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Late Carboniferous-Permian Unayzah development in North Ghawar, Saudi Arabia

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ABSTRACT

The Unayzah Group is one of the important hydrocarbon targets in Saudi Arabia. The porous sandstones of the Unayzah Group have significant hydrocarbon reserves in several fields in central Saudi Arabia. In this paper, we discuss the potential extent of the Unayzah Group succession in a broad paleovalley to the north of Ghawar.

The Unayzah Group sediments are deposited over the Hercynian unconformity with various older underlying units. The Unayzah Group is subdivided into two main periods of deposition; the glacio-fluvial to glacio-lacustrine Juwayl Formation, which is overlain by the post-glacial (fluvial, playa and eolian) Nuayyim Formation. The Juwayl Formation is subdivided into Ghazal Member (which includes the Unayzah C Reservoir) and Jawb Member (which includes the Unayzah B Reservoir). The Nuayyim Formation is subdivided into the Late Sakmarian Wudayhi Member and the Artinskian Tinat Member (which includes the Unayzah A Reservoir). Unayzah Group deposition represents cyclic transgressive and regressive deposits preceding the late Permian regional marine transgression, during which the massive carbonates of the overlying Khuff Formation were deposited. This Permian transgression marked a major change in the sedimentation and evolution of the Greater Arabian basin.

High-fold 3D seismic data has been used to map a Unayzah paleovalley, and seismic attributes were successful in identifying the boundary of the targeted reservoir. Recent core from nearby well has confirmed the presence of the Unayzah Group succession. A surface analogue of a Qusaiba Member erosional paleovalley feature in the northwest area of Saudi Arabia supports the geometry of the subsurface Unayzah valley. This study will investigate the potential for a new Unayzah play and challenge our current understanding of prospective Unayzah fairways to the north of Ghawar.