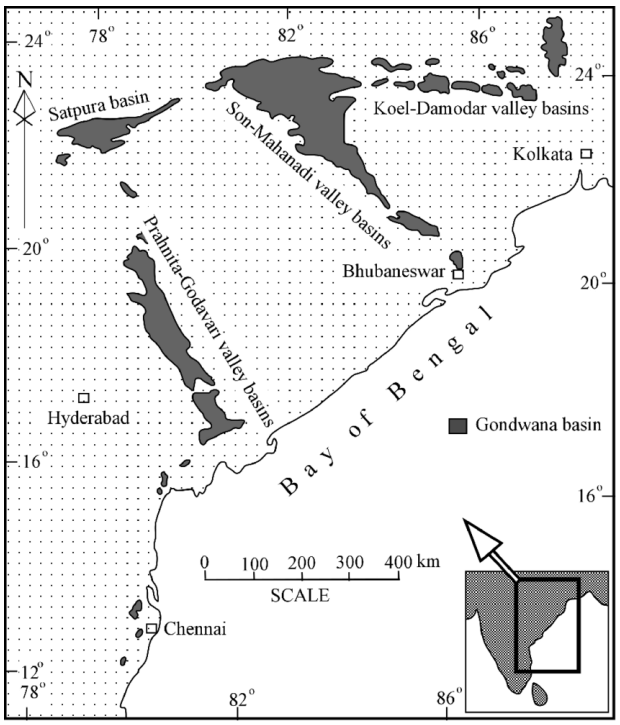
TERM PAPER REPORT

SEDIMENT FRAMEWORK IN BARAKAR FORMATION, SATPURA GONDWANA BASIN



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ABSTRACT

The Permian Barakar Formation in the Mohpani coalfield located in the Satpura Gondwana basin is composed of three lithologies. These include sandstone bodies, medium-to-fine-grained sandstone bodies, and mudstone-dominated packages. Previous interpretations suggested that the Barakar strata were formed by braided rivers and inter-channel flood basins in a continental setting. However, this study discovered signatures of tidal currents in the mudstone-dominated packages, which implies that the sedimentation was influenced by the marine environment. The study primarily focused on the mudstone-dominated sediment bodies that comprise three lithofacies bearing imprints of tidal processes during Barakar sedimentation. These lithofacies alternate within individual bodies and show cyclic variation, corroborating the spring-neap-spring (or neap-spring-neap) lunar cycle. The sandstone facies display wave-generated features, while the coal-carbonaceous shale facies indicate a supratidal marsh environment.

Key words: Gondwana basin, Permian coal measure, tidal rhythmites, tidal flat.

INTRODUCTION:

The Gondwana strata in India underwent a period of sedimentation during the Permo-Carboniferous period after a long break since the Proterozoic. The Talchir and Barakar Formations, which are part of the Indian Gondwana succession, signify the lowermost part and can be found in all basins. The Barakar Formation, known as the main source of coal in India, was formerly believed to be deposited in freshwater alluvial settings.

