GEOLOGY AND MINERAL POTENTIAL OF THE PURCELL WILDERNESS CONSERVANCY (82F/16; 82K/1, 8)

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KEYWORDS: Regional geology, Purcell Wilderness Conservancy, mineral potential, Purcell Supergroup, geochemistry, sedimentary exhalative deposits, veins, skarns.

INTRODUCTION

The Purcell Wilderness Conservancy was created in 1974 to preserve approximately 1320 square kilometres of the Purcell Mountains as a roadless tract of recreational wilderness area. It is located in the rugged mountain range between Kootenay Lake and the Columbia Valley, centred approximately 30 kilometres north of Kimberly (Figure 1-3-1) and is adjoined on the south by St. Mary's Alpine Provincial Park. Resource development, including mineral exploration and mining, was prohibited and any existing claims were frozen by a mineral reserve when the conservancy was established. Prospecting and mining are traditional land uses in this region of British Columbia as mineral discoveries were made at the turn of the century and continue to be made in the 1980s. The stratabound Sullivan massive sulphide orebody is located 30 kilometres to the southeast and the rocks hosting the orebody are known to extend into the conservancy. Despite this history of exploration and mining in the region, no systematic assessment of the mineral potential of the Purcell Wilderness Conservancy was undertaken prior to withdrawing it from the exploration land base.

In 1986 the Wilderness Advisory Committee studied the conservancy and recommended that resource assessments, specifically including a mineral potential study, should be completed prior to any final boundary decisions (Wilderness Advisory Committee, 1986). The Geological Survey Branch then summarized existing geological knowledge of the area preparatory to planning a mineral potential study (Grant, 1987). The Ministry of Parks subsequently identified a planning area for resource assessments surrounding the conservancy (Ministry of Parks, 1989). In the 1989 field season a mineral potential evaluation was initiated to provide the information required to settle the outstanding issues of mineral resource management in the conservancy.

The 1989 field project focused on the eastern side of the conservancy and the adjacent planning area (Figure 1-3-2). Work included geological mapping and a detailed stream-sediment survey together with prospecting and rock chip geochemical sampling. Approximately 1000 square kilometres were covered by the stream sediment sampling survey. Mapping at 1:50 000-scale was completed in much of this area, however, gaps remain where previous mapping and assessment report data have been assimilated into the summary map. Rock chip samples were collected wherever

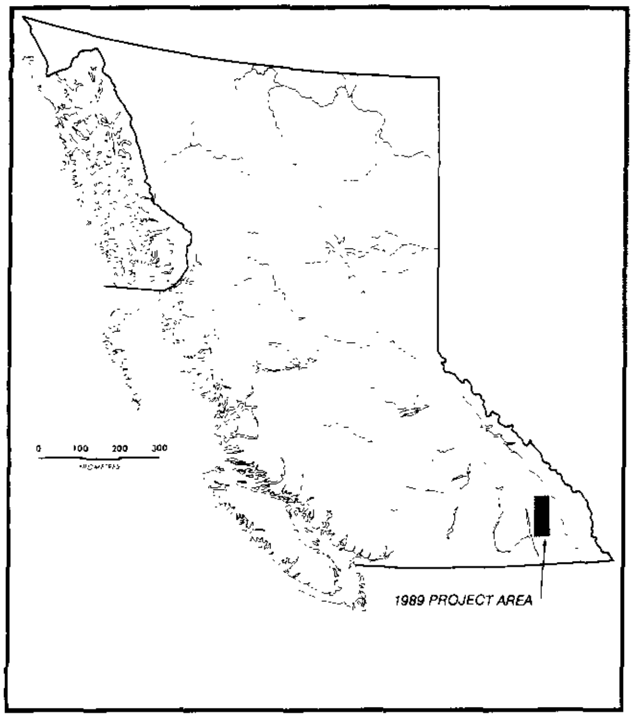

Figure 1-3-1. Location of 1989 study area.

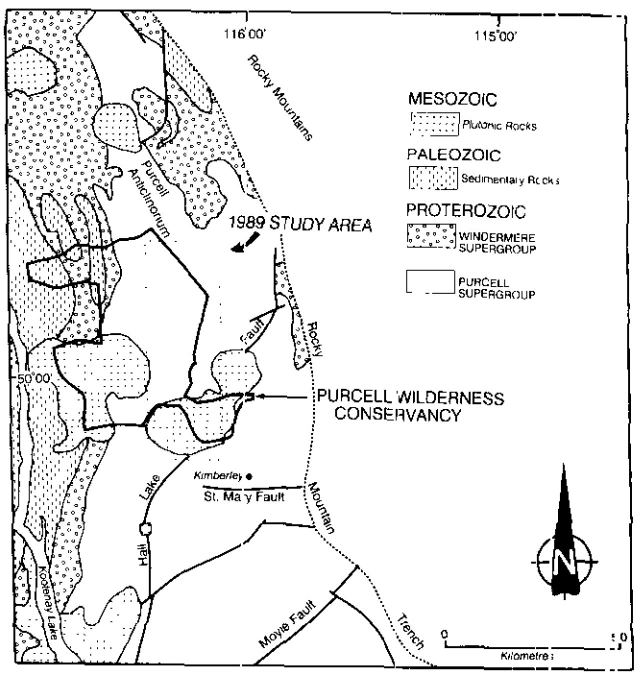

Figure 1-3-2. Regional geological setting of the Purcell Wilderness Conservancy and the 1989 study area

