pure marble succession, several metres thick, and the grey-weathering calcite marble of Unit 5. It is recognized in the field by its distinctive colour, numerous dispersed grains of brown mica and, less commonly, amphibole and abundant small clasts of granular, white albite. Analyses of the carbonatite (JR-1, JR-5, JR-11a; Table 2) shows that it contains up to 5800 ppm Sr, 146 ppm Nb, 0.58 percent P_2O_5, 0.29 percent Ba and 0.41 percent Mn. Rare earth element concentrations in two samples reported by Laird (1990) are also highly anomalous, with up to 608 ppm La, 1108 ppm Nd and 731 ppm Ce. Analyses of samples of buff to white marbles immediately adjacent to the carbonatite (Table 2) have trace and rare earth element concentrations that are comparable to marbles with sedimentary protoliths, as summarized in Höy (1997).

An orthogneiss, the Mount Copeland syenite, is exposed south of the Jordan River deposit area (Figure 9). It is a medium-grained, grey nepheline-feldspar-biotite gneiss that appears to have been involved in all deformation phases (Fyles, 1970). Lenses of coarse-grained K-feldspar pegmatites are common within it. The Mount Copeland syenite has been dated 740 ± 36 Ma (Parrish and Scammel, 1988), a similar age as the Mount Grace syenitic orthogneiss in the Cottonbelt area (Table 1; Crowley, 1997).

The structure of the deposit area is dominated by the Phase 2 Copeland syncline (Fyles, 1970). Its hinge and limbs are clearly outlined by Unit 5 and the sulphide layer. In the western part of the deposit area (Figure 9), the syncline plunges 30 degrees towards 150 degrees with an axial plane that dips south 45 degrees (Fyles, op. cit.). To the east, the fold becomes very tight and the plunge decreases through the horizontal to a low westerly plunge, resulting in the banana-shaped outcrop pattern. In the west, a syncline-anticline pair, folds E and F, warp the south limb of the Copeland syncline, and extend beyond the area mapped by Fyles, a distance of over 8 kilometres. The hinges of these Phase 2 folds are generally open and concentric with little appreciable thickening of the sulphide sequence (Photo 5).

Phase 1 folds are small recumbent isoclines with axial planes essentially parallel to layering. Fold axes are outlined by a penetrative mineral lineation which, throughout the deposit area, generally plunge to the southwest.

Mineralization

The Jordan River deposit comprises a sequence of one or more sulphide layers, with lenses of quartz and locally barite, in a calcsilicate gneiss succession that totals up to 10 metres in thickness (Fyles, 1970). Measured reserves reported by Riley (1961) total 2.6 million tonnes containing 5.6 percent Zn, 5.1 percent Pb and 37.7 g/tonne silver.

The sulphide layers are massive to crudely banded. They comprise mainly fine-grained pyrrhotite, sphalerite and galena with scattered grains of pyrite in a gangue of quartz, barite, calcite, plagioclase, garnet and some calcsilicate minerals. Barite content ranges from isolated grains within the sulphides to massive layers that contain variable amounts of sulphides.

Analyses of a number of hand samples of the sulphide layer in the northeast limb (Figure 9) are given in Table 3. A number of the samples contain considerable manganese, ranging up to 10653 ppm Mn, and relatively high cadmium and antimony. Silver content is higher than in other stratiform sulphide layers in the Northern Monashees, with three of the six samples containing more than 115 ppm Ag. These values are comparable to or somewhat lower than those reported by MacGillivray and Laird (1990) but much higher than in the measured reserves of Riley (1961). Gold content is also relatively high with one zinc-rich sample assaying 813 ppb Au (Table 3).

Discussion

The only age constraints on the Jordan River succession is the 740 Ma Copeland syenite that intrudes Unit 4 below the Jordan River deposit. However, the recognition of the carbonatite tuff and white calcite marble just below the Jordan River sulphide layer allows direct correlation with the Cottonbelt succession. Both sulphide deposits are stratabound layers at approximately the same stratigraphic level and, based on arguments from the Cottonbelt area, the Jordan River host succession may therefore be as old as 1.85 billion years. As in the Cottonbelt area, no unconformities have been recognized in the cover sequence below the Jordan River deposit.

Jordan River has many features that are typical of metamorphosed sedex deposits. Diagnostic features of Broken Hill-type deposits, such as siliceous or manganese rich envelopes, unusual chemistry, abundance of recognized exhalite facies in surrounding stratigraphy, or magnetite within ore lenses are not apparent. However, slightly elevated manganese, copper and antimony, and high gold and silver content, are typical of BHT deposits. It is probable that Jordan River represents a metamorphosed stratiform sulphide deposit that is closer to the sedex end of a BHT-sedex spectrum.

