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Reservoir Characterization of the Strawn (Desmoinesian) from St. Lawrence Field, Glasscock County, Texas

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The Strawn Formation is one of the more enigmatic hydrocarbon producing formations played on the Eastern Shelf in the Midland Basin. Production rates vary significantly over small regions. Of the Strawn fields discovered along the Eastern part of the Midland Basin, and the associated shelf region, the St. Lawrence (Strawn) field located in Glasscock County, Texas (Fig. 1) is one of more prolific. In order to gain a better understanding of the nature of the reservoir properties of the Strawn a continuous 120 ft thick core was taken by Texaco Exploration and Production, Inc. (Fig. 2). The core includes both the upper and lower contacts with the overlying Canyon sand/shale sequence and the underlying "Atoka" Formation.

The core is composed of 22 high-frequency, shallowing-upward cycles (Fig. 3). The cycles identified in the Strawn Formation begin with a black, fissile shale, or black argillaceous lime mudstone containing an open marine fauna. This part of a cycle is interpreted as representing the initial rise of relative sea level for each cycle. Overlying these muddy facies found at the base of each cycle are a succession of normal, open marine carbonate facies, which reflects a continuous shallowing of sea level, suggesting a reduction in the amount of available accommodation. The procession of facies observed in the cycles, from mud-rich to grain-rich, also indicates an increase in water energy. Cycles are capped by grain-rich packstones, or skeletal grainstones. These grain-rich facies represent the primary reservoir facies in the Strawn Formation. The high-frequency cycles can be grouped into three composite cycles, which likely represent three fourth order sequences. These larger packages of cycles, or cycle sets, can be correlated with cycles described in additional cores from the Strawn from the Eastern Shelf.

The tops of a majority of the cycles exhibit signs of exposure. These include karstification and the development of soils. The diagenetic processes associated with sub-aerial exposure acted in some cases to enhance porosity and in other cases to reduce porosity. This was done through the dissolution of unstable carbonate grains, which resulted in the creation of moldic and vuggy porosity. Where pervasive fresh-water cementation is present a significant amount of the primary porosity, and in many cases secondary porosity, is occluded. When porosity is preserved, it tends to be restricted to the upper, more grain-rich lithofacies in the cycle near the exposure surface. Maximum measured core porosities are 10%. These data compare well with log porosities measured over the same stratigraphic interval in the cored well, and with stratigraphically equivalent intervals in offsetting.

Utilizing core information in combination with porosity log data the Strawn can be easily correlated cycle to cycle with a higher degree of confidence. The ability to correlate cycles over long distances is an aid for better reservoir development, and the planning, drilling, and completion of more successful vertical and horizontal wells. This is not only true for the Strawn in the St. Lawrence area, but can be taken, with good geology to other areas along the Eastern Shelf and the Midland Basin.

