THE WILDS CREEK (LEG) ZINC-LEAD-BARITE DEPOSIT, SOUTHEASTERN BRITISH COLUMBIA: PRELIMINARY IDEAS (82F/2)

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INTRODUCTION

This article summarizes a preliminary study of the Wilds Creek (Leg or Legion) deposit, undertaken concurrently with regional mapping of the surrounding Creston map area as summarized in Brown *et al.* (1995, this volume). The Wilds Creek deposit is one of a series of stratabound zinc-lead-barite prospects and mines in upper Purcell Supergroup stratigraphy along the western edge of the Purcell anticlinorium (Figure 1). These deposits are typically hosted in dolomitic units of the Dutch Creek Formation near the contact of the overlying Mount Nelson Formation, although the stratigraphic nomenclature and correlation varies with different workers. They are intensely foliated and structurally complex. The occurrences all lie in the hangingwall (west) of the Hall Lake fault. They have received various amounts of exploration attention and there is potential for other deposits, as illustrated by the Mineral King mine located about 100 kilometres north of Wilds Creek. It produced 1.210 million tonnes of ore with an average grade of 4.12% Zn, 1.76% Pb and 24.8 g/t Ag between 1956 and 1964 (B.C. Minister of Mines Annual Reports, 1956-1964). Seven days of mapping and drill core examination on the Wilds Creek property, located about 12 kilometres north-northwest of Creston, suggest characteristics that are of exploration significance for this part of the Belt Basin. Access to the property is by the Bathie Road and a new private logging road (locked gate) that crosses a network of older roads and overgrown trails.

REGIONAL SETTING

Stratigraphic nomenclature and subdivision of the western part of the upper Purcell Supergroup is hindered by several factors: a lack of prominent stratigraphic markers, lithologically similar units are repeated in the succession, and penetrative fabrics are more intense here compared to farther to the east. Early mapping by Rice (1941) identified Purcell Supergroup rocks, a northwest-facing succession of Creston, Kitchener-Siyeh, Dutch Creek and Mount Nelson formations, intruded by Mesozoic granite. Our stratigraphic divisions are based on the regional stratigraphic succession farther to the east; Reesor's new nomenclature is not adopted here because new names were proposed without explanation (Reesor, 1993). Farther north, in the Toby Creek area, recent thesis studies by Root (1987) and Pope (1989) suggest that the Mount Nelson Formation lies unconformably on the Dutch Creek Formation. The Mount Nelson Formation may therefore be an unconformity-bounded succession between the Purcell and Windermere supergroups.

PROPERTY WORK HISTORY

Galena and sphalerite were discovered in 1924 in a showing located on Wilds Creek at about 1000 metres elevation. The showing was drilled by Newmont Mining Corporation of Canada Limited (1954 - six holes), Sheep Creek Mines Limited (1961 - two holes), Aspen Grove Mines Limited (1964 - five holes), Legion Resources Ltd. (1989 - seven holes), Kokanee Explorations Ltd. (1990 - five holes; 1992 - nine holes), and Ramrod Exploration (1992 - nine holes). These programs amounted to a total of over 5000 metres of drilling. Estimated reserves, generated from investigations prior to 1965, were reported at about 136 000 tonnes grading 6% Zn across widths of 1 to 6 metres (Aho, 1964). In addition to drilling, several mapping, soil geochemistry and geophysical surveys (VLF-EM, IP, magnetic) have been completed.

STRATIGRAPHY

The property stratigraphy comprises nine, poorly exposed units (Figure 2; Photo 1): (1) sericitic phyllite; (2) thin-bedded black argillite and tan dolomitic siltstone; (3) chlorite-sericite phyllite with prominent but minor light grey quartzite beds; (4) argillite and dolomitic siltstone; (5) mineralized phyllitic dolomite and dolomitic siltstone; (6) dark grey phyllitic argillite and siltstone; (7) dolomite and limestone hosting the sphalerite-barite mineralization; (8) mafic volcanic rocks; and (9) quartzite. Most units are phyllitic and internally tightly folded, although unit contacts are not recognizably folded. The gross stratigraphic succession is a steeply southeast dipping, overturned homocline. An alternative interpretation that the two dolomitic horizons (units 2 and 4) are limbs of a tight, fault-bounded fold was suggested by Aho (1964). However, with new exposures and additional drilling it is now apparent that the dolomites are different. Correlation of these units with the regional stratigraphic column is hindered by poor exposure, faulting and folding; possible correspondences are: Kitchener Formation (units 1 to 2); Dutch Creek Formation (units 3 to 7); and Mount Nelson Formation (unit 9). Recognition of mafic rocks (unit 8) is significant as they may correlate with the Nicol Creek Formation or represent a previously undocumented volcanic episode. Summary descriptions of the main units bounding the ore and characteristics of the mineralization follow.

