

Influence of Deep Salt on the Style of Major Structures in Northeast Saudi Arabia

Simon A. Stewart¹

¹Eastern Area Exploration Department, Saudi Aramco, Dhahran 31311, Saudi Arabia

ABSTRACT

Late-Precambrian to Cambrian Hormuz salt is well-known to have affected structural style in the Cretaceous to Recent Zagros thrust belt and its immediate foreland. The role of this salt further southwestwards into the Saudi Arabian part of the foreland is less well documented. This paper analyzes a series of major structures along a traverse from the Zagros foreland offshore Saudi Arabia through to structures on the Saudi Arabian coast, and progressively farther inland. All the structures considered here are large, with a wavelength of 10 to 20 km, height above regional elevation of 1 km or more and host giant or supergiant oil fields. The examples are drawn from previously-unreleased 2D and 3D seismic data. The Hormuz is generally at depths of 7 – 12 km and its distribution is inferred from seismic structural style, a method readily applicable to any seismic interpretation. Farthest east, offshore, are domal and periclinal structures such as Abu Sa'fah, Karan and Hasbah. These structures display steeply-dipping reflectors at depth, which can be interpreted as salt pillow flanks. Although basement faulting has influenced their development, salt has been the dominant factor determining the structural style. In the coastal area, structures such as Dammam, Fadhili, and Khursaniyah again display smooth, unfaulted domal profiles of the Phanerozoic section on reflection seismic profiles, and can be interpreted as salt domes, whereas Berri, Qatif and Manifa appear to be basement cored. Furthermore, onlap geometries are occasionally visible at base Hormuz level, allowing direct mapping of original Hormuz salt basin margins, explaining the variation in salt versus basement-cored structures. Further inland, structures such as Jauf, Juraybi'at and Jahan are clearly hard-linked basement structures with asymmetric, monoclinial hinge elements localized above basement faults. There is no evidence of salt this far southwest. This regional variation in structural style relates to the original distribution of Hormuz salt and laterally equivalent facies. The results underpin the deep interpretation of all the major structures in northeast Saudi Arabia, and also allow the original Hormuz salt basin margin to be detailed for the first time. Definition of structural style is also helpful in the interpretation of reservoir continuity in deep, poorly-imaged fold cores and is useful in petroleum system modeling since salt acts as a fluid seal and thermal conductor.