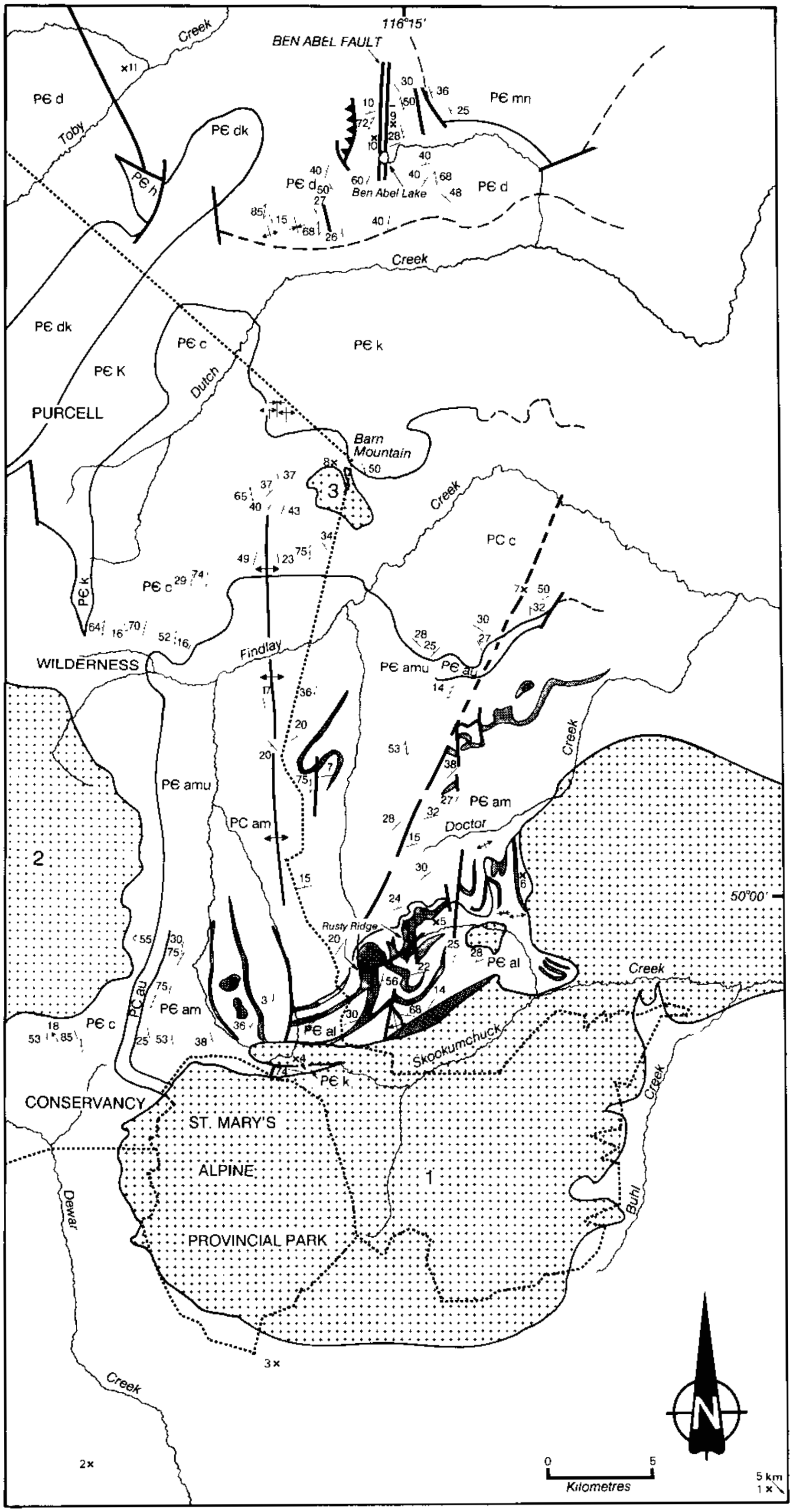

Figure 1-3-3. General geology of the project area.

LEGEND

INTRUSIVE ROCKS

MESOZOIC

CRETACEOUS

1	*WHITE CREEK BATHOLITH GRANODIORITE, QUARTZ MONZONITE, PEGMATITE*
2	*FRY CREEK BATHOLITH QUARTZ MONZONITE*
3	*FRYING PAN CREEK STOCK: QUARTZ MONZONITE, GRANODIORITE*

STRATIFIED ROCKS

PROTEROZOIC

WINDERMERE SUPERGROUP(HADRYNIAN)

PЄh	*HORSETHIEF CREEK GROUP PEBBLE CONGLOMERATE, GRITS, QUARTZITE AND SLATE*

PURCELL SUPERGROUP(HELIKIAN)