Two sequences of layered dolomite and impure quartzitic dolomite (units 5 and 7) host sulphides and are of prime economic interest. The **eastern dolomite** (unit 5) is more silicic and thinner than the recessive and poorly exposed dolomitic siltstone of unit 7 (at least 70 m thick). It comprises thin to very thinly layered silty dolomite and argillite. The **western dolomite** unit is a succession of white to cream-weathering, mottled grey to pale green impure dolomite, dolomitic siltstone with lesser interlayered green and maroon quartzitic phyllite and siltstone. The dolomite is commonly laminated to thinly layered, but locally it is massive. Disseminated pyrite (1 to 2%) occurs throughout the unit with rare, narrow pyrite lenses up to 10 centimetres thick. Baritic limestone is commonly associated with mineralized intervals within the unit. Tight to isoclinal minor folds are evident in drill core.

Distinctive carbonate breccia horizons (Photo 2; Figure 3) within the western dolomite horizon (unit 7) form an important marker unit. Several intervals of

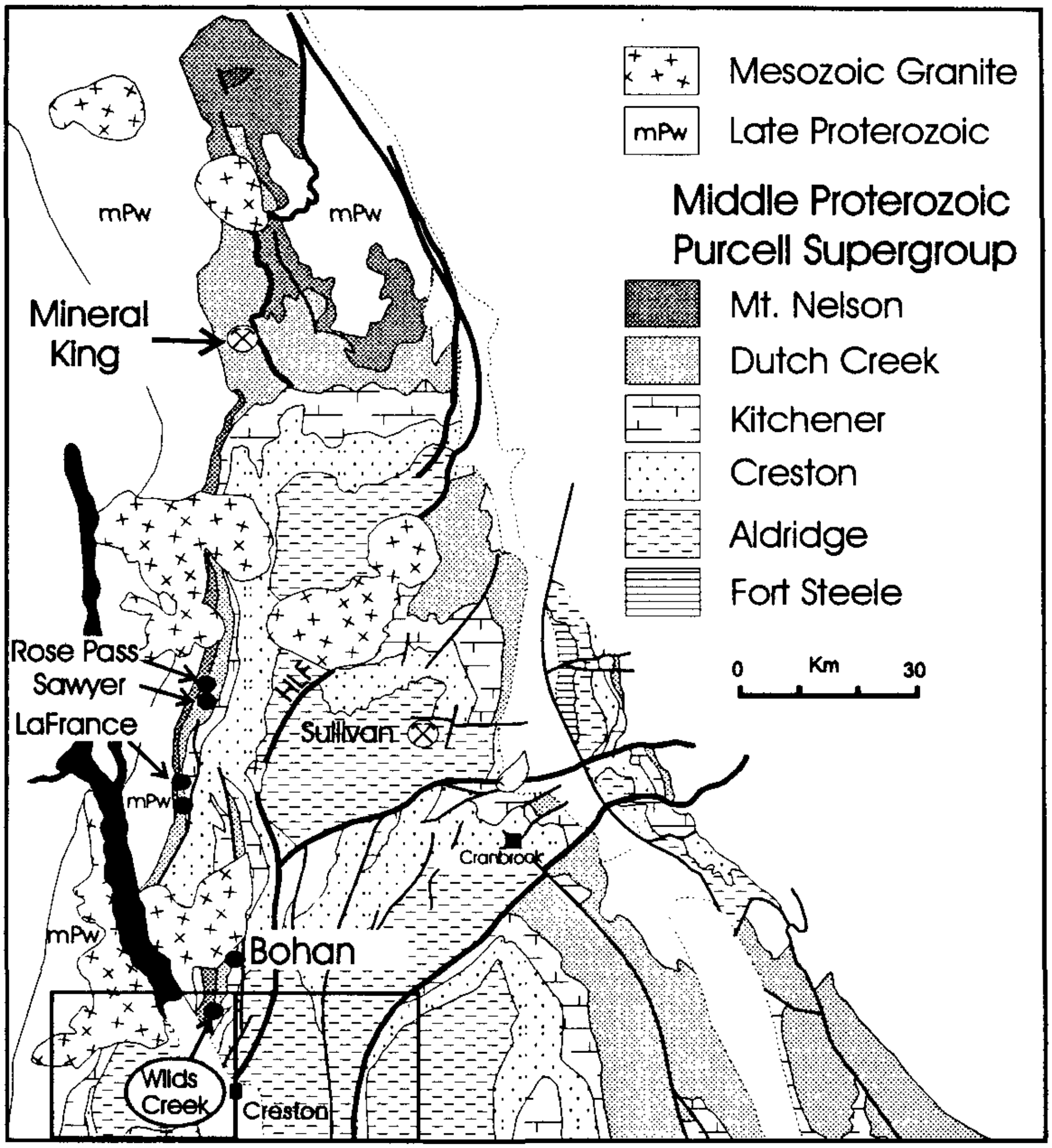

Figure 1. Regional distribution of stratabound zinc-lead-barite occurrences along the western flank of the Purcell anticlinorium. Rectangle outlines Yahk and Creston map areas (82F/1 and 2), mapped by East Kootenay project. HLF = Hall Lake fault. Map modified from Höy *et al.*, 1995.