RUDDOCK CREEK

Introduction

The Ruddock Creek deposit was discovered in 1960 by prospectors under the supervision of Earl Dodson of Falconbridge Nickel Mines Ltd. The property was mapped in detail by H.R. Morris of Falconbridge in the summers of 1961 to 1963 and by J. T. Fyles in 1968 (Fyles, 1970). The writer spent one week on the property in late August of this year, mapping in detail the eastern part of the Ruddock Creek property. Exploration on Ruddock Creek included considerable drilling by Falconbridge from 1961 to 1963. Cominco Ltd. optioned the property in 1976, and during the late 1970s conducted extensive exploration that included considerable drilling,

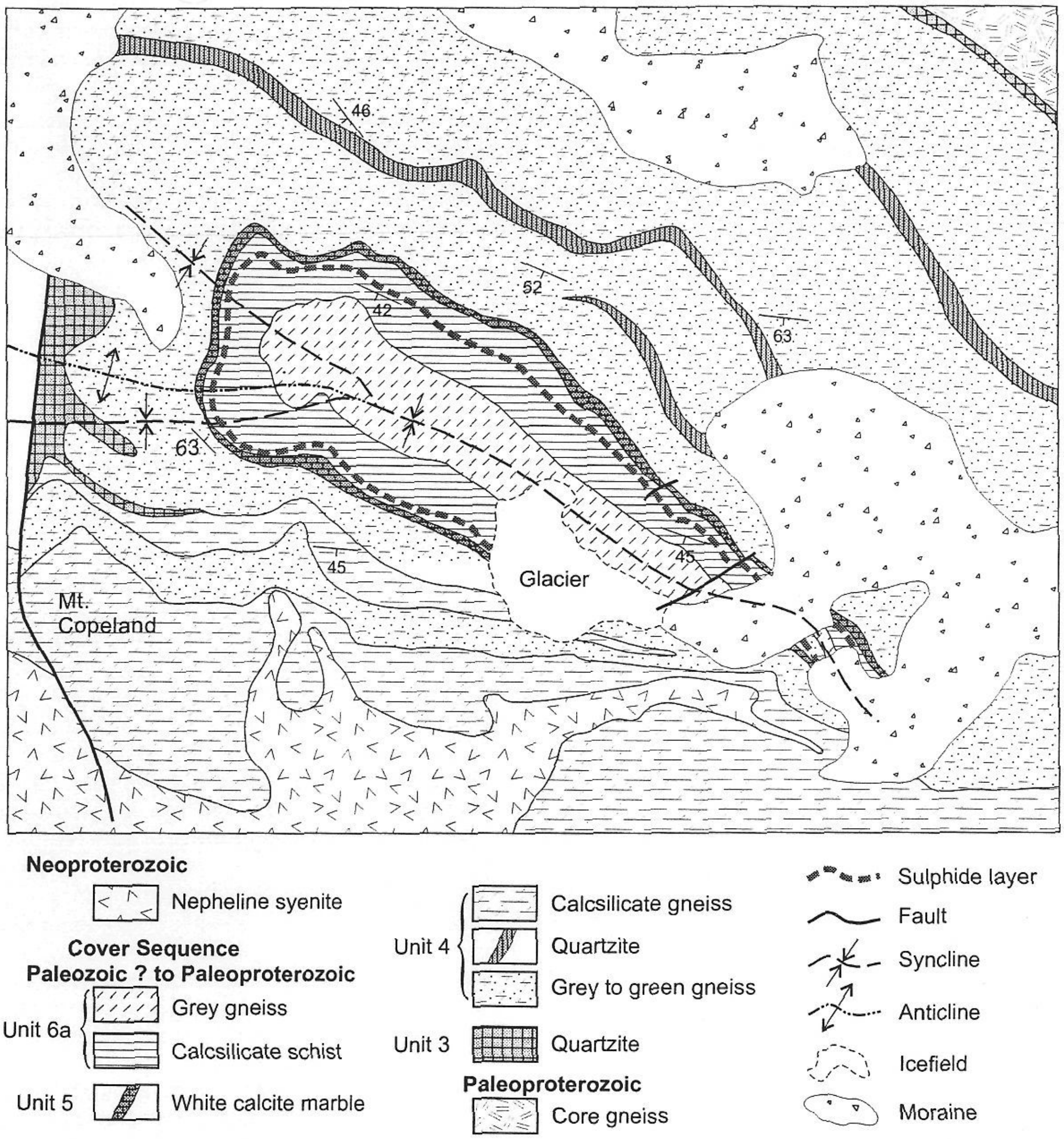

Figure 9. Geology of the Jordan River deposit area (after Fyles, 1970).

more detailed mapping, sampling and geophysical surveys. A considerable part of this work was directed towards defining the closure of the tight fold that forms the E zone. Double Star Resources Inc. obtained the Ruddock Creek claims in 1999 and this past summer began a program that consisted mainly of structural mapping and sampling. This report draws extensively on previous work; it describes main geological features, presents some new geochemical data and attempts correlations with units at other Monashee massive sulphide deposits to the south.

