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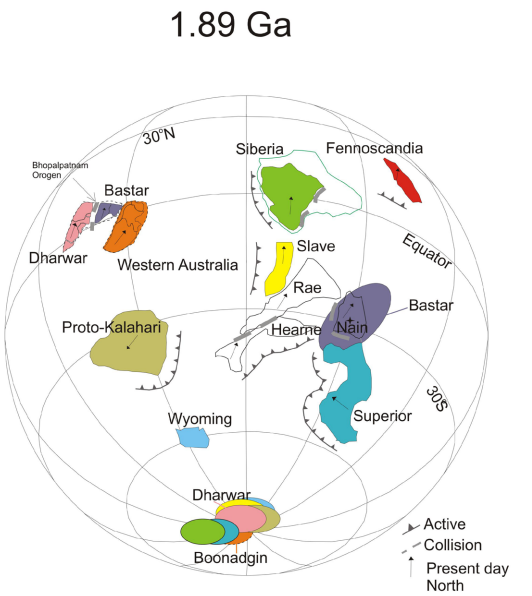
Was India part of Columbia? Reassessment from paleomagnetic and new chronological data

SHREYA MUKHERJEE AND RAVIKANT VADLAMANI
Indian Institute of Technology Kharagpur
Presenting Author: anuranan.sm@gmail.com

The position of Indic cratons within Columbia supercontinent is based on Paleoproterozoic age for the Central Indian Tectonic Zone inferred due to sequential amalgamation of the Bundelkhand and Bastar craton (BC) and Dharwar cratons. Furthermore, proximity of the BC and the Eastern Dharwar Craton (EDC), being part of the South Indian Block (SIB) along with the Singhbhum craton, was inferred based on interpreting widespread ~1.9 Ga dyke swarms from these cratons as cogenetic and feeder dykes to a Large Igneous Province (LIP). In extant paleomagnetic studies, the paleopole measured from individual dyke sets within a craton (EDC or BC) were considered representative of the whole SIB, and potential orogenic belts between SIB component cratons are not recognized. Thus paleogeographic reconstructions of the Bundelkhand and SIB component fragments in earlier studies (Fig. 1) are based on paleopoles measured from the Keskal dyke swarm in central BC and from EDC assuming that all SIB components assembled by Late Neoarchean or Paleroproterozoic time. This resulted in paleopoles from ~1.9 Ga mafic dyke swarm sets placing the SIB cratons near 30^{o}N at ~1.9 Ga [1] as opposed to these cratons assembled at equatorial position at ~1.88 Ga [1, 2].

We collate this paleomagnetic information and our geochronology from the Mesoproterozoic Bhopalpatnam orogen to infer that LIP need not represent cogenetic magmatism but could represent coeval global Paleoproterozoic breakout magmatism [1, 2] on several cratonic fragments and therefore not uniquely define an amalgamated supercontinent Columbia by 1.88-1.86 Ga. The refined petrochronological constraints on amalgamation between BC and EDC at ~1.7 Ga [5], therefore, defines collision to have post-dated the inferred LIP and also post-dates the accepted Columbia amalgamation time interval between 2.1-1.8 Ga. Thus, our chronological data indicate that BC and EDC were assembled only by early Mesoproterozoic time and supports largely independently drifting cratons separated by oceans at ca. 1.89 Ga and is in consistent with results of the earlier studies [6].

[1] Liu et al., 2019 PR, 329, 211-223 [2] Parshuramulu et al., 2021 Tectonophysics, 805, 228789 [5] Mukherjee et al., 2019 Lithos, 350, 105247 [6] Bhowmik et al., 2019 GJ, 54(5), 2912-2934



Paleopole reconstruction of Bastar (Keshkal dyke swarm 1.9 Ga) after Meert et al. 2011
Paleopole reconstruction of other cratons after Liu 2019 and Parshumarulu et al. 2021
Paleopole reconstruction on Boonadgin dyke swarm sets, Yilgarn Craton, Western Australia correlated Eastern Dharwar and Bastar cratons at 1.88 Ga (Shellnut et al., 2018)