

## Lithofacies and Petrographic study of the Gondwana Group in the boreholes GDH-40 and GDH-43, Barapukuria basin, Bangladesh

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The study deals with the lithofacies and petrographic study of the Gondwana Group in the Barapukuria basin. The Gondwana sequence possesses a very significant position in Bangladesh for coal mining as well as the stratigraphy of the basin but the systematic detailed study of these sediments especially in Bangladesh context is almost lacking. So, these cored Gondwana rocks offer great opportunities to work with especially in the field of sedimentology, Sedimentary sequences of Gondwana Group, Dupi Tila Formation, Barind Clay and Alluvium of Permian, Pliocene, Pleistocene and recent ages respectively, were deposited on the Archean Basement Complex in the basin. The Gondwana Group constitutes an alternated and monotonous sequence of conglomerate/tillite, conglomeratic sandstone, carbonaceous sandstone, ferruginous sandstone, feldspathic sandstones, siltstone, shale/mudstone and six coal seams. In this sequence, five broad lithofacies with their sub-lithofacies are identified. These are conglomerate/tillite, sandstone, siltstone, mudstone/shale and coal lithofacies. Conglomerate/tillite lithofacies indicates wet alluvial fan within the influence of fluvio-glacial to glacio-fluvial environments or channel lag or longitudinal braid bars in low sinuous streams. Sandstone lithofacies shows fining-upward sequences of channel lags-conglomeratic, pebbly or gritty, massive sandstone-trough cross-bedded sandstone-planar cross-bedded sandstone-ripple and parallel laminated sandstone or siltstone. These are generally deposited by gravely to sandy fluvial process within heavy loaded braided stream in alluvial fans and fluvial channels. Occasional coarsening upward sequence suggests crevasse-splay deposits within alluvial plain. Siltstone lithofacies indicates levee or floodplain by the unidirectional flow under shallow fluvial condition. Mudstone/shale lithofacies indicates moderately drained lacustrine in floodplain environment and coal lithofacies indicate a relatively short-lived peat-forming backswamps and a poorly-drained, densely vegetated and long persistent peat-forming backswamps.

Facies relationship derived from first order regular Markov chain analysis indicates a repetitive and cyclic sequence, which is the result of a periodic oscillation of channel, sub-channel and various sub-environments of fluvial regime. Depositional model and overall studies suggest a change of depositional environments from glacio-fluvial and fluvio-glacial braided stream, peat-forming backswamps, comparatively low sinuous to moderately sinuous stream and more sinuous channel-floodplain-backswamps.

From petrographic study, qualitative and quantitative microscopic analyses of the sandstones were carried out to classify the sandstones and to infer its provenance and tectonic setting of depositional basin as well as the source area. The sandstones comprise of 42% quartz, 12.1% feldspar, 1.7% rock fragments, 2.3% mica and 5.3% matrix and 37.2% authigenic components. The sandstones are sub-arkose with few sub-litharenite or arkosic arenites or arkose and sub-arkose. Detrital components of the sandstones and their plot in the diamond diagram indicate a dominance of plutonic igneous rocks with lesser extent of metamorphic rocks in the source area. QtFL and QmFLt triangular plots suggest a stable cratonic and transitional areas of continental block provenance and depositional area.