Ruddock Creek is located in the Script Ranges, nearly 100 kilometres north of Revelstoke (Figure 1). It is accessible by helicopter from both Revelstoke or Blue River, 50 km to the northwest. Ruddock Creek is a thin massive sulphide layer that can be traced or extrapolated through a distance of nearly 13 kilometres on south facing slopes near the headwaters of Ruddock Creek and a small tributary of Oliver Creek (Figure 10). Although most showings are above treeline and exposure is excellent, the steep topography on north facing slopes, together with glacier and snow cover, and very extensive "pegmatite" and "granite" tend to obscure this horizon.

Host Succession

As noted by previous workers, it is difficult to develop a composite section due to the pervasive "granite" and "pegmatite", and structural complexity. Much of this granitic material contains remnant metasedimentary lay-

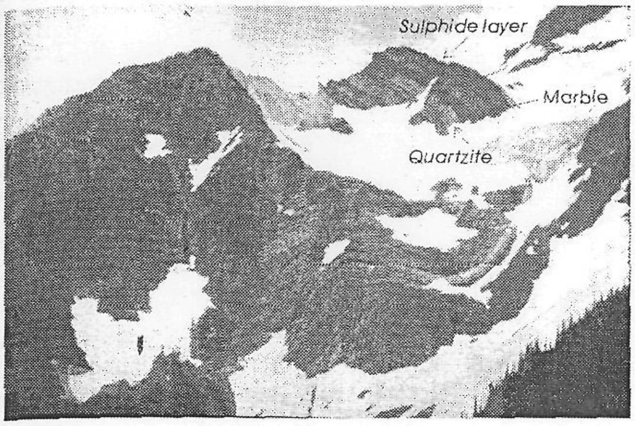

Photo 5. The Copeland syncline, viewed to the east, outlined by marble of Unit 5 and quartzites of Unit 6.

ers, only a few of which are shown on Figure 11. In some places, only the sulphide layer remains, entirely enclosed in granitic rock. However, a general succession, as noted by Fyles (1970), comprises a structurally lower calcareous section with the sulphide layer near the top, and an upper non-calcareous section. More detailed descriptions (below) are mainly from exposures on the slopes above the E zone and just west of the camp and E zone fault. As both of these exposure areas are on the upper limb of a tight, overturned syncline, they are interpreted to be inverted (Fyles, 1970).

The lower calcareous section comprises a mixture of calcsilicate gneisses, micaceous schist, pure to impure marble and minor amphibolites and thin quartzites. Calcsilicates are typically pale green with abundant diopside and variable garnet, quartz, feldspar and amphibole. They range in composition into impure quartzites with dispersed diopside and other calcareous minerals. At least two grey-weathering, white calcite marbles are recognized, separated by several hundred metres of mixed calcsilicates and schists. The lower grey marble, exposed northwest of camp (Figure 11) is structurally underlain by a tan to buff-coloured impure diopsidic marble and overlain by calcsilicate gneisses. Rusty-weathering biotite ± sillimanite schist layers are common within the calcareous section, particularly directly below the sulphide layer. Quartzites are not common, although a number of thin layers with minor diopside or garnet occur within a few hundred metres above and below the sulphide layer. Other thin quartzite layers that contain dispersed pyrrhotite and less commonly sphalerite occur in the section below the sulphide layer east of the E showing. They are interpreted to be recrystallized siliceous exhalite units. Some that contain only dispersed garnet may also be exhalative in origin, similar to those described at Broken Hill. Analyses of two of these quartzites (RC-52 and RC-57a, Table 2) show values fairly typical of impure sedimentary quartzites; however, slightly elevated Mn in one sample may reflect an exhalative origin.

The tan weathering marble described above was analyzed with the possibility that it is a carbonatite, even though it did not contain lithic clasts nor dispersed biotite characteristic of carbonatites at Jordan River and Cottonbelt. Analyses (RC-61a and RC-61b, Table 2) indi-

