STRATIGRAPHY AND STRUCTURE SOUTH OF GOLDSTREAM RIVER, SELKIRK MOUNTAINS (82M/8, 9)

By Richard L. Brown*, Trygve Höyt†, and Larry Lane*

INTRODUCTION

The area described in this report is now receiving considerable attention due to the discovery in 1975 of Noranda's massive sulphide deposit just south of Goldstream River. A number of other less significant but important massive sulphide deposits as well as a number of lead-zinc occurrences have been known and explored in this area since the early 1900's. This preliminary report, based on fieldwork by the authors in July through September, focuses attention on the regional stratigraphy and structure. A preliminary map of the area is in progress and one of us (Larry Lane) will be completing an M.Sc. structural-stratigraphic thesis on the area in 1977.

Access to the western part of the area is provided by the Big Bend Highway which follows the east bank of the Columbia River north from Revelstoke. Well-maintained gravel roads extend east from the highway for limited distances along the south banks of Goldstream River and Downie Creek. The nearest permanent helicopter bases are at Mica, 40 kilometres to the north, and Revelstoke, 50 kilometres to the south.

The area is generally very rugged and exploration is difficult. Valleys are till filled, rock exposures are rare, and thick underbrush hampers traversing. Above tree-line, at 1 800 to 1 950 metre elevation, exposures are abundant, although precipitous cliffs and snow and glacier cover again hamper exploration and mapping.

STRATIGRAPHY

Strata above the Horsethief Creek Group are subdivided into a lower dominantly psammitic unit, a variable metavolcanic/clastic unit, and a dominantly calcareous and pelitic unit.

Horsethief Creek Group in this area is characterized by pelitic schists which grade laterally into black graphitic schist, white calcitic marble, thin bands of brown-weathering quartz feldspathic grit, and minor rusty weathering pelitic marbles. These rocks are considered to belong to the upper Horsethief Creek Group due to their close similarity to the upper pelitic member of the Horsethief Creek Group which underlies Lower Cambrian Hamill Group to the east.

*Department of Geology, Carleton University.
†British Columbia Ministry of Mines and Petroleum Resources.

The psammitic unit overlying the Horsethief Creek Group is primarily a quartz-muscovite-chlorite sandstone interlayered with pelitic schist, black graphitic schist and quartzite, quartz feldspar grits with occasionally visible graded bedding, and minor well-layered dolomitic marble. The psammitic unit is interdigitated with, and locally occurs as large lenses within, the metavolcanic unit. This interlayering appears to be of primary origin, but has undoubtedly been augmented by deformation.

The metavolcanic unit consists of massive hornblende-feldspar-chlorite rock, and chloritic schist. Coarser grained equivalents may be of hypabyssal origin or are cores of thick flows. Relict primary textures occur in some of the less recrystallized specimens, and deformed pillows are preserved locally. The unit thickens and thins rapidly along strike, and is best envisaged as a series of lenses rather than one continuous stratigraphic horizon. Within the metavolcanic unit are thinly layered impure clastics with thin bands of carbonate. The clastic rocks include muscovite-chlorite-graphite schist, thinly laminated green quartzite with chlorite partings, and chlorite schist. The carbonates consist of thin grey calcitic marble interlayered with brown-weathering dolomite with phlogopite (?) or graphite partings. These metasedimentary rocks have variable thicknesses and exhibit considerable lateral variation, especially with respect to the presence of graphite and carbonate, as would be expected in an area of submarine volcanism where locally derived and transported sediments are deposited amongst flows.

Also associated with the metavolcanic rocks are brown-weathering talc-serpentine-dolomite ultramafic rocks. They are found primarily in fold closures, but one 10 to 20-metre-thick band occurs continuously for at least 2 kilometres (stratigraphically) above the massive metavolcanic unit that hosts the sulphide mineralization at Standard Peak. These ultramafic rocks may be related to one or two specific adjacent metavolcanic horizons which extend through both Standard and Keystone ridges.

Massive sulphides occur as pyrite, pyrrhotite, chalcopyrite, and sphalerite layers within metavolcanic rocks (Standard) or in metasedimentary rocks adjacent to them (Goldstream, Montgomery ?). They are often associated with very siliceous sedimentary rocks (chert ?), chlorite-phyllite (basic tuffs ?), and dark carbonaceous, calcareous phyllite (marls or calcareous shales ?).

The uppermost unit is dominantly calcareous, and is exposed only in the cores of the antiforms. It consists of interlayered grey banded calcitic marble, rusty weathering impure marble with pelitic interbeds, and massive structureless dolomitic marble. Also included in this unit is a black pyritic, calcareous graphitic schist. The marble unit has been thickened considerably in the core of the Keystone structure, and it forms a huge pod which comprises Keystone Peak.

