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PRELIMINARY MAP 25

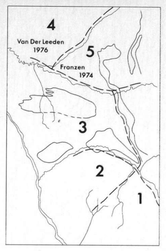
GEOLOGY OF THE GOLDSTREAM RIVER – DOWNIE CREEK AREA SOUTHEASTERN BRITISH COLUMBIA

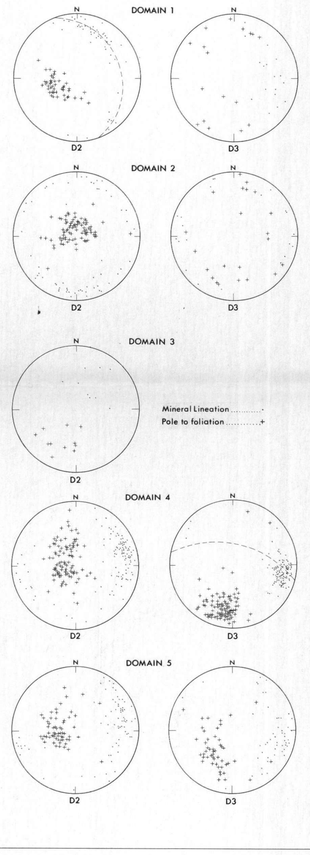
Compiled by : L. Lane

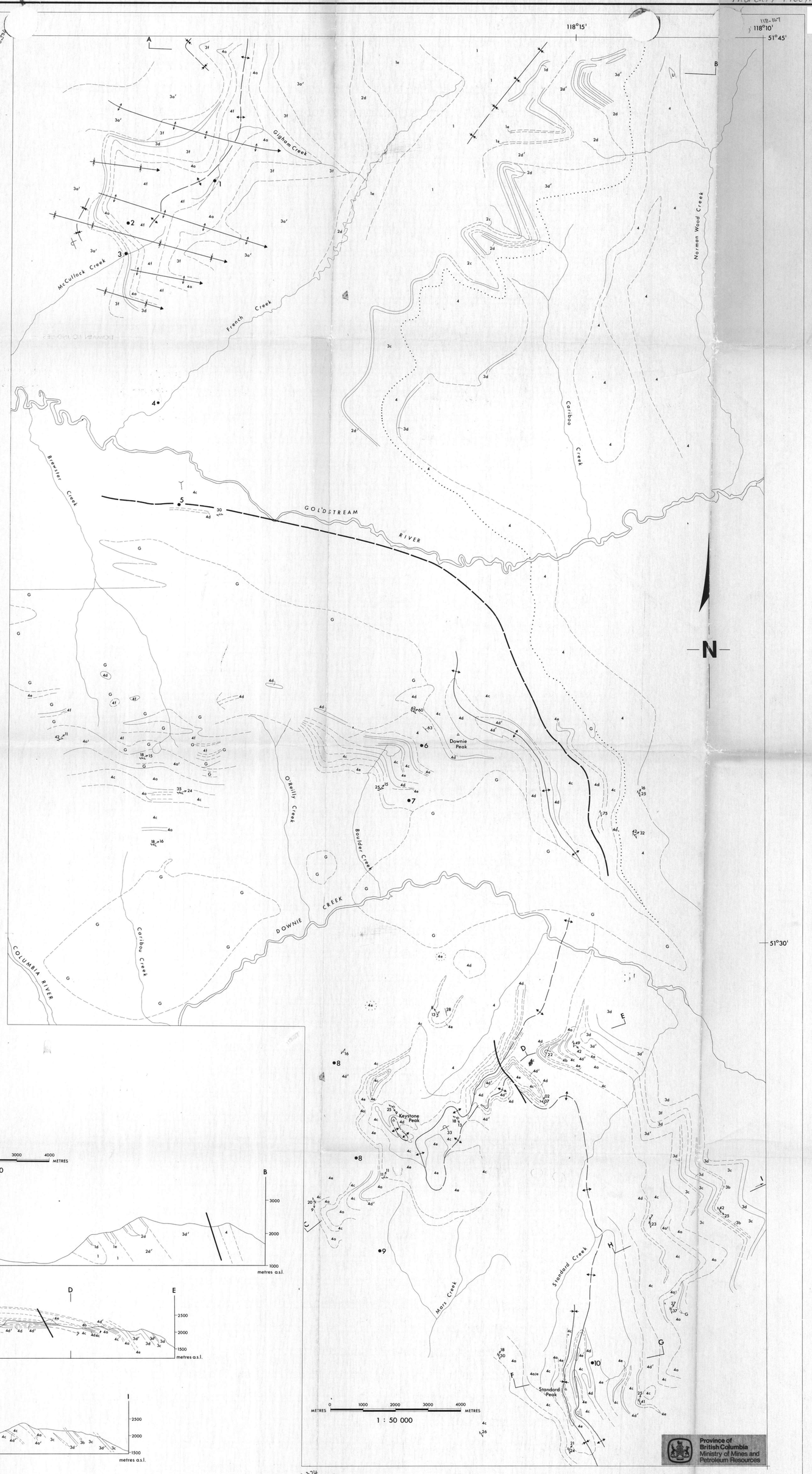
Geology by : R.L. Brown*, T. Höy**, L. Lane*

