

## **The Early Miocene Hadrukh Formation, Eastern Saudi Arabia: Facies heterogeneity and its implications for hydrocarbon reservoir prospectivity**

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### **ABSTRACT**

The Early Miocene Hadrukh Formation in Eastern Saudi Arabia consists of a mixed succession of siliciclastics, carbonates and evaporite deposits. It rests unconformably on the Paleogene, Dammam, Rus and Umm Er Rhaduma formations and is bounded at the top by the early Middle Miocene Dam Formation. The Hadrukh Formation contains important hydrocarbon accumulations and in the subsurface is subdivided into three members. This work integrates core based sedimentology, biostratigraphy, chemostratigraphy and wireline log data. The Lower Hadrukh Member is composed mainly of friable sandstone, dolomitic sandstone and carbonates facies containing terrestrial and marine palynological assemblages and local condensed intervals with gastropods and bivalves. This section contains a major maximum flooding surface that can be correlated on a regional scale. The Middle Hadrukh Member comprises mainly lagoonal marls, muddy limestones and coastal sabkha anhydrites. The Upper Hadrukh Member consists of calcareous sandstones and gypsiferous marls with sandy limestone intercalations. The depositional environment is marginal marine and tidally influenced fluvial, associated with coastal sabkha. Palaeocurrent measurements and facies interpretations indicate that the sediment supply direction for the sandstones was from west to east and northwest to southeast. The depositional facies of the Hadrukh Formation are controlled by a complex interaction between sea level fluctuations and climatic variations, which significantly influenced diagenetic processes and ultimately reservoir quality.