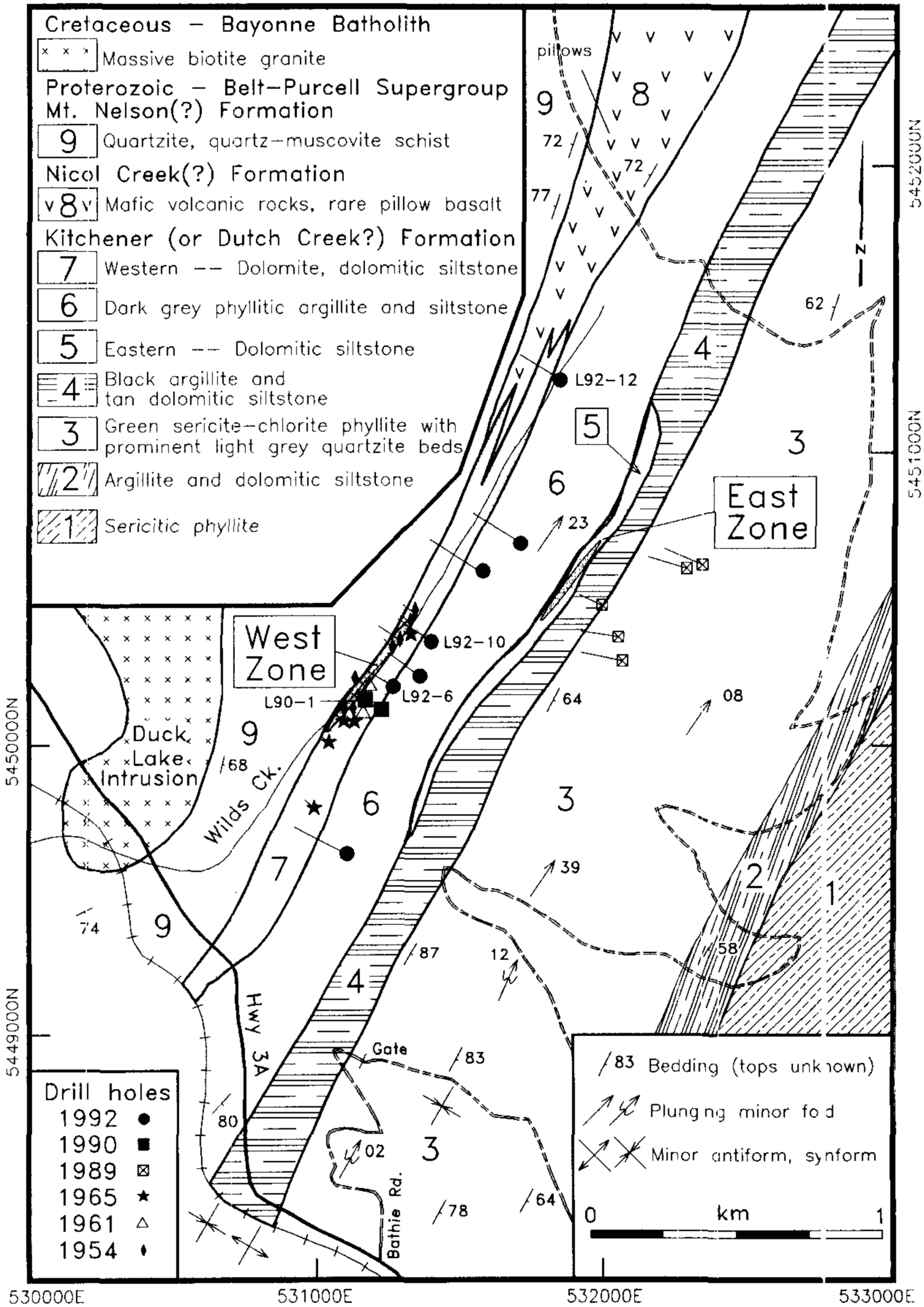

Figure 2. Simplified geology of the Wilds Creek (Leg) property.

Photo 1. View to northeast of the forested mountainside underlain by the poorly exposed Wilds Creek occurrence. Wilds Creek is shown by the white line and the town of Wynndel in the Duck Creek valley lies on the right side of the photo.

breccia up to 15 metres thick (apparent thickness), were intersected in drill core. This heterolithic breccia contains randomly oriented clasts a few millimetres to 15 centimetres long, supported in a carbonate matrix. The clasts form 30 to 70% of the rock and include angular argillite fragments, and subrounded quartz, dolomite and rare grey quartzite. Their relative proportions vary greatly, however dolomite and quartz dominate. A coarsening-upward (down the drill hole) accumulation of clasts was notable in one drill hole. The matrix-supported laminated argillite fragments weather out and contribute to the permeable character of this unit that now acts as an aquifer. Quartz fragments appear to be pieces of broken white quartz veins, perhaps derived from early diagenetic veins. Parts of the breccia are extremely vuggy and some are lined with quartz. The grey to white carbonate matrix is friable and soft. Locally, white quartz veins cut the breccia. Phyllitic siltstone layers occur within breccia units. At least three breccia horizons were intersected by drilling in this unit; they vary in apparent thickness from a few metres to 37 metres.

The breccia is thought to be a solution collapse (karst) deposit. Similar breccias occur at; the Mineral King mine, described by Pope (1989); Mount Bohan (Anderson, 1989); and LaFrance Creek (Slingsby, 1980; D. Wiklund, personal communication, 1994). Dolomite breccia is also exposed near North Star Mountain within strata currently included in the Kitchener Formation (see Brown *et al.