

India during the Mesozoic: Palaeogeographic constraints and stratigraphic impasse

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Mesozoic Era represents a time span of about 185 million years in the mids of Phanerozoic, starting at 252 Ma to its close at around 66 Ma. Divided into three periods, the Triassic (c. 252-201 Ma), the Jurassic (c. 201-145 Ma) and the Cretaceous (c. 145-66 Ma), each of these represent a unique time span of earth's history. As such, Triassic is marked by major extinction events both at its beginning as well as at its end, Jurassic is characterized by the "Age of the reptiles" and Cretaceous is distinctive on account of massive Chalk deposits, an indicator of warm climate with high eustatic conditions. Faunistically, marine reptiles, ammonites and dinosaurs saw there acme with new groups of mammals and birds with unique flowering plants appeared. The end of Cretaceous is marked by the mother of all the "Mass Extinctions" – The K-T Boundary (Cretaceous-Tertiary) and can be appropriately called as "the end of an Era !"

Having written that, it is worthwhile to discuss these time-spans in terms of Indian stratigraphic scenario vis-à-vis the palaeogeographic reconstructions. The end of the Permian or the beginning of Triassic witnessed the continuation of the Pangaeon super continent till the middle Triassic time when it split into the northern Laurasia land-mass and the southern Gondwanaland.

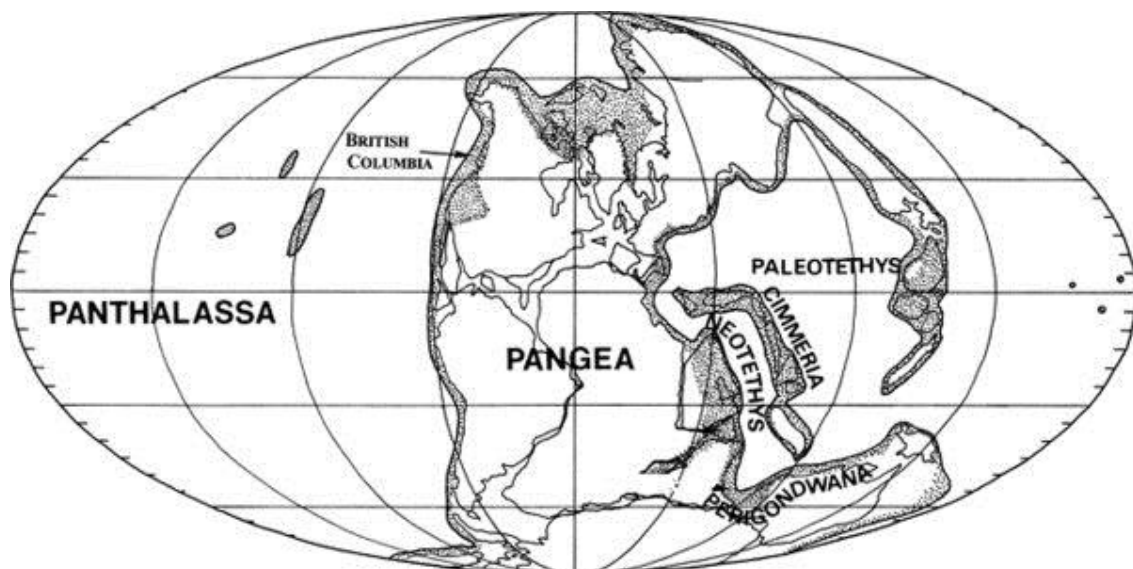


FIGURE 1. Global palaeogeography during the Permo-Triassic boundary interval (based from data in Stampfli et al., 1991, Scotese and Longford, 1995, and Kobayashi, 1999).

It is a well recorded fact that in India, the key Permo-Triassic marine deposits are developed in the Tethyan realm of Spiti valley area as well as in the salt-range region of Pakistan, the northern edge of the Indo-Australian-Arabian landmass with marine transgression in Madagascar. Nevertheless, India also witnessed the fluvial depocentres in the Gondwana basin, a rift related depression system (graben and half graben) in central Indian continental region as revealed by plant microfossils (mio-flora). By the Middle Triassic time, Indian sub-continent started splitting from its host Gondwanaland and this breaking of the marginal part and its subsequent shifting towards the north generated enough of tectonism and sea level changes. The opening of the ocean also triggered large scale flooding of the continental parts.

