

STRATIGRAPHIC CHARACTERISTICS AND SANDSTONE DISTRIBUTION OF THE HACKBERRY DEPOSITIONAL SYSTEM (MID OLIGOCENE), S.E. TEXAS AND S.W. LOUISIANA: A SAND-RICH SLOPE-FAN COMPLEX

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ABSTRACT

The Hackberry depositional system has been long recognized by Gulf Coast geologists by its anomalous deep-water fauna, rapid lateral variation in sandstone thicknesses, and prominent basal erosional unconformity. Hackberry sandstones also serve as major hydrocarbon reservoirs in many fields in southeast Texas and southwest Louisiana. A vertical succession through the Hackberry typically shows the basal erosional surface overlain by a variably sandy interval, informally termed the lower Hackberry sands, and capped by a thick deep-water interval, the Hackberry shale (Fig. 1).

High-quality seismic data indicate that the Hackberry has a distinctive seismic signature. This seismic signature permits the interpretation of Hackberry lithologic characteristics in a sequence stratigraphic framework. Key elements of the seismic signature (Fig. 2) include: (1) a series of half-graben-like slumps, marking the updip limit of the Hackberry depositional system, and representing the failure of an immediately pre-existing shelf edge, (2) a basal erosional surface, in some places channelized as deep as 1800 ft. and cutting as deeply as the Eocene, representing a prominent sequence boundary upon which the Hackberry was deposited, and (3) a pronounced downlap surface with well-developed suprajacent clinoform geometries, best developed in updip positions and representing a maximum flooding surface within the Hackberry shale.

Most Hackberry sandstone is confined to the lower Hackberry sand interval immediately above the sequence boundary. The Hackberry sandstone isopach shows numerous linear to ovoid-shaped areas of thickly developed sandstone separated by areas of little or no sandstone. In some places, linear sandstone depocenters can be related to eroded and channelized slope paleotopography that is discernable seismically. Elsewhere, linear areas of thickly developed sandstone are not associated with a clear erosional expression on seismic records and may represent broadly linear, aggradational turbidite fills in paleolow positions. Other, more irregular to ovoid-shaped sand patterns represent ponded aggradational deposits in intraslope paleolow areas and basins. Paleontologic data strongly suggest that this system was deposited at the time of the large mid Oligocene sea-level lowstand shown on the Haq *et al.* (1987) coastal onlap curve. Deposition of lower Hackberry sands commenced when fluvio-deltaic systems bypassed the foundered shelf edge and sediment-gravity flows ensued through a tortuous network of upper slope channels, gullies, and other paleolows. Collectively, these deposits represent the upper and middle portions of a sand-rich slope-fan complex.

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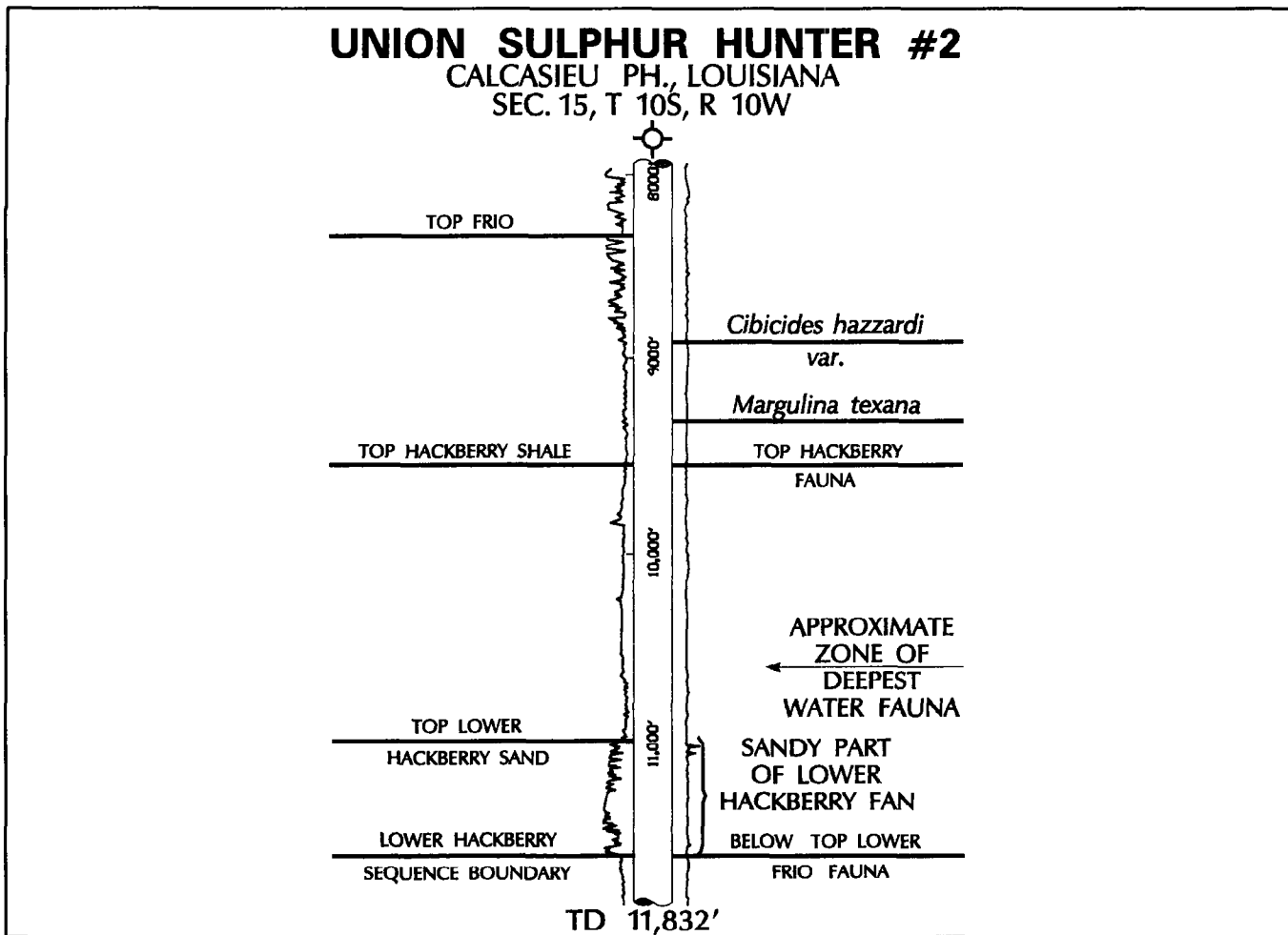