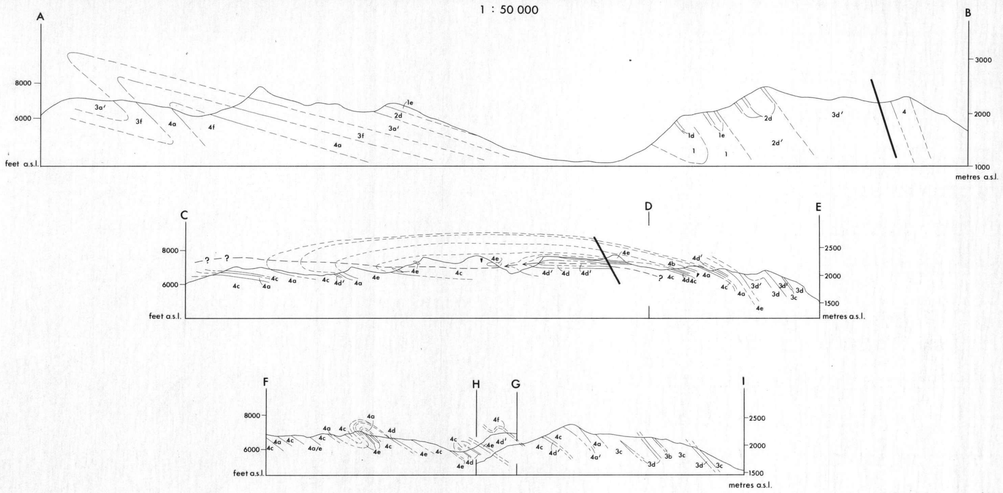
LOCATION MAP

DOMAIN BOUNDRIES









LEGEND

4 — **LOWER PALEOZOIC:** 4a – QUARTZITES, PSAMMITES; 4a' – SEMIPELITES; 4b – GRITS; 4c – PELITIC ROCKS INCLUDING GRAPHITIC SCHISTS; 4d – GREY MARBLES; 4d' – BROWN-WEATHERING AND IMPURE MICACEOUS MARBLES; 4e – METAVOLCANIC ROCKS, AMPHIBOLITES; 4f – CALCAREOUS PELITIC SCHISTS

3 — **UPPER HORSETHIEF CREEK GROUP:** 3a–3f – ROCK TYPES AS ABOVE

2 — **MIDDLE HORSETHIEF CREEK GROUP:** 2d – GREY OR BROWN MARBLES; 2f – CALCAREOUS PELITIC SCHISTS

1 — **LOWER HORSETHIEF CREEK GROUP:** 1c – PELITIC SCHISTS; 1d – MARBLES; 1e – AMPHIBOLITES

SYMBOLS

GEOLOGICAL BOUNDARY: KNOWN, INFERRED

F_1 ANTIFORM

F_2 SYNFORM

F_3 ANTIFORM

F_3 SYNFORM

SECTION LINE

F_2 PLANAR ELEMENT (AXIAL PLANE, CLEAVAGE), WITH LINEAR ELEMENT (FOLD AXIS, S_0–S_2 INTERSECTION)

