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Application of Capillary Pressure and Hydrodynamic Flow to Quantify Downdip Extension of Shallow, Low-gravity Oil Fields: An Example from South Texas

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The principles of capillary pressure and hydrodynamic flow can be useful for exploring in mature areas and exploiting oil fields. The principles are especially useful in the numerous shallow stratigraphic traps in the Jackson Group (Oligocene) in south Texas. The field example in this paper had produced oil since 1955 from wells on the updip limit of a shallow (1700 ft) barrier island sandstone reservoir. Despite the updip wells producing at a one percent oil cut, downdip wells were drilled and completed with a very commercial 25% average oil cut in 1990. Field reserves were doubled from 300,000 to 600,000 BO with the additional downdip wells.

The success of drilling downdip from watered-out wells can be quantified with capillary pressure and hydrodynamic flow calculations. The difference in density between oil and water is part of the divisor in both equations. The difference is only 0.08 g/cc in this area, because the oil is 19 gravity (.92 g/cc) and the water is brackish (1.0 g/cc). Thus, a relatively large column of

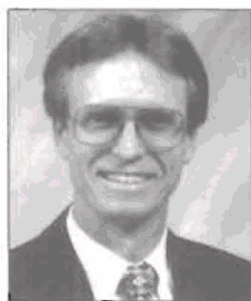
oil can be trapped downdip with only slight grain-size changes. Similarly, a relatively modest, downdip water flow within the reservoir could also trap a similar-sized oil column. Using reservoir conditions, each equation predicts an approximate oil column of 50 ft.

Using these principles, both exploration and development geologists can find commercial oil reserves downdip from existing wells that have watered out or wells with only a hydrocarbon show and water. These principles are especially useful with low-gravity oil accumulations, heterogeneous reservoirs, and downdip water flow.

Biographical Sketch

Lee T. Billingsley is an independent geologist, president, and founder of Sandia Oil & Gas Corporation in San Antonio. He has been an independent geologist since 1983. He received a B.S. in geology from Texas A&M University in 1975, a M.S. in geology from the Colorado School of

Mines in 1977, and a Ph.D. in geology from Texas A&M in 1983.



Current areas of interest include shallow oil plays in South Texas, as described in the attached abstract, and multiple regional exploration targets in the Texas and Oklahoma Panhandles.

Lee is active in geological professional activities. He is a past-president of the South Texas Geological Society, past co-editor of their *Bulletin*, and an active SIPES member. In the AAPG, he is the immediate past-treasurer, past and current member of the House of Delegates, and current Associate Editor. In addition, he will serve as Vice Chairman of the Annual AAPG Convention in San Antonio in 1999. ■