



APPENDIX
SUMMARY OF MAPPING PROJECT
TOBY CREEK AREA, NORTHEAST SECTION
LARDEAU DISTRICT, BRITISH COLUMBIA

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This manuscript was delayed by recent mail difficulties.

Eighty-five square kilometres along the north side of Toby Creek have been mapped at a scale of 1:5 840 (Fig. 24). The map-area extends from 11 to 27 kilometres west of Invermere and covers a section through the Mount Forster syncline (Reesor, 1973, Map 1326A). A more extensive account of structural, stratigraphic, and sedimentologic relations within the map-area and their regional implications is to be published in a forthcoming report. As well, a detailed, large-scale map of the surface geology in the Paradise Basin is in preparation (GEM, 1975).

Previous coverage of this area has been by Walker (1971). This study constitutes the first detailed mapping of the area including the type section of the Toby Formation. It reveals a structural and stratigraphic section hitherto unrealized or erroneously interpreted. As well, the geometry and age relations between folding, faulting, and zinc-lead-silver mineralization in and around the Paradise Basin have been recognized.

STRATIGRAPHY

The main lithologic units in the Toby Creek map-area are shown on Figure 25. The oldest rocks exposed are the upper 300 metres of the Dutch Creek Formation — uniform sequence of well-bedded, multi-layered, green and black argillites, slates, and greywackes. Thick units of argillite without visible sedimentary structures are common, as are thinner, coarser grained units with small-scale ripple-cross- stratification, distinctive graded beds and other finely laminated units. The whole sequence is interpreted as basin distal-intermediate turbidites.

This predominantly fine-grained off-shelf argillaceous clastic sequence provides the foundation for an apparently westward (and southward ?) facing shallow water dolomite shelf which, in the Toby Creek area, is about 700 metres thick. The basal member of these shallow water sedimentary rocks is a 70-metre-thick white to apple green crossbedded orthoquartzite (the lower quartzite of the Mount Nelson Formation). It is immediately overlain by cyclicly interbedded, finely laminated and graded sandstones, argillites, fine siltstones, and argillaceous dolomites. Up section these grade into more massively bedded, stromatolitic and oolitic dolomites and cherty dolomites near the top

of the sequence. Red mudstones occur at intervals within the dolomite phase and finely laminated red siltstones and fine quartzites in the eastern part of the area cap the dolomite phase (almost approaching iron-formation in appearance).

These thick red clastic rocks are not present over the western portion of the map-area but are replaced by a white crossbedded orthoquartzite up to 170 metres in thickness (upper quartzite of the Mount Nelson Formation).

The basal Windermere Toby Formation overlies a variety of lithologies in the Mount Nelson Formation: (1) a mottled grey dolomite in the east; (2) the upper quartzite (of variable thickness) over much of the central and western parts; (3) a green argillite locally within the Paradise Basin; and, (4) a grey cherty dolomite and green siltite (themselves above the upper quartzite) on the western end of the Paradise Ridge. The contact is well exposed in many places and the lack of an angular unconformity over much of the area is a significant feature.

Across the type section and much of the map-area the Toby Formation is a 500-metre-thick*† chaotic jumble of boulder to pebble-sized clasts which are supported by a fine argillaceous and dolomitic matrix. Clasts (dolomite, quartzite, argillite) are coarsest and most abundant near the base of the formation. Upward the basal conglomerate grades quickly into the pebbly mudstone so typical of the Toby Formation in this section. Deposition of the formation has probably taken place by shallow-water debris flows and mud-flows related to Windermere age fault scarps.

The Toby Formation is overlain by slates, limestones, and quartz (feldspar) pebblestones of the Horsethief Creek Group. Much of the upper part of the section mapped is dominated by upward fining fluvial cycles (1 to 5 metres thick) showing great variations in grain size, from coarse pebbles at the base to fine clay-sized material at the top. Scours and small channels trend 150 degrees indicating a local line of transport (probable *direction* is to the northwest).

STRUCTURE

The eastern and central part of the Purcell structure in the Lardeau district is dominated by the Mount Forster syncline (first-order fold) which parallels the Rocky Mountain Trench for 45 kilometres. The syncline is developed in rocks with a low to sub-greenschist grade of metamorphism. These rocks possess a single penetrative fabric – the result of one period of deformation during Cretaceous time. The Toby Creek map-area covers a

*The 1 000-metre thickness report by Aalto (1971) results from an incorrect interpretation of the structure and stratigraphy. The quartzite, dolomite, and argillite at the west side of his Figure 3 are actually part of the Mount Nelson Formation and not, as he reports, part of the Horsethief Creek Group.

