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Research Paper

Palynofloral and geochemical evidence for Permian-Triassic transition from Talcher Coalfield, Son-Mahanadi Basin, India: Insights into age, palaeovegetation, palaeoclimate and palaeowildfire

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ABSTRACT

The Permian-Triassic (P/T) transition is marked by the most severe mass-extinction event of the Phanerozoic. Although much is known about this event in the marine realm, there are many open questions regarding what happened during this period to many continental biota. In the case of plants, a drastic mass-extinction event has even been negated by some authors. To add about the knowledge on continental biota in India during this crucial time period, the present study analysed the palynology, palynofacies, organic geochemistry (biomarkers), stable isotopes, and charcoal within the subsurface Gondwana deposits of the Kamthi Formation (late Permian-early Triassic) from core TTB-7 from the Tribida block, located in the Talcher Coalfield of the Mahanadi Basin, India.

The primary objectives are to validate the age of the strata, ascertain the palaeodepositional setting of the palaeomire, and propose palaeobotanical evidence regarding the occurrence of wildfires within this stratigraphic succession and changes in floral content across the P/T transition. The palynological study proposes two palynoassemblage zones, *Densipollenites magnicorpus* and *Klausipollenites schaubergeri,* suggesting a latest Permian (Lopingian) and early Triassic (Induan?) age for the studied succession, respectively. The age is also inferred based on correlation with coeval assemblages from India and other Gondwana continents. The palynoassemblages reveal the dominance of Glossopteridales and Coniferales along with Filicales, Lycopsidales, Equisetales, Cordaitales and Peltaspermales. The relatively higher values of the carbon preference index and terrigenous/aquatic ratio also suggest higher plant input. However, a bimodal *n*-alkane distribution pattern suggests the contribution of terrigenous and microbial sources. Although the occurrences of long-chain alkanes indicate input of higher plants, the low P_{wax} values (<0.26) suggest relatively less contribution. The P_{aq}values (≅1) and amorphous organic matter (av. 33.24%) suggest a significant macrophyte input in the studied samples, pointing to the occurrence of moderate aquatic conditions in the basin.

Furthermore, the distribution of hopanoids and the content of degraded organic matter (av. 29.96%) reflect the bacterial degradation of organic matter. Also, the $\delta^{13}C$ values of the studied section varied from −31.2‰ to −21.8‰. A large carbon isotopic offset of 9.4‰ across the P/T transition, Pr/Ph ratio (0.3–1.3) and shift in the distribution pattern of palynofacies components is indicating a significant change in climatic conditions. Moreover, the presence of macroscopic charcoal fragments of gymnospermous affinity with pre-charring colonization by fungi provides evidence for wildfire occurring during the Lopingian (Late Permian) in this basin.

1. Introduction:

The P/T transition witnessed the most severe mass-extinction event of the entire Phanerozoic with an estimated loss of up to

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