The early Jurassic was the time when Indian ocean opened up all along its western margin (with Madagascar as the connecting link between India and Africa) that led to the extensive deposits of sediments all along the western coast including present day off-shore Bombay High area, Kathiawar and Kachchh and continued way up in Jaisalmer in India and Indus Basin, Axial Belt and Baluchistan areas in Pakistan. In the late Jurassic times, India almost got detached with Madagascar in the west as well as with Africa. However, perhaps, it was in soft contact with Antarctica and Australia in the east (present day eastern coast). The reconstruction can be substantiated with the help of palaeobiological evidences.

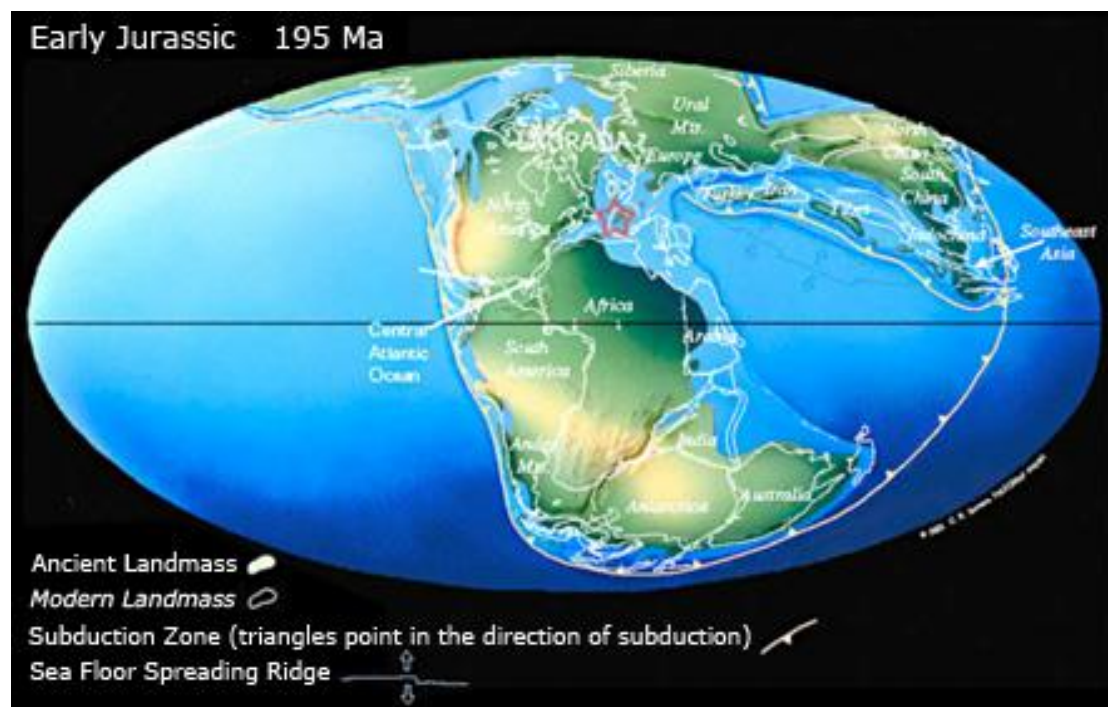


FIGURE 2. Global palaeogeography during the Early Jurassic times (After C. R. Scotese Paleomap Project).

The major tectonic detachment (complete) of India from the Gondwanaland initiated in early Cretaceous and very quickly, it started its northwards journey as a solo entity (a large island). All along the periphery of the Indian landmass, we find early Cretaceous deposits along different zones such as the Krishna-Godavari and Cauvery

basinal areas which were formed along the eastern passive, divergent, margin of the Indian craton when India split away from Australia and Antarctica in Early Cretaceous times. Similarly, we have Cambay, Barmer, Jaisalmer and Balochistan basins all along the western margin of Indian subcontinent, Another supportive evidence for this early Jurassic palaeogeography is obtained from the Rajmahal traps which are believed to have been formed from the eruptions of the [Kerguelen hot spot](#) during the early [Cretaceous](#) times. Most of the data for this time span from the northern edge of India has been buried with the Himalayan subduction and orogeny and just a few slivers in the southern Tibet and Spiti areas.



