ABSTRACT

EXPLORATION GEOLOGY AND DEPOSITIONAL MODELING OF A CONTINENTAL TIGHT SAND RESERVOIR THE ABO FORMATION, CHAVES COUNTY, N.M.

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The Wolfcampian-Leonardian age Abo Formation has been the major objective of exploration efforts in Southeastern New Mexico since 1980. The Abo Formation in Chavez County consists of red and green mudstones and shales interbedded with very fine-grained reddish-orange sandstones. The sandstones are sub-arkosic arenites deposited in a fluvial/delta plain environment on the Northwest Shelf of the Permian Basin. Producing sandstones are characterized by very low in-situ permeabilities (.006-.01 md) and porosities (determined from CNL density logs) ranging from 5-12%. Petrographic analysis of the producing zones yields only traces of visible porosity (1%) indicating the relative importance of fractures to total porosity. The importance of this secondary porosity is substantiated by the concentration of production within an area of major SW-NE trending buckles that result in folded and fractured zones parallel to their strike. Abo sediments were derived from the predominantly granitic Pedernal Uplift to the north and west of the producing area. The prograding fluvial/delta plain is evidenced by calcareous mudstones at the base of the Abo with calcite fracture fillings grading upward into anhydritic mudstones containing anhydrite fracture fillings and birdseye lenses. In general, three main producing zones are found in the upper Abo Formation. These sandstones occur either as a single thick (6-10 m) sand or several thin (2-4m) sands separated by thin mudstones. Changes in thickness and character of these three major sands represent lateral shifts in subaerially deposited, braided paleochannels. The relatively homogenous mudstone intervals between producing sands and at the base of the section represent delta switching and tidal backreef (submarine) deposition.

Gas wells in the Abo initially produce from 200-1000 MCFGPD of dry (1000 BTU) gas after considerable acidizing and fracturing. The modeling of the depositional environment of the Abo is critical to the selection of prime drilling locations. Paleochannel development and trends, as well as significant interbedded mudstone intervals, are essential

for good Abo potential. Several stratigraphic and diagenetic trapping processes may result in hydrocarbon accumulations within these anastomosed fluvial sandstones. Channel fills are most often contained laterally and vertically by mudstones. Differing amounts of calcite and anhydrite cement and argillaceous matrix within the sandstones may create diagenetic traps within the channels. The best Abo wells are located in areas where paleochannels are well developed and intersect SW-NE trending structural zones. The completion of these wells can be complicated by inadequate cementing prior to fracturing resulting in the fracturing of containing mudstones and shales instead of gas-bearing perforated sandstone intervals.

The relatively shallow (950-1300 m) depths to encounter pay, combined with the higher allowable tight gas (107) price in the Abo, has stimulated significant activity in this new play that is certain to expand as the reservoir and trapping mechanism is better understood.