Understanding the Salt Distribution in ARA Stringer Reservoir and its Impact on the Field Compartmentalization: A Case Study from South of Sultanate of Oman

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Abstract

Field-X is an oil field in Oman Salt Basin. The conventional structural seismic interpretation of the field, using structural attributes, showed that the area is unlikely segmented. Additionally, pressure data collected from different parts of the field confirmed that the field is in communication. Recently, a new well was drilled and unexpectedly found the reservoir at version pressure, although the pore pressure prediction was evaluated assuming a depleted reservoir scenario. Consequently, the drilling mud weight was increased to avoid well control incident. This study aims to go beyond the structural attributes and use different attributes along with drilling data to better delineate the trapping style. Understanding the potential segmentation will ultimately enhance the pore pressure prediction.

The objective of this study is to analyze different subsurface data to understand the compartmentalization in high pressure/H2S reservoir. A comprehensive understanding of the field compartmentalization is key in planning the infill wells, and equally important in the drilling phase. Different seismic attributes, such as semblance, spectral decomposition, and amplitude maps at varying window extraction, along with regional geological understanding, pressure data, log data and offset data were utilized in the study. Analog fields data were also used in this study.

The study showed that the field compartmentalization in carbonate stringer reservoir is unpredictable, and therefore the conventional structural interpretation tool is not sufficient. Evaluating the offset wells showed that the salt content, plugging the pore spaces in the reservoir rock, increases to one direction of the field which may act as a seal resulting in isolating part of the reservoir. Additionally, even though the structural attributes have not shown any evidence of the isolated field compartment, using other attributes such as amplitude map and spectral decomposition clearly showed a pronounced change in acoustic properties around this part of the field, indicating a possibility of compartmentalization. The study concluded that compartmentalization in such reservoirs cannot be only as a result of faulting but also the presence of salt and the salt distribution in the field can also act as a barrier and can cause segmentation. Also, the salt presence in the reservoir can significantly deteriorate the reservoir properties, therefore understanding the salt distribution is essential in planning the infill wells.

The study showed that compartmentalization in Ara Stringer reservoir is not only caused by faults, but the salt presence and its distribution within the field can also act as a boundary. Therefore, a throughout understanding of the salt content in the nearby wells, and consequently appreciating the salt distribution in the field is key in planning the wells and executing the drilling plan. Additionally, using variable seismic attributes, such as spectral decomposition, and amplitude extraction, is also important to define the potential isolated blocks within the field and these learnings are captured for all the future wells planned in Ara stringers.