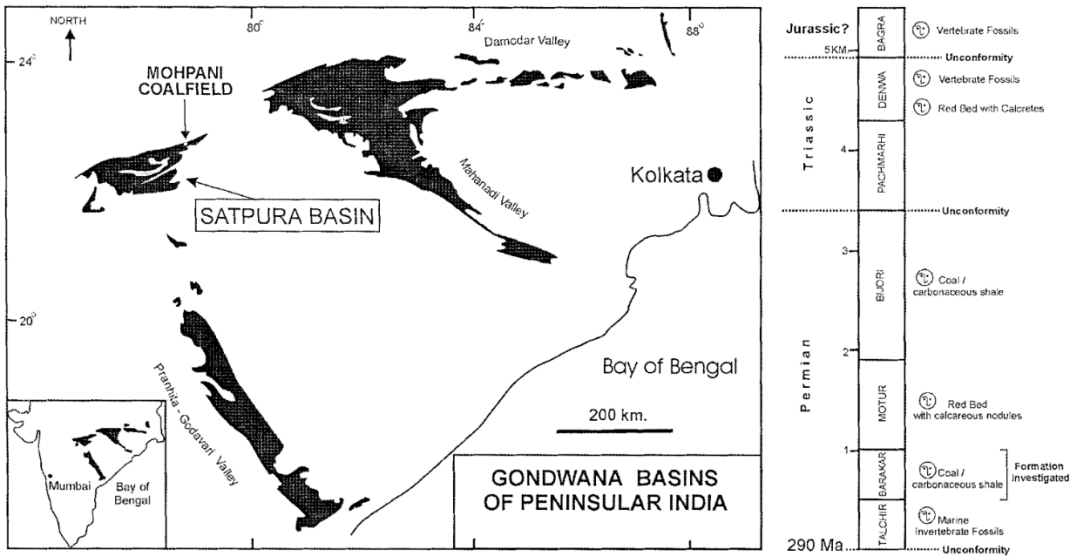

Fig .1 Disposition of the Gondwana basins of Peninsular India

Nonetheless, current research reveals the presence of marine-influenced deposits related to various coal-bearing fluvial successions, indicating that marine influence has affected the formation. This report demonstrates in detail the sedimentary features that indicate tidal-flat depositional regimes in the Barakar Formation, specifically in the Mohpani coalfield of the Satpura Gondwana basin, indicating marine influence during sedimentation. The research found signatures of tidal currents in the mudstone-dominated packages, indicating marine influence during sedimentation. The sedimentary package consisted of three lithofacies, each showing cyclic variation and alternating with one another: heterolith, sandstone, and coal-carbonaceous shale. The sandstone facies displayed wave-generated features, while the coal-carbonaceous shale facies suggested a supratidal marsh environment. These discoveries indicate that the Barakar Formation, which is the primary source of coal in India, has experienced marine influence during sedimentation. This study also highlights the geological record of tidal-flat deposits and their importance in determining marine influence during sedimentation of coal-bearing strata, which was previously unknown in the Barakar Formation.

BARAKAR SUCCESSION OF THE MOHPANI COALFIELD:

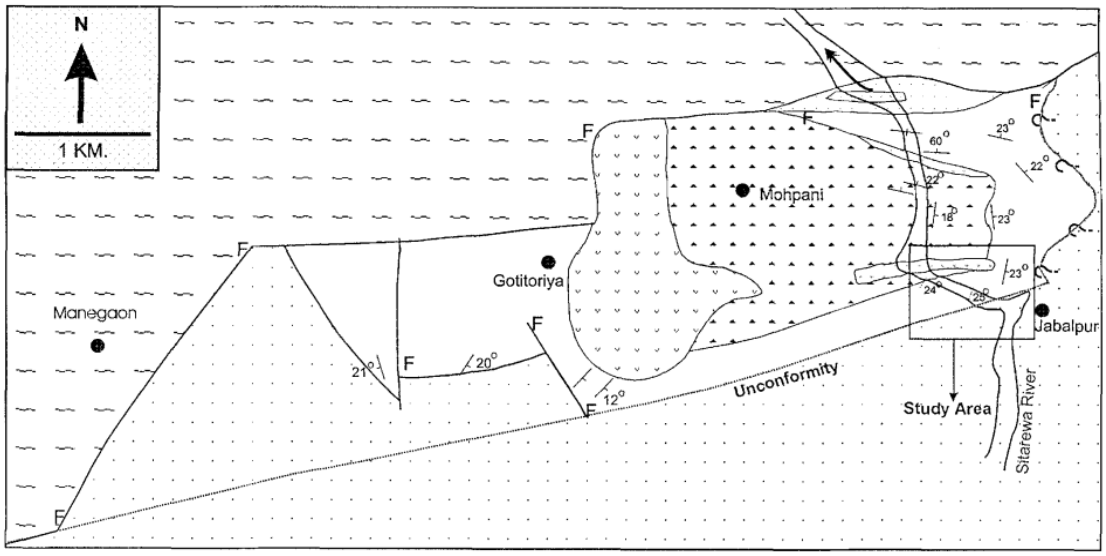

Fig .2 Geological map of the Mohpani coalfield Barakar Formation

In India's Mohpani coalfield, the Barakar succession is composed of three different lithologies: sandstone bodies with coarse to medium grains, sandstone bodies with medium to fine grains, and mudstone-dominated packages. The mudstone-dominated packages comprise three lithofacies that indicate the presence of tidal processes during sedimentation, namely heterolith, sandstone, and coal-carbonaceous shale. The lithofacies alternate within individual bodies and account for about 50%, 30%, and 20% of the succession, respectively. This study provides a detailed documentation of the sedimentary structures in the Barakar Formation and implies that marine influence played a role during sedimentation.