BEDDING: TOPS KNOWN; RIGHT SIDE UP, OVERTURNED

TOP DETERMINATION

SHEAR ZONE, FAULT

F_1 AXIAL SURFACE TRACE

MINERAL OCCURRENCE

ADIT

GRANITIC PLUTONIC ROCKS . . . G

ULTRAMAFIC BODY . . . U

MINERAL OCCURRENCES

No.	Name	Location	Commodity	Type	Status
1.	Graham Creek	51°43'; 118°25'	Au	placer	
2.	Stanmack (Ole Bull)	51°42'; 118°26'	Au	vein	prospect
3.	McCullough Creek	51°41'; 118°28'	Au	placer	
4.	French Creek	51°41'; 118°26'	Au	placer	producer
5.	Goldstream	51°37'; 118°25'	Cu, Zn, Ag	massive sulphide	potential producer
6.	K J	51°33'; 118°20'	Pb, Zn	replacement	prospect
7.	Montgomery	51°33'; 118°29'	Cu	replacement massive sulphide ?	prospect
8.	Keystone	51°27'; 118°20'	Pb, Zn	vein replacement	prospect
9.	Carbonate Chief	51°25'; 118°25'	Au	vein	occurrence
10.	Standard	51°23'; 118°16'	Cu, Zn	massive sulphide	prospect

DESCRIPTIVE NOTES

SETTING

The map-area (parts of NTS 82M/8 and 9) is located within the northern Selkirk Mts. claim approximately 50 kilometres north of Revelstoke in southeastern British Columbia. It is situated between the Shuswap Metamorphic Complex to the west and the Rocky Mountain Trench and the Main Ranges to the east.

The geology consists of multiply deformed metasedimentary and metavolcanic rocks of Upper Proterozoic and Lower Paleozoic age, which have been intruded by granitic plutons. A number of important copper-zinc and lead-zinc deposits, as well as a number of vein and placer gold deposits occur within the area. The most important is Noranda's recently discovered massive sulphide deposit just south of Goldstream River.

STRUCTURE

The structure of the area is dominated by northeast-plunging Phase II folds with nearly northwest-striking, easterly dipping axial surfaces. These structures have been superimposed on previously overturned stratigraphy (Phase I) and have in turn been refolded, in the northwest part of the map-area, by later Phase III folds that plunge at shallow angles to the southeast with northwest-striking axial surfaces.

The accompanying equal area stereo nets show the distribution of second and third phase fabric over the map-area. In domains 1, 4, and 5, second phase structures have a consistent axial surface orientation with fold axes plunging variably from horizontal to nearly vertical. In domain 3, however, axial surfaces of Phase II folds are noticeably steepened against the Goldstream pluton. In domain 2, the Keystone area, Phase II axial surfaces are nearly horizontal and lineations generally plunge south. The form and scale of the Keystone structure are also markedly different from structures in other parts of the map-area. The Keystone fold (cross section A–B–C) is a large, nearly recumbent anticlinal syncline with no exposed paired surfaces, whereas the normal Phase II fold style consists of S-folds viewed down plunge (cross sections D–E–F–G and H–I) with half-wavelengths ranging from 2 kilometres in the north to 0.5 kilometre in the south.

Phase III structures are only sufficiently well-developed to disrupt the Phase II fabric in domain 4. Elsewhere, Phase III structures consist only of small-scale (1-2 metre maximum) chevron folds and conjugate kink folds.

A shear zone south of the Goldstream River has caused at least minor disruption of stratigraphy in the vicinity of the Goldstream deposit. The eastward extension of this zone is a schematic representation of this loss of stratigraphy through several sheared-off small folds.