PЄmn	*MOUNT NELSON FORMATION WHITE QUARTZ ARENITE,GREEN SILTSTONE, DOLOMITIC QUARTZ WACKE AND SILTSTONE, MAROON ARGILLITE, BUFF DOLOMITE AND GREY LIMESTONE*
PЄdk	*DUTCH CREEK AND KITHCHENER FORMATIONS, UNDIVIDED*
PЄd	*DUTCH CREEK FORMATION GREEN SILSTONE, BROWN DOLOMITIC SILTSTONE, GREY ARGILLITE, BUFF WEATHERING, ALGAL DOLOMITE, MINOR QUARTZ WACKE*
PЄk	*KITCHENER FORMATION: BUFF-WEATHERING, DOLOMITIC SILTSTONE AND DOLOMITE, GREY AND GREEN ARGILLITE AND SILTSTONE, MNOR LIMESTONE*
PЄc	*CRESTON FORMATION: GREY AND GREEN QUARTZ SILTSTONE AND ARGILLITE, GREEN OR GREY-WHITE QUARTZITE, MINOR GREEN QUARTZ WACKE, MINOR DOLOMITIC SILSTONE*

ALDRIDGE FORMATION

PЄamu	*UPPER AND MIDDLE DIVISIONS: UNDIVIDED*
PЄau	*UPPER DIVISION. GREY ARGILLITE AND SILSTONE, MINOR QUARTZ WACKE*
PЄam	*MIDDLE DIVISION: MASSIVE GREY QUARTZ ARENITE AND QUARTZ WACKE INTERBEDDED WITH THIN-BEDDED ARGILLITE*
PЄal	*LOWER DIVISION: THIN-BEDDED, RUSTY WEATHERING, QUARTZ WACKE, QUARTZ ARENITE,SILTSTONE AND ARGILLITE*
/	*MOYIE SILLS. GABBRO AND DIORITE*

NAME	MINFILE NUMBER	COMMODITIES
1. Sullivan	082F NE 011	Pb,Zn,Ag
2. Great Dane	082F NE 051	Ag,Pb,Cu
3. Vulcan	082F NE 093	Pb,Zn
4. Molly	082F NE 073	W,Mo
5. Pico	082F NE 089	W
6. Silver Key	082K SE 053	Ag,Pb,Zn
7. Doc(Alpine)	082K SE 060	Pb
8. Barn	082K SE 025	Cu,Mo,W
9. Yornoc	082K SE 009	Pb,Ag,Ba
10. Shelly Carolle	082K SE 059	Pb,Cu,Ba
11. Mineral King	082K SE 001	Zn,Pb,Ag,Cu,Cd,Ba

potential for mineralization was identified. All the geological and geochemical data are being compiled for release as Open File publications in 1990.

REGIONAL GEOLOGY AND PREVIOUS WORK

The Purcell Wilderness Conservancy is underlain in the east by Proterozoic rocks of the Purcell and Windermere supergroups exposed in the Purcell anticlinorium, and in the west by Paleozoic strata of the Kootenay arc (Figure 1-3-2). Mafic sills and dikes intrude the lower Purcell stratigraphy. The sedimentary units are cut by two major Cretaceous batholiths and a number of Jurassic and Cretaceous stocks. The Fry Creek batholith is a large, relatively homogeneous quartz monzonite intrusion underlying much of the southwestern part of the conservancy. In contrast the White Creek batholith in the southeast is a well-differentiated and zoned intrusion.

Previous mapping in the conservancy itself is limited to that of Reesor (1958, 1973) in the Lardeau map area (82K) east-half, and in the Dewar Creek map area (82F/16). More recently, mapping to the east and southeast by Höy and Diakow (1982), Höy (1984) and Carter and Höy (1987a, b) has refined the Purcell stratigraphy. Stratigraphic descriptions by Höy (1985 and in preparation) have aided considerably in mapping during this project.

Government sponsored regional geochemical surveys have been conducted in map sheets 82F and 82K (National Geochemical Reconnaissance Program, 1977a, b), however, there has never been an opportunity to follow-up these results within the conservancy. Aeromagnetic data are available only for map sheet 82F/16 within the study area (Geological Survey of Canada, 1971).

LOCAL GEOLOGY

Figure 1-3-3 outlines the general geology of the eastern half of the Purcell Wilderness study area. As mapping at 1:50 000-scale in this season could not cover the entire area, the previous work by Reesor has been adopted in some parts, particularly in the northwest, to provide continuity across the map. Reesor (1958) has completed a much more detailed survey of the White Creek batholith than shown here. Most of the study area is underlain by Proterozoic Purcell Supergroup strata represented by the Aldridge, Creston, Kitchener, Dutch Creek and Mount Nelson formations. Time did not allow detailed mapping of the lithologies attributable to the Siyeh Formation overlying the Kitchener strata; as Reesor (1973) indicated that it is doubtful whether the Siyeh can be recognized as a separate formation, this entire sequence is mapped as Kitchener Formation here. Most of the contacts between stratigraphic units are gradational and therefore their positions are interpretative. Particular facies used to define contacts are identified in the following sections. The Kitchener – Dutch Creek contact is particularly difficult to identify and no clear contact was established in this project. Similar problems were encountered by Reesor and even though his contacts have been adopted in part in Figure 1-3-3, they are questionable in some areas. No outcrops of the volcanic lithologies of the Nicol Creek Formation, identified in the Skookumchuck area to the southeast (Carter and Höy, 1987a), were noted in this project.

