

Structural Evolution of the Central Oman Area - New Insights from Recent 3D WAZ and its Impact on Prospectivity

Kawther Al Quaraishi, Samah Al Rawahi, Abdullah Al Gahaffi, Amjad Al Shukri, Zuwaina Al Rawahi

Petroleum Development of Oman

Abstract

In 2017, PDO embarked on acquiring over 9000 km² of WAZ data in Central Oman, in a part of Block 6 that has been under-explored, particularly for gas exploration. The area had several oil fields discovered in the late 1980s in the Gharif reservoir but no deep opportunities discovered due to the poor imaging of the deeper stratigraphy. The Central Oman area comprises of discontinuous, but prominent structural highs that separate South Oman Salt Basin from the Fahud and Ghaba Salt Basins, and an extension of the Western Deformation Front. Detailed structural definition was poorly constrained due to lack of data and poor quality of existing data. The recent evaluation of the newly acquired data led to a better definition of deep-seated structural lineaments, and the delineation of the extent of the Cambrian Western Deformation Front to the east of Rub Al-Khali Basin. This refinement led to the subdivision of the area into 5 distinct structural domains. The domains were defined by the deep-seated older (Neoproterozoic- Early Cambrian) fault system, generally trending NE-SW, inherited by even older events that affected the overall early evolution of the basins in Oman. These tectonic events played a key role in the evolution of the Nafun Group, which influenced the subsequent deposition of the Ara Group. Mapping of key horizons showed that the long-lived highs greatly controlled basin fill, including the salt deposition, thinning, and thickening of the overlying stratigraphy, which were previously unrecognised. For example, the new seismic data demonstrated the presence of mini-basins of the Nimr Group. Regional mapping of key horizons and unconformities in the Haima Supergroup allowed definition of growth packages within the Miqrar, and thickness variations associated with intra-Haima events, especially above the highs. These are depositional patterns, which are not seen in North Oman and could be akin to South Oman and are likely related to salt movements during deposition of the Haima Supergroup sediments. Detailed seismo-stratigraphic interpretation is still proving difficult due to the lack of seismic contrasts in the Nimr/Haima clastic sediment, and absence of diagnostic biostratigraphy. Post Haima deposition, the basin fill showed quiescent stage characteristics (no clear thickness variation), which was later interrupted by base Jurassic regional unconformity resulting in truncation of the Triassic- Jurassic section similar to North Oman. Finally, the Alpine-1 and -2 tectonic events affected the area and led to re-activation of some of the pre-existing faults. In summary, the new 3D WAZ data allowed more understanding of the tectono-stratigraphic evolution of the Central Oman High area and its structural significance as a connection zone between the north and south of Oman. It also helped in unlocking the prospectivity of different plays in this under-explored area of Block 6.