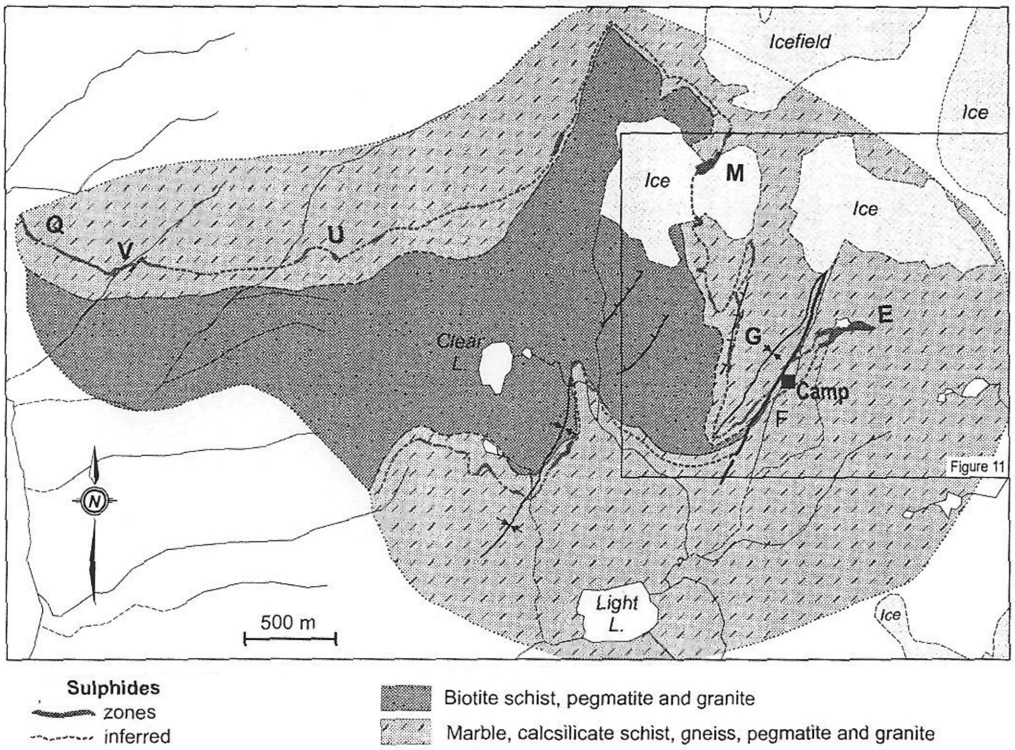

Figure 10. Geology of the Ruddock Creek deposit area (after Fyles, 1970).

cate it is mainly a calcitic marble with Ba and Mn contents typical of sedimentary limestones. Only Sr is anomalously high, but is still within the upper range of marble with a sedimentary protolith.

The upper non-calcareous section is only exposed as remnant brown-weathering biotite schist layers enclosed in pegmatite and granite in the western part of the map area (Figure 11). Fyles (1970) estimated that it may have a total stratigraphic thickness of 300 to 400 metres.

"PEGMATITE" AND "GRANITE"

These rocks include a wide variety of textures and grain sizes, ranging from coarse-grained unfoliated pegmatite, through medium-grained, massive to foliated quartz-feldspar "granite", to aplite and aplitic gneiss. They occur throughout the map area, typically covering more than 50 percent of the outcrop area (Figure 11). As described by Fyles (1970), they can form thick, essentially continuous sheets with only minor remnant metasedimentary layers to thin cross-cutting dykes. Contacts with metasediments are typically sharp whereas contacts between the granitic phases range from sharp to gradational. Most granitic bodies are foliated, although many appear to be massive and discordant. They were emplaced prior to, during and after penetrative deformation.

Structure

The structure of the Ruddock Creek area has been described in considerable detail by Fyles (1970) and Marshall (1978) and is reviewed only briefly here. It is dominated by the E fold, a tight Phase 1(?) synform with a hinge zone exposed at the E showing. The fold plunges 27 degrees towards 285 degrees, with an axial plane that dips 45 degrees to the north (Fyles op. cit.).

Phase 2 folds are recumbent with west-dipping axial surfaces. Their hinge zones range from tight to relatively open. On the slopes just west of the E fault, a Phase 2 synform (the FG synform of Fyles, op. cit.) plunges west and trends to the north-northeast (Figure 11). Layering in its eastern limb, including the F zone, strikes northeast and dips to the northwest, while layering in the west limb strikes more northerly, with a steep west dip. The apparent thickening of the Lower G zone is probably due to structural repetition by minor folds on the west limb of the FG synform.

Faults include north-trending mylonite zones and late northeast-trending faults that commonly form prominent air-photo lineaments. One of these, the E zone fault, has been studied in considerable detail as it offsets the mineralized hinge zone of the E fold. The mylonites are most conspicuous in sulphides in the Lower G zone and the M zone.

Mineralization

The distribution of the Ruddock Creek sulphide layer is shown in Figures 10 and 11. Zones of thickened mineralization, due either to structural complexity or possibly original sedimentary thickening, are also labeled. Between these zones, the sulphide layer is typically not recognized due to extensive granite, or may be marked by slight rusting in granite or a very thin sulphide layers in calcsilicates.

E ZONE

The E zone is well exposed at an elevation of 2230 metres, adjacent to a small lake (Photo 6). It is a thickened and structurally repeated sulphide zone in the hinge of the Phase 1 syncline. Mineralization in both limbs trends westward to the E fault where they are offset approximately 250 metres down to the west, measured in the plane of the fault (Fyles, 1970). The total exposed length of mineralization in the E zone is nearly 300 metres, with a width of 18 metres across strike in the east and 70 metres across the limbs in the west (Mawer, 1976). Drilling has extended the known plunge length of the hinge zone to approximately 200 metres, for a geological reserve of 1.4 million tonnes containing 10 percent Zn + Pb with a Zn to Pb ratio of 5:1 (Mawer, op. cit.).