STRUCTURE

The structure which dominates the map-area is a large, generally northeast-plunging antiformal syncline whose axial surface varies from very steeply dipping toward the east

in the Downie Peak area, to recumbent in the Keystone area and moderate toward the east in the vicinity of Standard Peak where it appears to be dying out (*see* Fig. 4 for location of axial surface trace and Fig. 5 for cross-section). In the Standard Peak area the antiform is paired with a synform; this couplet forms a northeast-plunging S fold with a wavelength of approximately 1 kilometre.

Throughout the terrain of Figure 4, Phase II folds have been superimposed on previously inverted stratigraphy, and Phase I minor fabrics have been deformed by the later deformation. These relationships which continue northward across the Goldstream River imply the existence of a Phase I nappe with an inverted limb of at least 25 kilometres (compare Van der Leeden, 1976).

METAMORPHISM AND PLUTONIC ACTIVITY

Pelitic rocks are generally chlorite-muscovite bearing and the metavolcanic rocks form chlorite schist at their borders. Regional metamorphism within the map-area does not appear to exceed greenschist grade, but hornblende and biotite are developed, in metavolcanics and pelites respectively, adjacent to granitic plutons. The largest granitic pluton outcrops south of the Goldstream River and its margins are deformed by Phase II structures. Later intrusives which truncate Phase II fabrics are generally porphyritic granites, while the older intrusion is a quartz monzonite.

STRATIGRAPHIC CORRELATION

The psammitic and metavolcanic package stratigraphically overlies rocks which on the basis of lithologic similarity have been tentatively assigned to the Proterozoic Horsethief Creek Group (Figs. 4 and 5), and as such may be correlated with Lower Cambrian Hamill Group. If this correlation is correct, it implies a northwestward shaling out of cross-bedded sandstones which to the southeast typify this group (compare Wheeler, 1965).

The possibility that the metavolcanic and associated rocks are part of the Lardeau Group as originally proposed by Wheeler (1965) cannot be ruled out, but this would require extensive tectonic disruption of stratigraphy.

ACKNOWLEDGMENTS

We would like to acknowledge the co-operation of a number of geologists working in the Goldstream area this past summer. In particular, discussions with Noranda's geologists, Gordon Gibson, Brian Hughes, and Laurie Reinertson, were most helpful.