†On the ridge northwest of the Paradise Basin little more than 70 metres of Toby Formation is present.

16-kilometre-wide section across this structure and its origin and regional significance will be more thoroughly dealt with in a Ph.D. thesis.

The eastern part of the map-area consists of broad, open flexures (second order) in the massive dolomites of the Mount Nelson Formation. Faults in the eastern part of the area (and elsewhere) are believed to be Cretaceous-Tertiary in age (rather than Proterozoic or otherwise) because: (1) they are associated with the formation of folds that are part of the regional deformation; or (2) they cut and brecciate Cretaceous-Tertiary structures. Second-order kink folds to the west are tighter and take up much greater shortening than those to the east. They have a very distinctive 'stair-step' profile so that a syncline will show a gently almost flat-lying east limb and a steep to overturned west limb. North to northwest-trending normal faults postdate folding and almost invariably occur in these steep to overturned fold limbs where finite strain is at its highest. The movement of faults is west side down with displacements in the order of 10 to 100 metres. Along the fault planes it is common to find: (1) narrow breccia zones involving dolomite or quartzite country rock; and (2) quartz-carbonate veins.

MINERALIZATION

Lead-zinc-silver mineralization in the Paradise Basin occurs along the late normal faults, commonly on the steep limbs of second order folds. It is primarily a fracture-filling occurrence, associated with zones of brecciated dolomite or quartzite found along and adjacent to the fault plane. Although the present local distribution of the sulphides is structurally controlled by Mesozoic folding and late(r) normal faulting it is not yet certain whether stratigraphic controls may originally have come into play. (A distinctive Late Proterozoic sedimentary breccia consisting of large rounded blocks of dolomite imbedded in chert is apparently restricted to the vicinity of the main Paradise ore zone.)

REFERENCES

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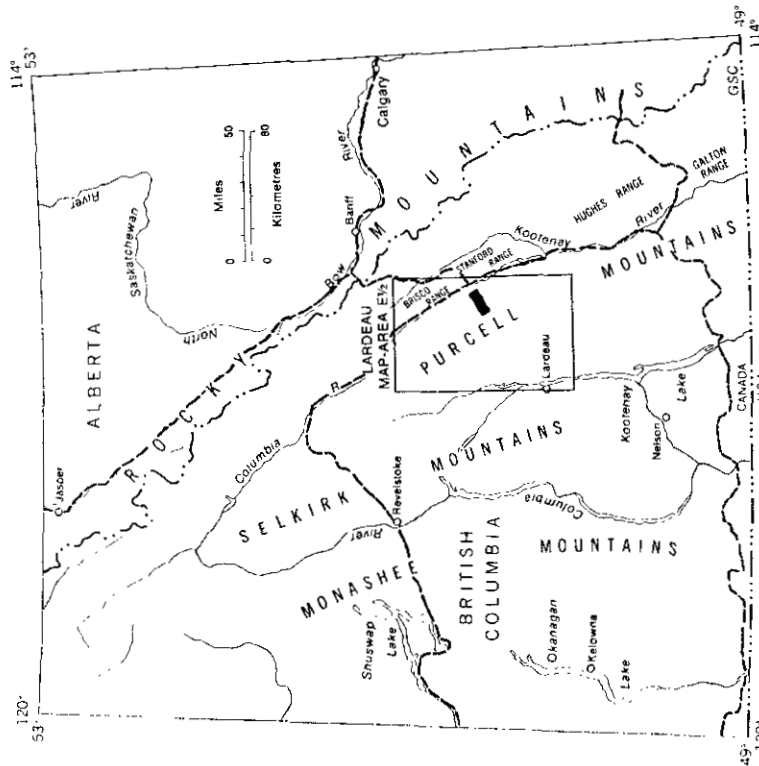


FIGURE 24 Location of Toby Creek, (North-East) map-area shown by small black rectangle within the Lardeau area. Main highways in black dash.