The zone comprises a number of individual sulphide layers, comprising mainly sphalerite and galena with pyrrhotite. They are separated by rusty-weathering quartzite with disseminated pyrrhotite and sphalerite, thin calcsilicate schist, and thin marble that contains sulphides and thin discontinuous laminations of fluorite (Photo 7). Fyles noted that the zone comprises two structurally repeated and thickened sulphide layers. However, a number of thin sulphide layers, as well as disseminated sulphides, occur throughout the rusty-weathering zone below the main sulphide layers. Marshall (1978) also recognized two additional layers and suggested that the E zone represents an original thicker portion of the Ruddock Creek horizon. He further argued that there appears to be little thickening of individual layers as they are traced around the hinge of the E fold. The conclusion that this zone represents an originally thicker mineralized interval seems to be reasonable in light of the thickness and extent of the alteration here, the number of sulphide layers, and the number of thin mineralized quartzite layers in the immediate underlying stratigraphy.

Mineralization comprises dark sphalerite and less galena, pyrrhotite, minor pyrite and trace chalcopyrite, in a rusty-weathering calcareous quartzite gangue. Gangue minerals include quartz, calcite, fluorite, feldspar, muscovite, brown mica, and minor amphiboles, pyroxene (diopside?) and barite.

Analyses of selected hand sample of the E zone are given in Table 3. Analyses of the mineralized quartzite layers in the section below the sulphide zone are also given in Tables 2 and 3. As described above, one of these layers has slightly elevated manganese content (compared to sedimentary quartzites) and sample RC-56 (Table 3) has elevated Pb, Zn, Mn, Ba and W suggesting that these may be exhalite horizons.

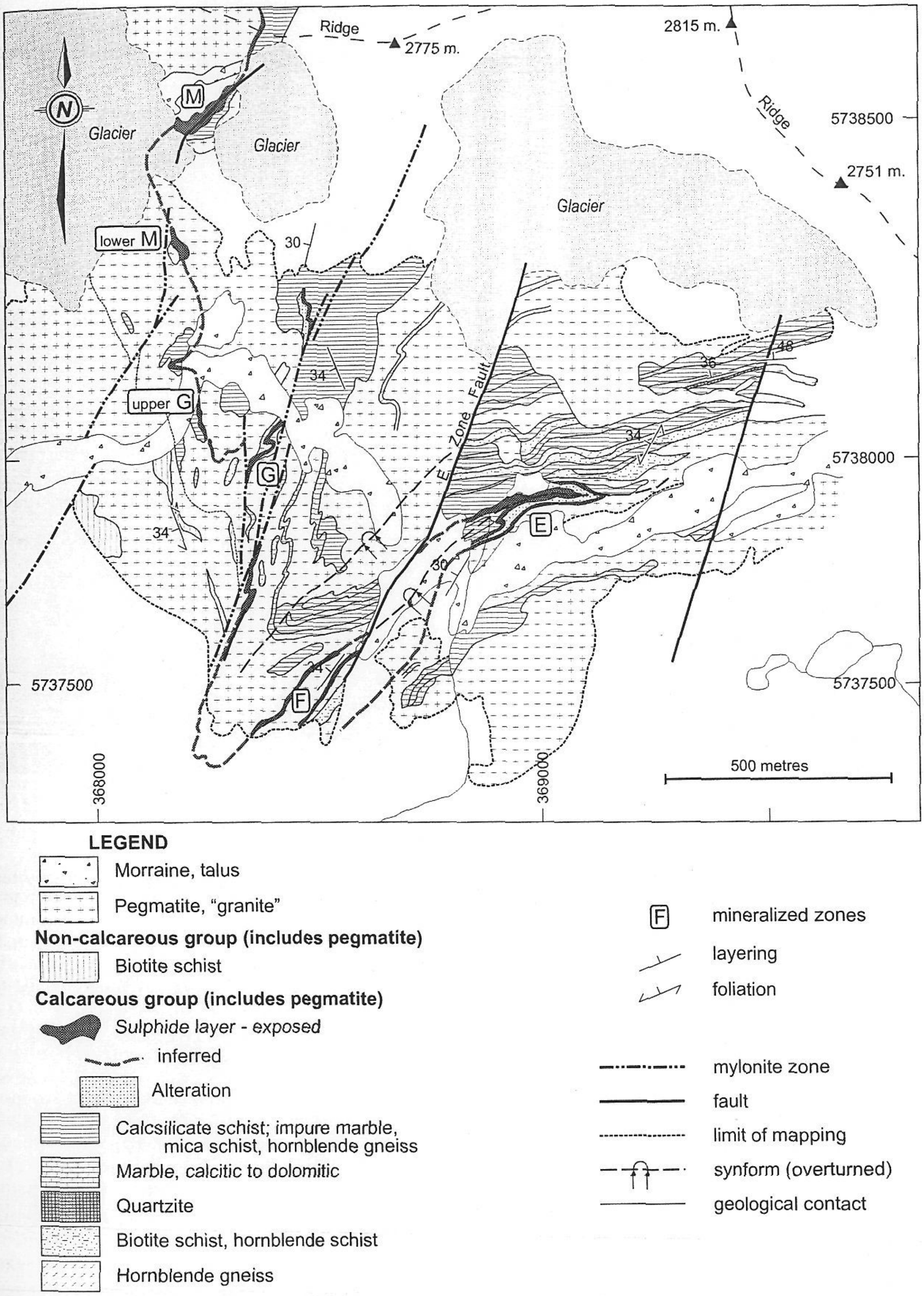

Figure 11. Detailed geology of the eastern part of the Ruddock Creek deposit area. UTM Nad 83 grid.