*, 1995, this volume). Farther east in the Purcell (Belt) Basin, carbonate-rich sedimentary breccias occur within the basal part of the middle member of the Wallace Formation (Harrison *et al.*, 1986), perhaps they have a similar origin. If these breccias are karst deposits, they mark a regionally significant regression, where dolomite was subaerially exposed.

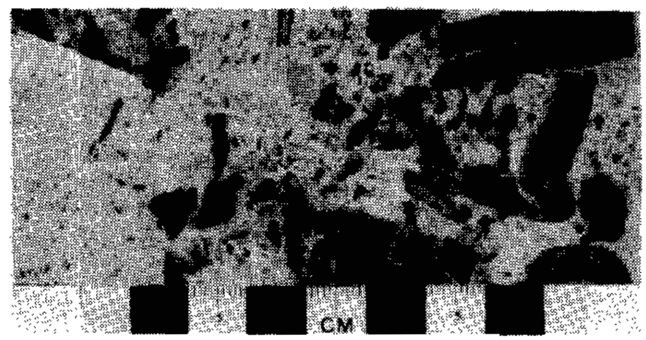

Photo 2. Dolomite breccia from the Wilds Creek deposit. (Hole L92-12, 231.3 m).

Variably foliated dark grey to silver argillite, interbedded with grey siltstone (unit 6), lies between units 5 and 7. The unit is recessive and poorly exposed. Individual laminae are discontinuous and irregular, probably due to tectonic attenuation. Minor interlayers of silty limestone occur locally. The unit exhibits small-scale tight folds in drill core.

A volcanic succession (unit 8) including probable pillow lavas (Photo 3) and associated tuffs is exposed along a new logging road north of the mineralized dolomite. The poorly developed pillows are up to 1 metre long with chloritic selvages, and locally contain plagioclase-porphyritic cores and amygdules. The brown-weathering, medium to fine-grained flows are dark green on fresh surfaces, and locally have oxidized flow tops seen in drill core. Fine pyrite euhedra (1 to 2%) are disseminated throughout the well foliated volcanics and magnetite concentrations occur locally. Prominent white plagioclase phenocrysts (15%) and rounded white amygdules (5%), filled with zeolites(?), are evident in drill core. Tuffs are deeply weathered, olive green to

Photo 3. Possible pillow lava exposed on a new logging road.

brown and friable. The 750-metre section exposed along the new logging road is dominated by recessive tuff and capped by about 75 metres of flows. The volcanic unit pinches out rapidly to the south, into flows 1 to 20 metres thick within dolomitic and siliciclastic rocks of unit 7.

