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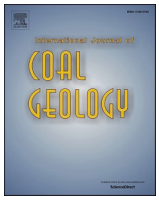

A multi-disciplinary study of the Ashoka coal-bearing succession, North Karanpura Basin, India: Palaeofloristics, petrography and geochemistry

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ABSTRACT

The coal-bearing succession associated with the Ashoka Coal Mine in the North Karanpura Basin has been studied to ascertain the palaeovegetation, palaeoecology and depositional settings. The basin contains an excellently preserved diverse plant fossil assemblage of Lower Gondwana successions. The megafossil assemblage retrieved from sediments shows rich floral diversity comprising 3 genera (*Gangamopteris, Glossopteris, Vertebraria*) and 14 species. Interestingly, one specimen features a remarkably well-preserved fructification of glossopterid affinity. The recovered palynoassemblage is dominated by palynomorphs belonging to Glossopteridales, with the domination of the *Scheuringipollenites* spp. (non-striate bisaccate pollen) and co-domination of the *Faunipollenites* (=*Protohaploxypinus*) spp. (striate bisaccate pollen). The dominance of Glossopteridales in both megafossil and microfossil assemblages suggests that warm and humid tropical conditions prevailed during deposition. While resembling the flora of the Barakar Formation in the Damodar Basin, this assemblage displays distinctive characteristics and is of Artinskian age.

The studied coal samples are constituted mainly by the inertinite group of macerals (avg. 44 vol%), followed by the vitrinite (avg. 34 vol%) group of macerals, indicating a woody origin of the organic matter. The CPI (carbon preference index) values (>1), along with the contents of collotelinite, sporinite and cutinite macerals, further confirm the significant input of higher plants to the peat. However, the appreciable amount of detro-vitrinite (avg. 9 vol%) suggests the contribution of herbaceous vegetation during peat accumulation. Moreover, the *n*-alkanes distribution reflects diverse organic matter sources. Likewise, highly non-opaque-non-biostructured and macrophyte tissue-derived amorphous organic matter indicates a significant alteration of organic matter. Further, the quantitative relationships between various petrographical indices (i.e., gelification index (0.20–3.72) vs tissue preservation index (1.44–9.12); groundwater index (0.07–6.01) vs vegetation index (1.07–4.23) advise that limno-telmatic to telmatic vegetation was deposited under dry (mainly) conditions. However, the large variations in the values of these indices also signal that conditions were repeatedly altered. Correspondingly, the dominance of the inertinite group also reinforces that the deposition occurred under relatively high oxic conditions, further supported by high Pr/Ph ratios (avg. 3.95) and substantial occurrence of opaque phytoclasts. Notably, the relatively high mineral matter contents (in some samples) indicate a sudden change in the hydrological settings (rheotrophic), which could be related to flood events during the peat accumulation. Moreover, the occurrence of framboidal pyrite and elevated sulphur content (3.65 wt%; in AKD-24) suggests that the progress of the brackish water condition in the mire was probably caused by either an alteration in the chemistry of the water or by marine incursion. Additionally, the vitrinite reflectance (VRo%) value (avg. 0.54 %) suggests that the coalification has progressed to 'Medium rank D'.

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