

The Delaware Mountain Group consists of a 1,000-m thick section of Permian siltstone and sandstone that was deposited in a euxinic, deep-water, intracratonic basin. More than 100 oil and gas fields produce from the upper part of the Delaware Mountain Group (Bell Canyon Formation) in western Texas and southeastern New Mexico. Stratigraphic traps occur where sandstone-filled channels are incised into less-permeable, interchannel siltstone. Subparallel, erosional channels are relatively broad, shallow features (0.5 to >8 km wide, 1 to >35 m deep) which trend at high angles to the basin margin and extend at least 70 km basinward. Channels are filled with siltstone and thick-bedded, moderately well-sorted, very fine sandstone. The sandstone contains abundant large- and small-scale tractive-produced stratification, generally lacks texturally graded sedimentation units, and shows no regular vertical sequence of stratification types. Channel erosion and sediment transport are interpreted to have resulted from long-lived, clay-free, density underflows of fluctuating flow strength. The flows may have originated by storm-ebb flushing of hypersaline shelf lagoons.

Reservoirs are subarkosic, poorly cemented sandstones with high intergranular porosity (15 to 25%) and relatively low permeability (<200 md). The presence of authigenic, pore-lining clay (principally chlorite) greatly affects reservoir properties in these sandstones. Source-rock analyses of the interbedded siltstones show large amounts of unstructured kerogen (TAI~2) and extractable organic matter (1,120 to 2,550 ppm), with high concentrations of hydrocarbons in the extractable organic matter (515 to 1,560 ppm). Delaware Mountain Group siltstones are good to very good source facies and are the most likely source for oil in Bell Canyon reservoirs.

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Permian-Pennsylvanian of West-Central Nebraska Panhandle

Pennsylvanian and Permian sediments in the sparsely drilled western panhandle of Nebraska reflect a transition through time from shallow-marine to restricted environments. Middle and Upper Pennsylvanian and Lower Permian beds are cyclic; a typical cycle sequence includes black shale and carbonate mudstones, wackestones, packstones, and grainstones.

The cyclic sequences, particularly those in the Desmoinesian series, can be compared to productive sequences in the Midland basin, the Four Corners, and the Dodge City embayment. The black shales are excellent source beds. Diagenetic processes both enhance and inhibit porosity. Dense, intratidal dolomites are the norm but the porous, supratidal dolomites associated with a shoal and strandline assemblage of carbonate grainstones in the Continental 1-35 Duncan (NW¼ SW¼, Sec. 35, T25N, R57W) strongly imply that a few feet of added elevation is the difference between tight rocks and those with effective porosity.

Lack of structural leads and scant deep drilling put strong emphasis on the stratigraphic interpretation of seismic data and modeling. A synthetic trace derived from a sonic log can be systematically altered by replacing high-velocity tight rock with porous-rock low veloc-

ities. Ideally, the modeled porous synthetic trace will compare favorably to the actual seismic traces.

Other factors must be integrated. Low-velocity rocks can be other than porous. Assuming porosity, where is it effective? At what position is the hydrocarbon trap along the updip edge of the effective porosity?

In addition to the Permian-Pennsylvanian cycles, the Niobrara chalks and the Cretaceous "D," "J," and Codell sandstones are potentially productive in the Nebraska panhandle.

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Lower Wilcox Shelf Edge in Texas—Relation to Growth Faulting and Geothermal Reservoir Quality

Most geopressed sandstone reservoirs in the lower Wilcox (Eocene) of Texas occur along a narrow trend associated with the ancient shelf margin. Traps for geopressed fluids were created by early, rapid growth of down-to-the-basin faults as part of a large-scale instability of the continental slope. Basinward translation and rotation of upper-slope fault blocks over a decollement zone of geopressed shale (south Texas) or salt (east Texas) initiated fault movement near the shelf break. After the shelf edge had prograded farther basinward, continued movement of some of these faults at a much reduced rate created normally-pressured traps in post-lower Wilcox formations. In east Texas, the shelf-edge structural style has been overprinted by growth of salt dome. Faults that originate near the restricts the volume of potential geothermal reservoirs.

Lower Wilcox deposition was dominated by the Rockdale delta system in east Texas, similar in scale to delta system of the Quaternary Mississippi depocenter. Sand distribution reached its maximum extent when deltas prograded to the shelf edge. The thickest geopressed sands occur in De Witt County at the southern edge of the Rockdale system. Maximum permeabilities occur in distributary sandstones; these are laterally continuous with extensive delta-front sandstones of lower permeability. A proposed test-well site for the Cuero geothermal prospect in De Witt County has been located to intersect the greatest total thickness of distributary sandstones.

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Proposed Model for Development of Red River (Ordovician) Porosity, Eastern Montana and Western North Dakota

Analysis of lithologic and electric log data from the Ordovician Red River Formation of eastern Montana and western North Dakota has been utilized to propose a diagenetic model of the nature, extent, and position of porosity development in this stratigraphic unit.

Abundant evidence suggests that porosity of reservoir quality developed around the perimeter of small structures exhibiting slight topographic expression during Ordovician time. Porosity of less than reservoir quality developed on the crests of these Ordovician highs. Sec-