An unmineralized, resistant, massive to thin-bedded quartzite and quartz-muscovite phyllite (unit 9) underlies the western edge of the property. Bedding dips steeply to the southeast. The fine to medium-grained well foliated quartzite is multicoloured - white, grey, pale green, mauve and maroon. It weathers grey to white and forms resistant outcrops. Some layers are more chloritic and probably represent argillaceous interbeds. The quartzitic succession may correlate with the base of the Mount Nelson Formation (Reesor, 1983); this contact is exposed in drill core and may be faulted.

INTRUSIVE ROCKS

A granitic stock, named here the Duck Lake intrusion, is about 500 metres wide and 1500 metres long and lies immediately west of the lower reaches of Wilds Creek. The massive biotite granite is related to the Cretaceous Bayonne batholith (Shaw Creek stock) that crops out farther to the northwest (Brown *et al.*, 1995, this volume). Calcsilicate assemblages, including coarse tremolite and biotite hornfels, are prominent in the southwestern part of the property. Regional aeromagnetic data show that anomalously high values extend southward from the Bayonne batholith under much of the property.

STRUCTURE

The Wilds Creek area lies on the west limb of the Goat River anticlinorium (Brown *et al.*, 1994) where it is part of a homoclinal succession from Creston Formation to Mount Nelson Formation. However, at the property scale the details are more complicated. On the property, bedding and penetrative phyllitic chlorite-sericite foliations strike north-northwest and dip steeply to the east (also locally to the west). The steep southeast dips and apparent northwest facing direction suggest the stratigraphic succession is overturned. Much of the structural style is controlled by competency contrasts of the different lithologies; tight chevron folds with gently north-plunging fold axes are abundant in the sericitic phyllite (unit 3; Photo 4) and transposed bedding is common in argillite units. Where macroscopic folds are not evident, bedding-cleavage relationships indicate tight folds within the green phyllite (unit 3). The mineralized carbonate (unit 7) is phyllitic but the enclosed carbonate breccia has no tectonic fabric, perhaps due to local flow of the carbonate unit along its contacts. Abrupt dip reversals in the quartzite (unit 9) suggest tight folding. Closures were not observed in outcrop, although millimetre to centimetre-scale chevron-style minor folds are evident in drill-core samples (Photo 5). The structural complexity of the property is illustrated by the variations in units and thicknesses, and difficulty in correlation between drill holes, even those holes collared at the same site.

Intense penetrative strain is evident in several polished samples of drill core. Pyrite euhedra fill brittle fractures (Photo 6a) or are disseminated along individual laminae (Photo 6b). Early quartz veins are folded with completely sheared limbs (intrafolial folds; Photo 6b).

Photo 5. Drill-core sample showing tight chevron folds in fine-grained quartzite of unit 9 (Hole L92-6, 150 m).

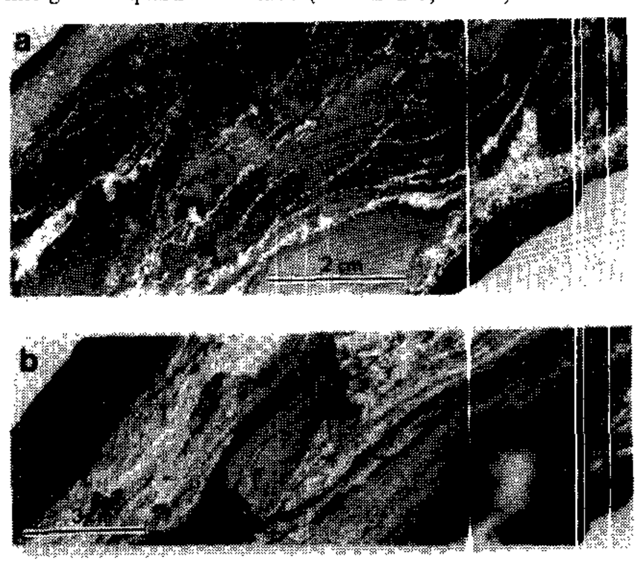

Photo 6. (a) Unmineralized, brecciated pale green silicic phyllite with pyrite introduced into the brittle fractures (Hole L90-1, 74.5 m). Faint laminations are probably relict primary bedding. The pressure shadow adjacent to quartz fragment is dominantly pyrite. (b) Highly strained dolomitic phyllite with rootless, folded quartz vein (Hole L90-1, 63.1 m). Possible S-C fabric is visible along left part of drill core.

