sericite and chlorite zone of the Cooper Lake profile are similar to those of the Late Archean Mt. Roe paleosol samples.

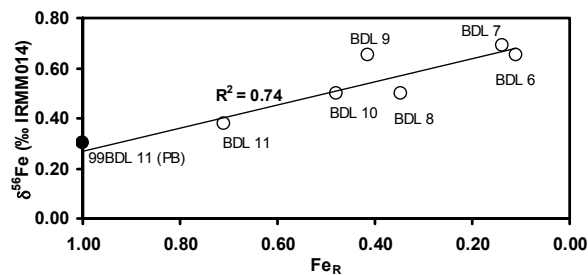


Figure 1: $\delta^{56}\text{Fe}$ vs. retention fractions of Fe.

[1] Utsunomiya, S., Murakami, T., Nakama, M., Kasada, T. (2003) *Geochim. Cosmochim. Acta* **67**, 213-221.