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Log Evaluation of Wells in Tuscaloosa Trend of South Louisiana

The Tuscaloosa trend of south Louisiana provides many challenges to oil and gas operators. The formations are found below a depth of 16,000 ft (4,877 m). At these depths, temperatures approach 400°F (204°C) and pressure gradients range from 0.459 to 0.96 psi/ft. Production tests have shown the presence of $CO_2$ and $H_2S$ and have revealed that formation water salinity ranges from 11,500 to 120,000 ppm NaCl. These salinity variations occur both vertically and laterally.

The combination of depth, high temperature, and varying pressure gradients along with the presence of $CO_2$ and $H_2S$ has complicated drilling, usually resulting in the use of oil-base mud below a depth of about 16, 000 ft (4,877 m). The logging tools used to evaluate these formations must operate in this hostile environment. Various combinations of tools are applicable to Tuscaloosa evaluation, with limitations. Difficulties in calculation of formation water salinity arise from logs run in oil-base mud.

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Atchafalaya Delta—Louisiana's New Prograding Coast

Building of the Atchafalaya delta constitutes one of the most significant geologic events in historical times within the Mississippi Delta complex. Periodic upstream diversions, such as the present Atchafalaya River, result in switching of the major loci of active deposition and are among the fundamental mechanisms of Mississippi delta growth.

Prior to 1950 Atchafalaya sediment was trapped in intrabasin lakes and swamps. Thereafter, progressive basin filling prompted silt and clay deposition in Atchafalaya Bay and initiated the subaqueous phase of delta building. This developmental stage continued until the appearance of sand-dominant subaerial lobes in 1972, after which rapid subaerial growth occurred.

Development of the Atchafalaya delta is related to major flood pulses of the Mississippi River. Interpretation of Landsat imagery and aerial photography indicates extensive subaqueous and subaerial growth during years of major floods. This trend is supported by subaerial transect measurements, which reveal maximum bar aggradation of 0.44 m and up to a 40% reduction in channel cross-sectional area due to levee migration and mid-channel bar formation during floods. In addition, major floods serve to repair lobes eroded during severe winter cold-front passages.

River-mouth processes are frictionally dominated. Channel-mouth bifurcation, accompanied by coarse-particle deposition, is the major process of lobe initiation. Larger lobes are the result of coalescence of numerous distributary-mouth bars and adjacent channels. Major channels, separating large lobes, supply sediment to areas bayward of the existing lobes. As the bars coalesce, the distance from the river mouth to the head of the emerging bar decreases and the bifurcation angle increases.

Retreat of this part of the Louisiana coast has occurred since the Bayou Black depositional phase of the Lafourche delta lobe, 1,000 to 2,000 years ago. The Atchafalaya delta, prograding at a maximum rate of 6.5 sq km/year, is helping offset the 42.2 sq km/year loss of Louisiana wetlands.

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Seismic-Stratigraphic Mapping of Gulf Coast Stratigraphic Traps

The mappability of a seismic-stratigraphic trap depends not only on the thickness and the stratigraphic position of the objective unit, but the velocity contrast with nearby beds. Analysis of band-pass filtered sonic logs provides a useful technique for determining the portion of the frequency spectrum that carries the basic stratigraphic information. Depending on local stratigraphy, both high (75 to 125 hz) and low (0 to 10 hz) frequency components may be important in defining the trap. The filtered sonic can be used to predict the seismic mappability of stratigraphic units.

Review of seismic-stratigraphic data over fields in the Gulf Coast indicates that determining the mappability of a feature depends on complete understanding of the trap. At Walker Creek field, Smackover porosity is not resolved with a 60-hz filtered sonic. Because the basic reservoir-seal relation is low frequency, however, the field limits are clearly expressed on real seismic-stratigraphic data. Alternatively, recognition of the pinch-out of the 20-ft (6.1 m) thick Spanish Camp Sand at South Lissie field serves as an excellent example of a trap expressed as a high frequency feature.

These simple examples illustrate clearly that both high and low frequency components are required for successful seismic mapping of Gulf Coast stratigraphic traps.

WEBER, ANTHONY

Pachuta Creek (Smackover) Field, Mississippi

The Pachuta Creek oil field, located in T2N, R14E, Clarke County, Mississippi, was discovered in 1968. Since that time, the field has yielded over 24 MM bbl of oil from the Smackover Formation. Eighty-one wells have been drilled in the field, with a good coverage of seismic data. However, previous studies of the Pachuta Creek area have been unable to thoroughly integrate the geophysical and geologic data into structural maps. This difficulty is due to the dynamic nature of the acoustic velocities associated with the changing lithologies in the area. The creation of average acoustic velocity maps has been accomplished by close correlation of the seismic data with the subsurface well information. These velocity maps represent the average acoustic velocity configuration from sea level to the top of each of three formations: Haynesville, Smackover, and Louann Salt. These average velocity maps provide the key for transforming seismic data (in time) to subsea depths consistent with the subsurface well control. Subsurface structure maps have been constructed at the top of the three formations previously identified. These maps represent a thorough integration of both geologic and geophysical data and provide a means for accurately ascer-