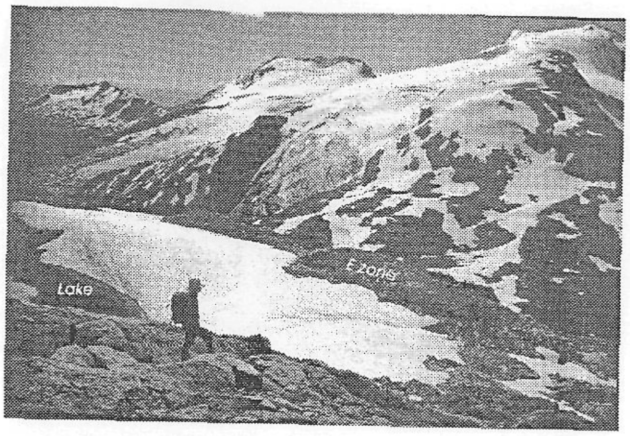

Photo 6. View to the southeast of the E zone in the core of the E zone syncline. The syncline closes to the east (left). Note abundant pegmatite in foreground.

F ZONE

The F zone is exposed as a number of sulphide lenses located southwest of the camp (Figure 11). One of these lenses (RC-11) is enclosed by pegmatite and has a pegmatite lens within it. The sulphide lens is exposed for 20 metres along a cliff face and is up to 2 metres thick. It comprises massive, fine-grained sphalerite, pyrrhotite and galena with minor to abundant clear quartz, feldspar and pyroxene? grains. Towards the margins of the lens, quartz content increases until it comprises a mineralized quartzite with dispersed sulphides.

RC-12 is a sulphide pod approximately 10 metres in length and 3 metres thick. It varies from massive pyrrhotite, sphalerite and galena with a quartz gangue to quartzite with disseminated sulphides.

RC-13 is a thin sulphide exposure, comprising mainly massive pyrrhotite with sphalerite and galena, on strike southwest of RC-11. It is immediately underlain by streaked, fine-grained quartzite with disseminated sulphides. The sulphide and siliceous envelope are within diopside-plagioclase calcsilicates. The analyzed sample (Table 3) is a quartz-diopside rock containing pyrrhotite, sphalerite and galena.

RC-14 is exposed at the top of a high steep cliff farther to the southwest. The massive sulphide layer (RC-14b; Table 3) is approximately one metre thick, and contains numerous small rounded quartz grains. Quartzite in its immediate footwall (RC-14a) and hangingwall (RC-14c) contains disseminated pyrrhotite, sphalerite and galena, pyroxene? and rare garnet and calcsilicate minerals. The sulphide zone is underlain by a thin impure marble layer that grades upward to calcsilicate just beneath the footwall quartzite, then granular biotite-quartz-feldspar gneiss, and finally calcsilicate gneiss.

G ZONE

The G zone includes a number of discrete sulphide zones on the inverted western limb of the FG synform.

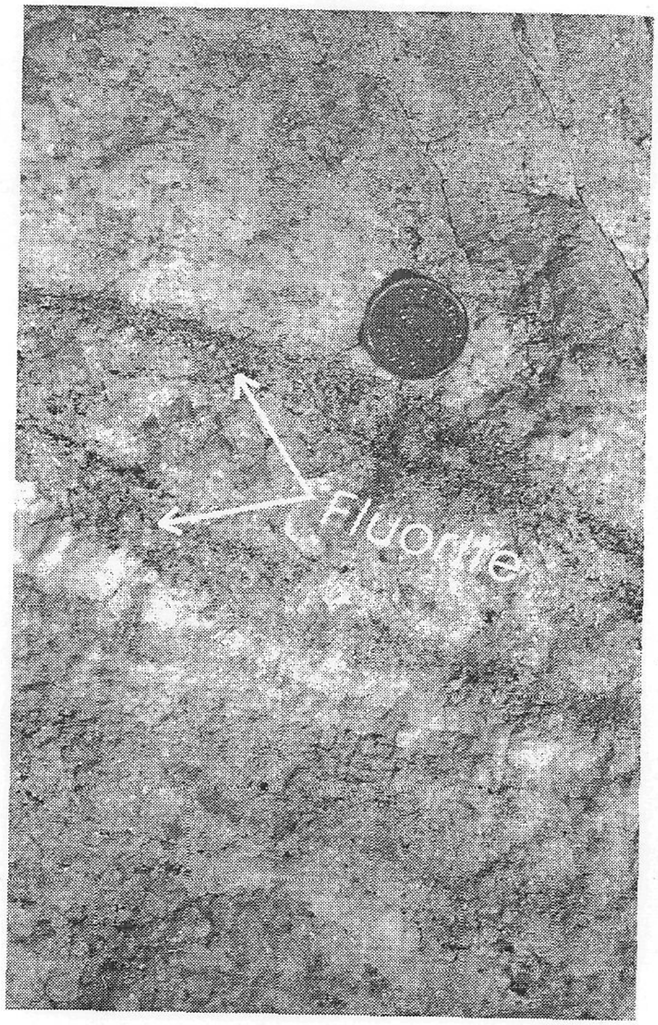

Photo 7. Fluorite layers in calcite marble in footwall rocks at the E zone.

