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Ministry of Energy and Mines
BC Geological Survey

Assessment Report
Title Page and Summary

TYPE OF REPORT [type of survey(s)]: Geological

TOTAL COST: 44,221.59

AUTHOR(S): Amber Henry

SIGNATURE(S):

NOTICE OF WORK PERMIT NUMBER(S)/DATE(S): n/a

YEAR OF WORK: 2011

STATEMENT OF WORK - CASH PAYMENTS EVENT NUMBER(S)/DATE(S): Event number 5151688, Recorded 2011/DEC/08

PROPERTY NAME: Crawford

CLAIM NAME(S) (on which the work was done): CRAWFORD 001, 002, and 003

COMMODITIES SOUGHT: Zn

MINERAL INVENTORY MINFILE NUMBER(S), IF KNOWN:

MINING DIVISION: Nelson

NTS/BCGS: 082F07, 082F10

LATITUDE: 49 ° 32 ' 0 " LONGITUDE: 116 ° 39 ' 0 " (at centre of work)

OWNER(S):
1) Teck Resources Limited
2)

MAILING ADDRESS:
3300 - 550 Burrard St.
Vancouver, BC, V6C 0B3

OPERATOR(S) [who paid for the work]:
1) Teck Resources Limited
2)

MAILING ADDRESS:
3300 - 550 Burrard St.
Vancouver, BC, V6C 0B3

PROPERTY GEOLOGY KEYWORDS (lithology, age, stratigraphy, structure, alteration, mineralization, size and attitude):
Purcell Supergroup, Kitchener Formation, Dutch Creek Formation, Mount Nelson Formation, Toby Formation, Neoproterozoic, Mesoproterozoic, shallow marine siliciclastic and carbonate lithologies, basal conglomerate, Dave- Wall showing, sedex-style mineralization, Pb-Zn mineralization,

REFERENCES TO PREVIOUS ASSESSMENT WORK AND ASSESSMENT REPORT NUMBERS: 04387, 05632, 05651, 05710, 06109, 06231, 06562, 06901, 07402, 07828, 08025, 08640, 09758, 11868, 20708, and 24329

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TYPE OF WORK IN THIS REPORT	EXTENT OF WORK (IN METRIC UNITS)	ON WHICH CLAIMS	PROJECT COSTS APPORTIONED (incl. support)
GEOLOGICAL (scale, area)			
Ground, mapping	1:10,000 scale, 1295.16 ha	CRAWFORD 001, 002, and 003	44,221.59
Photo interpretation			
GEOPHYSICAL (line-kilometres)			
Ground			
Magnetic			
Electromagnetic			
Induced Polarization			
Radiometric			
Seismic			
Other			
Airborne			
GEOCHEMICAL (number of samples analysed for...)			
Soil			
Silt			
Rock			
Other			
DRILLING (total metres; number of holes, size)			
Core			
Non-core			
RELATED TECHNICAL			
Sampling/assaying			
Petrographic			
Mineralographic			
Metallurgic			
PROSPECTING (scale, area)			
PREPARATORY / PHYSICAL			
Line/grid (kilometres)			
Topographic/Photogrammetric (scale, area)			
Legal surveys (scale, area)			
Road, local access (kilometres)/trail			
Trench (metres)			
Underground dev. (metres)			
Other			
		TOTAL COST:	44,221.59

Teck

Report on the 2011 Geological Mapping Program

for the

Crawford Property

Nelson Mining Division, Southeastern B.C.

NTS Map Sheets
082F07, 082F10

Latitude 49° 32.0' N, Longitude 116° 39.0' W

Report prepared by Amber Henry
March 7, 2012

Teck Resources Limited
Suite 3300 – 550 Burrard St.
Vancouver, BC, V6C 0B3

SUMMARY

The Crawford property is located in the Purcell Mountains in southeast British Columbia, east of Kootenay Lake and approximately 65 kilometres west of Cranbrook. The property comprises three contiguous claims, covering an area of 1,295.16 hectares owned 100% by Teck Resources Ltd.

The property is underlain by Meso- and Neoproterozoic rocks of the Purcell and Windermere Supergroups, respectively, located on the western limb of the Purcell anticlinorium. Shallow water carbonate and siliciclastic lithologies of the Kitchener Formation are overlain by the phyllite-rich Dutch Creek Formation and the four subunits of the Mount Nelson Formation, all of which form part of the Purcell Supergroup. Lying unconformably above the Mount Nelson rocks is the Toby Formation, a polymictic basal conglomerate deposited during a period of major extension and growth fault development in the Neoproterozoic. The Toby conglomerate is conformably overlain by phyllites and quartzites of the Horsethief Creek Group. The Toby Formation and the Horsethief Creek Group comprise the basal portion of the Windermere Supergroup.

The historic Dave-Wall showing, a vein and replacement galena-sphalerite-pyrite-tetrahedrite body found dominantly within the dolomitic units of the Mount Nelson Formation, is located on the Crawford property. Mapping and prospecting was completed during the 2011 summer program to identify other areas of potential sedex-style mineralization, including possible feeder zones, signs of alteration, and favorable lithologic and/or structural settings.

Indications of Dave-Wall sedex-style Pb-Zn mineralization were found elsewhere on the property, as were small-scale Cu-bearing veins along the northern property boundary. However, due to the small spatial extents and low grades of the observed mineralization, no further work on the Crawford property is recommended at this time.

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1 Introduction

1.1 Location, Access, and Physiography

The Crawford property is located in the Purcell Mountains in southeast British Columbia, east of Kootenay Lake and approximately 65 kilometres west of Cranbrook (Figure 1). The property is accessible by helicopter from Cranbrook (approximately 30 minutes flight time). There is a historic logging road that accesses the property from the eastern shore of Kootenay Lake, up La France Creek, but it is completely grown over and no longer usable.

Elevations on the property range from approximately 1400-2300 metres. The relief is moderate to steep. Outcrop exposure is typically widespread above tree line in alpine tundra areas, while extensive growth of pine, spruce, fir, larch, and forest undergrowth restricts outcrop exposure at lower elevations. The region is subject to moderate precipitation, and is generally free from snow cover from June to October, with summer temperatures averaging 20-25°C.

1.2 Tenure

The Crawford property comprises three contiguous claims, covering an area of 1,295.16 hectares owned 100% by Teck Resources Ltd. A tenure map is included as Figure 2 and a list of all pertinent tenure details is found in Table 1 below.

Tenure Number	CLAIM_NAME	Map Number	Good To Date*	Area (ha)
841424	CRAWFORD 001	082F10	2017/Nov/21	503.09
841425	CRAWFORD 002	082F10	2017/Nov/21	461.35
841426	CRAWFORD 003	082F10	2017/Nov/21	330.72
Total 3 claims				1295.16

Table 1. Summary of Crawford claims

*Good To Date pending acceptance of assessment

1.3 History and Previous Work

The following property work history is taken from Assessment Report Number 24329 (Denny, 1996) unless otherwise indicated.

"Prospecting in this area started about 1890. In 1891, Tom Wall discovered and staked the Snow King Group that straddled the summit north of La France Creek. By 1893 there were over 100 claims located in La France valley. By 1908, 12 claims had been surveyed and crown granted. From 1900 to 1926 considerable work was done especially on what at that time was called the Chicago Mine, owned by the La France Mining Company of Chicago. Three adits were driven on the Montana claim aggregating

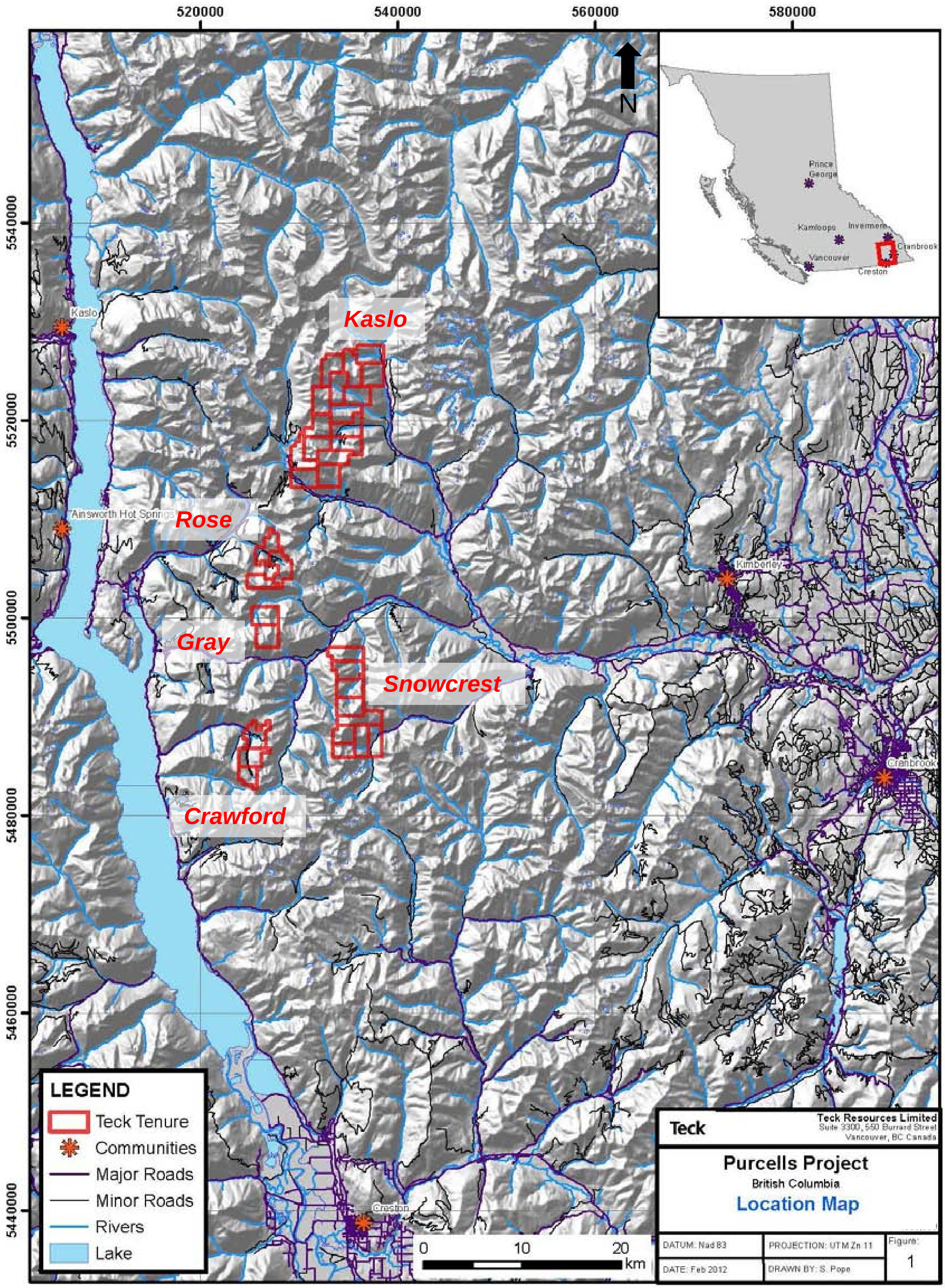

Figure 1. Location map for the Crawford property.