Photo 4. Decimetre-scale tight chevron fold developed in unit 3 on the Wilds Creek property (DBR94-105).

MINERALIZATION

The two separate carbonate horizons host different styles of mineralization. The **East zone** was explored by the 1989 drilling program; the best intersection was 0.78% Zn across a 75-centimetre interval (Giroux, 1990). The zone is more intensely silicified than the Main Zone, with abundant quartz veinlets and stockwork hosted within the eastern dolomitic horizon (unit 5). It comprises pyrite with sporadic tetrahedrite, galena, sphalerite and chalcopyrite in the quartz veinlets and stockwork (*ibid.*).

The **Main zone** is at least 300 metres long and 2 to 3 metres thick as defined by drilling between about 850 to 1250 metres elevation (Figure 2). It lies within the western dolomitic horizon (unit 7) and comprises at least two intervals of stratabound sulphide-rich material, 30 to 75% pyrite and sphalerite. These intervals are bedding parallel, fine-grained pale yellow to red-brown sphalerite (up to 10% Zn) and fine to medium-grained pyrite within laminated baritic dolomitic limestone and calcareous quartzite and argillite (Figure 2; Photo 7a). The semimassive and layered sulphides (sphalerite and pyrite) in the silicic rock form narrow zones less than 25 centimetres thick. The layering, alternating pyrite and sphalerite-rich layers, may be a primary structure with a prominent, superimposed penetrative tectonic foliation. Disseminated pyrite is ubiquitous. Traces of galena (<1%) occur sporadically in dolomite layers. At surface the zone is intensely oxidized and poorly exposed. Mineralization is banded in the south and becomes more silicified and massive to the north (Giroux, 1990). Baritic dolomite is important in this horizon (Figure 3) and may correlate with 1.3 metres of bedded barite which is reported farther north, near LaFrance Creek (D. Wiklund, personal communication, 1994). Drilling in

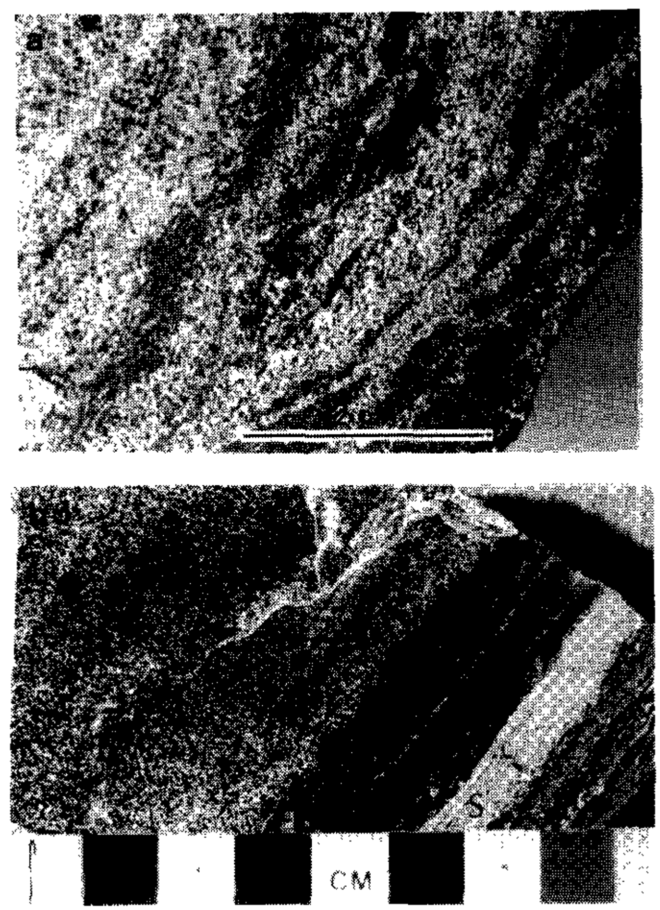

Photo 7. (a) Semimassive disseminated pyrite and sphalerite hosted in quartzitic siltstone (Hole L90-1, 80.0 m). This sample is from the interval of drill core that assayed 10.2% Zn over 2.6 metres. (b) Semimassive sulphide, disseminated pyrite with layered honey-coloured sphalerite ("S" on photo; Hole L92-6, 90.1 m). This sample is from a 1.1-metre drill-core interval that assayed 8.34% Zn, 0.74% Ag and 1.06% Ba.

