Paper Number: 966

Rift architecture and evolution of the Eastern Continental Margin of India – role of the intra-continental shear zones on style of rifting of the Indian subcontinent

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The Eastern Continental Margin of India (ECMI), a classical passive margin evolved after break-up of the Indian landmass from the East Antarctica during the Early Cretaceous period. Anomalous thick pre- and post-collisional sediments and absence of cohesive spreading-type magnetic anomalies in the Bay of Bengal prevented the delineation of rift-structure and age assignment to the commencement of the seafloor spreading activity between India and East Antarctica. Further, lack of lithological and geo-chronological information and good-quality seismic reflection profile data on the margin led the magnetic and gravity data to put forward several tectonic models for the rift initiation, style and evolution of the ECMI. Here, we analysed long-streamer seismic reflection data of the margin and correlated to deep-water drill well information to infer the buried rift architecture and stratigraphy along the ECMI. Based on the structural pattern, it is interpreted that the southern segment in the vicinity of the Cauvery Basin consists of steep continental shelf associated with few major normal faults, which indicates that the segment break-up was initiated in transform motion and eventually evolved as mix of shear and rifted margin. The central segment off southern part of the Krishna-Godavari Basin is controlled by a series of enechelon fault-bounded half-graben structures and presence of thinned continental crust over the exhumed mantle body reveals that the segment was formed by hyper-rifting process. While the northern segment that extends up to the Mahanadi Basin shows relatively less gradient continental slope with a few major faults, suggesting that the segment was evolved by hypo-extended process. Variable crustal architecture and basement topography of the ECMI unravel that each segment of the margin was bounded by intra-continental shear zones and evolved during a specific rift process. Breakup unconformity, an indicator for completion of rift process between India and East Antarctica is clearly mapped on hyper- and hypo-extended margin segments. On correlation of paleo rift structures with Indian Shield's geology, it is found that rheology of stable cratonic blocks and bordering Gondwana shear zones may have played a role in controlling the rift process between the continental masses, India and East Antarctica.