STRATIGRAPHY

PURCELL SUPERGROUP

LOWER ALDRIDGE FORMATION: UNIT PЄal

Strata belonging to the lower Aldridge Formation crop out immediately north of the White Creek batholith and are of limited extent in the map area. Dominant lithologies include quartz wacke, quartz arenite, siltstone and lesser argillite that are intruded by thick gabbroic sills. The sedimentary rocks are characteristically rusty weathering, fine to medium grained and thin to medium bedded. Finely disseminated pyrrhotite is common and imparts the rusty weathering to the rocks. Individual beds range from a few millimetres to 30 centimetres thick; thin black argillaceous laminae are common in some beds. Grading, crossbedding and basal scours, typical of the lower Aldridge elsewhere, are not readily evident in the present study area, primarily due to the degree of regional metamorphism. Discontinuous horizons of intraformational conglomerate were noted in a number of locations within lower Aldridge strata. These horizons are massive to poorly bedded. Clasts, generally less than 10 centimetres across, comprise angular to rounded pebbles of the surrounding lithologies set in an argillaceous matrix. Conglomerate float containing angular tourmalinite clasts in a siliceous matrix was found in one location. The conglomeratic horizons, and the tourmalinite fragments in particular, may be significant due to the occurrence of similar rocks in the footwall of the Sullivan and North Star orebodies. Medium to coarse-grained gabbroic to dioritic intrusions known as the Moyie sills are common within the lower Aldridge section (Plate 1-3-1) and will be discussed in more detail subsequently.

The sedimentary rocks in the lower Aldridge have undergone both thermal and regional metamorphism to at least greenschist facies. Biotite alteration in the argillaceous units and quartz-sericite alteration in the arenites and wackes have generated widespread phyllitic and schistose textures. Locally a spotted porphyroblastic texture has developed where knots of biotite and sericite alteration occur.

The base of the lower Aldridge is not exposed and the contact with the overlying middle Aldridge is gradational and difficult to identify. In accordance with other workers, this contact is placed beneath the first thick section of grey-weathering quartz wacke beds (Höy, in preparation).

MIDDLE ALDRIDGE FORMATION: UNIT P€ma

The middle Aldridge Formation comprises a thick succession of quartzite, quartz siltstone and argillite that is folded across the Purcell anticlinorium in the centre of the map area.

Plate 1-3-1. Interbedded lower Aldridge quartz arenite, quartz wacke and siltstone intruded by Moyie sills (m); Rusty Ridge area.

Pale grey to white, quartz-rich beds predominate. Coarse quartz arenite and quartz wacke beds may be over 1 metre thick; repetitive sequences of quartz siltstone beds 10 to 20 centimetres thick, separated by a few millimetres of argillite, are common. Many of the observed features are typical of extensive proximal turbidite deposition, however, bedding features are obscured by the penetrative foliation near the axis of the anticlinorium. Argillaceous and impure siltstone beds have undergone biotite and chlorite alteration and have developed schistose textures. Sericite and phyllitic textures are common in the cleaner, quartz-rich horizons.

The upper and lower contacts are both gradational. The lower part of the middle Aldridge may be rusty weathering and locally difficult to distinguish from lower Aldridge lithologies. The contact with the upper Aldridge is also gradational but is easier to identify at the last thick, pale grey weathering quartzite bed. This contact was not traced throughout the map area; where it was not mapped the undivided rocks are attributed to Unit PCamu.

UPPER ALDRIDGE FORMATION: UNIT P€au

A relatively thin (less than 200 metres) succession of limonitic grey argillite and siltstone with minor quartz wacke forms the upper Aldridge Formation. These rocks are thinly bedded and often thinly laminated. They are typically altered to dark grey phyllites. The contact with the overlying Creston Formation is gradational but is chosen where green phyllites and siltstones characteristic of the Creston begin to appear.

CRESTON FORMATION: UNIT P€c

Rocks of the Creston Formation occur in a broad band across the centre of the map area and along the western margin where they are cut by the Fry Creek batholith. This formation consists of an interbedded sequence of quartz siltstones and argillites with some quartz arenites and minor quartz wackes. The regular occurrence of green quartzites and quartz siltstones is characteristic of the Creston Formation, however grey-white quartzites and grey to black siltstone and argillite are common.

Traverses across most of the Creston Formation west of Barn Mountain revealed a lower section dominated by grey and green quartz siltstones and argillites with lesser quartz wackes and black limonitic argillites that passes upwards into a section dominated by thicker bedded (25 to 30 centimetres) pale grey to white quartzite and 6 to 8-centimetre beds of siltstone and argillite. This in turn grades back to grey-green quartz siltstone and argillite containing thin, brown, dolomitic siltstone beds. Disseminated pyrite and disseminated magnetite octahedra were noted in some beds, particularly in the middle quartzite member. Insufficient work was completed to confidently map these three members across the study area, however, this subdivision is similar to that reported by Carter and Höy (1987b) in the Skookumchuk area and is likely present throughout the study area.

Wherever mapped, the Creston Formation rocks are tightly to isoclinally folded (Plate 1-3-2) with local overturned beds. Along the axis of the Purcell anticlinorium axial plane cleavage is intense and often obscures all bedding features. Alteration to quartz-sericite phyllites and biotite schists is very common.

The contact with the overlying Kitchener Formation is marked either by the first thick, pure dolomite bed or at a point where brown-weathering dolomitic beds predominate over the green siltstones of the Creston.