Figure 1. Example of a log through the Hackberry system. This log shows a very thickly developed sandstone in the lower Hackberry interval. Location shown in Figure 3.

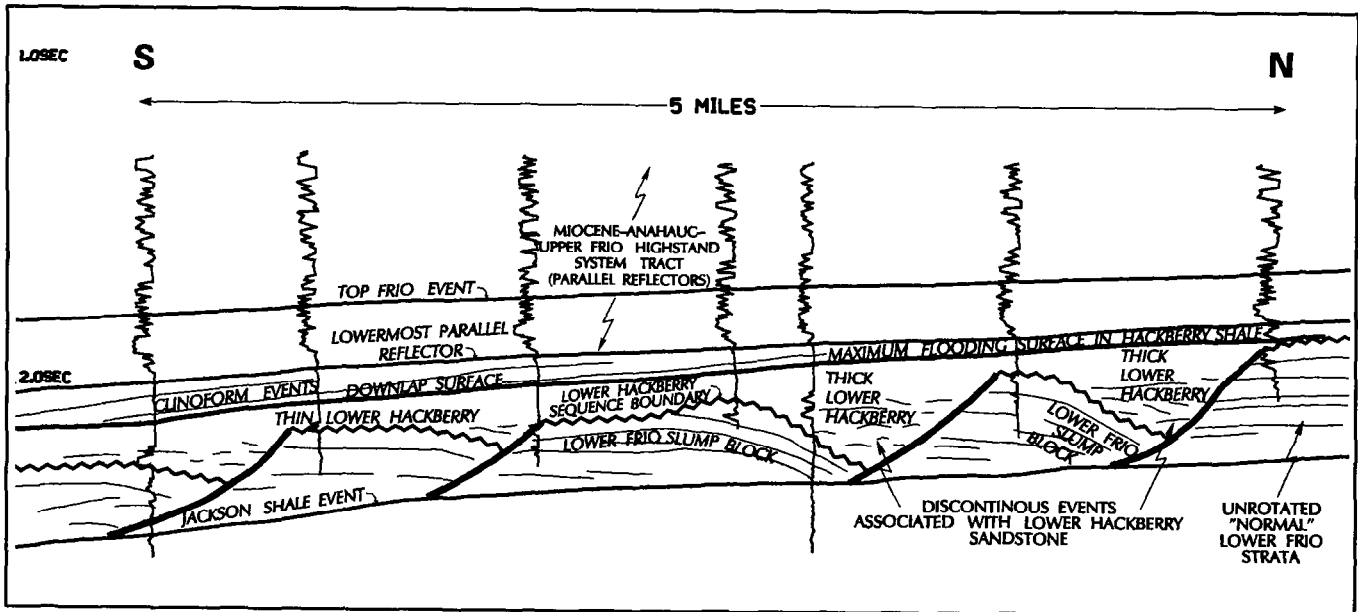


Figure 2. Key elements of the Hackberry seismic signature drawn from a seismic line at updip limit of Hackberry embayment in northwestern Calcasieu Parish. Line of section shown on Figure 3. Overall section shows a series of half-graben-like slumps representing a failed shelf edge that characterizes the updip limit of the Hackberry embayment. Note the lower Hackberry sequence boundary at base of Hackberry system and the downlap surface, representing a maximum flooding surface, within the Hackberry shale. Spontaneous potential curves from adjacent wells are replotted showing their vertical dimension in two-way acoustic travel time and added to the section.