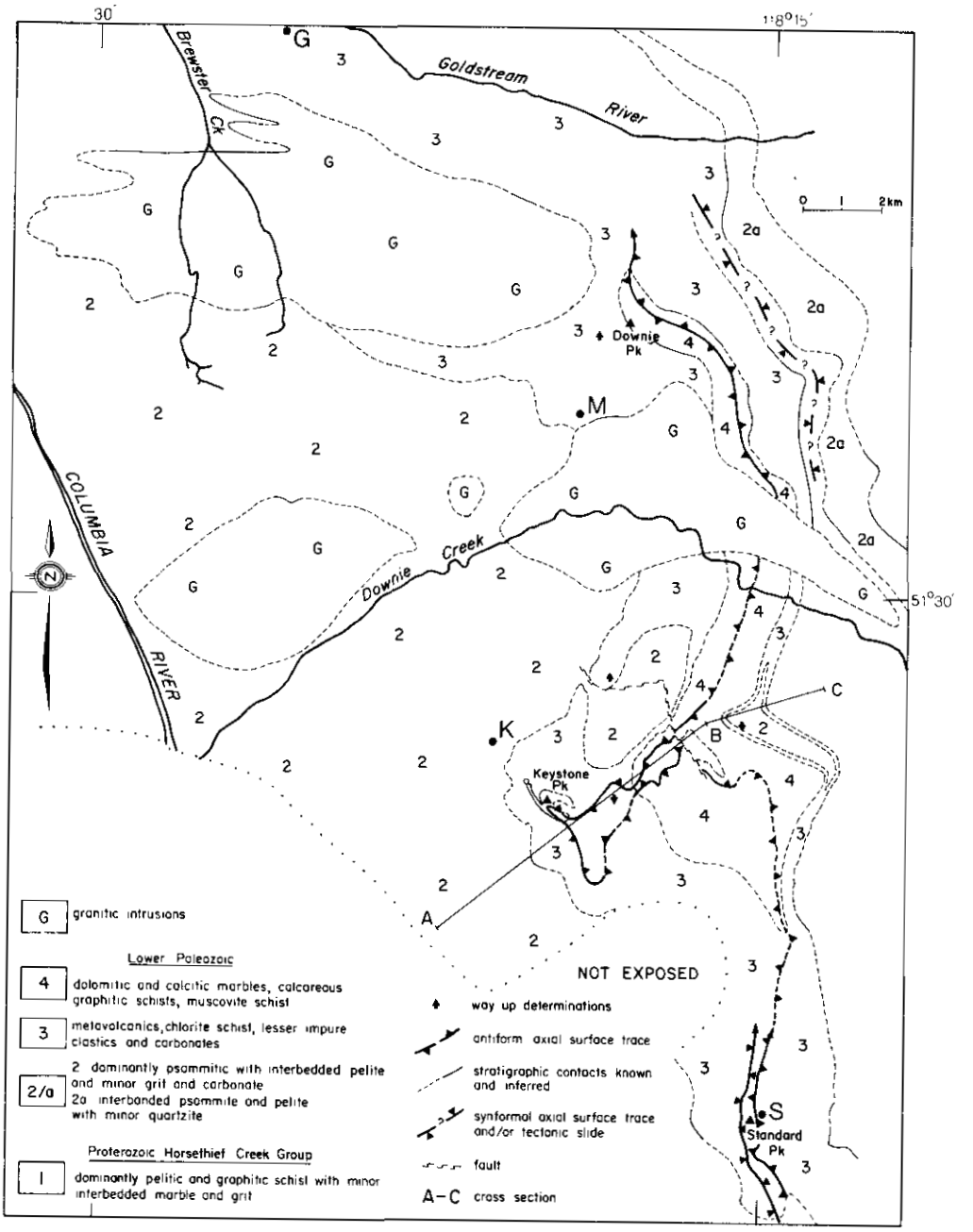

Figure 4. Regional geology of the area south of Goldstream River. Dots locate the mineral deposits referred to in text: G – Goldstream; M – Montgomery; K – Keystone; S – Standard.

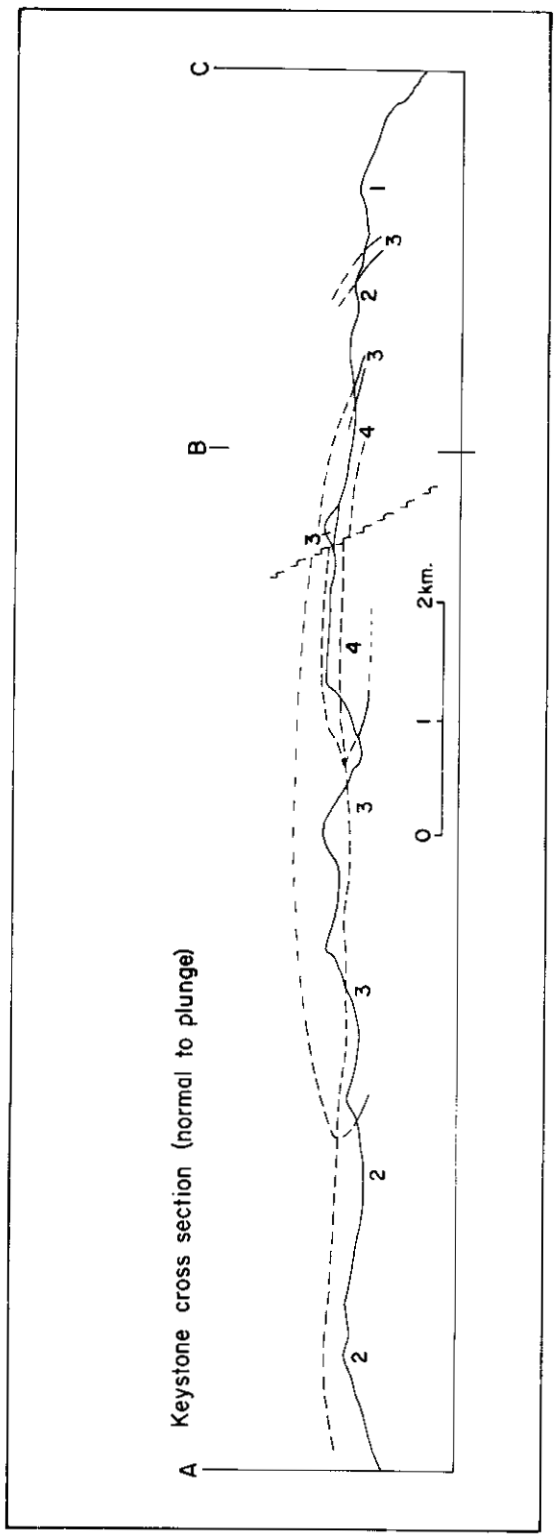

Figure 5. Cross-section through the Keystone area. For location and identification of units, refer to Figure 4.

REFERENCES

Van der Leeden, J. (1976): Stratigraphy, Structure, and Metamorphism in the Northern Selkirk Mountains Southwest of Argonaut Mountain, Southeastern British Columbia, unpublished M.Sc. thesis, *Carleton University,* Ottawa, Ontario, 105 pp.

Wheeler, J. O. (1965): Big Bend Map-Area, British Columbia (82M East Half), *Geol. Surv., Canada,* Paper 64-32, 37 pp.