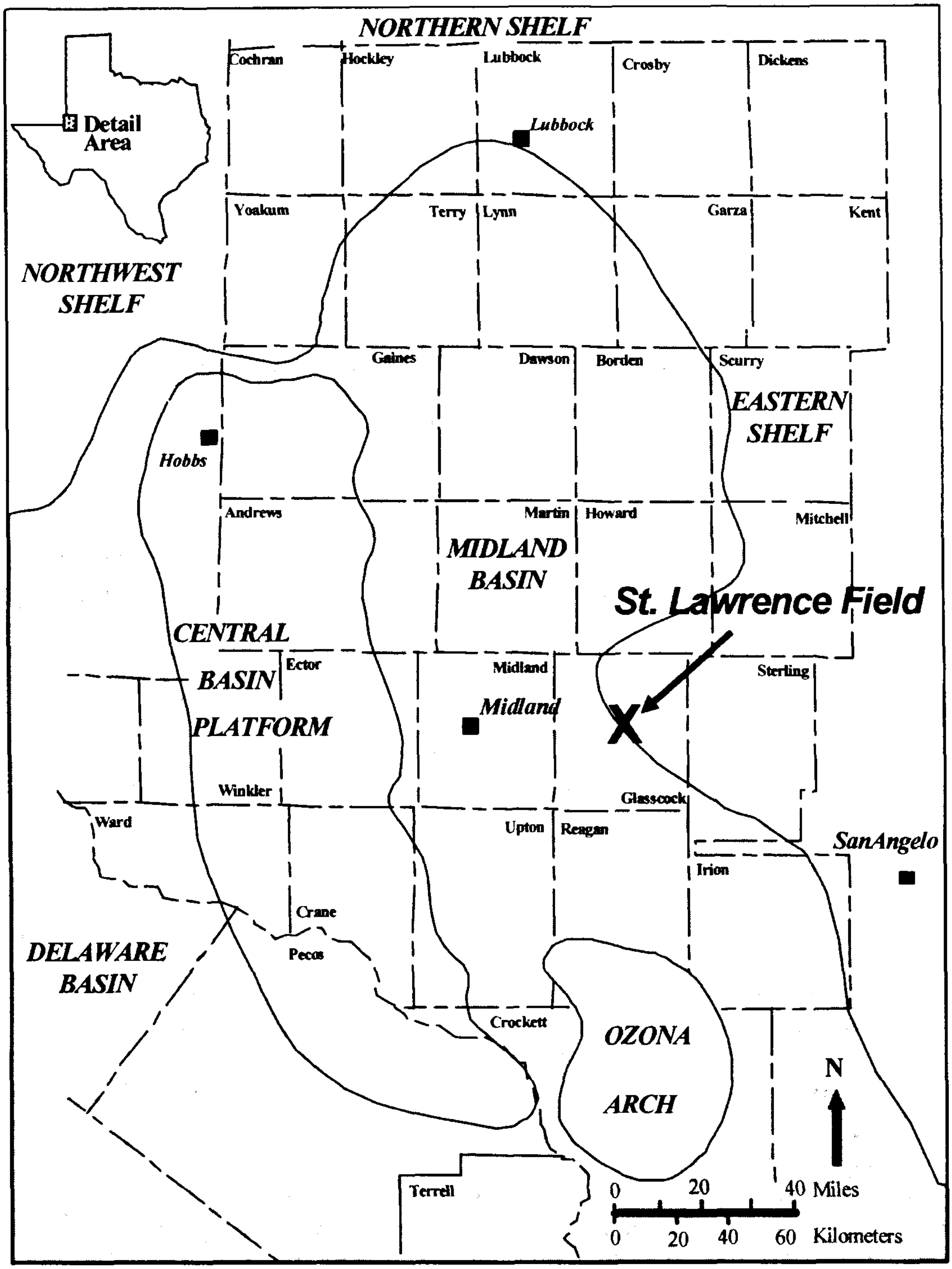


Figure 1. Location map illustrating the location of St. Lawrence Field, and the spatial relationship of the field to the major geologic elements of the Permian basin.

