

Seismic Reservoir Characterization of Hith and Gotnia Formations to Evaluate its Architecture and to Identify Carbonate Stringers - A Case Study from North Kuwait

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ABSTRACT

The North Kuwait comprises of many fields. Gotnia is the formation of below Cretaceous sequence where setting of the casing points for the deep exploratory wells is critical. In North Kuwait, significant challenges exist while drilling through and below the salt formations. Gotnia consists of salt, anhydrite and limestone. It is a problematic formation as it contains several high-pressure zones. Mapping of these zones are difficult as wireline logs rarely recorded in this high-pressure zones. Drilling through Gotnia formation is very difficult challenge. The drilling hazards can be reduced to a certain extent by accurately prognosing the thickness variation of different layers within Gotnia. The prediction of Gotnia can reduce the severity of the losses. This challenge remained to develop an effective tool to prevent the severe losses encountered below the salt formation. This late Jurassic of Hith and Gotnia Formations in Kuwait traditionally considered as regional seals for the underlying hydrocarbon bearing reservoirs. However, with the recent drilling and testing of exploration well "A" in Raudhatain field of North Kuwait has proved the potentiality of these formations as unconventional tight reservoirs and also the testing of this well which paved the way for opening up of large areas for future exploration. The preliminary study inferred, there might be presence of carbonate stringers within the anhydrites of Hith/ Gotnia Formation, which might be the potential reservoir for hydrocarbon accumulation. Anhydrite is a very hard rock; presence of carbonate stringer within the anhydrite will reduce the rock impedance of rock layer. Hence, the pre-stack inversion technique was employed to meet the challenge of identifying the carbonate stringers in and around the well "A" which was produced light oil from the anhydrite¹ and to explore the hydrocarbon potential of the Hith and Gotnia formations and also to evaluate the Gotnia architecture. The outputs of pre-stack inversion are P-impedance, S-impedance and V_p/V_s . The internal complex structure of Gotnia Salts was mapped using the inversion results. Identified carbonate stringers with combination of P-impedance, S-impedance and with V_p/V_s ratio. The anomaly observed at the well "A" in anhydrite¹ further extended towards the North. Carbonate stringers were located in Hith and anhydrite¹ at the few other well locations. These anomalies validated through the wells and in good agreement with the seismic data.