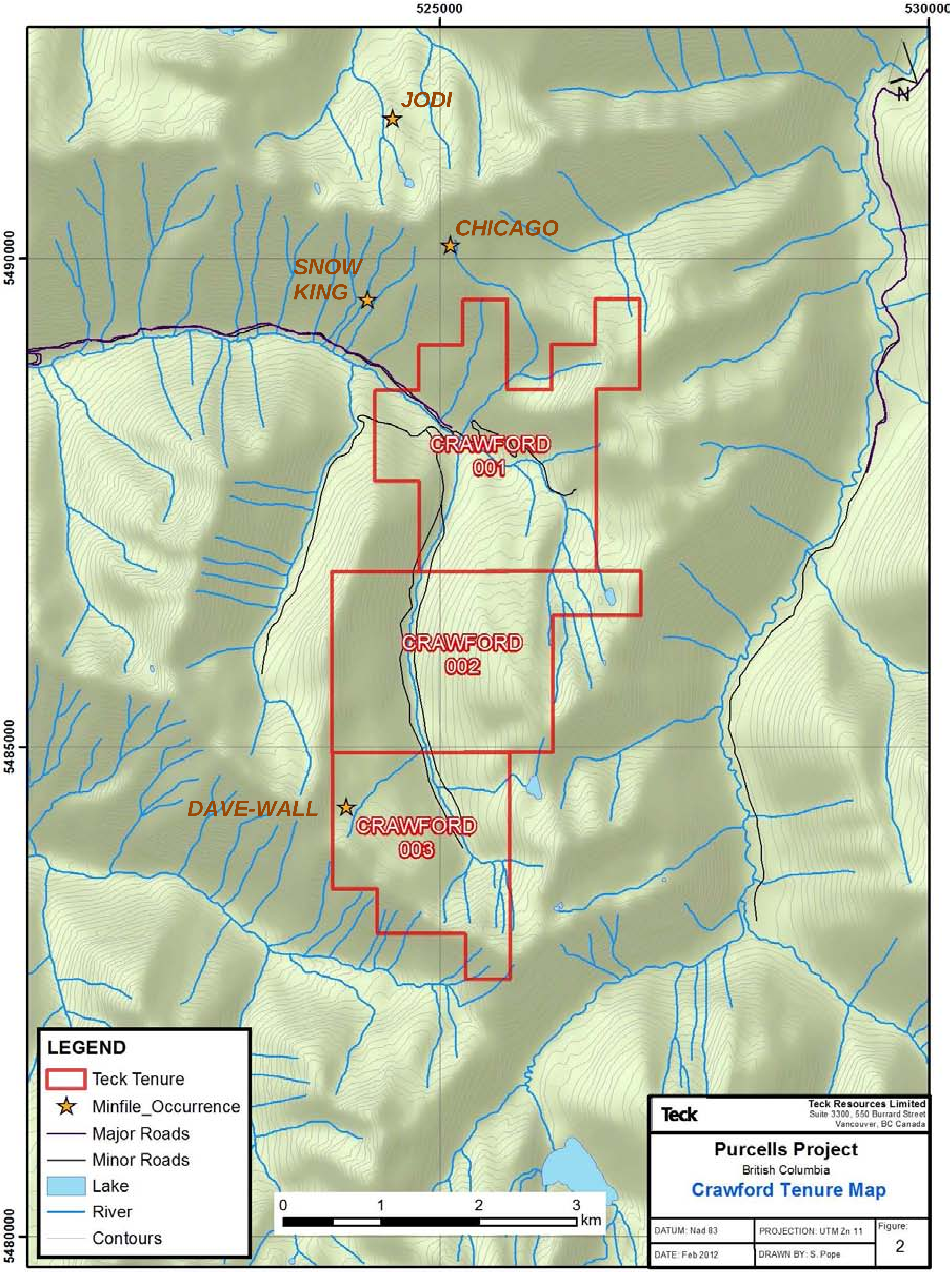

Figure 2. Tenure map for Crawford property.

over 650 metres (2120 feet) of drifting and crosscutting all done with hand steel, cabins were built and a good pack horse trail connected to Kootenay Lake. There is no record of any ore being shipped as the main logging road up the valley was not built until the 1960's and it did not extend to anywhere near the mine. Lockhart Creek never has had road access. The Dennys staked the Peg 1-12 in 1971 and re-staked it as the Wall Group in 1974 – the same year that R.G. Trenaman staked the Tren 1-4 and Dave staked the Dave Group and the Dennys acquired the reverted crown grants and bought the Montana Fraction Crown in 1975.

"The Wall Group [current "Chicago" minfile area] was optioned to Serem Ltd. in 1976 who did soil sampling, opened portals, ran a mag and an EM survey, sampled and did some geological mapping. Dekalb optioned the Wall Group in 1978 and extended the road to the mine cabins following the new trail the Dennys had built previously, put in a new grid, did further soil sampling and geological mapping and drilled 5 D.D. holes in 1978, 8 D.D. holes in 1979 and 4 D.D. holes in 1980. Cominco optioned the claims in 1990 but the largest part of their work was done on the Dave claims [current "Dave-Wall" minfile area]. The Dennys have done a lot of work on their claims over the years, such as building a slide free access trail, soil sampling, rock and ore sampling, clearing portals, trenching, prospecting, locating, marking old surveys, drilling and blasting, mapping.

"The Dave Group was optioned to Norcen Energy in 1980 and 1981 who did some gridding, geological mapping, soil sampling, VLF-EM and magnetometer surveys, trenching and sampling in 1980. In 1981 Norcen drilled 7 D.D. holes. Cominco optioned the claims in 1990 after a brief examination in 1989. Their work consisted of line cutting, geological mapping, soil and rock sampling, resampling some Norcen core, and HLEM and UTEM survey. In addition, to the above, the owners have carried out several soil sampling programs, maintained access, made several reports on their work." (Denny, 1996)

In 1995, a program to find and develop a feasible barite ore body was completed for Hunter Resources by E. and J. Denny, as there are several barite showings on both sides of La France Creek (Denny, 1996). This work involved a geological evaluation by barite expert S. Butrenchuk, some shallow trenching, prospecting, and soil sampling. Both the trenching and soil sampling were not finished due to weather and logistical issues. Denny (1996) recommended future work including a gravity survey and drilling targeting anomalous barium values.

Details of all the above work may be found in the assessment reports listed in the References section.

2 Geology

2.1 Regional Geology

The Middle Proterozoic Purcell Supergroup is considered to represent the infilling of an intracontinental rift within an Archean and Paleoproterozoic craton (Höy et al., 2000; Price and Sears, 2000). The basal part of the succession, the Aldridge Formation, records the early synrift fill and the overlying Creston, Kitchener, and younger formations represent the rift cover, or sag phase, succession (Figure 3). The Purcell Supergroup is unconformably overlain by rocks of the Windermere Supergroup, which includes a basal conglomerate deposited along a set of growth faults during the Late Proterozoic (T. Höy, pers. comm.). The entire rock package has undergone multiple cycles of orogeny and extension described briefly below. The Belt-Purcell basin rocks occur as a broad NNE-plunging anticlinal structure: the Purcell anticlinorium (Figure 4). The Crawford property is located on the western limb of the anticlinorium (Figure 5). The west limb has seen significantly less exploration and historical work than either the eastern limb or the core of the anticlinorium, thus the descriptions of the stratigraphic succession are less detailed than those for the eastern limb. There are also lateral facies changes within stratigraphic horizons, which do not always correlate between the limbs (c.f. Reesor, 1983 and Höy, 1993).

