Overpressure Origin in the Bossier Trend, Texas, from Gas Generation and Oil Cracking

Philip D. Heppard, Bill H. Babcock, Jeffrey R. Allwardt, and Sarah K. Collier

ConocoPhillips Company, 600 N. Dairy Ashford Rd., Houston, Texas 77079

ABSTRACT

Currently there is very active exploration and development of highly overpressured gas sands of Late Jurassic age in the Bossier Trend from onshore Texas to Louisiana in the U.S. Gulf Coast region. In the principal study area of Savell Field, Robertson County, Texas, the reservoir sands are overpressured to as high as 17.9 PPG (pounds per gallon) (6900 psi overpressure) at 14,500 feet, and are sealed vertically by marine to deltaic shales, and laterally by down-to-the-basin, northeast-southwest trending, normal faults. The Bossier section is directly overlain by a thin, dense limestone unit, and then by thousands of feet of normally pressured siltstone and sandstone of the Cretaceous Travis Peak Formation. Current reservoir temperatures are 320 to 370 degrees F. The lower Bossier shale section has log responses indicating an organic content and likely dispersed gas. Gas cracking of earlier reservoired oil in interbedded sandstone and organics in the shale is interpreted to begin from 60 to 50 Ma. Evidence that the overpressure is due to fluid expansion from gas generation is from the observations that the Bossier shale is relatively dense at 2.6 to 2.65 g/cc and normally compacted for its maximum burial depth; however, there is an obvious well-log response in terms of velocity and resistivity in the shale to the overpressure. Our working model is that the observed log response is due to the increasing overpressure slightly forcing apart grains and expanding the "connecting pores," while not significantly increasing the porosity. The increasing pressure in the pores decreases the grain-to-grain contact area, therefore decreasing the rigidity of the rock and as an effect reduces its velocity. The slight opening of the connecting pores also provides electrically-conductive pathways, reducing the rock resistivity yet having little overall affect on its total porosity.

Heppard, P. D., B. H. Babcock, J. R. Allwardt, and S. K. Collier, 2008, Overpressure origin in the Bossier trend, Texas, from gas generation and oil cracking: Gulf Coast Association of Geological Societies Transactions, v. 58, p. 379.