POTEROZOIC		thickness(m)	
WINDERMERE	HORSETHIEF CREEK GRP.	Limy shale, ls, argill, slst. Qtz(feld) peb-stone, ss, sh. Black slate, argill, slst, qtzite, dol.	} > 1100 4c 4b 4a
	TOBY FM.	Pebble cobble boulder - mudstone (diamictite) conglomerate, limy congl.	70 - 500 3
	MT. NELSON FM.	White quartzite Dolomite phases, red sh, slst. White, green, quartzite	} ~ 1100 2c 2b,d 2a
PURCELL	DUTCH CREEK FM.	Black, green, argillite, slate, siltstone, greywacke	> 300 1

FIGURE 25 Legend for Toby Creek (NE)

↗ Paradise Mine site

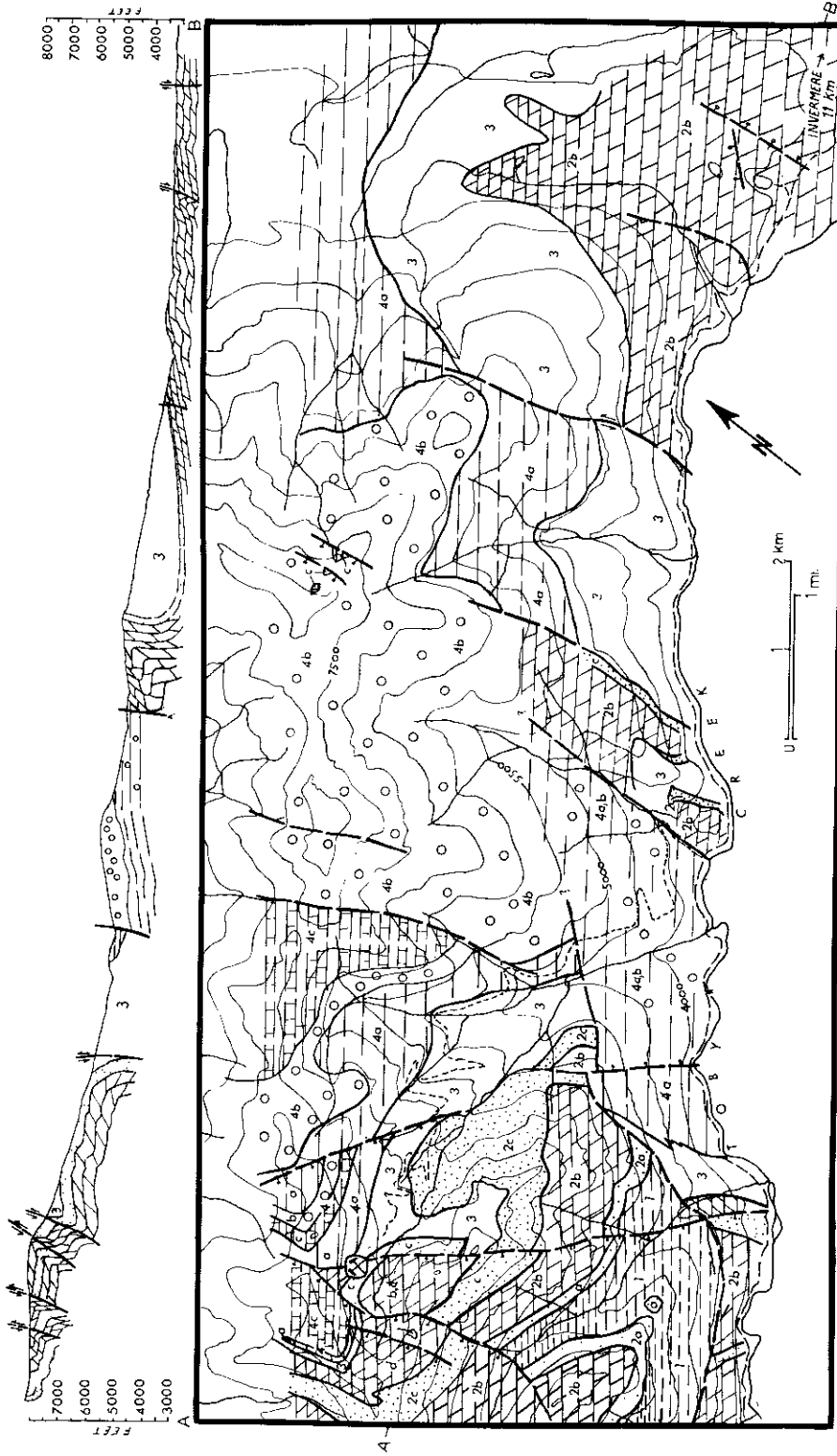


FIGURE 25- Geology of Toby Creek (NE); generalized map outlying main units.