Seismic Imaging of a “Sweet Spot” Formed by Incised Valley FIlled by the ‘Unayzah A Eolian Reservoir, Central Saudi Arabia

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ABSTRACT

Abstract Most of the publically documented incised valleys are presumed to be filled with sediments laid down in a fluvial dominated environment. Our current study in central Arabia indicates that incised valleys could be filled with Eolian sands deposited in an arid environment. The dominant working geological model for explored stratigraphic traps in central Arabia invokes lateral facies change, due to juxtaposition or inter-fingering of Eolian sand reservoirs and extensive playa-lake seal facies. Drilling results show that the massive nonreservoir siltstones normally occur on the paleo-highs, with reservoir development on the paleo-lows. This geological feature is hard to interpret with facies changes between playa and dune, because the playa accumulation normally develops in the paleo-low terrains. Both massive ‘Unayzah A nonreservoir and reservoir rocks are palynologically barren; therefore, it is very difficult to determine the age of the strata. From regional correlation and studies, the ‘Unayzah formation was determined to be deposited in the earlier part of the Permian. The ‘Unayzah A massive nonreservoir siltstone is interpreted to be deposited earlier than the reservoir of the Eolian dune based on the careful well correlation, core description, regional and modern analogue studies. The ‘Unayzah A reservoir is deposited in the paleo-low terrains, which are created by incised valley filled features that are clearly imaged on seismic and from well correlations. The well-to-seismic tie indicates the massive ‘Unayzah A nonreservoir exhibits very strong negative reflection seismic amplitude, while the ‘Unayzah A reservoir shows chaotic, discontinuous, and weak to strong positive reflection amplitude. Therefore, the sum of the negative amplitudes over target interval is useful in interpreting the nonreservoir strata, while the sum of the positive amplitudes is a good seismic attribute to image the “sweet spot” created by the Eolian filled valley. The proposed model is proving beneficial for further exploration of stratigraphically entrapped hydrocarbons in central Arabia.