Diagenetic Controls on the Reservoir Properties of Plio-Pleistocene Tidal Channel Sandstones in the Teknaf Anticline, SE Bangladesh

Mohammad Ullah [1] and Sifatul Chowdhury [2]
[1]Earth and Environmental Sciences, Vanderbilt University, Nashville, Tennessee, USA, Nashville, TN.
[2]Department of Geology, University of Dhaka, Dhaka, Bangladesh.

An in depth analysis of petroleum reservoir require extensive study of the post-depositional diagenetic processes as they control the reservoir's final potentiality. This study aims to define the diagenetic characteristics of the reservoir-quality tidal channel sandstone facies exposed in the Plio-Pleistocene Bokabil Formation in the Teknaf anticline, SE Bangladesh. The 775 m thick stratigraphic sequence consists mostly of shale, silty shale, and mud beds of variable thicknesses. Eight lens shaped channel sandstone bodies were identified at depths of 430 to 720 m, representing a gradual change from mud- to sand-dominating facies on a shallow marine shelf with tide influence. These lenticular sandstone bodies have limited dimensions with thickness varying from <1 m to 10 m and are generally enclosed by mud or shale. The sandstones are mostly medium to fine grained, sub-angular to sub-rounded, well to very well sorted and texturally mature with a wide range of porosity (0-11%). Diagenetic changes due to physical (compaction), physico-chemical (pressure solution) and chemical (cementation, replacement, recrystallization, alteration and dissolution) processes have progressively affected the sandstones with depth of burial. The primary alkaline pore-water condition was established with the initial burial, under which chlorite authigenesis, siderite crystallization, early poikilotopic calcite and dolomite cementation, quartz overgrowth cementation and late Fe-calcite and dolomite cementation took place, which significantly decreased the porosity. Later in the diagenetic history, the alkaline pore-water was replaced by an acidic pore-water environment leading to partial dissolution of carbonate cements and detrital feldspars (and minor lithic grains) with subsequent development of kaolinite clay. Partial dissolution of feldspars, lithic grains, and calcite cements have enhanced the reservoir properties for the channel sandstones, particularly in the lower part of the sequence, but this effect is reduced by generation of a later kaolinite cement in the secondary pore-spaces. The potentiality of these channel sandstones to form combination traps requires their greater abundance in the subsurface within a structural closure. However, the discovery of a gas seep during this study in the axial zone of the anticline indicates a good probability for the occurrence of hydrocarbons, which requires confirmation by exploratory drilling or seismic survey.