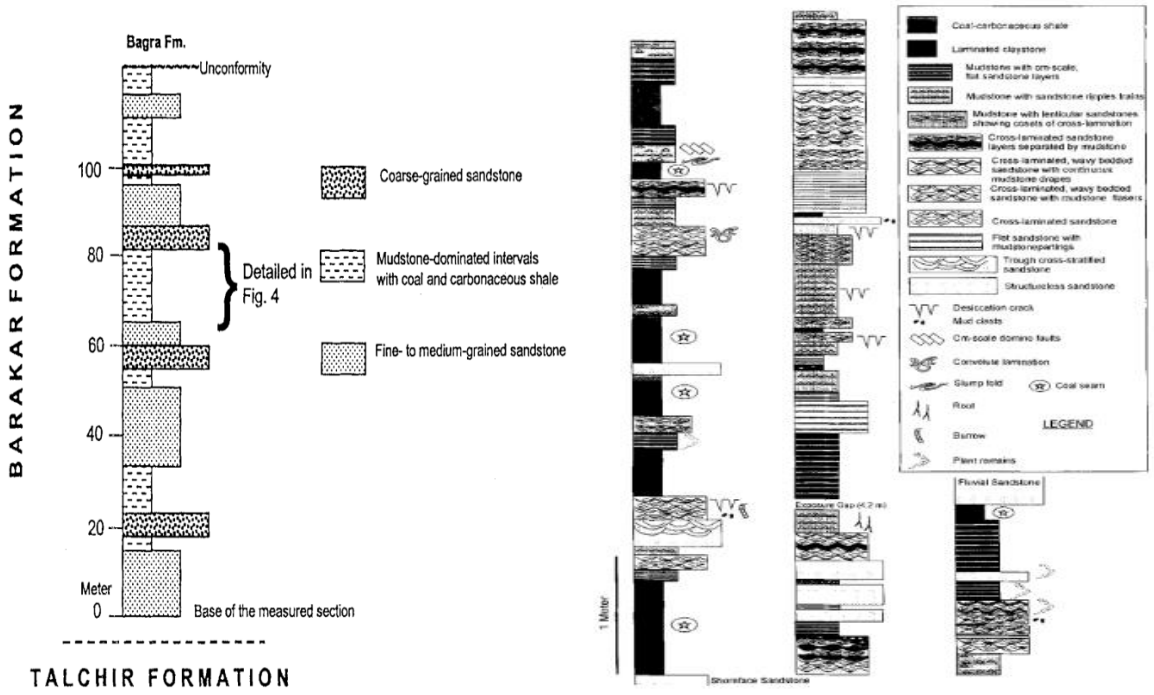

Fig .3 litholog of a mudstone-dominated intervalof the Barakar succession of the Mohpani coalfield.

LITHOFACIES 1: HETEROLITH

The Barakar Formation's heterolith facies in the Mohpani Coalfield of India comprises alternating layers of fine-sandstone and mudstone, along with desiccation cracks, plant litters, burrows, and rootlets. This facies varies in thickness and exhibits different bedding styles due to the proportion of sandstone and mudstone and their internal structure. Six sub facies have been identified, including ripple-laminated sandstone with thin, discontinuous mudstone layers, ripple cross-laminated sandstone with thin or slightly thick mudstone layers, centimetre-thick flat, massive/parallel-laminated sandstone layers, mudstone-rich packages with continuous ripple trains or isolated ripples, and mudstone-rich packages with millimetre-scale streaks of sandstone that define pinstripe stratification.

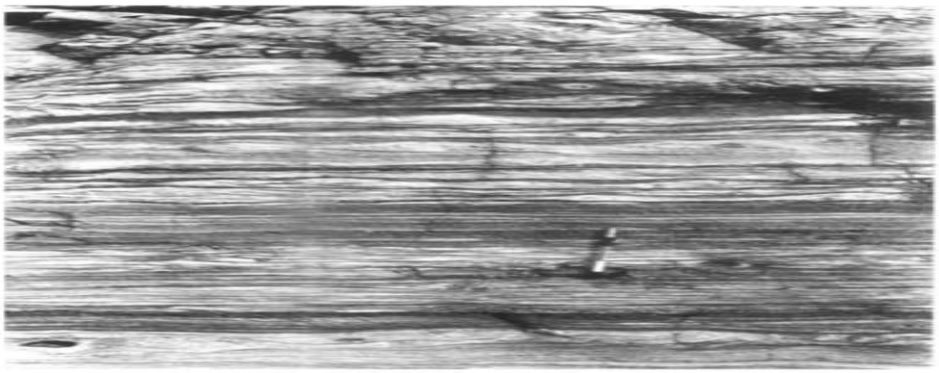

Fig .4 Heterolithic facies (lithofacies 1).

