

ABSTRACTS

AGUILERA, ROBERTO, Roberto Aguilera and Assoc., Inc., Calgary, Alta., Canada

Exploring for Naturally Fractured Reservoirs—A Petroleum Engineer's Point of View

Most fractures below 2,500 ft (762 m) are nearly vertical or of high inclination. Even if there are horizontal fractures, they probably tend to close owing to the effect of overburden.

What are the possibilities of intercepting a vertical fracture with a vertical hole? Most likely those probabilities are very slim. Therefore, when looking for naturally fractured reservoirs, the chances for success would be better if, instead of drilling vertical holes, directional holes, perpendicular to the orientation of the fractures, were drilled.

If the fractures are not intercepted, it is nearly impossible to detect potential hydrocarbon intervals from logs utilizing conventional techniques, as these techniques are based on invasion of the fractures by mud filtrate. Furthermore, a drill-stem test will probably recover only some mud and the pressure will not increase significantly because of the very tight characteristics of the primary porosity system. Under these circumstances, the prospect probably would be abandoned. The problem is that a potential hydrocarbon reservoir might be abandoned.

Directional holes have advantages over vertical holes in naturally fractured reservoirs. A method is available which allows recognition of naturally fractured intervals even though the fractures are not intercepted. Finally, the effects of small and large fracture treatments differ when the fractures are or are not intercepted by the borehole.

BLOOMER, R. R., R. R. Bloomer and Assoc., Abilene, TX

Depositional Environments and Reservoir Morphologies of Channel Sandstones

Channel sandstones are deposited in fluvial channels, fluvial-dominated deltas, submarine channels, and channel-dominated submarine fans on shelves and slopes of many basins. Excellent models of these channel-sandstone depositional environments and reservoirs are in Upper Pennsylvanian and Lower Permian sediments on the eastern shelves and slopes of the Permian basin. In dip-trending fluvial systems on superimposed coastal plains, sandstone reservoirs are in single and multiple strike-oriented point bars in meander belts, and longitudinal and transverse bars in braided belts. By differential compaction, these sandstone belts may produce oil where they drape over buried paleotopographic features such as reefs, structures, and sandstone bodies. Conversely, reservoirs may be found in and above these buried features by recognizing diversions in the trend of overlying channel-sandstone belts. Oil and gas in sediments adjacent to channels may be trapped by nonpermeable channel-fill barriers. Seismic cross sections of meander belts can clearly show convex-downward bases.

Stratigraphic traps are in thin distributary-channel sandstone facies of shelf-elongate deltas overlying limestone and shale beds and shelf. Shelf-margin lobate deltas have reservoirs in thick delta-front sheet, distributary-channel, and upper delta-plain sandstone facies on top of clastic wedges of sediments on slope.

"Packages" of fine-grained, lenticular turbidites can be correlated in submarine channels and fans on slope. Levees probably border submarine channels. Most Upper Pennsylvanian-Lower Permian slope sandstone reservoirs have been

stratigraphically miscorrelated with Lower Pennsylvanian sandstone formations on shelf.

BROWN, W. G., Baylor Univ., Waco, TX

Structural Geology Short Course

This 6-hour course presents a review of the basic structural principles which should guide any structural interpretation. Special attention is given to those principles which apply to the southern Oklahoma and west Texas areas. These principles include those related to thrust belt interpretation, reverse faulting and associated structures, wrench-fault tectonics, and extensional faulting. In keeping with the theme of this convention, several "new tricks"—or rather old and often unused techniques of structural analysis—are presented. These techniques include proper structural projection, down-plunge viewing, depth-to-detachment, and the concept of structural balancing.

CALDWELL, CRAIG D., and JOHN P. HOBSON, JR., Cities Service Co., Tulsa, OK, and DONALD F. TOOMEY, Cities Service Co., Midland, TX

Lithofacies and Paleontology of Early Permian, Allochthonous, Deep-Water Carbonates, Reagan and Crockett Counties, Texas—Some Paleogeographic and Exploration Concept Implications

Twenty-one lithologies have been identified in cores of lowermost Wolfcamp limestone and shale in 6 wells in the general area of World field, Midland basin. These lithologies are summarized into four major lithofacies. (1) One lithofacies is floatstone (greater than 10% clasts larger than 2 mm "floating" in finer matrix) and variably compacted rudstone (like floatstone, but grain supported) containing angular, lithologically diverse, platform-derived micritic intraclasts and bioclasts in a clayey or marly matrix. The lithoclasts are a product of disintegration of lithified platform facies, probably Wolfcampian. (2) A second facies is interbedded shale and thin, horizontal, and, in places, ripple-laminated carbonate sands mainly of allochthonous bioclasts. (3) Micritic rudstone and wackestone contain platform-derived micritic intraclasts and bioclasts. This facies is variably porous with intergranular, moldic, solution-enlarged moldic, intragranular, and fracture porosity. (4) Argillaceous packstone and wackestone with allochthonous bioclasts and intraclasts and semi-intraclasts are of off-platform origin. This facies displays a variety of soft sediment deformation features.

Facies components probably were supplied and emplaced episodically by a variety of shelf-edge and slope processes during a time of active faulting in the area. Rudite-size clasts were transported 15 mi (22.5 km) or more from the Central Basin platform on the west. Finer detritus swept basinward for much greater distances. Limited comparison is made with carbonate sediments of Exuma Sound, Bahamas.

Off-platform Wolfcamp facies abruptly overlie and contrast markedly with a variety of Desmoinesian (Strawn) shallow subtidal platform facies displayed in three cores. The contact, present in one core, is interpreted primarily as a nondepositional unconformity.

Age and facies determinations from the cores significantly alter correlations and interpretations made with wireline logs alone, resulting in improved exploration concepts. Allochthonous carbonate complexes may well provide new, potentially important, reservoirs in this region. Preliminary