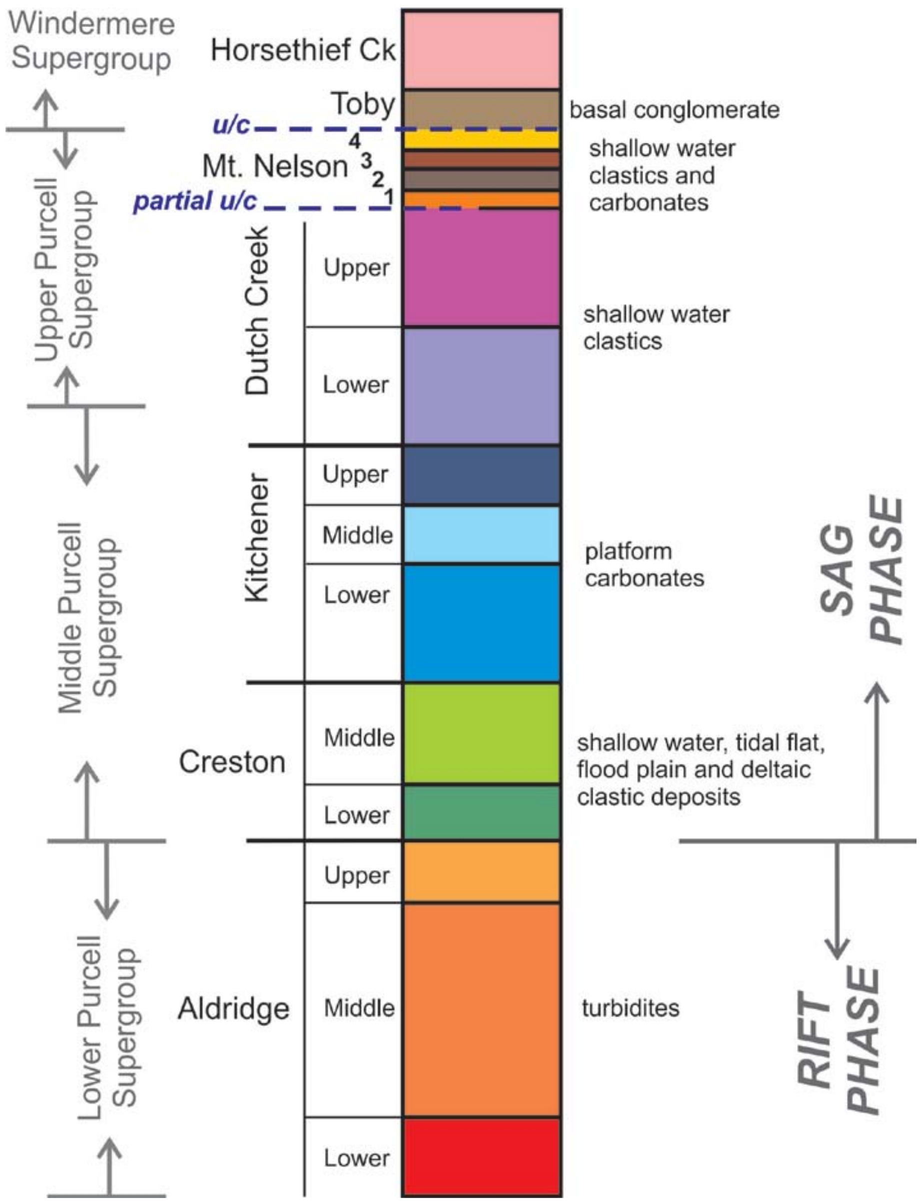

Figure 3. Schematic stratigraphic section of the Purcell Supergroup in the study area (on the western limb of the Purcell anticlinorium). N.B. not to scale.

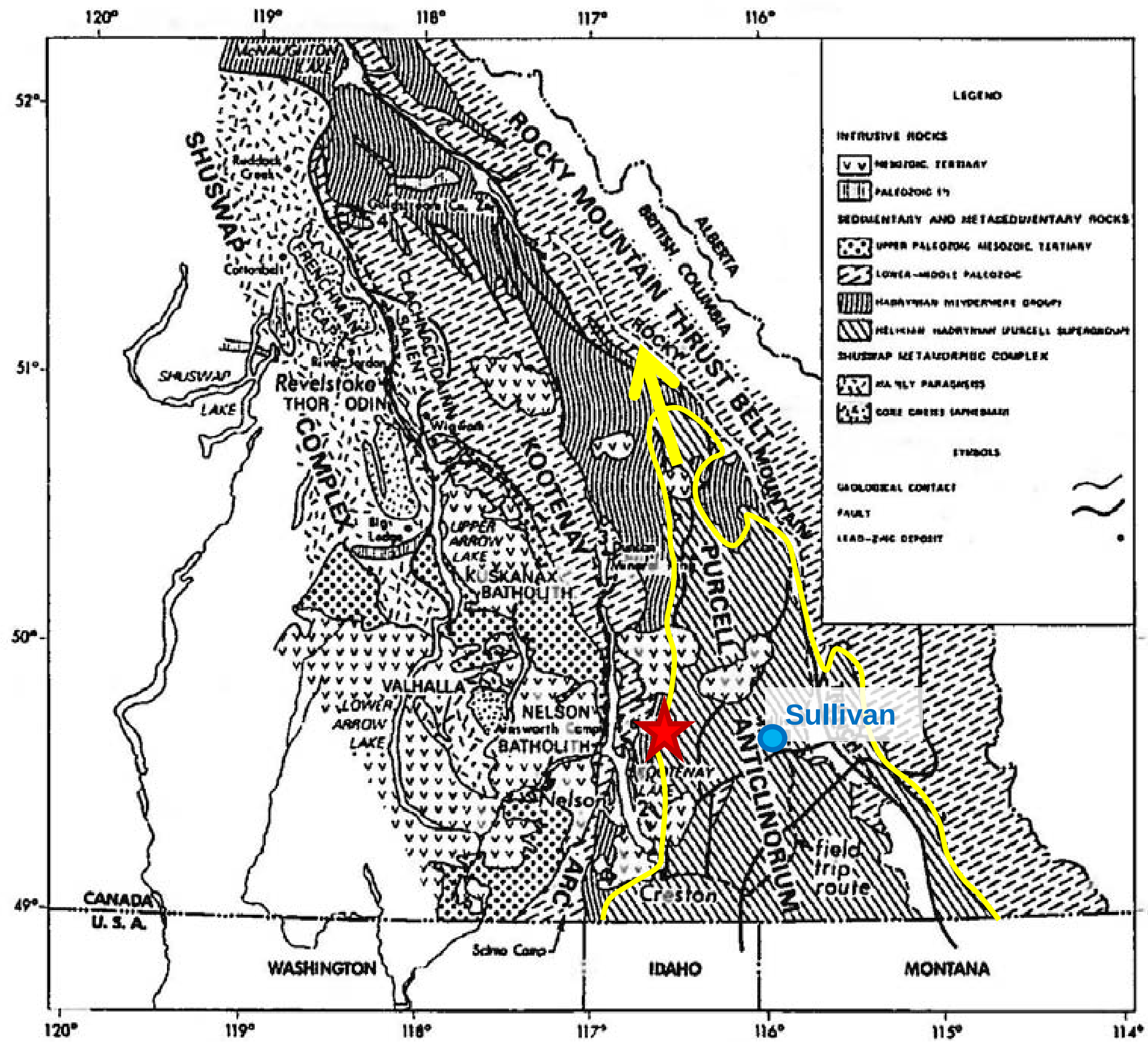

Figure 4. Purcell anticlinorium in SE B.C., dipping shallowly to the NNW (marked by yellow arrow). Teck properties are located on the western limb, approximate location shown by red star. Purcell Supergroup rocks outlined in yellow. (Höy et al., 1981)

2.1.1 Mesoproterozoic

Lower Purcell Supergroup

The Aldridge Formation, comprising the Lower Purcell Supergroup, is split into three units and represents the accumulation of ~10 kilometres of turbidites and intercalated mafic sills during Mesoproterozoic extension and the accompanying major episode of rifting at ~1470 Ma (Price and Sears, 2000). The Lower Aldridge comprises mainly thin to medium-bedded distal argillaceous turbidites, with a prominent quartzitic turbidite sequence of several hundred metres thickness. The Middle Aldridge is dominated by medium-bedded quartzitic turbidites with prominent intervals of laminated marker siltstones, and is up to 2.4 kilometres thick (Höy et al., 2000). The Sullivan Pb-Zn-Ag sedex deposit is located at this Lower-Middle Aldridge transition, commonly called the Sullivan horizon. This horizon is marked by abundant sedimentary fragmentals (interpreted as mud volcanos) and by cross-cutting discordant fragmentals which appear to record movement along growth faults (Höy et al., 2004). The Upper Aldridge comprises 300 metres of bedded to laminated argillite and siltstone which were deposited on a shallowing basin plain. The Aldridge Formation is found in the core of the Purcell anticlinorium.

A large part of the Lower and Middle Aldridge sequence is made up of numerous mafic sills, the Moyie intrusions, which range from gabbroic to dioritic in composition, and have been at least partly intruded into wet, unconsolidated sediments (Höy et al., 2000). This records a magmatic event during the deposition of the Aldridge, which supports the view of a syn-rift model for the basal Purcell Supergroup, and is a potential driver of hydrothermal mineralization at Sullivan.

Middle Purcell Supergroup

Following the main rifting episode and the deposition of the Aldridge Formation there was a period of thermal relaxation during which approximately 6 kilometres of shallow water sediments accumulated along the flanks of the rift zone (Price and Sears, 2000). The Middle Purcell Supergroup in the area includes the Creston and Kitchener Formations, which represent this shallow shelf environment. The Creston Formation conformably overlies Upper Aldridge rocks (Figure 3), and comprises green to grey siltstone, argillite, and quartzite, with abundant sedimentary structures along the eastern limb of the anticlinorium, indicative of shallow water deposition (Höy, 1993). On the western limb of the anticlinorium, however, the primary structures, mudcracks, and wavy bedding common in the east are seldom preserved (Reesor, 1983). The Lower Creston consists of thinly laminated grey and green phyllite/siltstone, commonly with thin carbonate-bearing layers. There is an abrupt transition to quartzites and dark grey to green siltstones in the overlying Middle Creston Formation, which is a much more resistant unit than the Lower Creston. The base of the Creston Formation is not exposed on any of the properties mapped during the 2011 program, which precludes an estimate of unit thickness; however, based on exposure in surrounding mapped areas the Creston Formation may range from 1000-1500 metres thick (Reesor, 1983). The Upper Creston does not extend laterally from the east into the western limb; in the west the Middle Creston continues conformably up into the overlying Kitchener Formation platformal carbonates.

