Integrating Seismic Multi-Attribute Classification and Forward Stratigraphic Modeling in Mid-Cretaceous Carbonate Sequences, Arabian Gulf, Offshore Iran

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The characterization of carbonate settings in seismic is often difficult, especially in areas with limited well control. This study presents an integrated approach where a geophysical method (seismic multi-attribute classification) is combined with a geological one (forward stratigraphic modeling). The combined results of both methods allow, to a certain extent, to predict lithology distribution within the interval of interest and to locate the position of defined depositional settings within extensive seismic surveys. The presented study is based on a 2D seismic survey located in the central Arabian Gulf, offshore Iran. The interval of interest is the salt tectonics influenced mid-Cretaceous Sarvak Formation, a stratigraphic equivalent to the Mauddud/Mishrif and Natih formations of the Arabian Plate.

For the multi-attribute classification (neural networks-based; unsupervised and supervised) a set of six volume- and grid-based seismic attributes was utilized. The classification result mapped the basic seismic facies distribution as well as large scale depositional domains (e.g. shallow carbonate platform, intrashelf basin, salt withdrawal basin, platform progradation front). For the forward stratigraphic modeling several seismic lines from the 2D survey were chosen as templates to be matched by the 2D computer models. To support the interpretation of the modeling approach, outcrop analogue studies from the Natih Formation in Oman were used. The resulting stratigraphic models provided an overview of the general facies distribution and their packaging, which combined with the seismic attribute classification, allowed a more realistic interpretation of carbonate depositional settings.