



Lower Permian Gondwana sequence of Rajhara (Daltonganj Coalfield), Damodar Basin, India: floristic and geochemical records and their implications on marine incursions and depositional environment

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Abstract Early Permian floral diversity and palaeodepositional environment of the Lower Permian Rajhara sequence of Damodar Basin have been studied based on mega-, microfossil and geochemical proxies. Even though Gondwana sediments are generally considered as fluvio-lacustrine deposits, recent studies indicate marine inundations with patchy records. Here in the present study, an attempt has been made to address the changeover from fluvial to shallow marine conditions and also to address the palaeodepositional aspects. Luxuriant vegetation during deposition of the Lower Barakar Formation

generated thick coal seams. The macroplant fossil assemblage shows Glossopteridales, Cordaitales and Equisetales comprising one palynoassemblage with the dominance of bisaccate pollen grains having glossopterid affinities. However, Lycopsids are absent in the megafossil record and are represented in megaspore assemblage. The present floral assemblage led to envisage the presence of dense forest with swampy conditions and prevalence of warm and humid climate during the deposition of Barakar sediments. Correlation with the coeval Indian assemblages and those from other Gondwanan continents also supports an Artinskian age and reveals a stronger affinity with flora of Africa than that of South America. Biomarker analysis reveals low pristane/phytane values (0.30–0.84), noticeable absence of hopanoid triterpenoids and long-chain *n*-alkanes that is attributed to the obliteration of organic compounds and subsequent alteration of composition due to thermal effect. The high chemical index of alteration, A–CN–K plot and PIA also suggest severe denudation under a warm/humid climate. The V/Al_2O_3 and P_2O_5/Al_2O_3 indicated freshwater–near-shore conditions. However, signature of possible marine influence is identified from Th/U and Sr/Ba ratios resulted from the eustatic fluctuations during Permian.

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