The Lower Kitchener Formation has a wide range of lithologies, all thinly interbedded in different combinations (all beds are a few centimetres or less in thickness), consisting of grey to white dolomites, green to grey to black to silvery phyllites, brown weathering carbonates, and white quartzites. The Middle Kitchener consists of laminated black and grey phyllite and siltstone, and though it has been described as not containing any carbonate units along the western limb of the anticlinorium (Reesor, 1983), the 2011 mapping program identified some minor dolomite with interbedded limestone and micaceous laminations within the Middle Kitchener (Section 2.2.1). The Upper Kitchener consists of a succession of thinly bedded, locally carbonate-bearing, silvery to dark grey phyllites and dolomites which transition up into interbedded cream-colored dolomite (stromatolite mounds are locally preserved; Reesor, 1983) and fine-grained white quartzite. An estimated thickness for the entire Kitchener Formation is approximately 1800 metres, including a thickness of ~250 metres for each of the Middle and Upper Kitchener subdivisions (Reesor, 1983).

Upper Purcell Supergroup
The Upper Purcell Supergroup in the area consists of the Dutch Creek and Mount Nelson Formations. The Dutch Creek Formation occurs conformably and abruptly above the Kitchener Formation (Figure 3). The Lower Dutch Creek is dominated by thinly bedded black and grey phyllite and siltstone, with rare carbonate and quartz-rich sandstone interbeds. There is a gradual transition into the overlying rocks of the Upper Dutch Creek, which also comprise interbedded grey to black siltstone, black phyllite, with rare thin carbonate-bearing siltstone beds towards the top of the unit. Locally there exists a distinctive metre-scale thick quartzite bed at the lower portion of the Upper Dutch Creek. The contact with the overlying Mount Nelson Formation is marked by a section of more massive siltstone and quartzite in beds much thicker than seen elsewhere in the Dutch Creek (Reesor, 1983). The true thickness of the Dutch Creek Formation is virtually impossible to determine based on the intensity of folding and faulting that it exhibits in the area, however a maximum thickness of 2400 metres is proposed near La France Creek, although in reality the true thickness may be much less (Reesor, 1983).

The Mount Nelson Formation is subdivided into four distinctive units, the total thickness of which is approximately 1200 metres, with individual units ranging from 250 to 350 metres (Reesor, 1983). The lowermost unit, Mount Nelson 1, comprises thickly bedded white to grey to green quartzite with rare phyllitic laminations, and is found directly above a distinctive quartzitic section of the Upper Dutch Creek. The Mount Nelson 2 unit lies conformably and abruptly over the Mount Nelson 1, and comprises brown weathering carbonate with interbedded black and grey phyllite and siltstone, and local quartzite and sandstone interbeds. Mount Nelson 3 is a thin to medium-bedded unit of black to grey phyllite and siltstone which gradationally overlies the Mount Nelson 2 unit. The uppermost subdivision of this formation, the Mount Nelson 4, is dominated by a medium-bedded, cream to brown weathered, white dolomite, with local thin laminations of green to black phyllite, lying gradationally over Mount Nelson 3 (Reesor, 1983).

2.1.2 Neoproterozoic

Windermere Supergroup
The onset of deposition of the Windermere Supergroup, which lies unconformably over the Upper Purcell Supergroup, is marked by the Goat River Orogeny in the Neoproterozoic (900-800 Ma; Lydon, 2007). The Toby Conglomerate of the Windermere Supergroup (Figure 3) is a polymictic basal conglomerate/tillite which developed to the north of the major NE-trending Moyie and St. Mary faults, indicating a time of major extension and movement along these growth faults. There was approximately 10-12 kilometres of movement along this fault system during the Proterozoic (T. Höy, pers. comm.). In different localities, the Mount Nelson 4 unit is variably preserved under the Toby Conglomerate; sometimes it only exists as a few thin beds, and in other areas it has been completely eroded away (Reesor, 1983). Clasts in the Toby Conglomerate consist mainly of quartzite and dolomite, within a matrix varying from quartzite to pelite to carbonate. Thickness of the unit varies from 10's of metres to as much as 700 metres, and both clast and matrix compositions are directly correlated to the lithologies found immediately below the basal unconformity. Overlying the conglomerate are the rocks of the Horsethief Creek Group, which vary in composition from phyllite to schist to quartzite to limestone/marble (Reesor, 1983).

2.1.3 Mesozoic

The Purcell anticlinorium was formed during Mesozoic contraction, when imbricate thrust faults carried up to 15 kilometres of Belt-Purcell and Paleozoic margin sedimentary rocks eastward on the basal decollement of the Rocky Mountain foreland thrust and fold belt (Cook and Van der Velden, 1995). The west flank of the Purcell anticlinorium is characterized by moderate to steeply dipping structures associated with the accretion of Quesnellia, a late Paleozoic-Jurassic terrane, to the western margin of North America during the Jurassic and Early Cretaceous (Cook and Van der Velden, 1995). This convergence resulted in the Late Jurassic-Cretaceous (Paleocene?) orogeny, 160-60 Ma, and involved a significant component of NW-SE shortening (Price and Sears, 2000). The Belt-Purcell basin underwent a tectonic inversion and was telescoped by these thrust faults, which young to the east (T. Höy, pers. comm.). At the Sullivan deposit, D1 and D2 structures potentially correlate with the regional development of the Purcell anticlinorium. The orientations of structural features suggest a similar stress field, so they may be closely associated in time (Höy et al., 1981).

There was widespread Mid Cretaceous granitic magmatism which intruded the rocks of the anticlinorium. The Fry Creek Batholith east of upper Kootenay Lake is one of these intrusions, and is a leucocratic granite consisting predominantly of equal parts feldspar, plagioclase, and quartz. It is equigranular, fine to medium grained, with less than 5% biotite on average (Reesor, 1983). Young mafic dykes, typically <2 metres wide (but ranging in width from <1 to ~10 metres), are recognized across the area. Dykes are dark grey to dark green, medium to finely crystalline, massive, equigranular, magnetic, commonly pervasively chloritized, basaltic in composition, and commonly display quartz+/-Cu oxide veins along their margins. They are found crosscutting the entire sequence of Purcell and Windermere Supergroup rocks.

The youngest deformational event to affect the Belt-Purcell rocks is prevalent extension in the Tertiary. The Purcell anticlinorium is cut by both NW- and NE-trending faults displaying evidence for normal-sense displacement (reactivation) late in the tectonic history (Cook and Van der Velden, 1995). Host rocks to the Sullivan deposit have been displaced approximately 10 kilometres southwestward relative to the North American craton by early Tertiary crustal extension (Price and Sears, 2000).

LEGEND
OCC_DEP_REG_MINFILE
Road
Purcell Mineralization
River
Communities
Wetlands
Railway
Lake
Teck Tenure
Geology
PUR_2011_Cren_Lin_Fold_Axes
PUR_2011_Bedding
PUR_2011_Faults_Fractures
PUR_2011_Cleavage_Axial_Planes
PUR_2011_Dykes
PUR_2011_Veins
2011 Fieldwork
Mapped Outcrops
Toby Formation
Mount Nelson 4 Formation
Mount Nelson 3 Formation
Mount Nelson 2 Formation
Mount Nelson 1 Formation
Upper Dutch Creek Formation
Lower Dutch Creek Formation
Dutch Creek Formation Undivided
Middle Kitchener Formation
Lower Kitchener Formation
Kitchener Formation Undivided
Structure
Classification
Fault Approximate
Fault Assumed
Fault Defined
Geological Contact; Geological contact
anticline
syncline
Upper Proterozoic Horsethief Group - Undivided
Upper Proterozoic Horsethief Group - Massive white Quartzite
Upper Proterozoic Horsethief Group - phyllite; siltite; carbonate
Upper Proterozoic Windermere Supergroup Toby Formation
Middle Proterozoic Purcell Supergroup - Mount Nelson Formation - Dolomite
Middle Proterozoic Purcell Supergroup - Mount Nelson Formation - Black Argillite
Middle Proterozoic Purcell Supergroup - Mount Nelson Formation - Dolomite
Middle Proterozoic Purcell Supergroup - Mount Nelson Formation - Quartzite
Middle Proterozoic Purcell Supergroup, Dutch Creek Formation-Upper
Middle Proterozoic Purcell Supergroup, Dutch Creek Formation-Lower
Middle Proterozoic Dutch Creek Formation - Undivided Sedimentary rocks
Middle Proterozoic Purcell Supergroup -Kitchener Formation - Middle
Middle Proterozoic Purcell Supergroup -Kitchener Formation - Lower
Middle Proterozoic Purcell Supergroup -Creston Formation - Middle
Middle Proterozoic Purcell Supergroup -Creston Formation - Lower
523000
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5484500
5484000
5483500
5483000
5482500
N
Name:CHICAGO Commodities:ZN
PB AG Deposit Type:Polymetallic veins
Ag-Pb-Zn+/-Au
Name:SNOW KING (L.7235)
Commodities:PB
ZN CU Deposit
Type:Polymetallic
veins Ag-Pb-Zn+/-Au
Quartz,Chalcopyrite,Cu
Oxides,
Veins
La France Creek
Name:DAVE Commodities:BA
AG PB Deposit
Type:Sediment-hosted barite
Sphalerite,
, ,Veinlets
Teck
Teck Resources Limited
Suite 3300, 550 Burrard Street
Vancouver, BC Canada
Purcells Project
British Columbia
Crawford Property
0
500
1,000
m
1:10,000
Fig.
5
DATUM: Nad 83
PROJECTION: UTM Zone 11
DATE: March 1, 2012
DRAWN BY: A. Henry

2.2 Property Geology

The Crawford property is underlain by Upper and Middle Proterozoic clastic and carbonate units found along the western limb of the Purcell anticlinorium. The west limb has seen significantly less exploration and historical work than either the eastern limb or the core of the anticlinorium, thus the descriptions of the stratigraphic succession are less detailed than those for the eastern limb. There are also lateral facies changes within stratigraphic horizons, which do not always correlate between the limbs (c.f. Reesor, 1983 and Höy, 1993). Overall, the stratigraphy on the Crawford property dips moderately to the west, is pervasively folded on mm- to m-scales, and comprises rocks from the Kitchener Formation up through the Toby conglomerate (Figure 5). The detailed lithologic descriptions and photos presented here are products of the 2011 mapping program.

