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Character of Overpressure in the Deep Tuscaloosa Trend, Louisiana

The deep Tuscaloosa trend extends across the State of Louisiana and provides gas from overpressured reservoirs at depths greater than 15,000 ft. The existence of overpressure is manifested in dense mud required to control the well while drilling, in pressures measured in sandstone reservoirs with repeat formation testers, in elevated temperature gradients below the top of the Upper Cretaceous chalks, in decreased electrical resistivity, and in increased sonic slowness (decreased velocity). Pressure, temperature, and well-log data from wells along the length of the Tuscaloosa trend show that shales are everywhere overpressured. Overpressure exists in three major shale units: the lowermost Midway Group, the marine shale of the Tuscaloosa Formation, and thick shales underlying the sandstone-shale sequence of the lower Tuscaloosa Formation.

Using an equation relating sonic velocity and effective stress, pore pressure computed from sonic logs within shales in the Morganza field is found to be comparable to pressures measured in overlying sandstone reservoirs. The close agreement between shale and sandstone pressures indicates that gas reservoirs are probably sourced by underlying shales and that migration paths may be short. Maximum pore pressures computed in shales of the Midway Group and the Tuscaloosa marine shale increase with depth, and depth increases with distance from the Cretaceous shelf edge. Consequently, the likelihood of encountering highly overpressured reservoirs increases with distance from the shelf edge.