3D Curvature analysis for investigating natural fractures in the Horn River Basin, northeast British Columbia

Abdallah Al-Zahrani *
University of Calgary
aaalzahr@ucalgary.ca
and
Don C. Lawton
University of Calgary

Summary
A 3D multicomponent seismic dataset from the Horn River Basin was assessed for mapping fractures. The data had good fold, offset and azimuth distributions and several approaches were used to interpret the distribution of natural fractures. In addition to amplitude mapping, PP and PS curvature maps enhanced the structural interpretation of the data and enabled the lateral continuity of faults and fractures to be mapped across the area of the seismic survey.

Both horizon and volume based most negative curvature were effective in mapping fault and fracture trends within both Exshaw and Muskwa shale gas targets. At the Exshaw level, the curvature shows two main fault trends: northwest-southeast trending normal faults that dip toward the southwest, as well as northeast-southwest strike-slip faults. At the Muskwa level, the curvature image shows different major fault trends, namely northeast-southwest, and northwest-southeast faults (normal and reverse faults). Fractures interpreted using curvature attributes are close to the major faults and their dominant trends are generally parallel to the major faults in the area.

Figure 1 shows a realization of fracture systems in the Muskwa Formation, based on negative curvature (PP data). Curvature attributes derived from the PS data were found to be contaminated by subtle artifacts from shallow channels in the survey area.
Figure 1: Horizon-slice through the most negative curvature volume at the base of the Muskwa horizon shows the two major faults indicated by the red arrows and the four fracture trends in the area highlighted by the yellow arrows.