

## **Petrography and depositional environment of Manchar Formation (Mid Miocene-Pliocene), Central Kirthar Range, Pakistan**

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### **Abstract**

The Manchar Formation equivalent to Dhok Pathan Formation Upper Indus Basin is extensively exposed in various sections of Kirthar and Laki Ranges, Lower Indus Basin. The Mio-Pliocene Manchar Formation records an important interval of tectono-sedimentary events of the regional transition from marginal marine (deltaic) to continental (fluvial) depositional environments. It is exposed throughout the eastern flank of Kirthar Range while in the Laki Range; it is exposed on both the eastern and western flank and shows vertical and lateral variation in lithofacies. In the Upper Indus Basin, on the basis of geochemistry, mineralogy and field observations, the depositional environment of Dhok Pathan Formation is exclusively fluvial, whereas in the central Kirthar Range and Laki Range it is controversial. The present work focuses on petrographical and field data for Manchar Formation to interpret the depositional environment. The field studies reveal that the formation mainly comprises of six siltstone and sandstone units that are generally grey in colour and are separated by thick mudstones. The distinct and remarkable facies are characterized by yellow-brown siltstone, mudstones of flood plains, massive silica rich off-white to cream colored sandstones probably of beach environment. However, medium grained, moderately sorted grey sandstone sequence with hematitic altered beds, trough cross beds, wood logs & presence of terrestrial vertebrate fossils all are indicative of a fluvial system. The fluvial grey sandstone facies show a general predominance over beach related transitional facies. The common sedimentary structures such as trough cross bedding, planar lamination, tabular cross bedding and herringbone are observed in grey sandstone units that clearly indicates strong fluvial system whereas hummocky cross stratification, ripple cross lamination and, bioturbation indicate marginal marine facies.

The petrographic results indicate that the sandstones of Manchar Formation on QFL diagram are mostly quartz arenite and a few units are sub-arkose to sub-litharenite. Microphotographs of both the thin sections and SEM data reveal that the shape of detrital quartz grains is generally sub-angular to sub-rounded and the grains are moderately sorted, which reflects that the source of sediments was not far away. Therefore, it is suggested that the sediments possibly came from the western highlands rather than the northern Himalayas.

Based on the overall results it can be concluded that the Manchar formation deposited in both, fluvial and marginal marine depositional environments having sediment source in western highlands.