geoconvention
Calgary • Canada • May 7-11 2018

Pan-African Footprints in a Shuaiba Carbonate Field Northern Oman and its Implication for Field Development Planning and Well Reservoir Management

Ruikun Liu
Petroleum Development Oman/Shell International Joint Ventures (Email: Ruikun.Liu@shell.com)

Abstract

The Shuaiba carbonate field described in this study is located in the Ghaba Salt Basin, northern Oman. It was discovered in 1972 with 37° API light oil: its reservoir consists of lower Shuaiba floatstones, boundstones and packstones that were deposited in a wide carbonate ramp (mid to inner ramp?) environment; at Shuaiba level, the structure is a broad, low relief, three-way dip-closed anticline with fault closure on its SW flank. The field is very mature with horizontal drilling and water flooding development since 1991. However, the very low reservoir pressure (lack of bottom water drive) and the tilted OWC encountered in the recent SE flank drilling are still lacking of understanding.

It has long been realized that Pan-African fabrics in the Arabian basement have placed significant control on salt basin development, hydrocarbon trap formation etc. (e.g., Al-Husseini, 2000; Stern & Johnson, 2010). However, little attention has been paid to the Pan-African control on the Shuaiba carbonate field described here, northern Oman. By compiling previous studies and integrating 3D seismic data, the author identified two basement features in the field that line up very well with regional Pan-African fabrics. It is clear from seismic that these features overprint its Shuaiba reservoir during its late cretaceous reactivation.

Coincidentally, where the recognized Pan-African fabrics join together become the locus of the Salt Withdrawal Basin in the QA area of the Ghaba Salt Basin. It seems that these basement features control not only the initial salt distribution, but also its late cretaceous reactivation (Salt withdrawal), which in turn causes the tilting of the SE flank of the Shuaiba field and affects the bottom water behavior in the region: bottom water was likely pulled from west to the east as evidenced from the two fields on both side of the salt withdrawal basin. Pressure data from the water leg of the Shuaiba field indicates that the bottom water was pulled differentially across the field: slightly lower pressure gradient to the South. These slightly differentiated bottom water behaviors across the field caused the titled OWC, as well as the extremely low bottom water drive in the SE flank.

This study has provided new perspectives on the Pan-African control of the Shuaiba field described here in northern Oman. Future field development and WRM activities should take into account of the effects of Pan-African fabrics recognized in this study.

References

Al-Husseini, M.I. 2000. Origin of the Arabian Plate structures: Amar collision and Najd rift. GeoArabia, v. 5, no. 4, p. 527–542.
Stern R.J., Johnson P., 2010. Continental lithosphere of the Arabian Plate: A geologic, petrologic, and geophysical synthesis. Earth-Science Reviews 101 (2010) 29–67.