Shearing, probably related to east-directed thrusting, has both attenuated sulphide layers of the G zone and repeated them farther northwest as the upper G zone. The mineralized layers are exposed discontinuously along a strike length of approximately 400 metres. Although relatively thin or poorly exposed at surface, drilling (DDH ED-4) intersected a true thickness of 16 metres at the upper G zone containing 6.12 percent Zn and 0.79 percent Pb (Mawer, 1976). This interval included barren pegmatite as well as a number of higher grade sulphide layers. Eight X-ray holes drilled in 1977 also intersected mineralization, with the one 2-metre interval in DDH UG 77-4 containing 1.79 % Pb and 11.08 % Zn within a zone 28 metres thick that contained 0.32 % Pb and 2.28 % Zn (Nichols, 1978). The lower G was also tested by six X-ray drill holes with one intersection of 5 metres grading 2.59 % Pb and 11.91 % Zn (Nichols, op. cit.).

The lower G zone (Figure 11) comprises a contorted massive sulphide layer that is intermixed with remnants of impure marble and calcsilicate gneiss layers. It is stratigraphically underlain by impure tan to white calcite (with minor fluorite) marble and calcsilicate and overlain by quartzite with disseminated sulphides and rare emerald green gahnite? grains. Open to relatively tight macroscopic folds, with similar vergence as the FG synform, repeat the sulphide layer. North-striking mylonites cut both sulphides and host rocks. Analyses of a number of selected hand samples of the lower G zone (RC-17, RC-18 and RC-23) are given in Table 3. They are similar to those of the E and F zones, with high Zn and Pb values and low silver content.

The upper G zone is exposed on both sides of a moraine northwest of the lower G zone. A small exposure (partially snow covered) just south of the moraine comprises a 1-metre thick, medium-grained black, sphalerite-pyrrhotite-galena layer with quartz and minor calcite and garnet gangue. It is underlain by dark quartz that contains disseminated sulphides and garnet, and locally overlain by massive coarse-grained garnet-pyroxene skarn that contains variable quartz and sulphides. Analyses of a sample of the sulphide layer (RC-43a) is shown in Table 3. High manganese content of the garnet-rich skarn (RC-43b) indicates that the garnet is mainly spessartine. The high zinc content of the quartzite in the footwall (RC-43c) suggests that it is an alteration assemblage.

M ZONE

The M zone comprises a number of exposures, largely enclosed by glacier ice, at elevations ranging from 2450 metres to 2675 metres. The largest of these (RC-26; Figure 11) includes several sulphide layers that are structurally repeated by tight, west-plunging recumbent folds. The lower exposure of the M zone is 260 metres downslope to the south from the main showing, and the highest exposure is located on the ridge to the north of the main showing.

Sulphide layers at the main M showing comprise mainly sphalerite, pyrrhotite and galena with quartz and minor calcite and fluorite gangue. Sulphides (sample RC-26b, Table 3) are generally massive with clear quartz eyes, but also are locally layered or mylonitized. They are within a siliceous, tan-weathering calcite marble that contains streaks of fluorite, minor barite and occasional to relatively abundant sulphides (RC-26a, 26d). In some places, a siliceous, quartz-sulphide envelope (RC-26e) surrounds the sulphide layers, or occurs below them. The sulphide layers and host rocks are stacked due to a series of recumbent Phase 2? folds with rounded hinge zones that plunge at variable angles to the west and northwest. These folds are broadly warped by south plunging Phase 3 folds.

The lower M zone was only partially exposed within glacier ice and snow. The exposed sulphide layer has a thickness of 2 metres; it comprises mainly pyrrhotite and sphalerite and minor galena with a quartz-rich gangue (sample RC-47a). It is structurally underlain by "pegmatite" and overlain by a very silicified zone comprising mixed quartzites, calcsilicates and marbles.

The quartzite, commonly in contact with the sulphide layer, ranges from pure to containing variable amounts of garnet and diopside and randomly dispersed grains of gahnite(?) or sulphides. It is overlain by a pale green to tan siliceous calcsilicate or skarn assemblage, comprising mainly diopside, quartz, minor garnet and some dispersed sulphides. Lenses of swirled sphalerite, galena, quartz and calcite, but virtually no iron sulphide, occur within the calcsilicate zone. One of these lenses (RC-47b) contains the highest silver content (18.5 g/tonne) of any sample analyzed from the Ruddock Creek area. Other lenses in the calcsilicate unit include quartz-garnet, quartz-garnet + diopside and quartz - pyrrhotite units. Farther removed from the massive sulphides, the calcsilicate zone is less quartz rich, comprising mainly diopside or garnet, or a diopside - garnet ± quartz assemblage. This alteration zonation appears to reflect decreasing silica and increasing manganese with distance above the sulphide layer.