FIGURE 3. Global paleogeography during the Early Cretaceous times (After Smith et al. 1994).



FIGURE 4. Global palaeogeography during the Mid Cretaceous times (After Smith et al. 1994).

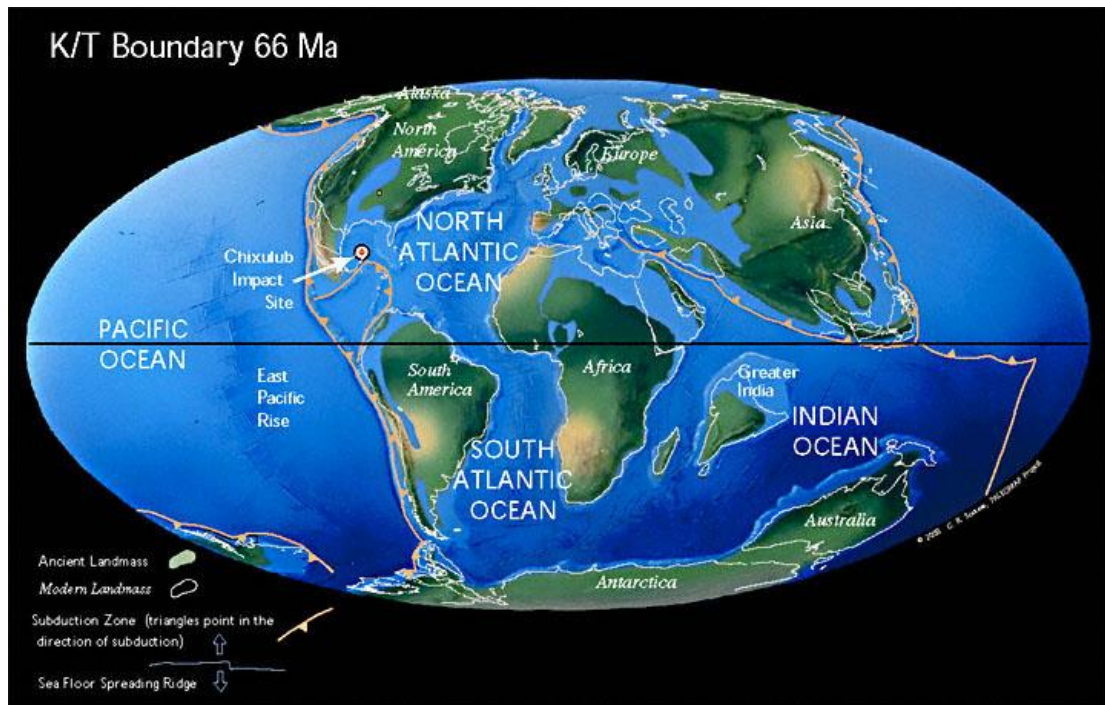


FIGURE 5. Global palaeogeography at the K-T boundary times (After C. R. Scotese Paleomap Project).

The late Cretaceous Indian subcontinent is a unique geological odyssey of this massive mass of continent which moved very quickly northwards passing over the Reunion hotspot at around 65 million years ago (the scar of this hot spot is what we call as the Deccan Basalt).

What is least understood that despite a fairly good palaeomagnetic constraint, for the K-T boundary for India's position on the globe, the geological successions of this time span at the northern margin do not substantiate the position. Some of the research contributions suggest that at the K-T boundary, the hard collision had started between Indian and Asian continental masses whereas other suggest that most of the data has been obliterated due to orogenic upheaval of the Hiamalayas. A third view further complicates the issue as that suggests that most of the northern margin with its deposits have been subducted underneath the Himalayas ! All of the last three geological postulations are far from the palaeomagnetic data ! That's the dilemma we are all in. This impasse needs to be cleared as some critical geomagnetic/ palaeogeographical/ Palaeontological/ Tectonic and Sedimentological inputs needs to be brought to a common model of acceptance as we have to use our geological acumen and wisdom to thrash out the inconsistencies. The K-T boundary reconstruction may need to be understood in the light of some new thinking where paranoid ideas ought to be discarded for ever. It may be a simple issue for the Earth but is certainly an issue with lot many questions for the Earth scientists.

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