Evidence for Deep Tectonic Influence on Mannville Deposition at Suffield, Alberta.

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Introduction

The Suffield area of southern Alberta has had an intense history of industry activity since drilling began around 1932. While thousands of wells have been spudded in the area, the vast majority of them have targetted shallow gas opportunities. The Precambrian basement has been evaluated by only 18 wells (0.24%) in the study area. Geological understanding of the influence of basement tectonic activity on overlying sedimentation clearly cannot be advanced through the study of the existing well database alone. Recent modern acquisition of High Resolution Aeromagnetic (HRAM) data and large scale 3D seismic surveys provide the opportunity to study the relationship between the tectonic history of the area and sedimentation. The combination of the detailed geological information in the Mannville section with the detailed structural information at depth from the 3D seismic data and basement trend information from the HRAM data provide a unique opportunity to develop a more complete understanding of the influences of tectonism on sedimentation in this part of the Western Canada Sedimentary Basin.

Discussion

The area under discussion in this paper (TWP 16-17, RGE 8-9 W4) is covered by a larger HRAM data acquired in 1996 and 1998 over the Alderson-Suffield area (TWP 11-23, RGE 7-16 W4M). The HRAM data has been processed to enhance the magnetic signal from the shallow magnetic basement. Interpretation of the processed results in the local study area reveals strong evidence for basement rooted faults which strike NE-SW and NW-SE. Figure 1 shows an example of a filtered HRAM output representing magnetic signal from the upper magnetic basement at an estimated depth of 2 to 4 Km. Note the lateral offsets of the major magnetic features in both NE-SW and NW-SE orientations.

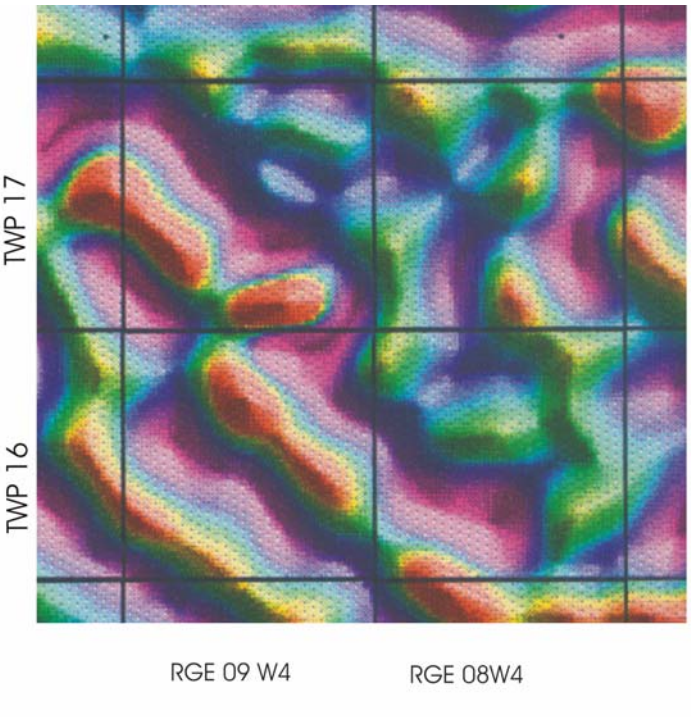

Figure 1: Filtered HRAM data over the study area. Note the lateral offsets of the major NW-SE oriented magnetic reatures suggesting NE-SW oriented faults.

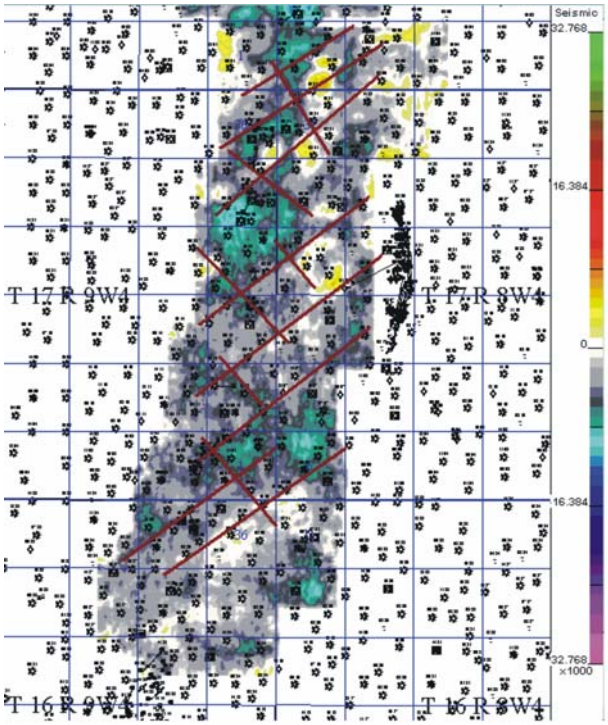

Figure 2. Timeslice through merged 3D seismic volume at basement level. Note the linear offsets associated with the interpreted faults.

The 3D seismic data, as seen in Figure 2, was acquired as several smaller surveys and merged into a large contiguous survey by EnCana in 2001. Interpretation of the deep reflectors in the vicinity of the PreCambrian basement at approximately 2 km depth show distinct evidence of NE-SW and NW-SE oriented fault patterns as seen on the timeslice in Figure 2. The details identifiable from the seismic show much denser fault patterns than can be resolved by the HRAM data. Investigation further reveals that tectonic movement along these faults has occurred periodically throughout the sedimentary depositional history of the area, well into the Cretaceous.

Detailed understanding of much of the depositional history of the Mannville section is possible due to the extensive well control in the area. Of particular interest is the deposition and subsequent structural distortion of the Glauconitic sequence in the Lower Mannville. 3D seismic data provides vital information on the structural distribution of the Glauconite, as well as geomorphologic information throughout the Mannville. Many channels and other depositional features can be clearly related to the deeply rooted faults identified on HRAM and 3D seismic data. The post depositional structural distortion of the Mannville section can be directly ascribed to reactivated movements of older structural features.

Conclusions

There is sufficient evidence from seismic, HRAM and well data in the Suffield area to illustrate that deep tectonic patterns have influenced both sedimentation and eventual structural orientation of many of the important reservoir units within the Mannville section.

References

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