A refined model for Gondwana dispersal and its consequences for the evolution of India's passive margins

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Evidence from marine magnetic anomalies is fragmentary in the Indian Ocean and totally absent for the Cretaceous Normal Superchron (KNS), 84-120 Ma. Meanwhile, evidence of transforms and fault zones from ocean-floor topography is, since 1997, more complete. Using all this evidence to constrain a geometrically correct animation of Gondwana dispersal, free from jerky or discontinuous movements and avoiding the destruction of any new oceanic crust once created, produces a quantified model of continental movements that may yet be further refined but which leaves little room for fundamental changes or inconsistencies (Reeves, 2009, and references therein).

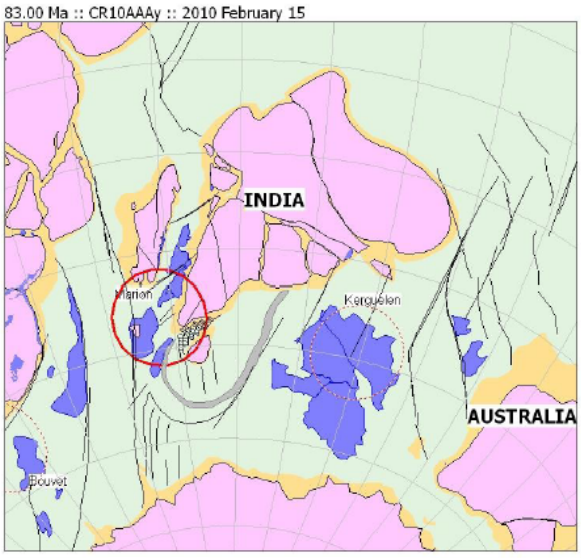

***Figure 1**. India at about 10 million years after the outbreak of the Marion mantle plume, starting its northward journey.*

Retracing major transforms indicates that India started going north from a position

well south of Madagascar. Evidence of Madagascar's trajectory with respect to Africa is not consistent with East Gondwana remaining as one intact fragment until the outbreak of the Kerguelen mantle plume and the separation of Greater India from Australia-Antarctica at ~130 Ma. These two observations are reconciled by prolonged dextral strike-slip between India and Madagascar in the Jurassic and early Cretaceous. In the original Gondwana reassembly, India's present passive margins are conjugate with no less than seven other fragments, namely: The Seychelles, Madagascar, Madagascar Rise, Sri Lanka, Antarctica, Kerguelen and Australia. The tectonic history that has been worked out in building the animation indicates that the timing and method of departure of each of these partners has led to distinct stories for each of the seven stretches of conjugate Indian coastline.

On the west coast, we propose the prolonged development of a rift between Madagascar and India that could have accumulated sediment from mid-Jurassic times until the eruption of the Marion mantle plume at ~93 Ma. The new crust grown in this process is now distributed between Madagascar (mostly in the Madagascar Rise), the Mascarene plateaus and India's wide western continental shelf. The stratigraphy has been obscured by the subsequent outbreak of the Reunion mantle plume (Deccan Traps, ~65 Ma) and its southward tracking offshore.

On the east coast, the separation of Greater India from Australia-Antarctica propagated from off West Bengal (Rajmahal Traps ~115 Ma) towards Sri Lanka, with Sri Lanka itself first 'folding out' from India and then departing from Antarctica, from evidence left in the orientation of transforms. At ~93 Ma, virtually all of the new oceanic crust of the simple mid-ridged ocean between India and Antarctica-Australia stayed with Antarctica-Australia with the exception of only the crust west and north of the 85 East Ridge which we interpret as one shoulder of a rift in pre-existing oceanic crust. Having its origin mostly after ~120 Ma (the start of the KNS), this crust should be devoid of magnetic anomalies. A new ridge, close to the NE coast of India, would also not create anomalies until Chron 34 (84 Ma, Figure 1). The growing oceanic plateau of Kerguelen could have been a land-bridge from India to Australia-Antarctica until at least ~90 Ma.

With the advent of the Cenozoic period, most of India's present coastline was established as passive margin. The rifting off of India's SW margin from the Mascarene plateaus was the last rifting event before the collision of India with Asia commenced.

References

Reeves, C.V., 2009*. Re-examining the evidence from plate-tectonics for the initiation of Africa's passive margins. Extended abstract, 'Africa' meeting, Geological Society of Houston/Petroleum Exploration Society of Great Britain, London, September 9-10, 2009. Website for ongoing research and downloading latest animation:* ***www.reeves.nl***