

Facies and diagenetic analysis of Pab Sandstone in Rakhi Nala Section, Eastern Sulaiman Fold and Thrust Belt: implication for provenance and hydrocarbon reservoir characterization

Imran Khan; Sajjad Ahmad and Nowrad Ali
Department of Geology, University of Peshawar
dr.s_ahmed@upesh.edu.pk

Abstract

A 551 meter thick section of Upper Cretaceous (Maastrichtian) Pab Sandstone has been measured and logged in the Rakhi Nala Section of the Eastern Sulaiman Fold and Thrust Belt. The succession is mainly composed of thin-thick bedded, fine-coarse grained sandstone with subordinate mudstone and occasional marl. The whole succession was deposited in the western passive margin of the Indian Plate. Eight facies have been identified in the Pab Sandstone which are grouped together in three facies associations which includes inner shelf or pro-delta, delta-front, and delta-plane facies associations. The deposition of these facies took place on flood dominated siliciclastic deltaic platform having low gradient. This Upper Cretaceous succession represents the regressive phase of deposition as indicated by several thickening upward cycles, increase in grain size and increase in bed thickness. The framework composition and petrographic classification suggest that the Pab Sandstone is sub-mature to mature, quartz arenite, sub-arkosic, and sub-lithic arenite with few subordinate wackes. The physiography and tectonic setting along with NW paleocurrent direction suggests Indian Craton as the source area for the studied sandstone. The studied sandstone shows complex and intense phases of burial diagenesis. Different clay minerals observed by SEM and XRD analysis are the result of alteration of unstable framework grains and volcanic lithics. Both physical and chemical compaction, authigenic mineralization and cementation, and late stage dissolution of cement/matrix are commonly observed. Authigenic cements which include calcite, silicious cement in the form of quartz overgrowths, ferroan dolomite, iron oxide and clays are commonly observed. The primary porosity of these sandstones is almost completely destroyed by compaction and authigenic mineralization. However, dissolution of feldspar, unstable lithics and pre-existing cement/matrix has enhanced the secondary porosity. The petrographic studies and plug porosity/permeability results of outcrop sandstone samples suggest that thick, laterally continuous, vertically stacked sandstone sequences of delta-front lobes of the Pab Sandstone have good reservoir potential. The texturally mature sandstone of the delta-front lobes also shows good effective porosity values in subsurface as interpreted from wireline logs and thus is an excellent reservoir.