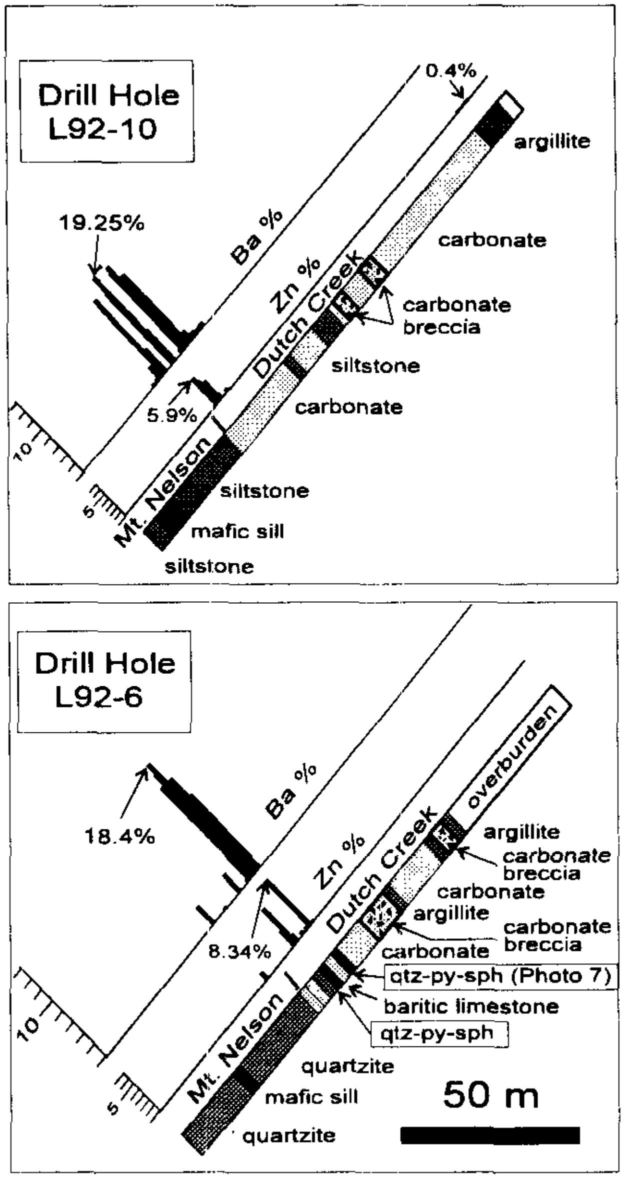

Figure 3. Simplified graphic drill-logs for two holes from the Wilds Creek (Leg) deposit, illustrating the association of barite with zinc mineralization.

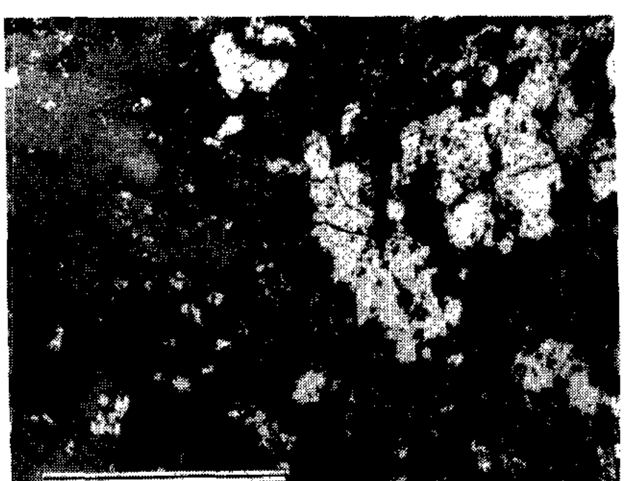

Photo 8. Pyrite blebs rimmed by magnetite within an epidote-rich gangue (Hole L90-1, 103.0 m).

