

Lithological studies and petroleum system potential of the Eocene Chorgali Formation using outcrop data and geophysical logs, Potwar Plateau, Pakistan

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Abstract

The Eocene carbonate rocks of the Potwar Plateau are composed of Nammal Formation, Sakesar Limestone, Margalla Hill Limestone and Chorgali Formation. The Chorgali Formation is a mix of carbonates and clastic. An integrated approach has been deployed to investigate lithology and petroleum system potential of the Chorgali Formation using surface outcrop and subsurface geophysical data at different locations of the Potwar Plateau. The outcrop sections include Choa-Saidan Shah, Karoli, Wasnal, Nilawahan Nala, Gali Jagir School and Gali Jagir Dam Site. The subsurface wells include Meyal-01, Meyal-08P and Meyal-10P. From the outcrop studies, the lithology of the Chorgali Formation is found out to be dominantly carbonates (limestone and dolostone) with minor sandy limestone, evaporites (gypsum), calcareous sandstone, marl, conglomerate and shale intercalations. In the subsurface, the gamma ray and combined neutron-density logs extrapolated the lithology of the Chorgali Formation. Within the Meyal Oil Field wells, the Chorgali Formation is dominated by dolostone, dolostone associated with evaporites (gypsum, anhydrite, halite), minor limestone and shale intercalations.

In the context of petroleum exploration, the limestone and dolostone are reservoir rocks while shale can be a source and seal rock. The marls and carbonates can also be source rocks provided they contain sufficient organic matter. In addition, evaporites can act as seal rocks. There can be stratigraphic traps as the limestone/dolostone is sandwiched between the shales. In Gali Jagir Dam Site (Khair-e-Murat Range) and Karoli sections (Salt Range), there is well developed folding implying the presence of potential structural trap in the respective area. The surface reservoir properties are mainly fractures, cavities (minor), and dolomitization. The dominant porosity type is fracture which is common throughout the different outcrop sections. The subsurface porosity types are interpreted using bulk volume water (BVW) values of carbonates. The identified porosity types include vuggy, vuggy and intercrystalline, intercrystalline and chalky. However, core data is recommended prior to final confirmation of lithology and pore types in the subsurface; which is not available.