Plate 1-3-2. Tightly folded Creston Formation sediments cut by quartz veins following axial plane fractures. Thin dark grey beds are biotite-altered argillite interbedded with green phyllitic siltstones (pale grey).

KITCHENER FORMATION: UNIT PЄk

The Kitchener Formation is exposed in a broad belt across the north-central part of the map area, however, only a lower section of this unit was studied, mainly in the vicinity of Barn Mountain. At this point, Kitchener rocks consist of brown to buff-weathering dolomitic siltstone and impure dolomite. They are well bedded with individual beds up to 50 centimetres thick. Grey argillite and green chloritic phyllite occur as thin interbeds in this sequence. Dolomite and dolomitic siltstone are also seen at the southern tip of a long narrow strip of Kitchener Formation (Figure 1-3-3) previously mapped in the centre of the Purcell Wilderness Conservancy by Reesor (1973). A thin wedge of dolomitic marble and dolomitic siltstone and argillite was mapped between a lobe and the main body of the White Creek batholith along its northern border. Similar rocks attributed to the Kitchener Formation were previously mapped on the southern margin of the batholith (Reesor, 1958).

In the Skookumchuk area, Carter and Höy (1987b) described the entire Kitchener Formation as consisting of a lower dolomitic siltstone member and an upper carbonaceous dolomite and limestone member with molar tooth structures. Further mapping is required to determine if this division can be applied to the Purcell Wilderness Conservancy.

The contact with the overlying Dutch Creek Formation was not observed in this project. It is a gradational contact very difficult to recognize in this area. In the absence of a defined Siyeh Formation or the volcanic rocks of the Nicol Creek Formation there are no distinct markers between the top of the Kitchener and the base of the Dutch Creek. Reesor (1973) has identified a large area as undivided Kitchener and Dutch Creek rocks between Toby and Dutch Creeks in the northwest part of the map area (Unit PCdk in Figure 1-3-3). This contact, as shown in Figure 1-3-3, must be considered approximate.

DUTCH CREEK FORMATION: UNIT PЄd

The Dutch Creek Formation underlies much of the northern margin of the field area. It has never been subdivided in the area of the Purcell Wilderness Conservancy, however, it is thought to be correlative with the Sheppard, Gateway and Roosville formations (Höy, in preparation).

In the vicinity of Ben Abel Lake rocks mapped as Dutch Creek Formation can be subdivided into a lower sequence of interbedded pale green to brown-weathering dolomitic siltstone, green siltstone, buff-weathering silty dolomite and minor quartz wackes; a prominent buff-weathering algal-laminated dolomite approximately 300 metres thick (Plate 1-3-3); and a thick upper sequence of interbedded green siltstones, brown dolomitic siltstone, dark grey argillite and minor oolitic dolomite. The upper sequence contains at least two distinct sections of dark grey argillite and may be further subdivided in the future. All of these rocks tend to be very well bedded. The siltstones commonly display upward grading, ripple marks and horizons with rip-up clasts.

Northeast of Ben Abel Lake the Dutch Creek rocks pass quickly, but conformably, into white to buff-weathering quartz arenite of the Mount Nelson Formation. Elsewhere this conformable contact is obscured by faulting. These strata are repeatedly folded and locally cut by thrust faults across the northern part of the study area.

MOUNT NELSON FORMATION: UNIT PЄmn

One section of the Mount Nelson Formation was studied in the northeast corner of the map area. Strata observed conform to the divisions described by Höy (in preparation) in the Fernie west-half map area. The basal unit is a white quartz arenite with minor interbedded green siltstone and weakly dolomitic siltstone and quartzite. Disseminated pyrite occurs locally in some of these beds. These rocks pass upwards into a sequence of buff-weathering dolomitic quartz wacke and siltstone and distinctive maroon argillites and pink siltstones

Plate 1-3-3. Dutch Creek Formation at Ben Abel Lake. Ben Abel fault zone contains copper-bearing quartz-barite veins (x). Agal-laminated dolomite (d) west of lake (to right) has been uplifted approximately 300 metres on the Ben Abel fault (photo looks southwest).

These in turn grade quickly into a unit of buff dolomite and grey limestone with minor grey argillite. Stromatolitic laminae and oolitic horizons are common in the carbonates. Another distinctive maroon to red-weathering argillite unit was seen to overly the previously mentioned rocks but mapping did not extend to this unit. Bennett (1986) describes this upper maroon argillite unit at the top of a redefined Mount Nelson Formation in the Mount Forster map area to the northeast.

WINDERMERE SUPERGROUP

Windermere Supergroup rocks were not studied in the mapping phase of the 1989 season, however, some geochemical samples were collected from basins draining these strata. They unconformably overly Purcell Supergroup rocks near the northern boundary of the study area. A basal polymictic conglomerate, the Toby Formation, is generally conformably overlain by sedimentary rocks of the Horsethief Creek Group (Reesor, 1973). A small fault-bounded wedge of Horsethief Creek sediments, shown in Figure 1-3-3, is included from Reesor's mapping.

