New Exploration Techniques in Low Relief, Mature Conventional Oil Fields: A Case Study from Central Louisiana

Tim Rynott

Ridge Resources LLC

ABSTRACT

Many low relief mature oil fields, in active deltaic settings with associated stacked pays, cannot use 3D seismic in the traditional sense when direct hydrocarbon indicators (HCI's) are not prevalent, and velocity issues are pervasive. Therefore, the tools for a geoscientist are limited when attempting to accurately define 4-way subtle structures resulting from variable stratigraphy (differential compaction structures). Nearshore deltaics are commonly associated with strong water drive reservoirs; from an economic prospective, diagnosing the structural apex is essential for location of optimum drainage points to maximize production and recovery. In these situations, a combination of zonal net sand isopaching and seismic flattening become the essential tools for most effective development drilling.

Well established methods for understanding depositional environment include interpreting SP (spontaneous potential) patterns and mastering the relevance of sandstone geometries. For instance, prograding nearshore channel sands typically have sharp top and base contacts and linear geometries which are perpendicular to the coast line.

Differential compaction structures are associated with sands which are laterally encased by low net-to-gross sand/shale intervals. These sandstones become rigid geometries relative to the softer de-watering (compressing) shales. Since the corresponding structural high could have relief of less than 1 degree, the resolution of 2D and 3D seismic is often inadequate for mapping the structure with sufficient accuracy. Because of this, early operators were flying blind had they not considered stratigraphic changes.

Once a stratigraphic anomaly is identified (e.g., channel sand, distributary mouth-bar, barrier bar, etc.), a 3D dataset brings value when a reflector associated with the base of the sand body is flattened, and a time slice is created immediately above the flattened reflector. The differential compac-

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tion component of the feature should be enhanced, providing a potential roadmap to remaining hydrocarbons. Keep in mind: (1) Interpretation reliability is proportional to the thickness of the sand geometry, and (2) poorly imaged/processed data, or data which contains low frequency content, or low acoustic impendence contrasts can be problematic.

Since nearshore deltaics (high energy) have corresponding high permeabilities/porosities (resulting in high recovery factors), modest 5–10 ft of structural gain to abandoned producers can yield attractive economics even with soft commodity prices.

Low entry fees into shallow, onshore conventional oil fields are attainable, plus infrastructure is often already in-place. Therefore, the economics for these types of low cost ventures are lucrative for small independents who struggle competing with capital intensive resource plays.