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Sri Lanka's Paleogeographic Evolution During the Breakup of Gondwana: Insights from Geological and Geophysical Evidence

Wasundara RAS, Samaranayake SA¹, Wijewardane HO¹, Dahanayake U¹, Prasanna HMI², Subasinghe ND³,
Nalin De Silva⁴, Thilakarathna MP³

¹*Faculty of Applied Sciences, Rajarata University of Sri Lanka*

²*Faculty of Geomatics, Sabaragamuwa University of Sri Lanka*

³*National Institute of Fundamental Studies, Kandy*

⁴*Geological Survey and Mines Bureau, Epitamulla road, Pitakotte*

The breakup of Gondwana was a diachronous process that shaped the configuration of present-day continents through rifting and magmatism between ~200–125 Ma. Sri Lanka, situated at the junction of India, Madagascar, and Antarctica, provides a key record of this disintegration. This study integrates geological and geophysical evidence, with emphasis on ground magnetic surveys, magnetic susceptibility measurements, structural mapping, and theoretical modeling of dolerite dykes within the Vijayan Complex. Dolerite dykes in Sri Lanka, trending predominantly NNW–SSE, exhibit high magnetic susceptibility values (average ~40 SI) compared to surrounding country rocks (<15 SI). Magnetic anomalies reveal strong remnant components, with consistent signatures across dykes suggesting synchronous emplacement under a stable geomagnetic field. No polarity reversals were observed, reinforcing rotational rather than polarity-change models of continental movement. Forward modeling indicates Sri Lanka was positioned near 50°S during dyke emplacement and experienced a clockwise rotation of ~154°–156° relative to its present orientation. Chronologically, these magmatic events (160–170 Ma) correlate with Karoo (~180 Ma) and Ferrar (~176 Ma) magmatism, as well as dyke swarms in Heimefrontfjella (~165 Ma) and Rajmahal Traps (~125–130 Ma). The results confirm that Sri Lanka was not merely attached to the southern tip of India, as traditionally assumed, but likely aligned with its eastern margin. This reconfiguration better explains both geological correlations and magnetic data. The unique magnetic signatures of Sri Lankan dykes provide critical constraints for Gondwana reconstruction models, underscoring the island's pivotal role in linking Africa, India, Madagascar, and Antarctica during the supercontinent's fragmentation.

Keywords: Gondwana Reconstruction, Sri Lanka, India, Madagascar, Antarctica, Vijayan Complex, Magnetic