

Variations in Structural Style of the Triangle Zone and External Foothills between Oldman River and Turner Valley, Southwestern Alberta: The Influence of Mechanical Stratigraphy

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ABSTRACT

The eastern margin of the Foothills belt, southwestern Alberta, is characterized by a thin-skinned, north-northwest striking, structural triangle zone (tectonic wedge) and steep, imbricated, dominantly foreland-vergent thrusts. New, detailed 1:50,000 scale mapping, undertaken for the Geological Survey of Canada's Southeastern Cordillera NATMAP project (designed to remap the Foothills between the international border and Turner Valley), demonstrates that structures between Oldman River (49°45' N) and Turner Valley (50°40' N) vary significantly. These variations occur in concert with lateral changes in Cretaceous-Tertiary foreland stratigraphy and the composition of units structurally inserted into the triangle zone. We interpret these variations to reflect the influence of mechanical stratigraphy.

Between Oldman River and Chaffen Creek (50°05' N), deformation is characterized by a series of dominantly hinterland-vergent structures in the hanging wall (east of) the triangle zone upper detachment (the Big Coulee Fault zone), including thrusts and large, kilometre-scale folds and folded thrusts. The upper detachment (a broad regional backthrust shear zone) lies within the mechanically weak Bearpaw Formation marine shale interval, which locally is greatly thickened structurally.

At Chaffen Creek, a smooth and continuous eastward step of the trace of the upper detachment coincides with exposure of a southward-plunging antiformal stack in its footwall. The prominent, orogen-vergent structures in the hanging wall of the upper detachment, characteristic of the southern area, apparently die out at this latitude. Instead, the triangle zone resembles a simple passive roof duplex, with the upper detachment remaining within the structurally thickened Bearpaw interval. The antiformal stack reflects the presence at depth of a mechanically competent beam of Mississippian carbonates carried on the blind, foreland-vergent Outwest Thrust. A hanging wall lateral ramp cuts out the carbonates to the south, coincident with the southward plunge of the duplex stack and the eastward swing in the trace of the upper detachment. Lower Cretaceous Blairmore Group rocks are exposed along the crest of the antiformal stack to the north, only 1 km from the trace of the upper detachment.

Between Chaffen Creek and Stimson Creek (50°23'), the triangle zone continues to resemble a simple passive roof duplex, but the Outwest Thrust splays to the surface and the hinterland-vergent upper detachment in the Bearpaw Formation is apparently offset by younger

continued

**Variations in Structural Style of the Triangle Zone and External Foothills between
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foreland-vergent thrust(s). A younger hinterland-vergent roof thrust has developed to the east in stratigraphically younger strata at Stimson Creek.

Between Pekisko Creek (50°26') and Sheep River (50°40'), the Bearpaw stratigraphic level remains the locus of an internally complex, hinterland-vergent upper detachment zone. However, the Bearpaw thins substantially from south to north, becoming an increasingly poor detachment to the triangle zone; this results in the distribution of shear strain over a broad zone, involving marginal marine sediments in adjacent units. On Pekisko Creek, primarily hinterland-vergent folds and faults are developed in the overlying St. Mary River Formation, forming a mappable zone 2 km wide, and on Highwood River (50°32') a similar broad zone also involves strata of the underlying Belly River Group. This broad, mappable zone of intense strain may represent a transition to the intercutaneous wedge-style triangle zone documented farther north.