LITHOFACIES 2: SANDSTONE

in the Mohpani Coalfield's Barakar Formation is composed of predominantly fine- to medium-grained sandstone bodies, with thicknesses ranging from 0.3 m to greater than 1 m. Coarser-grained sandstone beds containing platy-mud clasts are infrequent. Cross-lamination and undulatory parallel-lamination are among the internal structures, and lamina-sets exhibit bundled and chevron upbuilding, bi-directional foreset orientations, offshooting and draping laminae, and scour-and-drape features. Some sandstone bodies have a stratification style that systematically varies upwards from parallel lamination to ripple bedding.

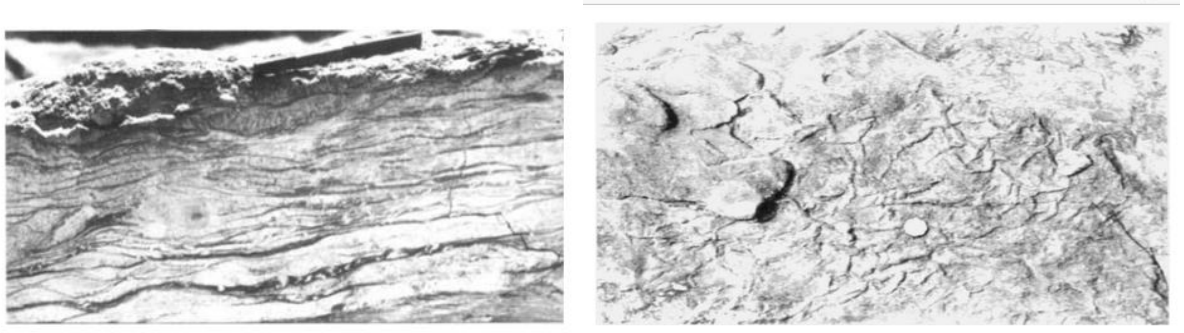

Fig .5 Ripple-bedded unit thin and continuous mudstone partings and Desiccation Cracks (lithofacies 1).

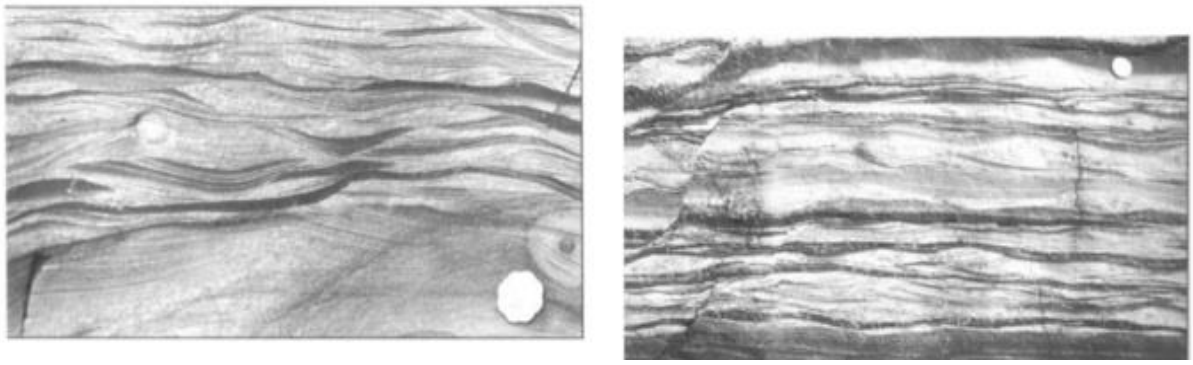

Fig .6 Ripple cross-laminated sets and Ripple-bedded unit with thick continuous mudstone layers (lithofacies 1).

LITHOFACIES 3: COAL-CARBONACEOUS SHALE

This lithofacies is composed of interbedded carbonaceous claystone and coaly stringers which transition into coal seams. The thickness varies from 0.2 to 1 meter, and drilling revealed four significant coal seams that range from 1.22 to 10 meters thick. The ratio of coal stringers to claystone increases closer to the coal seams, and some claystones exhibit fine lamination. The coal displays moderate specific gravity, with interlayering of vitrain-clarain and vitrain-durain bands and a low fusain content. The coal's approximate maceral composition consists of vitrain-40%, clarain-48%, durain-10%, and fusain-2%. The coal's rank is within the medium-volatile bituminous (mvb) to high-volatile B-bituminous (hvBb) range.