Top determinations in the Downie Peak area and northwest of the Goldstream River (Van der Leeden, 1976) show that Phase II structures developed in an inverted sequence of rocks whereas farther east, the stratigraphy is right-side-up with respect to Phase II structures. This indicates the presence of a Phase I synclinal core separating these areas. The axial surface trace of this structure is probably located within or along the western boundary of Hamill rocks at the eastern edge of the map-area.

STRATIGRAPHY

Rocks south of the Goldstream River were correlated by Wheeler (1965) with the Lower Paleozoic Lardeau Group, while those to the north were assigned to the Upper Proterozoic Horsethief Creek Group. Based on more recent work to the north and south (Brown, et al., 1977), it is more likely that rocks in the Goldstream area are correlative with the Upper Proterozoic Horsethief Creek Group and the Lower Paleozoic Hamill Group. However, it is possible that these latter rocks are in fact Lardeau Group, which they closely resemble.

The lower and middle units of the Horsethief Creek Group occur only in the northern part of the map-area. The lower unit comprises sequences of pelitic schists, which contain conformable bands and lenses of amphibolite. The middle unit consists of layers of white to grey calcite marble interlayered with rusty weathering impure marbles. The upper boundary of the middle unit is difficult to place in this area because the Upper Horsethief Creek Group consists of calcareous pelitic schists, interlayered with rusty weathering marbles and pelitic schists. Thus the middle and upper units of the Horsethief Creek Group are calcareous in nature and may be regarded as a single package in this area.

South of the Goldstream River, the Keystone area affords the best stratigraphic control. Here, internal structural and stratigraphic relationships are well established and will be described in some detail. The lowest part of the exposed stratigraphy is a thick sequence of grey and white calcite marble with brown graphite-dolomite marble and minor pelitic and siliceous layers. Minimum thickness of this combined unit is approximately 800 metres.

Up-section is an approximately 1 100-metre thickness of massive metavolcanic rock, with black quartzite and graphitic schist at its contacts. This unit is overlain by 200 to 300 metres of psammite and quartzite containing thin layers of pelitic schist, graphitic schist, and dolomitic marble. This unit also contains some poorly graded quartzofeldspathic grits from which an overturned top determination was tentatively established.

Above the quartzites is another metavolcanic unit that varies from a 10-metre-thick chloritic schist in the east to a prominent 300-metre-thick massive unit in the west, which is visible in a cliff exposure southeast of Keystone Peak. This is the thickest single metavolcanic unit found in the area, and comprises a large lens, folded near the middle. Its thickness and resistance to deformation may be responsible for the unusual shape of the Keystone structure. Small pods of pelitic schist are found locally within the metavolcanic unit. Along its upper contact are discontinuous pods of talc-dolomite-serpentine ultramafic rock that locally contains fuchsite.

Above the metavolcanic unit is a sequence of muscovite-graphite schist grading to black graphite schist, with minor dolomite, grit, graphitic marble, and graphitic psammite. Also contained within this unit are large boudins of metabasaltic and ultramafic rock. This unit is considerably thickened in the core of the Keystone fold, but has a limb thickness of only about 20 metres.

The youngest rocks to outcrop in this section occur in the core of the Keystone structure. They consist of clean grey to white calcite marble interlayered with brown impure dolomite and minor black calcareous pyrite-graphite schist of unknown thickness. The graphite schist either thins westward or grades into impure marble (see cross-section). The outer grey marble member has a thickness of 25 metres on the upper limb of the fold.

Southward toward Standard Peak, several changes occur in the stratigraphy. First, pelitic rocks increase in importance at the expense of the carbonates. At the base of the exposed section in the east, the large marble units are embedded in very large thicknesses of grey to black muscovite-graphite-dolomite schists, with minor grits and quartzites. Second, the total volume of metavolcanic rocks decreases; metavolcanic rocks occur as several thin discontinuous lenses interlayered with thinly bedded sediments that vary from chloritic and pelitic schists to quartzites and carbonates. Talc-dolomite-serpentine ultramafic rocks occur with some of the metavolcanic rocks. Above the metavolcanic unit are thin quartzite layers which grade rapidly into pelites, locally bearing minor carbonate. Farther up-section the stratigraphy is dominantly pelitic with some bands of psammite. In the Standard area there are no major carbonates above the metavolcanic succession.

