3D Seismic Characterisation of the Hay River Wrench Fault Zone and its Relationship to Slave Point Reef Depositional Patterns and Diagenesis.

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The Hay River Fault Zone (HRFZ) is a structural feature that trends in a SW-NE orientation adjacent to the prospect area which lies west of the Ladyfern field in NEBC. The HRFZ is thought to be a right lateral wrench fault zone that initiated at about 2000 Ma and has remained active up to the late Paleozoic; and perhaps even to the present day.

Fault patterns conforming to the right lateral wrench fault strain ellipse of Harding (1974) were mapped through out the Paleozoic section utilising a dip azimuth attribute analysis. This strain ellipse (Fig.1) is an excellent template to apply to the structural texture that the seismic attribute analysis illuminates within the 3D dataset (Fig. 2). It enables the interpreter to apply a structural model to each set of faults (i.e. shear, folds, etc.) and with this understanding it can be demonstrated how these various structural components impacted the sedimentary section.

It became apparent while mapping a Slave Point reefal complex that a strike-slip or shear set of faults was active prior, during and post Slave Point deposition. This set of faults is high frequency in its spacing and relatively low amplitude in its relief. The high energy reef facies within the complex have a strong sense of conforming to the strike of these shear faults and therefore it is thought that the pre-Slave Point topography created by these shear sets were initiation points for reef growth.

Present day structural closures within this reef complex are associated with the compressional folds predicted by the strain ellipse. These folds are more widely spaced than the spacing of the shear sets and have a much greater vertical amplitude when compared to the shear set of faults. The impression is that this structural component was also active prior, during and post Slave Point deposition but its impact on the stratigraphy is relatively subtle. The primary importance of the folds is due to structural closures within the carbonate complex; and for the present day interpreter they created a compelling trapping mechanism to be exploited.

The well-defined wrench system demonstrated on this 3D survey permits investigation of the hypothesis that flow paths of hydrothermal dolomitising fluids were controlled by this system of faults. There are a number of intriguing clues which lead to speculation regarding the identification of the critical structural component to this diagenetic story, but at the present time the well control is too sparse to constrain the various alternatives.

References

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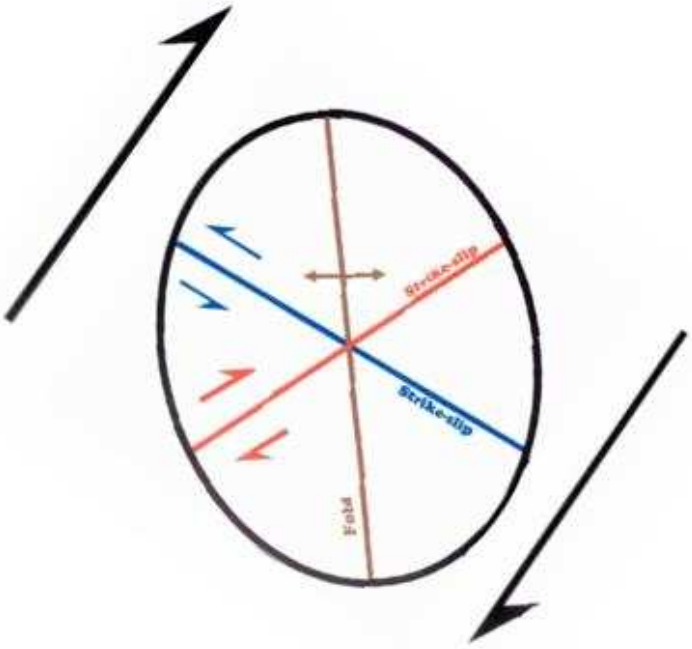

Fig.1 Strain Ellipse for a right lateral wrench fault system (from Harding 1974). The relative sense of movement across the fault zone (i.e. HRFZ) is denoted by the black arrows. The coloured arrows denote some of the structures that can result.

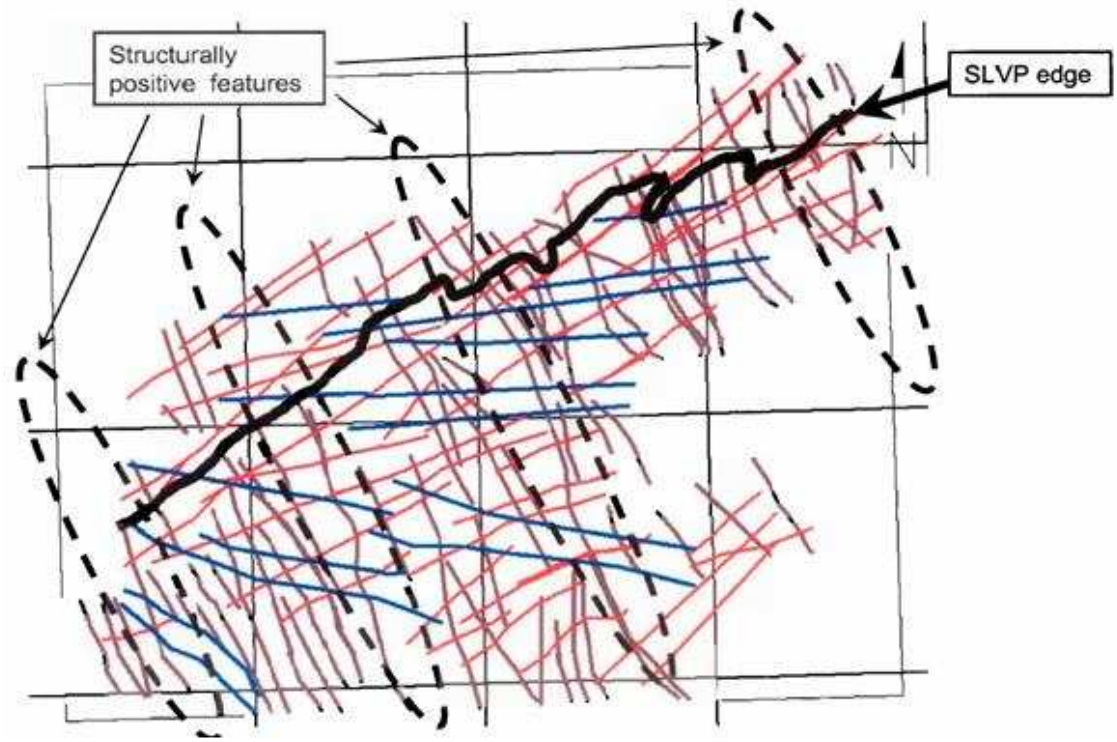

Fig. 2 Each fault type has a different impact upon the SLVP reef complex. The red shear set strongly influences the reefal facies, whereas the brown normal faults leave a pronounced structural overprint.