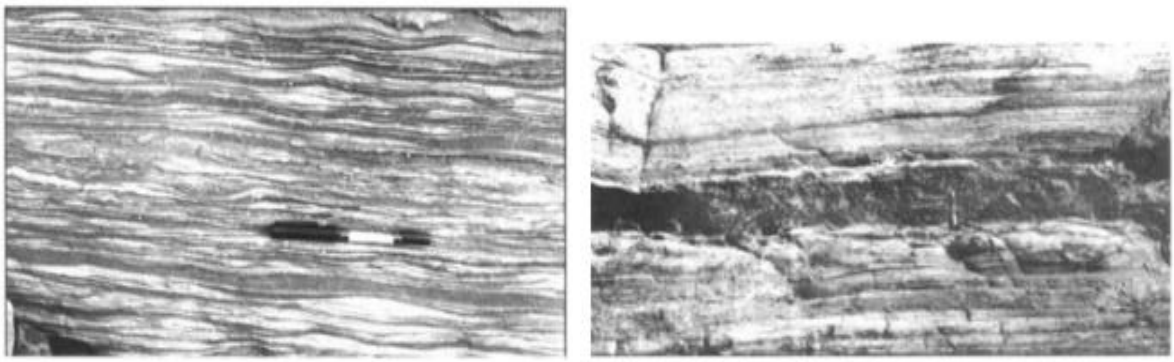

Fig .7 Isolated sandstone ripple and Parallel-laminated sandstone bodies (lithofacies 1).

DISCUSSION:

The occurrence of tidal features in a continental sedimentary succession provides significant evidence of marine influence, aiding in the understanding of the basin's paleogeography and assisting in chronostratigraphic correlation. The Barakar Formation in the Satpura basin, previously thought to be entirely alluvial, contains evidence of tidal current and storm-induced flows, suggesting a tide-storm interactive subtidal, shoreface setting for the deposition of fine-to medium-grained sandstone bodies. This implies a transitional marine depositional setting characterized by concurrent fluvial, marginal marine, and shoreface environments. The stacking pattern of the fluvial, tidal-flat, and shoreface deposits in the Barakar successions reveals several progradational cycles, indicating a wave and tide-influenced, fluvio-deltaic environment for the formation of the Barakar Formation.

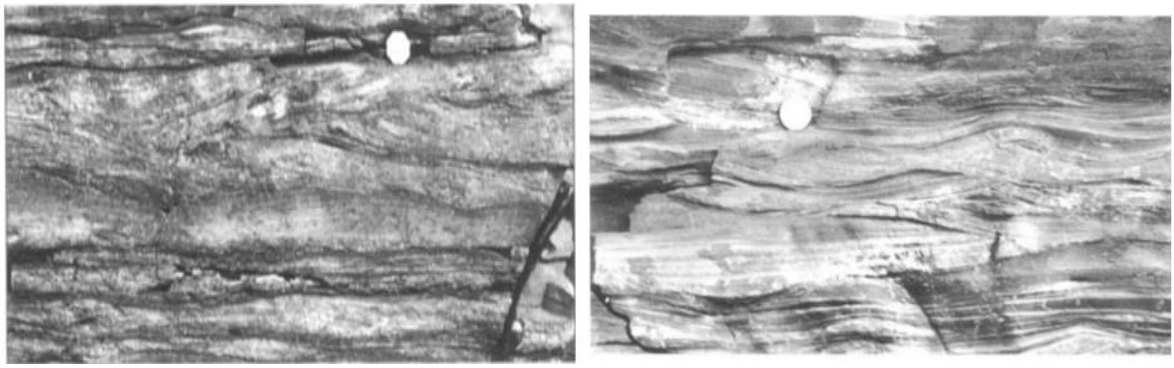

Fig .8 wavy-bedded sandstone and wavy-bedded cross-laminated sandstone (lithofacies 2).

CONCLUSION:

The Mohpani coalfield's Barakar coal measures exhibit sedimentation patterns impacted by the actions of waves and tides. The rhythmic layering of sandstone and claystone in the strata suggests a tidal-flat environment, as evidenced by the presence of desiccation cracks. The paleogeography of the area is transitional marine rather than alluvial, with an E-W shoreline

and fluvial transport towards the north. The Barakar Formation was likely deposited in an embayment, which trended ENE-WNW and was linked to the Tethys in the east.

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