

Recognition of a Stacked Wave-Tide Dominated Fluvio-Marine Depositional System in an Ancient Rock Record, Proterozoic Simla Group, Lesser Himalaya, India

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Abstract : Outcrop-based facies analysis of the Proterozoic rock successions in the Simla Basin, Lesser Himalaya was combined with the application of sequence stratigraphy to delineate the stages of wave-tide dominated fluvio-marine depositional system development. On this basis, a vertical profile depositional model has been developed. Based on lateral and vertical facies transitions, twenty lithofacies have been delineated from the lower-middle-upper part of the Simla Group, which are categorized into four major facies (FA1, FA2, FA3 and FA4) belts. FA1 documented from the Basantpur Formation (lower part of the Simla Group) indicates evolution of a distally steepened carbonate ramp deposits) highly influenced by sea level fluctuations, where outer, mid and inner ramp sub environments were identified. This transition from inner-mid to outer ramp is marked by a distinct slope break that has been widely cited as an example of a distally steepened ramp. The Basantpur carbonate ramp represents two different systems tracts: TST and HST which developed at different stages of sea level fluctuations. FA2 manifested from the Kunihar Formation (unconformably overlying the Basantpur Formation) indicates deposition in a rimmed shelf (rich in microbial activity) sub-environment and bears the signature of an HST. FA3 delineated from the Chhaosa Formation (unconformably overlying the Kunihar mixed siliciclastic carbonates, middle part of the Simla Group) provides an excellent example of tide- and wave influenced deltaic deposit (FA3) which is characterized by wave dominated shorefacies deposit in the lower part, sharply overlain by fluvio-tidal channel and/or estuarine bay successions in the middle part followed by a tide dominated muddy tidal flat in the upper part. Despite large-scale progradation, the Chhaosa deltaic deposits are volumetrically dominated by transgressive estuarine deposits. The transgressive deposits are overlain by highstand units which are characterized by muddy tidal flat deposit. The Sanjauli Formation (upper part of the Simla Basin) records a major marine regression leading to the shifting of the shoreline basinward thereby resulting in fluvial incision on the top of the Chhaosa deltaic succession. The development of a braided fluvial system (FA4) with prominent fluvial incision is marked by presence of conglomerate-sandstone facies associations. Prominent fluvial incision on top of the delta deposits indicates the presence of sub-aerial TYPE 1 unconformity. The fluvial deposits mark the closure of sedimentation in the Simla basin that evolved during high frequency periods of coastal progradation and retrogradation. Each of the depositional cycles represents shoreline regression followed by transgression which is bounded by flooding surfaces and further followed by regression. The proposed depositional model in the present work deals with lateral facies variation due to shift in shore line along with fluctuations in accommodation space on a wave-tide influenced depositional system owing to fluctuations of sea level. This model will probably find its applicability in similar depositional setups.

Keywords : proterozoic, carbonate ramp, tide dominated delta, braided fluvial system, TYPE 1 unconformity

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