Immediately south and east of the Goldstream pluton, the succession is very similar to that at Keystone. The lowest exposed sequence comprises interlayered psammite and pelite overlain by impure micaceous carbonate (which is cut by considerable plutonic material) and finally, well into the pluton, by a remnant band of amphibolite. This band may correlate with the stratigraphically lowest amphibolite that was mapped east of the pluton. Here, the amphibolite is part of a succession of amphibolites, semipelitic and pelitic rocks, and carbonates with minor grits. This succession is overlain by an amphibolite-free succession comprising interlayered carbonates and impure siliceous rocks with minor grits and calc-silicates. Stratigraphically higher in the section, toward the core of the antiform at Downie Peak, are dark pelitic rocks, and, in the core itself, a thick sequence of grey marble and impure rusty weathering marble.

It is evident that the exposed succession from Downie Peak in the north, through the Keystone area, to the Standard area in the south is the same stratigraphic level. Hence, variations between these areas can be accounted for by variations in sedimentation.

A correlation of the succession with known units to the east is tentative. However, based on the lithologic similarity of rock units in the map-area to calcareous Upper Horsethief Creek rocks to the north and east and to Hamill quartzite, psammite, grit, and pelite in close association with metavolcanic rocks to the east, the rocks are tentatively correlated with these Upper Proterozoic – Lower Cambrian groups. The young carbonates are not believed to correlate with the Badshot Formation because they decrease in importance southward, and are not present at Standard, whereas the Badshot marble is known to be extensive to the south and east of the map-area (Wheeler, 1965).

Stratigraphic correlation eastward across Downie Creek is complicated by the inferred existence of the Phase I fold core in the vicinity. Thus, correlation is based partly on the assumption that there is no great stratigraphic break across this early fold core.

METAMORPHISM AND PLUTONIC ACTIVITY

South of the Goldstream River, the regional metamorphic grade ranges from greenschist to lower amphibolite facies. Pelitic rocks contain muscovite-chlorite and occasionally kyanite. In the immediate vicinity of granitic plutons biotite and hornblende are developed in pelites and metavolcanic rocks. At the Goldstream deposit, spessartine garnets are locally abundant. North of Goldstream River the regional metamorphic grade rises rapidly through amphibolite facies, and sillimanite-bearing rocks occur in the extreme north of the map-area (Wheeler, 1965; Franzen, 1974).

The Goldstream pluton is a quartz monzonite intrusion which is deformed by Phase II structures. Smaller granite porphyry intrusions truncate Phase II structures.

MINERAL DEPOSITS

The Goldstream area contains a number of lead-zinc, copper-zinc, and vein and placer gold occurrences. These are plotted on the map and listed in the accompanying table. Goldstream, the most significant of these, is a massive sulphide copper-zinc deposit, located on the south side of Goldstream River. Geological reserves include approximately 3.175 million tonnes containing 4.49 per cent copper; 3.124 per cent zinc; and 10 grams per tonne silver. The deposit occurs as a sheet of massive sulphides 2 to 4 metres thick, 500 metres wide, and at least 1 200 metres long. The sulphide lens is overlain by dark calcareous phyllite, quartz-chlorite phyllite, and a manganese-rich chert horizon. Structural footwall rocks include quartz-chlorite phyllite, a prominent limestone unit, and quartz-sericite phyllite. A number of features within the massive sulphide layer and host rocks suggest that the deposit may be inverted. These include a sharp lower contact as opposed to a generally more gradational upper contact, a relatively higher abundance of sulphides in structural hangingwall rocks than in footwall rocks, and the more common occurrence of disseminated sulphides in the hangingwall as opposed to layered sulphides in the footwall.

ACKNOWLEDGMENTS

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*Carleton University, Ottawa, Ontario.
**British Columbia Ministry of Mines and Petroleum Resources.

Province of British Columbia
Ministry of Mines and Petroleum Resources