2.2.1 Middle Purcell Supergroup

Kitchener Formation

The Kitchener Formation is split into four subunits: Upper, Middle, Lower, and undivided (Table 2). The Upper Kitchener was not observed on the Crawford property.

The Lower Kitchener is composed mostly of pale to dark grey, rarely green or buff, fine grained sandstone to siltstone interbedded with phyllite (Figure 6a). Also present are light green/grey to medium grey quartzite beds +/- phyllitic laminations or dolomite beds, and typically dark grey to black or green phyllite, with mm-scale quartz-rich laminations. Carbonate units in the Lower Kitchener Formation are commonly white to light grey/buff dolomite interbedded with maximum 50% limestone, 30% phyllite, or 20% fine sandstone.

The Middle Kitchener Formation is dominated by laminated light grey to black phyllite and fine sandstones (Figure 6b), with occasional pale quartzite beds (mm- to cm-scales) and minor dolomite with interbedded limestone and micaceous laminations.

The lithologies described above are also typical of the “undivided” Kitchener Formation subunit, with quartzite and phyllite as the most abundant lithologies mapped in the field. Along the western limb of the anticlinorium, certain exposures of the Kitchener Formation lie within the biotite zone of metamorphism.

6a. Dark grey and buff Lower Kitchener laminated phyllite and siltstone

6b. Middle Kitchener light grey phyllite

Figure 6. Photos of Kitchener Formation.

Middle Kitchener Fm	quartzite	white to light grey or green to medium grey, pale grey weathering, mm- to cm-scale beds, commonly with phyllitic laminations, rarely massive, commonly bearing magnetite and/or biotite (up to 10%)
	phyllite	light grey to black +/- green tint, can be interbedded with quartzite (up to 40%), dolomite, or argillite, mm-scale laminae
	fine to very fine sandstone	light grey to dark grey +/- green tint, +/- phyllitic laminations
	dolomite	with limestone interbeds and micaceous laminations
	medium sandstone	dark grey
Lower Kitchener Fm	fine sandstone	mid grey to brown weathering, light grey to black +/- green tint, mm-scale laminations of phyllite and siltstone
	phyllite	light green to medium grey to black, +/- quartz-rich and/or green or black phyllitic mm-scale laminations, rare biotite crystals
	quartzite	light green grey to medium grey, commonly with phyllitic laminations, or interbedded with dolomite, grey quartzite or grey/black/green phyllite, quartzite commonly constitutes at least 50% of the rock, can also be massive
	dolomite	buff to white, fine to medium grained, massive or with quartz-rich layers, or light green phyllite (up to 40% of the rock in cm-scale beds)
	very fine sandstone	dolomitic with phyllitic laminations
	siltstone to mudstone	dark grey/green, with mm- to cm-scale phyllitic laminations, mudstone has slatey cleavage
	medium sandstone	green
	limestone	with phyllitic laminations and sandstone beds
Kitchener Fm – undivided	quartzite	white to medium grey, can be massive or interbedded with phyllitic laminations or dolomitic layers (dm- to m-scale beds) or have a dolomitic matrix
	fine and minor very fine sandstone	dark grey green, quartz-rich, phyllitic laminations (mm-scale), +/- white quartzite laminae (dm-scale)
	phyllite	light to dark grey, +/- green tint, pale buff weathering, units can be >3m thick, interbedded with phyllitic dolomite, and rare schistose patches
	dolomite	dark to medium grey, pale grey buff weathering, can be medium bedded, +/- interbedded with white fine sandstone and green phyllite
	dolomitic quartzite	medium bedded with phyllitic laminations
	coarse sandstone	massive, rare phyllitic laminations

Table 2. Lithologic descriptions of the Kitchener Formation.

2.2.2 Upper Purcell Supergroup

Dutch Creek Formation

The Dutch Creek Formation is split into three subunits: Upper, Lower, and undivided. In contrast to the Kitchener Formation, Dutch Creek carbonate units are relatively rare. Light grey to black (less commonly green) phyllite composes the majority of mapped Lower Dutch Creek units (Figure 7a). It is typically laminated on mm- to cm-scale with quartz-rich or rare argillite or phyllite beds. Rusty weathering and Fe-oxide veinlets parallel to cleavage are common. Up to 50% phyllite laminations also occur in the typically grey/green fine to very fine sandstone and light grey/buff quartzite units (Figure 7b).

There is a gradual transition into the overlying rocks of the Upper Dutch Creek Formation, which is also dominated by interbedded light grey to black phyllite with fine sandstone/siltstone interbeds (Figure 7c). Locally there exists a distinctive metre-scale thick quartzite bed at the lower portion of the Upper Dutch Creek. Light grey to black and green phyllite and light to medium grey quartzite are the most common lithologies in the undivided Dutch Creek unit, with occasional fine sandstone interbeds (Figure 7d). These rock types are interbedded on mm- to cm-scale. Dolomite is less common, and is almost solely confined to the undivided Dutch Creek Formation (Table 3). These buff/light grey units can be quartz-rich +/- phyllitic laminations.

The Dutch Creek Formation is intensely deformed and lies partly within both the biotite and garnet zones of regional metamorphism (Figures 7e and f). Biotite and pink/red garnet porphyroblasts are commonly concentrated along planar cleavage.

7a. Lower Dutch Creek black and silvery phyllites displaying crenulation lineations on S2 cleavage face

7b. Light grey Lower Dutch Creek quartzite with light grey phyllitic partings (in the plane of the page)

7c. Light grey Upper Dutch Creek phyllite

7d. Laminated Dutch Creek (undiv) fine sandst.

7e. Small biotite porphyroblasts in light grey phyllite of Upper Dutch Creek

7f. Garnet porphyroblasts with biotite coronas in pale grey Lower Dutch Creek phyllite

Figure 7. Photos of Dutch Creek Formation.

Upper Dutch Creek Fm	quartzite	light grey/green to medium grey, can have mm- to rare dm-scale phyllitic laminations (up to 40% of the rock), or be schistose or massive, rare interbedded dolomitic beds, +/- magnetite, +/- secondary biotite, can show rusty weathering
	phyllite	light to dark grey/green with quartz-rich or biotite-rich laminations, mm- to dm-scale, can be overall biotite-rich with rare garnet porphyroblasts, can be pervasively altered to hematite
	fine to medium or very fine sandstone	white to light grey/green to medium grey, micaceous with phyllitic laminations (up to 40% of the rock), rarely displays up to 30% biotite?/garnet?/andalusite porphyroblasts
Lower Dutch Creek Fm	phyllite	light green/grey to dark grey, commonly with sandstone, quartzite +/- black argillite laminae (mm- to cm-scale) making up 10-40% of the rock, commonly biotite-rich with rare garnet porphyroblasts, rusty weathering common, can be pervasively replaced by hematite
	fine sandstone	with rare very fine or medium sandstone, light green/grey to dark grey, quartz-rich, typically with dark grey phyllite, argillite, or quartzite laminations (dark/pale laminations on mm-scale), rare porphyroblasts (biotite? garnet? up to 15% of the rock), pale grey to rusty weathering
	quartzite	white to buff to medium grey in colour, commonly green due to phyllite laminae which constitute 5-40% of the rock +/- up to 10% disseminated magnetite
Dutch Creek Fm - undivided	phyllite	light to dark grey +/- light green tint, pale grey weathering, can be interbedded with quartz-rich laminae (~ 10-20% of rock), +/- dolomite beds
	quartzite	60% quartzite, 40% pale grey/green +/- up to 40% phyllitic laminations

	fine sandstone/ very fine sandstone	quartz-rich, light to dark grey +/- light green tint, +/- dark and light mm-scale phyllitic laminations
	dolomite	buff to light grey, buff weathered, +/- minor phyllitic partings and laminations on mm-scale
	mudstone	dark grey with phyllitic laminations
	siltstone	light to dark grey/green micaceous, indurated, laminated on mm-scale

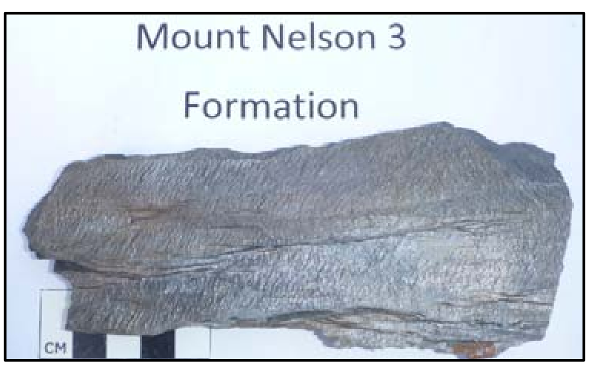
Table 3. Lithologic descriptions of the Dutch Creek Formation.