DISCUSSION

Ruddock Creek comprises a number of sulphide layers within a thin (less than 20 metre thick) stratigraphic package. These can be traced or extrapolated through a strike length of approximately 13 kilometres. Locally, they are structurally repeated or thickened by folding and possibly thrust faulting. The E zone may be structurally thickened, but it is also possible that it comprises an originally thicker sedimentary succession that localized the tight E syncline.

The sulphide layers are commonly enclosed, overlain or underlain by a zone of intense silicification, now occurring as a quartzite with variable garnet, sulphide and calcsilicate mineral content. This zone typically grades outward to a magnesium-rich calcsilicate zone or manganiferous garnet "skarn" assemblage. Dispersed sulphides, commonly with higher lead/zinc ratios occur in the alteration envelope.

A number of thin quartzite layers in the underlying succession are interpreted to be exhalite units. They may contain disseminated sulphides, mainly pyrrhotite and minor sphalerite, garnet, and rarely gahnite.

It is difficult to correlate the Ruddock Creek stratigraphy with that at Cottonbelt and Jordan River as there are no distinctive marker units other than the sulphide layer itself; carbonatites were not clearly identified at Ruddock Creek, although a tan-weathering marble in the underlying stratigraphy superficially resembles the Mount Grace carbonatite. Despite this, it is possible that Ruddock Creek is in the same package as other stratabound sulphide occurrences as most appear to be at a similar stratigraphic level. As well, the broad subdivision between a lower calcareous and an upper noncalcareous section is common to all occurrences. This, however, may simply reflect a similar change in depositional environment at all occurrences, from more shallow to deeper water environments that reflects extensional tectonics and basin deepening.

Ruddock Creek has some features diagnostic of Broken Hill-type deposits. The relatively high base metal/iron sulphide ratio, high fluorine and the calcareous host typify BHT deposits. As well, the pronounced quartz and spessartine alteration envelope around sulphide layers is characteristic of these deposits. Finally, the numerous sulphide-quartzite layers in the footwall stratigraphy, and occasional gahnite-quartzite and garnet-quartzite layers, are similar to the exhalite horizons around BHT deposits.

SUMMARY

A number of stratabound zinc-lead-silver deposits occur in highly metamorphosed and deformed metasedimentary rocks in the Monashee Mountains in southeastern British Columbia. Some of these, including Big Ledge and Kingfisher south of Revelstoke and Jordan River, Cottonbelt and Ruddock Creek to the north, have been fairly extensively explored, but none have had any production. The deposits are thin layers of massive to semi-massive sulphides that have strike lengths of several kilometers and widths of generally less than a few meters. They are intensively deformed and metamorphosed and locally invaded by extensive zones of pegmatite and granite.

The deposits are within the Monashee Complex, a succession of mainly platformal rocks, referred to as the cover sequence, that unconformably overlies crystalline basement of the core complex. The core complexes are exposed in two structural culminations, the Frenchman Cap dome in the north and Thor-Odin in the south. The age of the core complex is reasonably well constrained by Paleoproterozoic granitic orthogneisses that range in age from ca. 1.87 to 2.27 Ga.

The age of the cover sequence, particularly that part of the succession hosting the sulphide layers, is not as well known. Estimates based mainly on lithologic correlations with Kootenay terrane and North American rocks to the east have ranged from Mesoproterozoic to Paleozoic. Recent dating of detrital zircons and intrusions, however, indicate that deposition of the basal part of the cover sequence occurred between ca. 1.95 and 1.85 Ga (Crowley, 1997). The sulphide layers occur only a few hundred meters above this basal part of the sequence. A maximum age for rocks considerably higher in the succession, above the sulfide layers, is provided by 1.2 Ga detrital zircons, and a minimum age by a 541 Ma magmatic amphibolite. These ages are compatible with a Cambrian Pb-Pb galena date on Cottonbelt. However, if the sulphide layers are Cambrian, then the thin interval separating them from the basal part of the sequence requires a major unconformity, recording a hiatus of ca. 1.3 billion years. As this unconformity is not recognized in the field, either by omission of units or distinctive lithologies, the suggestion that the sulphide layers themselves are Paleoproterozoic must be considered. This requires reevaluation of the lead isotopic systematics of Cottonbelt.

A number of features of some of the deposits, and of the host successions, are typical of a class of deposits referred to as the Broken Hill-type. These include skarn-like mineralogy, a result of a calcareous gangue, locally high Mn content, and the abundance of magnetite (at Cottonbelt) rather than iron sulphide phases more common in typical sedex deposits. Immediate host rocks may contain fluorite and have abundant garnet and sillimanite, similar to Broken Hill host rocks. As well, thin quartzite, garnet-quartzite and sulphide-quartzite layers are similar to some of the exhalite facies that characterize Broken Hill stratigraphy, as is the local occurrence of gahnite in some of these layers.

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