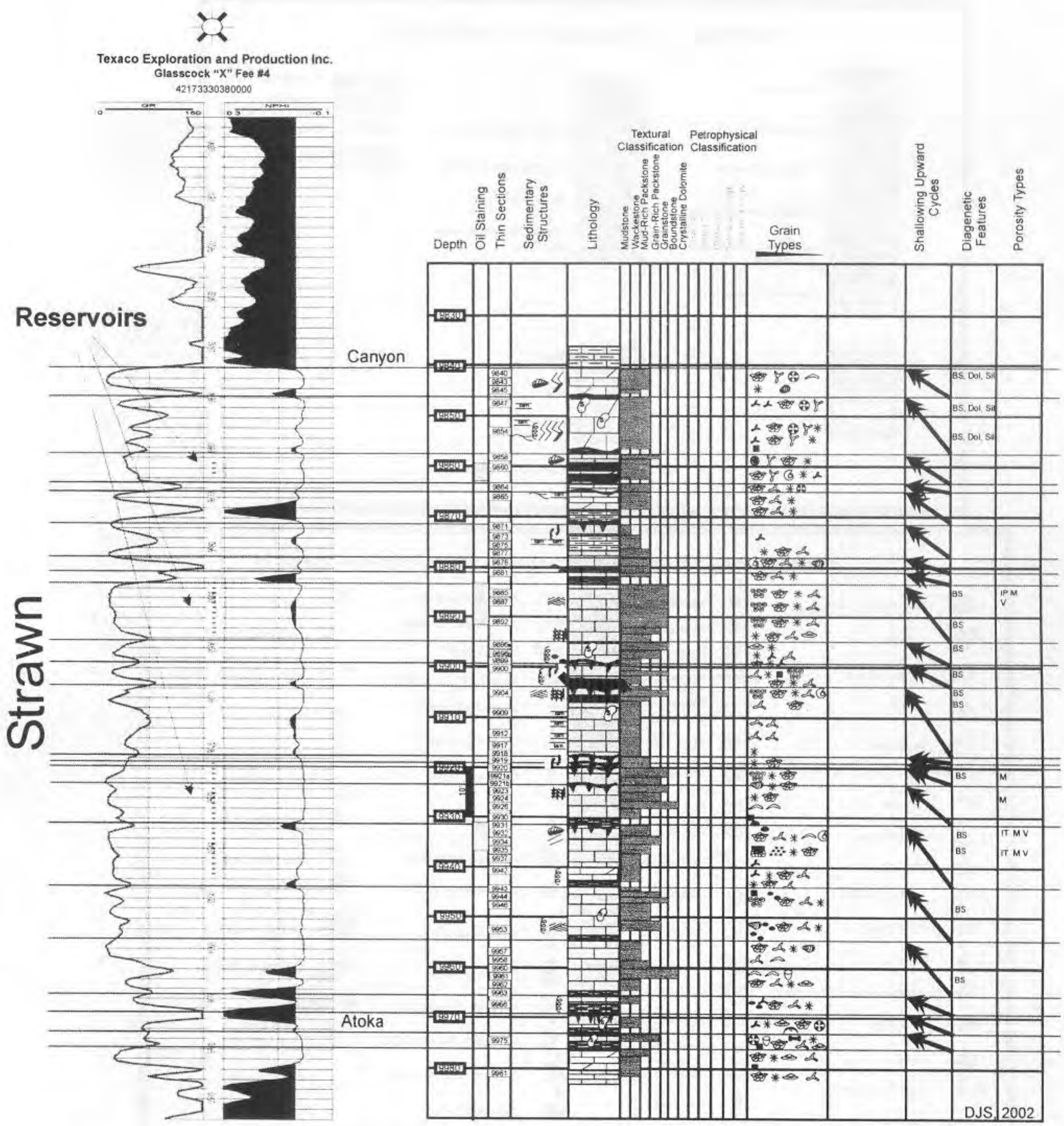
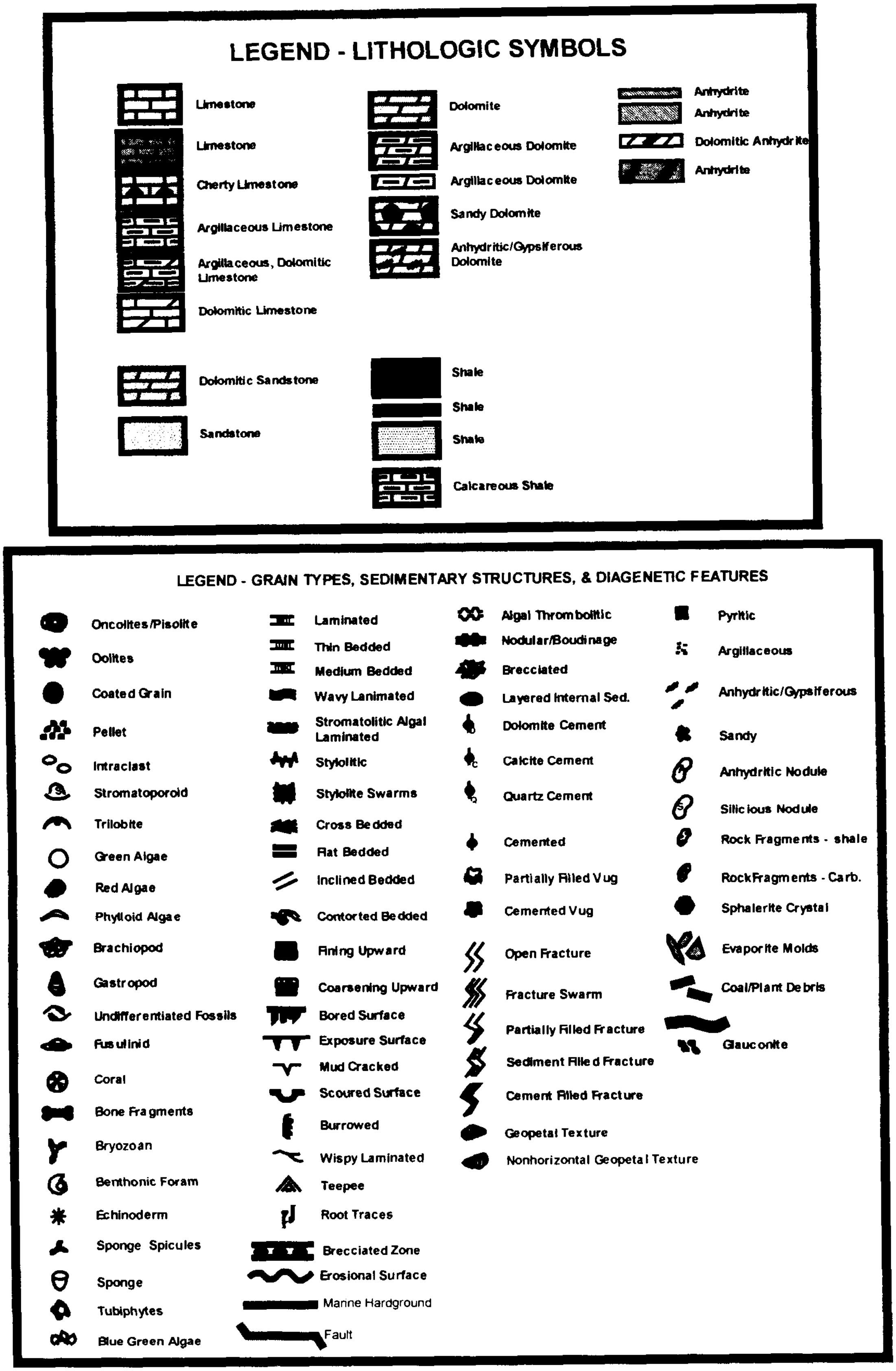