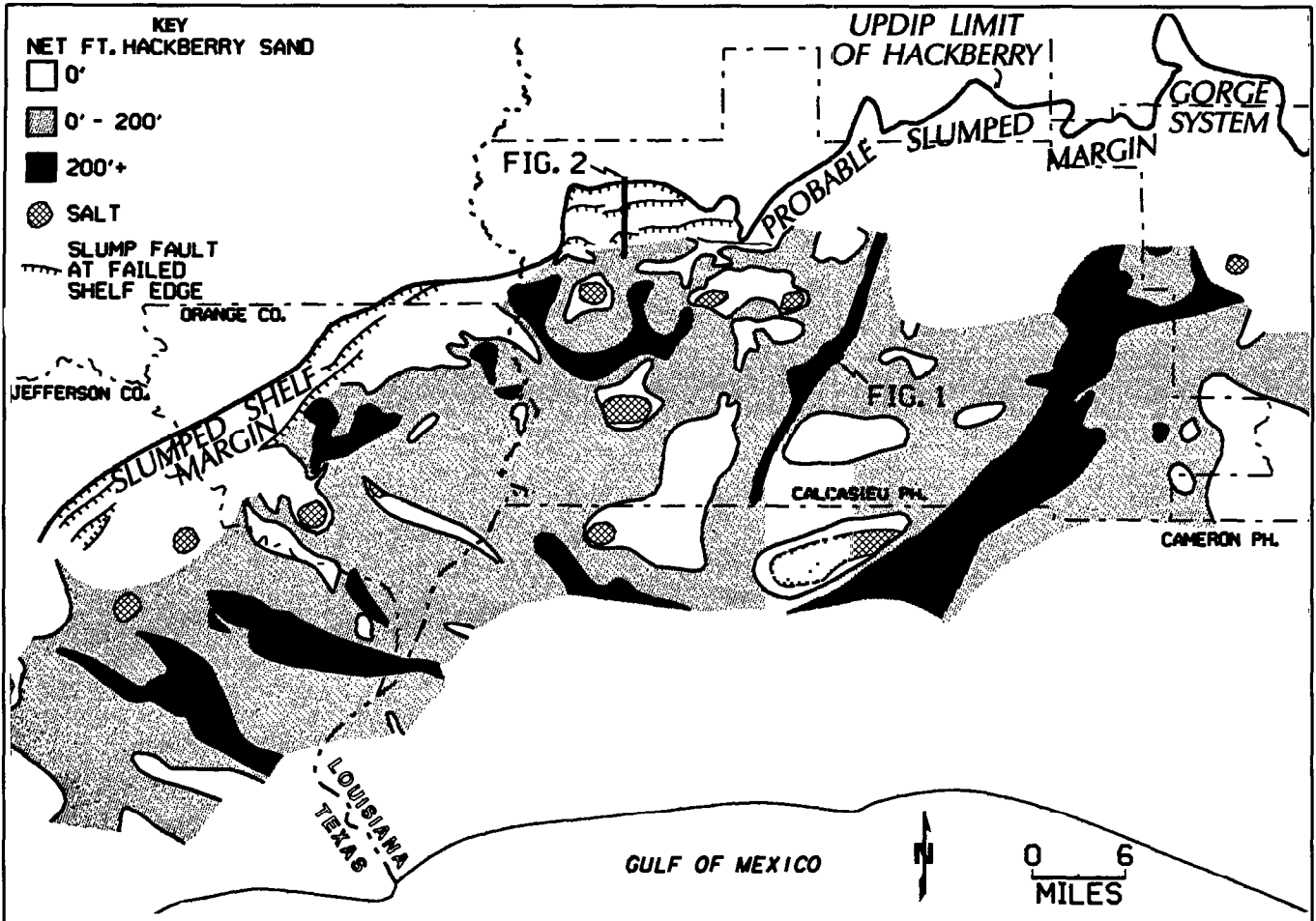


Figure 3. Map of net feet of sandstone in the Hackberry system. Map includes all sandstone from top Hackberry shale to the lower Hackberry sequence boundary. Most of the sandstone is restricted to the lower part of the system, below top lower Hackberry sand (Fig. 1), and map pattern shows sandstone depositional patterns of lower Hackberry interval. Two principal depositional geometries are apparent: linear sandstone depocenters and ovoid-shaped depocenters. Details of sandstone distribution were not evaluated and are not shown for the updip slumped shelf margin zone and in northeastern Calcasieu and northwestern Jeff Davis Parishes, Louisiana.