Mount Nelson Formation

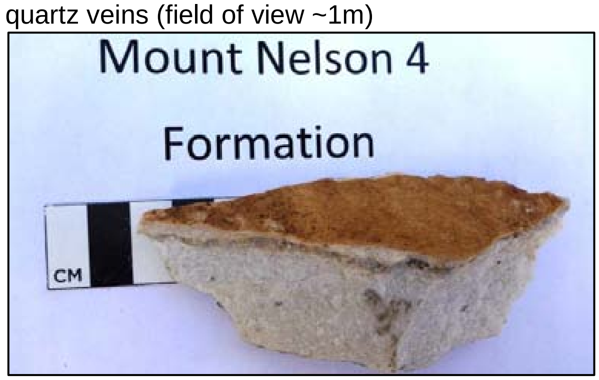
This formation is sub-divided into four units, Mount Nelson Formations 1 to 4, each with fairly distinctive lithologies (Table 4). Mount Nelson 1 is a massive white to light grey to light green quartzite which displays minor phyllite laminations (Figure 8a). Mount Nelson 2 has the widest range of lithologies, encompassing dark grey, thinly bedded phyllite, brown quartzite, dark green to mauve-brown, laminated fine sandstone, and buff dolomite (Figure 8b). Mount Nelson 3 is typically dark grey to black phyllite with quartz-rich laminations and rare dark grey dolomitic quartzite (Figure 8c). Dolomite is the only lithology mapped for Mount Nelson 4, and is buff to white, finely crystalline, massive to medium-bedded +/- phyllitic laminations (Figure 8d).

8a. Medium grey Mount Nelson 1 quartzite

8b. Mount Nelson 2 buff colored dolomite with quartz veins (field of view ~1m)



8c. Dark grey Mount Nelson 3 phyllite



8d. Buff to white, massive Mount Nelson 4 dolomite

Figure 8. Photos of Mount Nelson Formation.

Mount Nelson 4 Fm	dolomite	finely crystalline, medium bedded, massive to cross bedded with silty or phyllitic laminations, buff weathering
Mount Nelson 3 Fm	phyllite	dark grey to black, with pale/dark laminations of quartz-rich beds (up to 40% of the rock)
	dolomitic quartzite	dark grey, interbedded with grey fine sandstone
Mount Nelson 2 Fm	phyllite	dark grey, mm- to cm-scale compositional banding
	dolomite	buff, interbedded with fine sandstone
	quartzite	brown, interbedded with stromatolitic? dolomite on m-scale
	fine sandstone	dark green to mauve-brown, minor phyllitic laminations
Mount Nelson 1 Fm	quartzite	white to medium grey, +/- green tint, with minor phyllitic laminations, rare mafic mineral grains, commonly massive
	fine sandstone	light grey green, pale/dark laminations on a mm scale

Table 4. Lithologic descriptions of the Mount Nelson Formation.

2.2.3 Windermere Supergroup (Late Proterozoic)

Toby Formation and Horsethief Creek Group

The Mount Nelson Formation at the top of the Purcell Supergroup is separated from the overlying Windermere Supergroup by the Windermere unconformity (Höy, 1993). Above the unconformity lie the Toby Formation conglomerate and the Horsethief Creek Group (Figure 3, Table 5). The Toby Formation is a syn-rift deposit and the basal unit of the Windermere Supergroup (Pope, 1990). It is a polymictic basal conglomerate whose clasts consist mainly of quartzite and dolomite, within a matrix varying from quartzite to pelite to carbonate (Figure 9). Both clast and matrix compositions are directly correlated to the lithologies found immediately below the basal unconformity.

Overlying the conglomerate are the rocks of the Horsethief Creek Group, which are the youngest rocks mapped on Crawford. These rocks vary in composition from light grey phyllite to white and dark grey laminated quartzite. The exposure of Windermere Supergroup rocks on the property is not extensive.

Figure 9. Toby conglomerate, dolomite and quartzite clasts in a quartz-rich sandstone matrix

Horsethief Creek Group – undivided	quartzite	dark grey and white, laminated to massive
	phyllite	light grey
Toby Fm	quartzite	massive, white to medium grey to green, local discontinuous mica-rich fine grained laminations (up to 10% of rock)
	conglomerate	dark grey green, fine-grained sandstone to phyllitic matrix, pebble to gravel-sized rounded lithic clasts (quartzite, bull quartz, rare dolomite) up to 10 cm across +/- phyllitic laminations, locally is a quartz pebble conglomeratic unit with quartzite matrix
	fine sandstone	quartz-rich, with rare pebble clasts, limestone dolomite beds, some chloritization

Table 5. Lithologic descriptions of the Toby Formation and Horsethief Creek Group.

2.3 Structural Geology

Table 6 provides a correlation of different ductile deformational events and structures predominantly for the western limb of the Purcell anticlinorium described within several internal Cominco reports (Callan, 1990; Hawkins, 1991; Ransom and Anderson, 1993) and mapping done for the government in the early 80's (Reesor, 1983). These observations are compared to some general observations for the eastern limb (Höy et al., 1981). Movement along faults in the area has not been assigned here to specific deformational episodes; there have been multiple episodes of reactivation along N-S, NE- and NW-trending faults (starting with the initial Paleoproterozoic rifting event) which complicate the deformational history and preclude assigning deformational stages to fault sets at this point. In addition to the historic work, observations from the 2011 field program (including mapping done on four nearby Teck claims: Kaslo, Rose, Gray, and Snowcrest) have been included and correlated with the most likely deformational stage (Table 6, purple highlighted column). These are discussed in Section 4.

The Purcell Supergroup rocks on the western limb of the Purcell anticlinorium generally dip to the west, with many repetitions and omissions due to isoclinal folding and faulting oriented sub-parallel to the strike of the formations. Faulting in the region is dominated by a set of west-dipping, roughly N-S trending reverse faults. All formations exhibit open to isoclinal folding on cm-scale to several 10's of metres, which are parasitic on doubly plunging, NNW-SSE trending, km-scale folds that control the overall geometry of the Purcell anticlinorium. The geometry of folding is largely dependent on rock type, with open folds developing in thickly bedded and/or coarse clastic units and tighter folds developing in thinly bedded, finer grained clastic and carbonate units. Examples of inhomogeneous strain across sedimentary contacts between units with markedly different competencies are common, and folding typically becomes more complex adjacent to sedimentary-intrusive contacts (Hawkins, 1991).

These N- to NNW-trending, doubly plunging folds are observed at all scales, and are assigned to the D1 and D2 deformational episodes (Table 6). D1 and D2 are here correlated to two separate deformational events during the Jurassic-Cretaceous orogeny (160-60Ma age; e.g. Cook and Van der Velden, 1995). Folds commonly verge westward, with steep to overturned east limbs, and moderate to steeply dipping west limbs; this is opposite to the east-vergent folds observed at the Sullivan deposit on the eastern limb of Purcell anticlinorium (e.g. Höy et al., 1981; Table 6). Cleavage is very well developed in the area across most lithologies, ranges from N- to NW-trending, with moderate to steep eastward and westward dips, and is referred to as S1 and S2 in internal Cominco reports depending on local overprinting relationships (Hawkins, 1991; Ransom and Anderson, 1993). The timing of this cleavage development likely corresponds with the development of W-dipping axial planar cleavage and N-trending fold axes on the eastern limb of the Purcell anticlinorium (e.g. Höy et al., 1981; Table 6).

Locally, a W- to WNW-trending "cross folding" has been observed on a smaller scale than the regional S2 cleavage (Reesor, 1983; Ransom and Anderson, 1993), which is attributed here to a younger deformational event (D3), potentially the Cretaceous-Paleogene orogeny (Table 6). At Sullivan, F3 fold axes plunge variably to the NW or SE and the "cross folds" on the western limb of the anticlinorium are described as oriented W to WNW, which may be slightly different variations of the same regional deformation. The dominant N-S trending reverse faults in the area appear to be truncated by Mid Cretaceous intrusions such as the Bayonne Batholith (e.g. Reesor, 1983), indicating that, at least to the west of the Moyie Fault, thrusting and folding within the Belt-Purcell rocks had ended by this time (Price and Sears, 2000). On the eastern limb of the anticlinorium at Sullivan, D3 folds associated with low angle, E-dipping thrusts are found to offset early Cretaceous dykes, which suggests that the D3 deformational event occurred regionally sometime between these two early and Mid Cretaceous intrusive events.

D4 is represented by a second set of crenulation lineations mentioned briefly in the internal Cominco 1992 Recce report (Ransom and Anderson, 1993) but not referred to in any other reports to the author's knowledge.

The youngest deformational event to affect the Belt-Purcell rocks is prevalent extension in the Tertiary. The Purcell anticlinorium is cut by both NW- and NE-trending faults displaying evidence for normal-sense displacement (reactivation) late in the tectonic history (Cook and Van der Velden, 1995). Host rocks to the Sullivan deposit have been displaced approximately 10 kilometres southwestward relative to the North American craton by early Tertiary crustal extension (Price and Sears, 2000).

2.4 Mineralization and Alteration

At Dave-Wall, vein and replacement galena-sphalerite-pyrite-tetrahedrite mineralization is found locally within the dolomitic units of the Mount Nelson Formation, as well as in a local dolomitic variation of the Toby Formation conglomerate (Callan, 1990). Mineralization is found in networks of veins, stringers, and irregular pods. Gangue minerals at the Dave-Wall showing include quartz, calcite, barite, Fe-carbonate, and minor fluorite. Wallrock alteration in dolomitic host rocks includes silicification, calcitic alteration, and disseminated euhedral pyrite (trace to 3%). In addition, local mudstone layers of the Mount Nelson 4 formation are almost completely bleached and sericitized (Callan, 1990). Details of mineralization and alteration styles at the Dave-Wall showing may also be found in the assessment reports listed in the References section.

The Snow King showing is located immediately to the north of the Crawford property boundary (Figure 5), where a galena-tetrahedrite-chalcopyrite-malachite vein system has been described hosted within a dolomite/arenite conglomeratic unit (Callan, 1990).

