

## **Lessons Learned from Modeling a Mature Carbonate Field: Rock Typing and Facies Distribution of the Miocene Syn-Rift Oil Bearing Carbonate Reservoirs, Analogue for Calibration for 3D Static Model Building, Zeit Bay Field, Gulf of Suez, Egypt**

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### **Abstract**

Syn-Rift Miocene oil-bearing sequences of Zeit Bay Field, GOS are studied to highlight the role of depositional facies in controlling the reservoir properties and behavior of siliciclastic and carbonate rock types. Lessons learned from modeling carbonate reservoirs were applied in a mature field by detailed examination of more than 2000' conventional cored intervals in 17 wells, supported by petrographic examination of 1000 thin sections. Hydraulic rock typing results are matched and correlated with RCA, SCAL and wireline logs in order to build a rock typing model that extended to uncored intervals for better prediction of reservoir properties and rock typing distribution in different cycles and subcycles.

Reservoir rock typing was classified within a sequence stratigraphic framework. Depositional, diagenetic and fractured processes were identified from core and thin section and calibrated using R35, RQI and FZI methods as a quantitative measure of reservoir flow unit building block. Reservoir rock types were controlled essentially by depositional systems that were modified later by diagenetic features and fracture networks. The Miocene reservoirs were differentiated into 18 rock types; sandstone (S1-S6), limestone (L1-L6), and dolomite facies (D1-D6).

Basal Miocene clastics represent prograding east and southeastward fan-lobe shape. High quality reservoir, types S6/S5 are developed at lobe margins. Some patchy dolomite occurs within sandy facies having different quality. The lower cycle of Rudeis reservoirs are represented by dolomite facies made of partly restricted subtidal lagoon with the development of patch reef with high quality facies of D6/D5. Sandy channels are developed in the northern area with high quality facies of S6/S5.

Rudeis reservoirs include high quality dolomite reservoir (D6) decreasing laterally westwards to (D4/D3), representing partly restricted lagoons of paleotroughs within pre-Cambrian paleorelief. Marginal reef facies are represented by limestone in the north. High quality dolomite is developed around the marginal clusters, whereas limestone facies are over crestal parts (L6/L4). The upper cycles of Rudeis Formation is built up of carbonates, mainly of high quality limestone (L6/L5/ L4) being developed over the crests, while the margins are made of dolomite facies (D6/ D5). Lateral and vertical prediction of various rock types was mapped in 3D to aid the building of the 3D static model honoring the reservoir quality and heterogeneity.