

Facies, Diagenetic Analysis and Sequence Stratigraphy of Habib Rahi Formation Dwelling in the Vicinity of Jacobabad Khairpur High, Southern Indus Basin, Pakistan

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Abstract : Jacobabad Khairpur High, part of a Sukkur rift zone, is the separating boundary between Central and Southern Indus Basin, formed as a result of Post-Jurassic uplift after the deposition of Middle Jurassic Chiltan Formation. Habib Rahi Formation of Middle to Late Eocene outcrops in the vicinity of Jacobabad Khairpur High, a section at Rohri near Sukkur is measured in detail for lithofacies, microfacies, diagenetic analysis and sequence stratigraphy. Habib Rahi Formation is richly fossiliferous and consists of mostly limestone with subordinate clays and marl. The total thickness of the formation in this section is 28.8m. The bottom of the formation is not exposed, while the upper contact with the Sirki Shale of the Middle Eocene age is unconformable in some places. A section is measured using Jacob's Staff method, and traverses were made perpendicular to the strike. Four different lithofacies were identified based on outcrop geology which includes coarse-grained limestone facies (HR-1 to HR-5), massive bedded limestone facies (HR-6 HR-7), and micritic limestone facies (HR-8 to HR-13) and algal dolomitic limestone facie (HR-14). Total 14 rock samples were collected from outcrop for detailed petrographic studies, and thin sections of respective samples were prepared and analyzed under the microscope. On the basis of Dunham's (1962) classification systems after studying textures, grain size, and fossil content and using Folk's (1959) classification system after reviewing Allochems type, four microfacies were identified. These microfacies include HR-MF 1: Benthonic Foraminiferal Wackstone/Biomicroite Microfacies, HR-MF 2: Foraminiferal Nummulites Wackstone-Packstone/Biomicroite Microfacies HR-MF 3: Benthonic Foraminiferal Packstone/Biomicroite Microfacies, HR-MF 4: Bioclasts Carbonate Mudstone/Microite Microfacies. The abundance of larger benthic Foraminifera's (LBF), including *Assilina* sp., *A. spiral* abraide, *A. granulosa*, *A. dandotica*, *A. laminosa*, *Nummulite* sp., *N. fabiani*, *N. stratus*, *N. globulus*, *Textularia*, *Bioclasts*, and *Red algae* indicates shallow marine (Tidal Flat) environment of deposition. Based on variations in rock types, grain size, and marina fauna Habib Rahi Formation shows progradational stacking patterns, which indicates coarsening upward cycles. The second order of sea-level rise is identified (spanning from Y-Persian to Bartonian age) that represents the Transgressive System Tract (TST) and a third-order Regressive System Tract (RST) (spanning from Bartonian to Priabonian age). Diagenetic processes include fossils replacement by mud, dolomitization, pressure dissolution associated stylolites features and filling with dark organic matter. The presence of the microfossils includes *Nummulite. striatus*, *N. fabiani*, and *Assilina. dandotica*, signify Bartonian to Priabonian age of Habib Rahi Formation.

Keywords : Jacobabad Khairpur High, Habib Rahi Formation, lithofacies, microfacies, sequence stratigraphy, diagenetic history

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