Deformational episode	2011 Teck Mapping Program (west limb)	Akokli Creek (southern area, west limb)	Baker Creek (central area, west limb)	Sawyer Creek (northern area, west limb)	West limb	Wall-Dave showing (west limb)	West limb	Sullivan (east limb)
	this report	Ransom and Anderson, 1993	Ransom and Anderson, 1993	Ransom and Anderson, 1993	Hawkins, 1991	Callan, 1990	Reesor, 1983	Hoy et al., 1981
D0	***S0***		***S0***	***S0***		***S0***		
	average NNE and SW striking bedding, moderate to steeply dipping (two limbs of regional D2 folds)		N-S trending, steep dips to E or W	W-dipping		NNW to NNE striking stratigraphy		
D1 Jurassic-Cretaceous orogeny	***S1***	***S1***	***S1***	***S1***	***S1***	***S1***	***S1***	***S1***
	average orientation 017/79, dm-scale cleavage	N-S trending continuous cleavage, 0.1mm scale, moderate to steep E-dipping, and steep W-dipping	N-S trending continuous cleavage, steep dips to E or W	pervasive	shear zones, N to NW trending, steeply dipping, folded by F2 and truncated by later, steep E-dipping brittle/ductile faults	axial surface concordant with general stratigraphy, axial planar cleavage also concordant with, and probably related to, bedding parallel cleavage	cleavage well-developed, moderately E-dipping	axial planes parallel to bedding on isoclinal folds (potentially Mesozoic contraction, during formation of anticlinorium, closely associated with D2 structures?)
			F1	***F1***		***F1***		***F1***
			Average 350-20	N-trending fold axes, isoclinal folds, limbs are approx. parallel to strike of formations		early, close to tight, cm- to m-scale folds, steep N and S plunging axes		isoclinal folds with N-trending fold axes, E-vergent folds (on the east limb of anticlinorium)
D2 Jurassic-Cretaceous orogeny	***S2***	***S2***	***S2***		***S2***	***S2***	***S2***	***S2***
	the dominant regional cleavage, trends NNW through NNE and dips steeply to both the E and W	N-S trending continuous or spaced cleavage, 5mm scale, moderate to steep E-dipping, and steep W-dipping	N-S trending continuous to spaced cleavage, steep dips to E or W		the only pervasive event, cleavage is regionally dominant, strikes N to NW and dips steeply to the W (locally rotated by subsequent deformation)	axial surfaces and closely spaced cleavage trend NW and dip moderately to E (commonly refolding bedding parallel S1 cleavage)	cleavage well-developed, moderately E-dipping	moderately W-dipping axial planes (potentially Mesozoic contraction, during formation of anticlinorium, closely associated with D1 structures?)
	F2		***F2***	***F2***	***F2***	***F2***		***F2***
	doubly plunging folds, fold axes display shallow plunges to both the NNW and SSW, average orientations are 357-16 and 185-24		Average 350-20	shallow plunge to the SW	folds earlier (D1) shear zones, usually upright or NEsterly overturned, open folds in thickly bedded and/or coarse clastics, tight folds in thinly bedded and fine-grained units	ubiquitous F2 folds, mm- to 100m-scale, open to tight folds, shallow to moderate NW to NNW plunges		open folds with gentle N or S plunges, E-vergent folds (on the east limb of anticlinorium)

Table 6. Comparison of ductile deformational episodes for the western and eastern limbs of the Purcell anticlinorium. Work completed in 2011 highlighted in purple. Continued on next page.

Deformational episode	**2011 Teck Mapping Program (west limb)**	**Akokli Creek (southern area, west limb)**	**Baker Creek (central area, west limb)**	**Sawyer Creek (northern area, west limb)**	**West limb**	**Wall-Dave showing (west limb)**	**West limb**	**Sullivan (east limb)**
	this report	Ransom and Anderson, 1993	Ransom and Anderson, 1993	Ransom and Anderson, 1993	Hawkins, 1991	Callan, 1990	Reesor, 1983	Hoy et al., 1981
D3 Cretaceous-Paleogene orogeny	***S3***							***S3***
	crenulation cleavage, average orientation 061/87							steep axial planes
	F3?	***F3***		***F3***			***F3***	***F3***
	crenulations on S2 cleavage surfaces, fold axes plunge steeply to the W, average orientation is 280-70	crenulations		smaller scale "cross-folding" (?), axes (?) plunge W to NW			"cross folding, oriented commonly W to WNW", axes and axial planes?	fold axes plunge variably to NW or SE, folds associated with low angle, E-dipping thrust faults (which offset early Cretaceous dykes)
D4	***F4?***	***F4***						
	crenulations on S2 cleavage surfaces, fold axes plunge steeply to the ESE, average orientation is 112-56	crenulations						

Table 6 cont. Comparison of ductile deformational episodes for the western and eastern limbs of the Purcell anticlinorium. Work completed in 2011 highlighted in purple.

3 2011 Exploration Program

Geological fieldwork in 2011 included geological traverses, property inspections of known mineralization, and visits to several nearby Minfile occurrences. In addition to the mapping there were rock and stream sediment samples collected on or around the Crawford property. However, for assessment purposes, only the geological mapping is discussed in this report. The goal of mapping and prospecting was to identify areas of potential sedex-style mineralization, including looking for possible feeder zones/structures allowing fluid flow, signs of alteration, and favorable lithologic and/or structural settings.

Late snow melt in the Purcell Mountains delayed the start of the field season until mid-July, although initial property visits were done over the course of a week in mid-June. Field work continued until September 18, 2011. Prospecting and mapping was completed at 1:10,000 scale using multiple mylar overlays on satellite images. All structural measurements were recorded using the 360° Right Hand Rule, and location coordinates recorded in UTM Zone 11, NAD 83.

4 2011 Exploration Results

Geological Mapping

Figure 5 is an outcrop map, including measured and inferred structural features, that was created during the 2011 mapping program. All lithological descriptions recorded during the mapping program are summarized in Section 2.2. Structural observations made by previous workers in the area were confirmed during the 2011 program, with slight local variations. A summary of the 2011 observations is found in the first column of Table 6, and these have been broadly correlated to the regional tectonic deformational events described in the literature (Section 2.3). The results presented in this report also include observations and measurements taken on four nearby Teck claims during the field season: the Kaslo, Rose, Gray, and Snowcrest claims (Figure 1).

As described in Section 2.3, rocks on the western limb of the Purcell anticlinorium generally dip to the west, with many repetitions and omissions due to folding and faulting oriented sub-parallel to the strike of the formations. On all five Teck properties, the rock units exhibit open to isoclinal folding on cm-scale to several 10's of metres, which are parasitic on regional doubly plunging, NNW-SSE trending folds. These folds are assigned to the D1 and D2 deformational episodes which have historically been attributed to a similar regional stress regime (Table 6). Only one crosscutting example was observed which distinguished S1 from S2 cleavage; S1 averages 017/79 E and displays dm-scale spacing. S2 cleavage is the dominant structural element regionally and trends NNW through NNE with steep dips to both the E and W (Figure 10a). The doubly plunging nature of these D2 folds is evident in Figure 10b as two populations of shallowly plunging fold axes (F2): a shallow N-plunging population averaging 357-16 N and a shallow S-plunging population averaging 185-24 S. Younger events in the geological evolution of the area have taken advantage of the pre-existing planes of weakness (S1 and S2) in the rock package. Figures 10c and 10d display Cretaceous mafic dyke and vein orientations (both barren and Cu-bearing veins, see Section 2.4) taken across all five properties. Both dyke and veins are developed sub-parallel to the regional, pervasive cleavage, having exploited these pre-existing planes of weakness as fluid pathways. This highlights a potential regional structural control on mineralized systems.

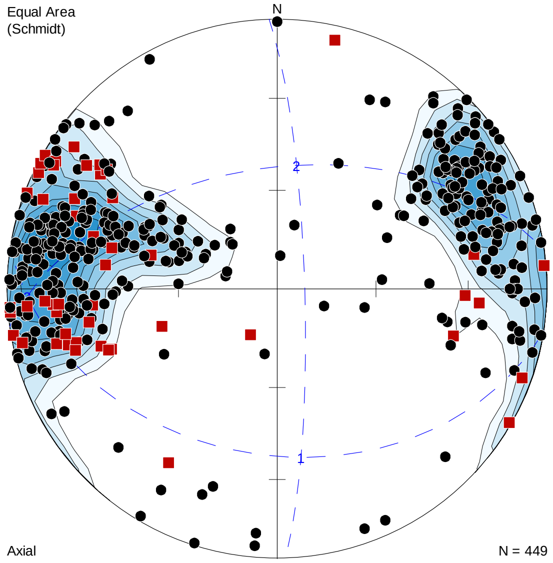
Two different sets of crenulations are developed on S2 cleavage on all five properties, most commonly observed in fine-grained phyllitic clastic units (e.g. dark Lower Dutch Creek phyllites in Figure 7a, and Mount Nelson 3 phyllite in Figure 8c). A steep set of W-plunging crenulations was recorded during the 2011 program (F3 in Figure 10b) which averages 280-70 W and is attributed to the D3 deformational event (Table 6). These crenulations potentially correlate to the small scale "cross folds" reported by previous workers (Reesor, 1983; Ransom and Anderson, 1993). The second set of crenulations developed on S2 cleavage planes, and locally overprinting F3 lineations, plunge moderately to steeply to the east, with an average orientation of 112-56 E (F4 in Figure 10b). An internal Cominco report (Ransom and Anderson, 1993) mentions this crenulation set briefly, but does not provide any orientations (Table 6).

Large-scale N-S trending, W-dipping thrust faults are found throughout the area, which record a period of compression that brittlely offset, and which locally caused repetitions of, the previously folded stratigraphic sequence. These thrust faults have themselves been affected by prevalent extension in the Tertiary; the youngest deformational event to affect the Belt-Purcell rocks. The Purcell anticlinorium is cut by both NW- and NE-trending faults displaying evidence for normal-sense displacement (reactivation) late in the tectonic history (Cook and Van der Velden, 1995).

