

The triangle zone north of Grande Cache, Alberta

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Surface geology, new seismic and coal drilling data are integrated with regional seismic and well data to delineate the 3D geometry of the triangle zone north of Grande Cache, Alberta. Seismic sections are depth-converted and integrated with surface and well data and structurally balanced in 2D and 3D.

Upper Cretaceous and Tertiary strata at surface in the Outer Foothills are deformed by open folds, northeast-verging thrusts (such as the Muskeg and Copton Thrusts) and southwest-verging backthrusts (such as the Morley Thrust). The Morley Thrust, which forms the eastern limit of the triangle zone, ramps up-section laterally to the southeast through the Upper Cretaceous Smoky Group, from the Kaskapau shales into the Wapiabi shales. In the northwestern part of the area, near Kakwa River, minor backthrusts observed northeast of the Morley Thrust may define an incipient younger triangle zone. Structures in Lower Cretaceous strata in the subsurface are interpreted to be detachment folds similar to those exposed in the Inner Foothills. However, the steep limbs of these folds are not well imaged seismically and as a consequence folding appears to be under-represented on seismic sections. The blind, northeast-verging Findley Thrust roots in the Devonian and has several blind splays. The overlying antiformal Findley Structure shows the combined effects of detachment folding, fault-propagation folding and fault-bend folding and can be described as a modified fault-propagation fold. The Paleozoic strata in the subsurface of the Outer Foothills display additional detachment folds, some of which have limbs that are cut by northeast-verging thrust faults. These structures are better imaged in the southeastern part of the study area and can also be described as modified fault-propagation folds. A major detachment in the Jurassic shales separates these structures from the smaller scale folds and faults developed in the overlying Lower Cretaceous Luscar and Upper Cretaceous Smoky groups. This detachment appears to form the floor thrust of the incipient triangle zone interpreted in the northeastern part of the area.