

BIRBAL SAHNI AND INDIA – MADAGASCAR FIT

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Birbal Sahni warned us half a century back against assuming that India originally lay quite so far south as Madagascar. Current data on paleomagnetism, lithology and fossil biota uphold his penetrating insight.

The birth centenary of Birbal Sahni was celebrated in November 1991 with geologists participating in academic presentations at Allahabad¹ and Lucknow². The five seminal papers of Sahni³ that indicated 'new angles of vision for further studies' in Indian geology were, however, hardly discussed. In one⁴ of these five papers, Sahni stated: 'We are not bound to accept the details of Wegener's reconstruction of Pangaea... nor is it necessary to assume with Wegener that India originally lay quite so far south as Madagascar'.

According to Wegener⁵, Madagascar separated from India last in Cretaceous or Lower Tertiary. Even before Wegener, Suess' Gondwanaland⁶ always included part of Africa, Madagascar and the Indian Peninsula. Australia was excluded in the earlier version prior to 1901. We are coming back to a similar position through the recent analysis⁷ of fossil biota, that puts Peninsular India 'always near Asia' and 'not near Western Australia or Antarctica'.

The position of Sahni, quoted above, evolved in response to discussions in 1937 at Indian Science Congress⁸. In 1936, he did not question Wegener's Theory⁹. He explained his paleobotanical evidences by a 'sporadically interrupted' (p.329) sea-barrier as well as a 'high basaltic table land' (p 326), east of the Indian Gondwana. He assigned the role of 'a resistant pivot' (p. 324) to Assam promontory of Gondwanaland in any drift. In 1937, he pointed out that the majority of rivers in northeast India are 'strike rivers' as a consequence¹⁰. Opposition to drift was voiced then by L. Ramarao and A.K. Dey¹¹. Even the session President, W.D. West¹², held it 'very rash' to put India adjacent to South Africa and Madagascar.

Before taking up Sahni's paleogeographic suggestion on India, let us recall that the present latitudes of Indian Gondwana are 16°-25° N and those of Madagascar, 12°-26° S. They are quite symmetrical with respect to present Equator, but not so *vis-à-vis* Reunion Islands, a hot plume around which is now invoked by the most favoured plate tectonic incarnation of Wegener's Theory. Reunion Islands are slightly east of Madagascar with tropical latitude,

suggesting little change in the paleolatitude of the latter. In fact, Du Toit¹³ placed the limit of Gondwana ice 'at 22° S in Madagascar'.

The most favoured reconstruction again shows Madagascar opposite southern Somalia, Kenya and Tanzania¹⁴. This requires 'transcurrent motion' between India and Madagascar¹⁵. Recently, a 'counterclockwise rotation' of Africa relative to India in Late Permian and Early Triassic has been envisaged¹⁶. To what extent this affected India-Madagascar fit is yet to be worked out, as possibilities of 'differential rates' as well as reversals of direction in space and time are implied by the present author¹⁷ for such rotation.

New paleomagnetic evidences¹⁸ indicate India drifting in Carboniferous away from its 'long-occupied equatorial position'. Tropical latitude for India even in Paleogene and Neogene has been highlighted on paleobotanical evidence¹⁹. Earlier, in Mesozoic we find²⁰ Kashmir at 22° S with East Coast facing Antarctica, as visualised by the present author²¹ as well. For Devonian to Carboniferous, again, Kashmir is placed at 23° S on the evidence of arborescent lycopods, etc.²² The misfit with Sahni views is articulated recently by workers from Birbal Sahni Institute of Paleobotany²³. From the evidence of spora-dispersae they placed India in a far southern position of 50°-70° S in Permo-Carboniferous, 40° S in Upper Permian and 60°-30° S in Triassic. Was then the paleolatitude of Madagascar more southern?

From phytogeographic evidence, O. Hankel²⁴ considers Madagascar placed 'too far to north' in the most favoured reconstruction. He suggests an alternative fit opposite the present southeast Kenya, Tanzania and northern Mozambique, a shift from 9° S to 18° S. Paleolatitudes envisaged are, however, much higher (p.38) with the minimum at 30° S. Drunning Maud land of Antarctica is placed (p. 35) close to Mozambique. Our Dakshin Gangotri samples (A. Joshi of GSI – personal communication) recall Madagascar, not India.

Hankel relies most on Dolly and Balme phytogeographic model, worked out in Australia, in his reconstructions. This model invokes two types of palynofloras (p. 38): 'Onslow' and 'Ipswich'. The former in northwestern Australia contains a mixed association of Gondwana and European forms, while the latter of southern and eastern Australia lacks the European taxa. 'Ipswich' situation obtains in New Zealand, Antarctica and Argentina. 'Onslow' is found in northern Madagascar, Tanzania and Rewa, India. No reversal in latitude is thereby implied nor any plate boundary envisaged between the 'Onslow' and the 'Ipswich'. Thus, Madagascar in terms of Triassic paleolatitude is found only slightly south of, and close to, the Rewa tip of Peninsular India, lying in the 'mid-latitudinal belt' (p. 39) that extended from northwest Australia to southern Tanzania.

All these bear out the current vitality of the Sahni vision and doubt, articulated way back in the thirties, on the India-Madagascar fit.

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