

Lithofacies and petrographic analyses of Laki Formation: implications for petroleum potential reservoir

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Abstract

The present study is intended to describe lithofacies and petrographic studies of the Laki Formation and its implications for petroleum potential reservoir. The Laki Formation is mainly developed in the southern part of the Kirthar Province and in the vicinity of the Marri-Bugti hills in the Sulaiman Province. Its type locality is Mari Nai (Lat. 26°06'N: Long. 67°51'E), southwest of Bara Nai, of the northern Laki Range. In Sui, it has been encountered in different wells and attains the thickness of 468 m. However, study area of Laki Formation comprises eastern part of the Surjan Anticline, 5 km northeast of Karachi National Highway, approximately 180 km north of Karachi and lying opposite to Thanobullah Khan. Different lithofacies of Laki Formation are defined on the basis of its characteristic features i.e. (1). Less fossiliferous micritic limestone facies (2). Pure white chalky limestone facies (3). Pink fossiliferous chalky limestone facies (4). Dark yellowish brown limestone facies. Laki Formation of Eocene age is mainly composed of massive to thick bedded pure white fossiliferous limestone, light pink to cream colored, medium to thick bedded, micritic and fossiliferous limestone. Dark yellowish brown, less fossiliferous lithofacies also exposed at some places. The petrographic analysis of samples reveals that rock consist of dolomite, calcite and grains/allochems. Siliciclastic sediments (quartz) and haematite occur as minor minerals in few thin sections. The microscopic texture is crystalline. Dolomite rhombs are clearly visible in thin sections and have been confirmed through staining techniques. The crystals shape of dolomite are euhedral to subhedral. The dolomitization is non-fabric selective, because they are replacing all components of the sediments in an indiscriminate fashion. Staining result shows that calcite occurs in relatively less amount. The crystal shape of calcite is usually anhedral. Grains/allochems include: foraminifera (especially Nummulite). Moreover dolomitization has partially replaced original shape of the fossils. The porosity types observed in thin sections include: intercrystalline porosity (due to dolomitization), intragranular porosity, and fracture porosity. Pores are interconnected at some places, which is a significant feature of reservoir rock. After petrographic analyses the rock samples are classified as “dolomite wackestone”, which shows low energy setting of deposition. Later on, diagenesis resulted in dolomitization. The diagenetic processes of dolomitization effectively replace the primary sedimentary structures, preserving minor detail, including fossil structures, allochems, and fine laminations. Lithofacies and petrographic analyses indicate that Laki Formation can be a potential reservoir of petroleum.