

## Seismic Facies Recognition and Analysis of Stratigraphic Traps in Central Saudi Arabia

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### ABSTRACT

Stratigraphic traps in the Unayzah group (Permian) from lateral facies changes play an important role in central Saudi Arabia where Aeolian sandstone with good reservoir quality is laterally sealed by up-dip playa siltstone with low-porosity and low-permeability. The recognition of facies and lithology from well and seismic data, is therefore a good way to characterize possible stratigraphic traps. The top of the Unayzah group comprises a complex succession of continental clastics which was impacted by two significant events comprising the Hercynian Orogeny and Gondwana glaciation. The differing sedimentary environments contribute to the laterally varying lithology and makes the presence of stratigraphic traps possible. Supervised artificial neural networks (ANNs) have been proven to be a successful classification technique. Here the ANN is implemented using a two layer multi-layer perceptron (MLP). Seismic waveforms are employed with the ANN to classify and identify the seismic facies since they carry multiple information types such as amplitude, frequency and phase variations. Prior lithofacies information from well log and core data is used for network training and validation. The recognized distribution of micro facies and lithology is very consistent with the drilled wells. Generally, the two sedimentary systems developed in the research area are the Aeolian system in the west and the fluvial flood reworked Aeolian sands in the eastern area. Both can result in good sandstone, but playa siltstone is the only effective seal. The configuration of sandstone and up-dip siltstone based on the identified facies characterizes the stratigraphic traps. Therefore, the facies distribution indicates that the western region is prospective which is also verified by the success of oil and gas wells drilled in dune facies surrounded by playa. The fluvial-dominated eastern area appears less promising due to the absence of an effective lateral seal.