Figure 2. Gamma Ray/Neutron log through the Strawn Formation with the corresponding detailed cored description for the Texaco Glasscock "X" Fee #4. Note the cyclic nature of the Strawn, and the position of the reservoir in relation to the distribution cycles. This diagram also illustrates the close tie between the electric log signature of cycles and the cycles observed in the core.



Symbol Legend for Figure 2.

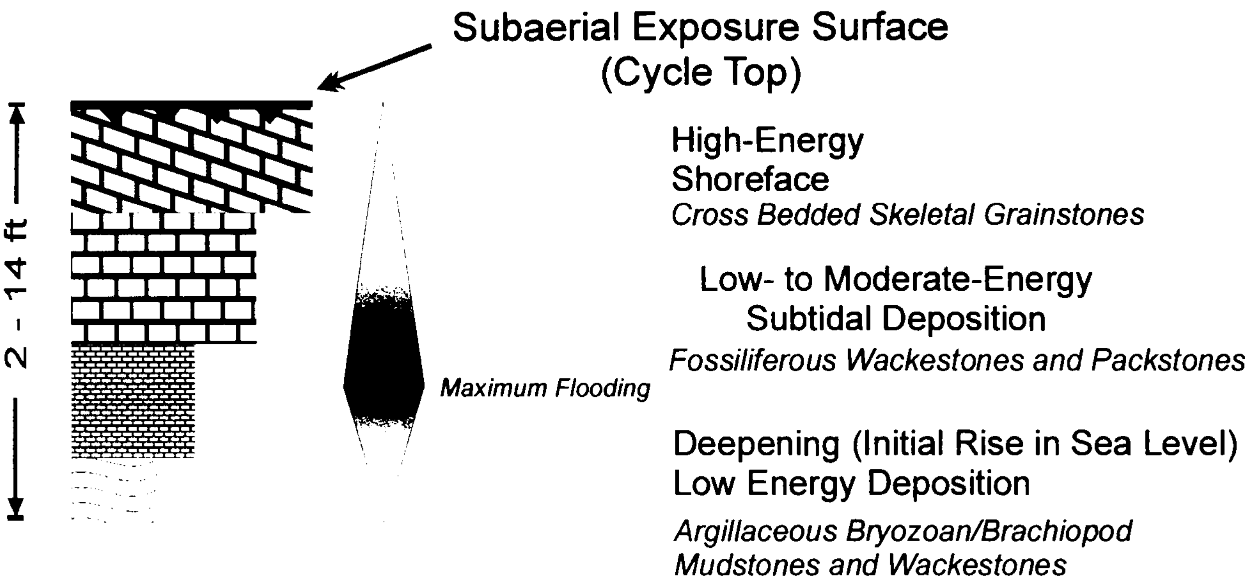


Figure 3. Ideal cycle for the Strawn Formation in the St. Lawrence (Strawn) Field. This generalized illustration shows the overall change from low-energy, mud-rich facies found at the bases of cycles to high-energy grain-rich facies found in the upper portions of cyles. These grain-rich facies, the grainstones and the grain-rich packstones, are the reservoirs. The exposure surfaces and basal mud-rich facies provide the upper seal for the reservoir. Lateral seals are either facies changes, or created by diagenesis.