INTRUSIVE ROCKS

MAFIC SILLS AND DIKES

The lower Purcell Supergroup rocks have been intruded by a large number of mafic sills and dikes. The Moyie sills cutting the lower Aldridge (Plate 1-3-1) and lower part of the middle Aldridge Formation have been shown to be distinct from mafic sills higher in the Purcell succession (Höy, 1989). Figure 1-3-3 outlines the general distribution of Moyie sills mapped in this project. These intrusions are sill-like in overall form but often crosscut bedding or appear as irregular lenses. Some are in excess of 100 metres thick and can be traced almost 10 kilometres in the map area. The thicker sills have coarse-grained gabbroic cores and finer dioritic margins. They are all primarily composed of hornblende and plagioclase phenocrysts set in a matrix of similar composition that has often undergone considerable chloritic alteration. Due to their irregular nature, the large number of sills in some areas, and the folding in the surrounding rocks, these sills are often difficult to correlate accurately across valleys or fault zones. Höy (1989) suggests they are an integral part of the Aldridge depositional environment and are therefore of the same Proterozoic age.

Dioritic sills and dikes of similar appearance in the field are common in the remainder of the Aldridge, Creston and parts of the Kitchener formations. These intrusions tend to be only a few metres thick and can only be traced for a few hundred metres at most. Their precise age is unknown.

WHITE CREEK BATHOLITH

The White Creek batholith is a well-differentiated granitic intrusion underlying much of the southern boundary of the study area. Only the marginal phases were mapped as a detailed discussion of this Cretaceous batholith is provided by Reesor (1958).

Along the northern border of the batholith a megacrystic granodiorite phase is common. Plagioclase phenocrysts are commonly 3 to 5 centimetres long, set in a matrix of fine to medium-grained plagioclase, potassium feldspar, quartz and biotite. Magnetite and pyrite occur locally. Aplitic and pegmatitic dikes are common. Reesor has mapped a number of pegmatitic bodies within lower Aldridge strata north of Skookumchuk Creek. Pegmatitic float with coarse beryl crystals was noted east of Rusty Ridge. Greisen-type quartz veins with muscovite selvages are common along the northern border of the batholith; further discussion of these veins is given in the mineral occurrences section. The aeromagnetic map for sheet 82F/16 clearly defines the outer boundary of the White Creek batholith (Geological Survey of Canada, 1971).

FRY CREEK BATHOLITH

The Fry Creek batholith is a large, essentially uniform Cretaceous quartz monzonite body (Reesor, 1973) in the centre of the Purcell Wilderness Conservancy. It is a distinctive pale grey, blocky weathering unit cutting the sedimentary rocks. This intrusion was not mapped in any detail in the present study.

FRYING PAN CREEK STOCK

The Frying Pan Creek stock cuts Creston Formation sediments near Barn Mountain on the boundary of the Purcell Wilderness Conservancy. This irregularly shaped intrusion is a grey-weathering granodiorite to quartz monzonite consisting of variable percentages of quartz, plagioclase, potassium feldspar, biotite and hornblende. Pegmatitic border phases are locally present. Numerous quartz veins, often with muscovite selvages, cut the stock and the surrounding sedimentary rocks. These veins carry minor amounts of chalcopyrite, chalcocite, molybdenite, galena and pyrite. Near the eastern contact, dolomitic units in the Kitchener Formation have been partially converted to epidote-magnetite skarns.

STRUCTURE

A broad north-plunging anticlinal fold, referred to as the Purcell anticlinorium, dominates the structural geology of the map area. Regionally the outcrop pattern of all stratigraphic units reflects this wide, open fold. On a more local scale, tight isoclinal folds are characteristic, particularly in the finer grained lithologies. A prominent axial plane cleavage that completely obscures bedding has developed within the core of the anticlinorium. Elsewhere the strata commonly take on a phyllitic or schistose texture in response to the tight minor folds.

Across the northern part of the study area a series of tight folds and related easterly directed reverse faults are present. The Ben Abel fault zone (Plate 1-3-3) is a high-angle reverse fault with approximately 300 metres of displacement across Ben Abel Lake. This zone is up to 100 metres wide, can be traced for 5 kilometres, and can be seen cutting stratigraphy a further 5 kilometres to the north. Even further to the north, in Toby Creek valley, the trace of the Mount Forster syncline and fault zone (Atkinson, 1976) lies along the projected strike extension of the Ben Abel fault. One kilometre west of the lake thrust faulting repeats the distinctive algal-laminated dolomite unit of the Dutch Creek Formation. Mapping has just begun to identify the complexities in this northern area but has shown that copper-bearing quartz-barite veins have developed in some of the faults. Another strongly deformed zone extends from the headwaters of Dutch Creek northwards toward the Mineral King mine in Toby Creek valley. This northern area will be studied in more detail during the next season.

Displacements on north to northeast-trending faults in the central part of the study area are difficult to establish due to their location or to the gradational nature of the stratigraphic contacts. The dramatic change in bedding attitudes and truncation of lower Aldridge strata across Alton Creek valley, a headwater tributary of Findlay Creek, strongly suggests a fault in this valley, however it is not exposed anywhere. It is likely that tight folding along the axis of the Purcell anticlinorium led to left lateral and/or west-side-down displacement of the lower and middle Aldridge rocks in this area.

A fault zone with little visible displacement, but marked by a line of limonitic and carbonate-altered outcrops, was traced from north of Rusty Ridge to Findlay Creek, a distance of 15 kilometres. This fault truncates some dioritic sills, however, no major displacements of the stratigraphic contacts were noted. Further discussion of this fault is given in the mineral occurrences section.