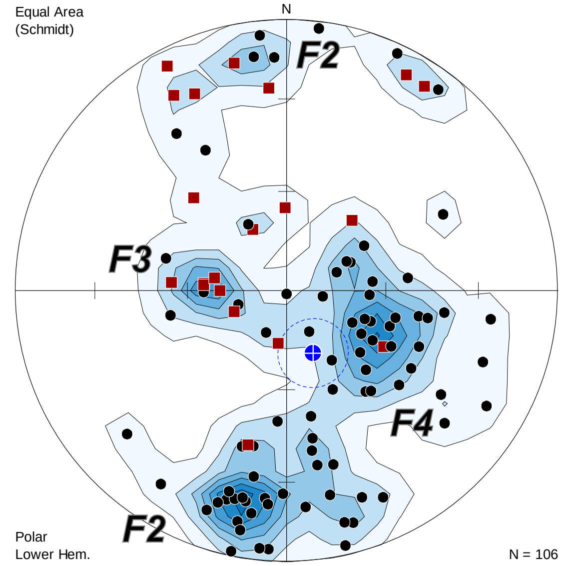
Small-scale, young, brittle faults and fracture sets were observed on all five of the properties during the 2011 program. There are three main populations of these steeply dipping brittle structures: an E-W-trending set, a NW-trending set, and a NE-trending set (Figure 10e).

The only major structure to crosscut the lithologies underlying the Crawford property is an inferred N-S trending fault along the eastern property boundary (Figure 5) which omits the Upper Kitchener Formation from the stratigraphic succession. This inferred fault is associated with a NE-dipping thrust faults that has been mapped approximately 3.5km to the north. There is no indication for any major mineralizing events associated with this structure.

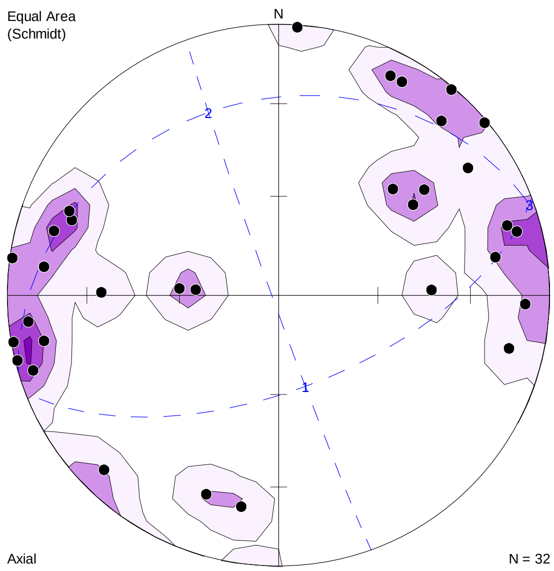
Due to high snow levels, neither exposed rocks of the Dave-Wall showing nor any historic drill hole collars were located during the 2011 program. However, a few sphalerite veinlets (mm-scales) were observed in the Mount Nelson 2 rocks directly to the south of the Dave-Wall minfile location (Figure 5). As described in Section 2.4, quartz-chalcopyrite-Cu oxide-bearing veins were observed along the northern extent of the Crawford property, to the east of the Snow King minfile location (Figure 5). Neither of these mineralized occurrences indicate large enough grades or areal extents to warrant further examination.



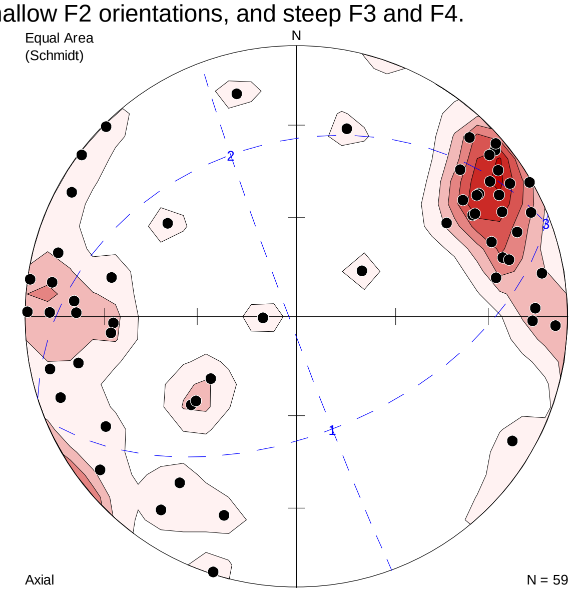
10a. Cleavage (black circles) and axial planar cleavage (red squares) across all five properties. (poles to planes)



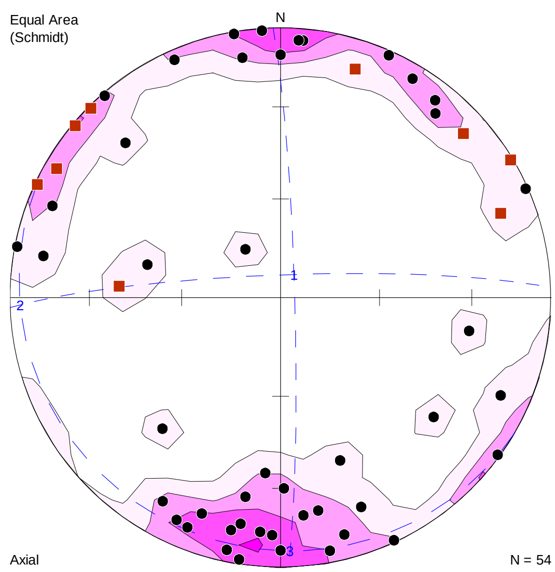
10b. Crenulation lineations (black circles) and fold axes (red squares). Four different populations: two shallow F2 orientations, and steep F3 and F4.



10c. Mafic dyke margins, observed on all properties except Crawford, are sub-parallel to regional cleavage (pre-existing planes of weakness). (poles to planes)



10d. Vein orientations, observed on all five properties, are sub-parallel to regional cleavage (pre-existing planes of weakness). (poles to planes)



10e. Brittle faults (red squares) and fracture planes (black circles) across all five properties. (poles to planes)

Figure 10. Stereonets of structural data collected during 2011 mapping program.

5 Conclusions and Recommendations

During the 2011 mapping and prospecting program on the Crawford property, indications of the historic Dave-Wall sedex-style Pb-Zn showing were found, as were Cu-bearing veins associated with the Snow King occurrence to the northwest of the property. However, due to the small areal extents and apparent low grades of the observed mineralization, and due to the paucity of evidence for nearby sedex-style mineralization, no further work on the Crawford property is recommended at this time.

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Appendix I – Statement of Qualifications

Amber Henry, M.Sc., B.Sc. Honours

I, Amber Henry, M.Sc., B.Sc. Honours, do hereby certify that:

- I am a Project Geologist currently employed by Teck Resources Ltd., 3300-550 Burrard Street, Vancouver, B.C., V6C 0B3 (business phone 604-699-4448)

- I am a graduate of the University of British Columbia, Canada, with a research based Masters of Science, completed in 2008.

- I am a graduate of the University of Alberta, Canada, with a Bachelor of Science with Honours in Geology, completed in 2002.

- I have been practicing my profession since graduation in 2002 as a geologist in Canada, the U.S., and Mexico.

- I was the project geologist at the Crawford property in 2011, and that data contained in this report, and interpretations drawn from it, are true and accurate to the best of my knowledge.

Amber Henry, M.Sc., B.Sc. (Hon)

dated at Vancouver, British Columbia, Canada this 7 day of March, 2012

Appendix II – Statement of Costs

Crawford 2011 Expenditures					
Exploration Work type	**Comment**	**Days**			**Totals**
Personnel	**Field Days**	**Days**	**Rate**	**Subtotal**	
Project Geologist	June 16 - Sept 18, 2012	8	$454.29	$3,634.32	
Geologist 1	June 16 - Sept 18, 2012	7	$415.43	$2,741.34	
Geologist 2	June 16 - Sept 18, 2012	9	$306.98	$2,715.30	
Geologist 3	June 16 - Sept 18, 2012	8	$295.22	$2,258.96	
Principal Geologist	June 16 - Sept 18, 2012	1	$724.38	$724.38	
				$12,074.30	**$12,074.30**
Office Studies	**List Personnel (Office only)**				
Literature search	Principal Geologist	1	$724.38	$724.38	
Database compilation	GIS Support	21	$356.83	$7,493.43	
General research	Project Geologist	9	$454.29	$4,088.61	
Report preparation	Project Geologist	4	$454.29	$1,817.16	
				$14,123.58	**$14,123.58**
Ground Exploration Surveys	**Area in Hectares/List Personnel**				
Geological mapping	1295.16 ha/4 geologists				
Regional		*note: expenditures here*			
Reconnaissance		*are captured in Personnel*			
Prospect		*field expenditures above*			
				$0.00	**$0.00**
Transportation		**No.**	**Rate**	**Subtotal**	
Airfare				$512.60	
Taxi				$236.16	
truck rental (days)		7.26	$125.00	$907.91	
fuel				$132.29	
Helicopter (hours)		6.71	$1,634.81	$10,975.94	
Fuel (litres/hour)		6.71	$242.12	$1,624.63	
				$14,389.53	**$14,389.53**
Accommodation & Food	**Rates per day**				
Hotel and Rental House	actual costs			$994.42	
Meals	actual costs			$686.20	
				$1,680.62	**$1,680.62**
Miscellaneous					
Telecommunications				$284.67	
Office Supplies and Maps	Maps, prints, drafting, office supplies			$392.14	
				$676.81	**$676.81**
Equipment Rentals					
Field Gear (Specify)	Safety, mapping, prospecting, and first aid gear			$1,276.74	
				$1,276.74	**$1,276.74**
Field cost subtotal					**$18,023.70**
HST on field costs				HST (12%)	**$2,162.84**
Salary cost subtotal					**$26,197.88**
TOTAL Expenditures					**$46,384.43**