

Outcrop to Desk-Top, Modern and Ancient Analogues Provide Geological Controls for Reservoir Layering and Object Modeling in a 'Wet' Eolian Depositional System, Unayzah 'A' Reservoir, Saudi Arabia

Heine, Christian J., Saudi Aramco, Dhahran, Saudi Arabia

The borehole image log is a critical tool for facies recognition of the Permian Unayzah sandstone of Saudi Arabia. Four distinct depositional facies: dune, sand-sheet, paleosol and playa have been identified on image log and confirmed with detailed core description. The core and image log studies indicate the Unayzah reservoir was laid down in a 'wet' eolian transverse dune depositional system. The Unayzah reservoir was then layered based on a 'wet' eolian depositional model using the Permian Cedar Mesa sandstone in Utah as an outcrop analog. In well log cross-section 'wet' and 'dry' eolian depositional cycles were recognized and incorporated into the geocellular model as 'time lines' based on field observations from Cedar Mesa outcrops.

A numerical proportion of each facies was determined from well data for each reservoir sequence. An object-based modeling technique was used to distribute the image log identified facies. The transverse dunes were modeled as 3-D objects oriented with the dune crest striking N-S based on image log data. The interdune was incorporated as elongate 3-D objects paralleling the transverse dunes. Object sizes and shapes were measured from satellite images of present-day transverse dune fields in Saudi Arabia. The dune-interdune relationship is modeled after the satellite images as well. The resulting geocellular model was viewed in cross-section, which displayed the characteristic 'wet' and 'dry' cycles observed in the Cedar Mesa outcrop. In plan view, we captured the facies distribution seen in satellite images from present-day transverse dune fields.