GEOCHEMISTRY

A total of 183 stream sediment samples were collected from an area of approximately 100 150 hectares in and adjacent to the eastern boundary of the Purcell Wilderness Conservancy. The density of sampling is approximately 1 site per 5.5 square kilometres. Samples are being analyzed for 30 elements using an inductively coupled plasma (ICP) technique, for gold by fire assay and neutron activation analysis. In excess of 100 samples were also collected in this region during the 1977 government regional geochemical survey (National Geochemical Reconnaisance Program, 1977a,b). These samples were not originally analyzed for gold or rare earth elements, however, the archived samples are now being re-analyzed for these and other elements and results will be made available in Open File publications.

Rock chip samples were collected from all locations containing mineralization or alteration potentially related to mineralization. A total of 157 rock samples will be analyzed for 14 elements, including base and precious metals and indicators.

MINERAL OCCURRENCES

Exploration and mining in this region of the Purcell Mountains began at the turn of the century with discoveries of the stratabound silver-lead-zinc Sullivan orebody; lead-zinc-silver vein occurrences in Toby Creek valley north of the conservancy and near Dewar Creek to the south; and of the replacement and vein lead-zinc-silver-barite orebody at Mineral King mine. Subsequent discoveries include skarn mineralization, porphyry molybdenum occurrences and greisen-vein tin and tungsten occurrences. Beryllium has been located in pegmatite along the north side of the White Creek batholith. The regional geology also suggests potential for stratiform copper-silver occurrences similar to that at Spar Lake, Montana, and possibly for stratiform barite-lead-zinc mineralization within thrust-emplaced Paleozoic carbonates. The potential for Kootenay arc type silver-lead-zinc deposits exists primarily to the west of the current study area and will be evaluated in the future.

In the Purcell Wilderness Conservancy planning area and surrounding environs, known mineral occurrences can be grouped into the following types: Sullivan-type sedimentary exhalative (sedex) deposits, structurally controlled silver-lead-zinc vein deposits, replacement and vein deposits similar to the Mineral King, skarn occurrences, and veins associated with felsic intrusions.

SULLIVAN-TYPE SEDEX DEPOSITS

The hostrocks for the Sullivan ore body (MINFILE 82FNE011) are exposed immediately south of the study area and in it at Rusty Ridge (Figure 1-3-3). Minor showings of laminated Sullivan-type lead-zinc mineralization occurring on the Vulcan property (MINFILE 082FNE093) have been explored by geophysical surveys and limited diamond drilling. This prospect, just south of the conservancy, appears to have excellent potential for lead-zinc sulphide mineralization. In the Rusty Ridge area the lower-middle Aldridge stratigraphy favorable for Sullivan-type mineralization extends through the study area and into the Purcell Wilderness Conservancy itself. Although no stratabound mineralization has been discovered, quartz-tourmaline veins are common, conglomeratic horizons similar to those in the footwall of the Sullivan mine are present, as are isolated veinlets with pockets of galena and minor sphalerite. Exploration of this area is continuing just outside the conservancy boundary.

STRUCTURALLY CONTROLLED SILVER-LEAD-ZINC VEIN DEPOSITS

Lodes of massive galena with associated sphalerite and chalcopyrite occur within vein-like structures on the Great Dane property (MINFILE 082FNE051) south of the conservancy (Figure 1-3-3). This silver-bearing mineralization, hosted by quartzite of the Creston Formation, is concentrated in reef structures in the axial zones of tight folds (Scott, 1986). Little work has been completed on the property in recent years but further evaluation appears warranted. Barren quartz veins within axial plane fractures or crests of folds were noted in many locations in the Creston Formation (Plate 1-3-2).

A similar structural control is shown at the Silver Key occurrence (MINFILE 082KSE053) where quartz-carbonate veins within tightly folded and sheared lower Aldridge sediments contain galena, sphalerite, pyrite and minor tetrahedrite and arsenopyrite. This occurrence is located very close to the edge of the White Creek batholith, however, the relationship to the intrusion is unknown. Two adits and a number of open cuts have been developed on the property (Minister of Mines Annual Report, 1938).

The Doc (Alpine) occurrence (MINFILE 082KSE060) consists of disseminations and streaks of galena, sphalerite pyrite and ankerite within a strongly albitized and silicified fault zone. The main showing averages 3.5 metres thick over an 80 metre length (Mawer, 1986). Discontinuous patches of similar alteration can be traced along strike as far as the Rusty Ridge area to the southwest (Figure 1-3-3). Limonitic and ankeritic alteration in middle Aldridge sediments occurs in an aligned series of recessive saddles where this fault zone crosses ridges. Partially leached pyrite mineralization was noted but no other lead or zinc mineralization was found along this fault.

Copper mineralization was found in quartz or quartz-barite veins at a number of locations in the northeast-trending Ben Abel fault zone. Near Ben Abel Lake chalcopyrite, tetrahedrite, pyrite and traces of galena occur in veins or irregular lenses of intense silicification up to 3 metres wide; barite-rich pods are common (Plate 1-3-2). Malachite and azurite are abundant and fluorite crystals and manganese staining are locally present. Elsewhere along the fault, veins 15 to 30 centimetres wide carry pockets of similar mineralization. This trend is not documented in MINFILE records however the Yornoc (MINFILE 082KSE009) and Shelly Carolle (MINFILE 082KSE059) occurrences are described to the east and west of this fault respectively.

