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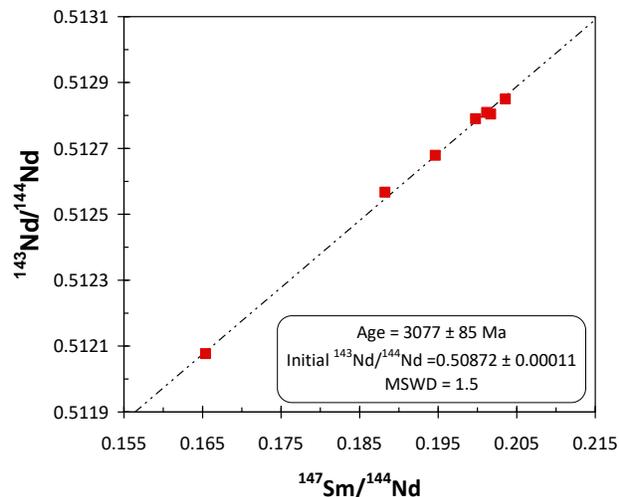
Evidence for Mesoarchean magmatism in the Dharwar craton from Sm-Nd isotope studies on mafic metavolcanic rocks of the Chitradurga greenstone belt, India

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Determining the age of mafic volcanic rocks in greenstone belts is important for correlation of geological events between various greenstone belts in a given craton and across cratons. Although the Dharwar craton in southern India is well studied, time of formation of supracrustal rocks in different greenstone belts is not fully known. Whether the Sargur Group is distinctly older than the Dharwar Supergroup or forms a continuum is debated. Furthermore, relative stratigraphic position of mafic metavolcanic rocks in the Chitradurga greenstone belt is ambiguous. Chadwick et al. [1] included the mafic metavolcanics occurring below the Banded Iron Formation (BIF-I) and those occurring between BIF-I and BIF-II in the Bababudan Group whereas, a Sm-Nd isochron age of 2.74 Ga [2] on whole-rock samples of mafic metavolcanics, meta-andesites and rhyolites places it in the younger Chitradurga Group. To resolve this, geochemical and Sm-Nd isotopic studies were carried out on the mafic meta-volcanic rocks occurring below BIF-II in the Chitradurga greenstone belt.



Fourteen metavolcanic rock samples were collected of which stratigraphically five are below and two are above BIF I [1]; these are considered to be part of the Bababudan Group (Jogimaradi). Five metavolcanic rock samples were collected between BIF II and BIF III and two samples above the BIF III band belong to the Hiriyr Formation of the Chitradurga Group were also collected. The metavolcanic rocks are mostly foliated, exhibit pillow structures and preserve relict textures. The mineral assemblage of hornblende, actinolite, plagioclase and quartz indicates greenschist facies metamorphism.

Figure 1: Sm-Nd isochron for seven mafic meta-volcanic rocks of Chitradurga greenstone belt of the Dharwar Craton

The Rb-Sr isotope system has been disturbed and partly reset in these samples possibly due to low temperature alteration and metamorphism of these rocks. Seven Jogimaradi metavolcanic rock samples define a positive co-linear array (Figure 1) whose slope corresponds to an age of 3077 ± 85 Ma, (MSWD=1.5) with a $^{143}\text{Nd}/^{144}\text{Nd}$ initial ratio of 0.50872 (ϵ_{Nd} value = +1.57). There is no correlation observed between $^{143}\text{Nd}/^{144}\text{Nd}$ and $1/\text{Nd}$ ruling out the possibility of the isochron being a mixing line. The metavolcanic samples from the younger, Hiriyr Formation, however, do not yield a meaningful

isochron due to large scatter of the data. The Sm-Nd isochron age of 3077 ± 85 Ma represents the time of igneous crystallization of the Jogimaradi metabasalts. This age is similar to the Sm-Nd age of 2911 ± 49 Ma reported for metabasalts from the lower Kalasapura Formation, the oldest Formation in the Bababudan greenstone belt by Kumar et al. [2] and agrees well with the grouping of these rocks as part of the Bababudan Group in the Chitradurga greenstone belt by Chadwick et al. [1]. Mesoproterozoic mafic magmatism appears to be widespread in the western Dharwar craton as also in other cratons of the world, such as, the Pongola Supergroup of the Kaapvaal craton.

References:

[1] Chadwick B et al. (1981) Precambrian Res 16: 31-54

[2] Kumar A et al. (1996) Precambrian Res 80: 205-216

