Unveiling Hydrocarbon Potential of Hith and Gotnia Formations Using Seismic Attributes – A Case Study from Dhabi-Liyah Area, North Kuwait

Rosmari D. Usta[1], Sawsan B. Al Faraj[1], Arasu R. Tirunavukka[1], Meshal Al-Wadi[1], and Reyad Ibrahim Abu-Taleb[1]

[1]Kuwait Oil Company, Ahmadi, Kuwait.

ABSTRACT

Late Jurassic Hith and Gotnia formations are traditionally considered as regional seals for the underlying hydrocarbon bearing Jurassic reservoirs. Gotnia and Hith formations in Kuwait comprise alternate sequences of anhydrites and salts with thin limestone layers interbedded with anhydrites, which are usually over pressured. Recent oil strike in a well in North Kuwait Raudhatain Field has opened up a new opportunity for exploration and production of hydrocarbons from untapped limestone reservoirs within anhydrites of Gotnia and Hith Formations in the entire Kuwait. The purpose of the present study is to investigate hydrocarbon potential of limestone reservoirs lying within Hith and Gotnia anhydrites using seismic attributes in the Dhabi-Liyah area of North Kuwait. To achieve this objective, detailed mapping of Hith Formation and three consecutive Gotnia anhydrite-salt units were carried out in 3D seismic data over the study area. At base Gotnia level, the Dhabi structure is a doubly plunging, tight, elongated anticline trending NNE-SSW direction. Southwards, N-S oriented independent Liyah structure shows similar structural setup. Both structures appear to have formed under compressional regime. They are separated by NW-SE oriented saddle which was probably created by a left-lateral strike-slip movement along a cross fault. Near the Top of Gotnia, Dhabi and Liyah structures become almost a single entity, taking an arc shape. Underlying Najmah structure and halokinetic effects control the structural elements of Gotnia Formation. Amplitude based attributes and acoustic impedance are used to identify the potential reservoir intervals in conjunctions with geological observations during drilling. The difference in acoustic impedance between salt and anhydrite layers and the thin lenses of medium acoustic impedance observed sporadically within anhydrites, which correspond to carbonate reservoir facies, has enabled identification of potential hydrocarbon prospective areas. The present study has proved that integrated analysis of seismic attributes and impedance is a powerful and useful tool to unravel the presence of thin carbonate stringers and their possible hydrocarbon potential in anhydrite environment. Mapping of these unconventional reservoirs and drilling these high-pressure wells though a challenge, could possibly establish significant oil and gas reserves in North Kuwait area.