Nd isotope geochemistry of Archaean Banded Iron Formations in the Chitradurga Schist Belt, Dharwar Craton Southern India.

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Banded iron formations (BIFs) are chemically deposited sediments mainly composed of quartz and iron minerals and preserve geochemical signatures of seawater. We have studied the geochemical characteristics of c. 3.0 Ga BIFs in the Chitradurga schist belt, Dharwar craton, Southern India. This region exposes the Archaean strata predominated by supracrustal greenstone belts, stratigraphically overlying the tonalitic Peninsular gneiss. Peninsular gneiss (~3.0Ga) with enclaves of Sargur group (3.3–3.1Ga) forms the basement, which is overlain by Dharwar supergroup. Dharwar supergroup is subdivided into lower Bababudan group and upper Chitradurga group. The depositional age of Bababudan group and lowest Chitradurga group is estimated to be c. 3.14 Ga and 3.22–2.92 Ga, respectively, whereas the depositional age of middle and upper Chitradurga group are considered to be around 2.68 Ga and 2.63 Ga (Hokada et al., 2013). Three important BIF layers are distributed in the Bababudan and Chitradurga groups. The BIF layer in the stratigraphically lowest horizon is named as BIF I, the middle one is BIF II and the upper is BIF III. The BIF II layer is the most prominent iron formation in the schist belt and can be traced to about 30 km along its strike. In this study we present geochemical characteristics and strontium and neodymium isotope results of BIF II exposed in the south of Vanivilas-sagar Dam. Moreover, we compare the results with other BIFs layers in the north of the Vanivilas-sagar Dam and also with the isotopic characteristics of metabasalts exposed near the BIFs.

Mineralogically the Chitradurga BIFs are mostly composed of quartz, magnetite and hematite and rarely contain carbonates. They contain very low content of Al₂O₃ (<1wt.%.) indicating less detrital components. The PAAS-normalized REY patterns show positive La and Eu anomaly, depletion in light rare earth elements (LREEs) relative to heavy rare earth elements (HREEs). These characteristics are similar to widely reported Archaean BIFs from South Africa and Australia, except lack of positive Y anomaly. The large positive Eu anomalies in BIFs in the Chitradurga schist belt attribute to high temperature hydrothermal fluid fluxes (>250°C), while the lack of negative Ce anomalies reflect absence of oxidizing condition. Initial Sr isotopic ratios of BIFs have variations which suggest post depositional alterations, whereas Nd isotope compositions gave consistent primary values. Most of the samples show $\varepsilon$Nd(3.0Ga) in the range between +2 to +4 and $T_{DM}$ model age of Nd are equivalent to inferred sedimentation age around 3.0Ga. The $\varepsilon$Nd(3.0Ga) of depleted mantle is about +4, which suggests that most of the Chitradurga BIFs were deposited in an environment strongly affected by the input from a depleted mantle. However some samples have different REY pattern and high $\varepsilon$Nd(3.0Ga) between +6 and +14. Their $T_{DM}$ model ages are not in accordance with the depositional age. We discuss these results in the presentation and propose that the BIFs in the Chitradurga schist belt were deposited very close to ridges and hydrothermally active.

References
Hokada, T., Horiea, K., Satish-Kumar, M., Ueno, Y., Nasheethe, A., Mishimad, K., Mishima, K., Shiraiishi, K., 2013 An appraisal of Archaean supracrustal sequences in Chitradurga Schist Belt, Western Dharwar Craton, Southern India. Precambrian Research 227, 99-119

Fig.1 Nd isotope ratio of Chitradurga BIFs in comparison with other worldwide occurrence (Alexander et al., 2009)