Irregular patches of pyrite with reaction rims of magnetite and associated narrow intervals of epidote and diopside occur locally in dolomitic sediments (Photo 8). These patches also have associated tungsten and minor molybdenum (up to 200 ppm W and 130 ppm Mo). They are interpreted to be superimposed calcsilicate hornfels assemblages in the thermal aureole of the Duck Lake intrusion, an offshoot of the Shaw Creek stock.

PRELIMINARY MODEL

The stratabound main zone at Wilds Creek is intensely foliated and probably remobilized. Detailed mapping and isotopic studies are required to distinguish the two most probable models of ore deposition; sedex or replacement (manto). The stratabound zinc-lead-barite mineralization hosted by dolomite lies adjacent to mafic volcanics that thicken rapidly to the north. The rapid change in the thickness of the mafic volcanic rocks is speculated to be controlled by synvolcanic growth faults developed during rifting. This block faulting may have provided conduits for a hydrothermal system associated with volcanic activity that produced sedex style mineralization. The east zone could be a stringer feeder zone, although it was not examined in this study and its relationship to the main zone remains unclear. In this model, replacement and exhalative mineralization are predicted, depending upon where the hydrothermal fluid precipitates the ore (Figure 4).

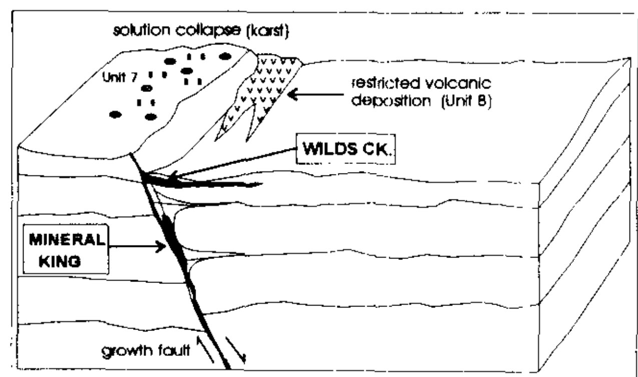

Figure 4. Preliminary depositional cartoon for the Wilds Creek deposit. The Mineral King mine, shown as a replacement-type deposit.

REGIONAL SIGNIFICANCE

The Wilds Creek deposit is one of several similar occurrences along the western margin of the Purcell anticlinorium, hosted by strata believed to be near the Dutch Creek - Mount Nelson formational contact (Figure 1). The next occurrence to the north is near Mount Bohan (Hall property), first staked after follow-up of a zinc-lead Regional Geochemical Survey stream sediment anomaly in Arrow Creek. It was drilled by Cominco Ltd. in 1989 (Klein, 1988; Anderson, 1989). Soil geochemical anomalies, geophysical responses and carbonate breccia on this property are similar to the Wilds Creek deposit; however, little mineralization was intersected. The Wall and Dave claims, owned by Eric and Jack Denny, and David Wiklund respectively (Callan, 1990), lie between LaFrance and Lockhart creeks and have been explored intermittently since 1900 (82F/7; Slingsby, 1981). A barite unit, over 1 metre thick, believed to be bedded, occurs on the Wall claims. Similar mineralization has been reported near Rose Pass and in recent prospecting discoveries associated with isoclinally folded silty dolomite on Sawyer and Baker creeks (H.P. Wilton, personal communication, 1994). Ore shoots at the Mineral King deposit were concentrated in fold closures, indicating that the ore has been remobilized; details of the deposit are provide by Fyles (1960) and Pope (1989). They considered the ore to be replacement or manto-type. Most of these deposits are structurally and stratigraphically complex; future exploration will require careful geological evaluation prior to drilling.

CONCLUSIONS

Several key points stem from the preliminary study of the Wilds Creek deposit. Exploration criteria for the Wilds Creek deposit can be summarized as follows. The top of the Dutch Creek near the Mount Nelson contact appears to be a critical stratigraphic interval. The local association of mineralization with silty dolomite, baritic dolomite and bedded barite that contain a carbonate breccia unit (possible karst) is important. The mafic volcanic rocks at Wilds Creek thicken abruptly, possibly due to synvolcanic faulting. Stratabound sphalerite and minor galena are hosted in dolomitic and baritic gangue. These occurrences produce strong lead, zinc and barium soil anomalies. Locally there is a spatial association with magnetic mafic volcanic rocks (flows and sills).

In terms of regional stratigraphic significance, two highlights are: recognition of mafic volcanic rocks representing either a western equivalent of the Nicol Creek Formation or a different, previously unrecognized, volcanic episode; and, the carbonate breccias (karst deposits) may indicate a regression.

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