

Structural Geology of the Southern Livingstone Range Anticlinorium and the Architecture of the Centre Peak Anticline; A Paleo-Hydrocarbon Reservoir

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ABSTRACT

The Livingstone Range Anticlinorium is a hanging-wall ramp anticline that developed where the Livingstone thrust cuts up-section from a regional detachment in Devonian Palliser Formation to an upper detachment horizon in Jurassic Fernie Formation.

The dominant structure is a north-trending fault-propagation fold called the Centre Peak anticline. Three separate zones of tear faulting with a regular spacing of about 8 kilometres offset the Centre peak anticline and adjacent structures. The southernmost tear fault, at Morin Creek, dextrally offsets the Caudron Peak anticline and the Centre Peak anticline, and provides a termination surface for a third anticline.

The anticline cores are cut by evenly-spaced minor tear faults or cross faults that strike east-west and extend through the Livingstone Formation and older units but not into the overlying Mount Head Formation. These cross faults are interpreted to have developed during the formation of the fault-propagation folds as a necessary mechanism for accommodating lateral variations in the amount of thrusting and folding. Cross faults were a vital part of the plumbing system for this paleo-hydrocarbon reservoir, an interpretation supported by pervasive hydrocarbon residue within cross fault zones.

Carbon and oxygen stable isotope signatures of calcite veins from cross faults have a formation-fluid signature, implying that the cross faults were a closed system that was not infiltrated by meteoric waters either from surface or from the thrust faults.