At the Yornoc prospect a number of pits have been cut on an east-trending zone of quartz-barite veining up to 2 metres wide and contain chalcopyrite, galena and pyrite with considerable malachite and azurite. The mineralized section of this vein system extends over 500 metres, however, outcrops of vein material can be traced across an overburden-covered valley for over a kilometre. Similar mineralization was seen in two small pits at the Shelly Carolle occurrence, however the veins here trend north to northeasterly and follow the regional axial plane fractures.

Mineral King Vein/Replacement Deposits

The Mineral King mine (MINFILE 082KSE001), located 6 kilometres northeast of the conservancy boundary, produced 2.1 million tonnes of silver, copper, lead, zinc and cadmium ore between 1953 and 1967. More recently the property has been operated as a barite producer. Mineralization occurs as veins and replacements in tightly folded and faulted dolomitic sediments of the Mount Nelson Formation (Fyles, 1959). No similar mineralization was found in the study area however the complex structural zone containing the deposit extends southwards, well inside the conservancy, to the headwaters of Dutch Creek. This area will be prospected in the future. Stratiform mineralization similar in appearance to that at the Mineral King mine is known within thrust-emplaced wedges of Devonian rocks to the northeast (Redmac occurrence, MINFILE 082KNE059). The thrusting identified in this northern part of the study area suggests this style of mineralization should be evaluated along the Mineral King trend.

Skarn Occurrences

The Molly occurrence (MINFILE 082FNE073) is located within the Purcell Wilderness Conservancy. A section of dolomitic marble and dolomitic siltstones was mapped on a ridge at the headwaters of Skookumchuk Creek between two lobes of the White Creek batholith. These sediments are approximately 350 metres thick on the ridge but are truncated by the intrusion in upper Skookumchuk valley. Calcsilicate alteration of the sediments to epidote, tremolite and calcite is common along the ridge. Tungsten and molybdenum mineralization are reported in skarn occurrences in the valley and have been trenched and diamond drilled to a limited extent (Minister of Mines Annual Report, 1969). No work has been permitted on this property since the conservancy was established.

Minor pockets of epidote-magnetite skarn are present in Kitchener Formation sediments along the eastern border of the Frying Pan Creek stock. Traces of scheelite were also noted in samples from this area. Virtually all of the prospective alteration zones around this stock are within the Purcell Wilderness Conservancy.

Veins Associated With Felsic Intrusions

Greisen-type veins with muscovite selvages are common in the sedimentary rocks along the northern margin of the White Creek batholith. Tin and tungsten mineralization has been reported from a number of locations (MINFILE 082FNE089, 90, 92). Veins sampled in this study contain variable amounts of scheelite and, at one location, considerable fluorite. Overall, the veins are thin (5 to 20 centimetres wide), appear scattered and mineralization is sparse.

Within and to the west of the Frying Pan Creek stock quartz veins up to 2 metres wide can be traced across a ridge for hundreds of metres. The veins generally have muscovite selvages or contain vugs filled with quartz and muscovite crystals. Some veins have brecciated contacts with the wall-rocks. Sparsely disseminated mineralization in the veins includes molybdenite, chalcopyrite, pyrite, chalcocite and traces of galena.

Beryl crystals have been identified in pegmatite bodies along the northern contact of the White Creek batholith (MINFILE 082FNE107, 112). These occurrences were not examined in this project and their extent is unknown, however, coarse beryl crystals were noted in float east of the Rusty Ridge area.

SUMMARY: MINERAL POTENTIAL

In the vicinity of the Purcell Wilderness Conservancy the Proterozoic Purcell Supergroup comprises a thick succession of clastic and carbonate sedimentary lithologies. These rocks reflect both deep and shallow-water depositional facies within the larger Belt-Purcell basin. Syndepositional faulting has controlled facies changes in some areas of this basin (Höy, in preparation). Subsequent folding, faulting and intrusion by granitic batholiths and stocks have further modified the original sedimentary lithologies. Phyllitic and schistose textures and structurally controlled veins are common. The primary sedimentary depositional environments and the subsequent igneous and structural events combine to provide a variety of metallogenic settings and a varied mineral potential.

A good potential for Sullivan-type massive sulphide deposits has been identified in the Rusty Ridge area; this potential extends at least 1 to 2 kilometres into the Purcell Wilderness Conservancy. There is also potential for structurally controlled vein deposits, skarn deposits, tin or tungsten vein occurrences and possibly some pegmatite-related industrial mineral occurrences in this part of the 1989 study area. Mineral claim staking and exploration have been common activities in this locality for decades and can be expected to continue in the future.

Further analysis of the structural geology is required to determine the potential for vein and replacement deposits. Numerous vein occurrences are present within the planning area but outside the boundaries of the Purcell Wilderness Conservancy. However major structural zones not previously defined in detail, such as the zone including the Mineral King mine, extend well inside the conservancy and require evaluation.

The first year of this mineral potential assessment has identified a number of favourable metallogenic environments and has provided reconnaissance data for further prospecting. This work will be supported by interpretation and follow-up of the 1989 geochemical data. Evaluation of the mineral potential of the Kootenay arc stratigraphy will be completed in the future.

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