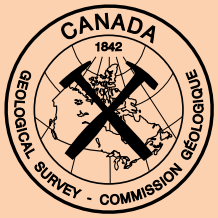

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Abstract: The upper Purcell Supergroup was deposited in a marine to lagoonal setting ca. 1.4 Ga. Sections measured and mapping completed during the summer 2006, in combination with existing maps, permits a test of previous stratigraphic correlations. Replacement of Dutch Creek Formation to the west by the La France Creek Group reflects the westward thinning and increased sand content of this unit. The Dutch Creek Formation is replaced to the south by the Gateway and Roosville formations. A micaceous north-tapering sandstone unit, the Phillips Formation, separates the Gateway and Roosville formations, and provides a record of syndepositional change in the architecture of the Purcell Basin. The authors speculate on potential reasons for Phillips Formation pinch out and attribute it to either continued basin subsidence to the south or to the presence of an unidentified large-scale fault.

Résumé : La partie supérieure du Supergroupe de Purcell s'est accumulée dans un milieu allant de lagunaire à marin, il y a environ 1,4 Ga. Les coupes stratigraphiques et les travaux de cartographie réalisés pendant l'été de 2006, alliés aux cartes existantes, permettent de mettre à l'épreuve les corrélations stratigraphiques établies antérieurement. Le Groupe de La France Creek a remplacé la Formation de Dutch Creek à l'ouest, reflétant la teneur accrue en sable et l'amincissement vers l'ouest de cette unité. Les formations de Gateway et de Roosville ont remplacé la Formation de Dutch Creek au sud. La Formation de Phillips, unité de grès micacé qui s'amincie progressivement vers le nord, sépare les formations de Gateway et de Roosville; elle témoigne d'un changement synsédimentaire survenu dans l'architecture du bassin de Purcell. Nous avançons des hypothèses pour expliquer l'amincissement progressif jusqu'à disparition de la Formation de Phillips et l'attribuons à une subsidence continue du bassin au sud ou à la présence d'une faille majeure non identifiée.

INTRODUCTION

The 12 km thick Purcell Supergroup (Fig. 1a) is one of the most intensely studied Mesoproterozoic sedimentary successions in the Canadian Cordillera. Occurrence of SEDEX Pb-Zn deposits in turbidite units of the Aldridge Formation, lower Purcell Supergroup, provide economic motivation for further understanding the origin and tectonic history of the sedimentary succession. Despite more than a century of study questions remain concerning the depositional and tectonic setting of the upper Purcell Supergroup. The present study is based on mapping and measurement of detailed sedimentary sections through the upper Purcell sedimentary sequence, specifically the Dutch Creek Formation, and aimed to identify syndepositional changes in basin architecture. Here the authors report on the initial results of mapping and stratigraphic studies conducted during the summer of 2006. Initial results indicate that variations in stratigraphic nomenclature of the upper Purcell Supergroup occur where a micaceous sandstone, the Phillips Formation, pinches out to the north (Leech, 1960; McMechan, 1981; Carter and Höy, 1987; Höy, 1993). The geometry and physical characteristics of the Phillips Formation sandstone suggest that it may denote and record a syndepositional tectonic event.

STUDY LOCATIONS

Field measurements completed during the summer of 2006 were focused on the Skookumchuck (NAD 83) NTS 82 G/13 map area, the location where the Phillips Formation pinches out. Regional crossbasin measurements were acquired in five locals: The Toby Creek area (northern Purcell Mountains), the Hughes Range (western Rocky Mountains), the Caven Creek area (south of Cranbrook), the Creston area (western Purcell Mountains), and the Skookumchuck area (central Purcell Mountains).

GEOLOGICAL BACKGROUND

The Purcell Supergroup in Canada and the contiguous Belt Supergroup in the United States were part of a Mesoproterozoic passive rift-and-fill sequence deposited between ca. 1.48 Ga and 1.40 Ga. The sequence was subsequently thrust east onto the North American craton during the late Cretaceous, producing its current northwest-trending anticlinal geometry (Chandler, 2000; Lydon, 2000; Höy et al., 2000; Price and Sears, 2000; Sears et al., 2004). The Purcell

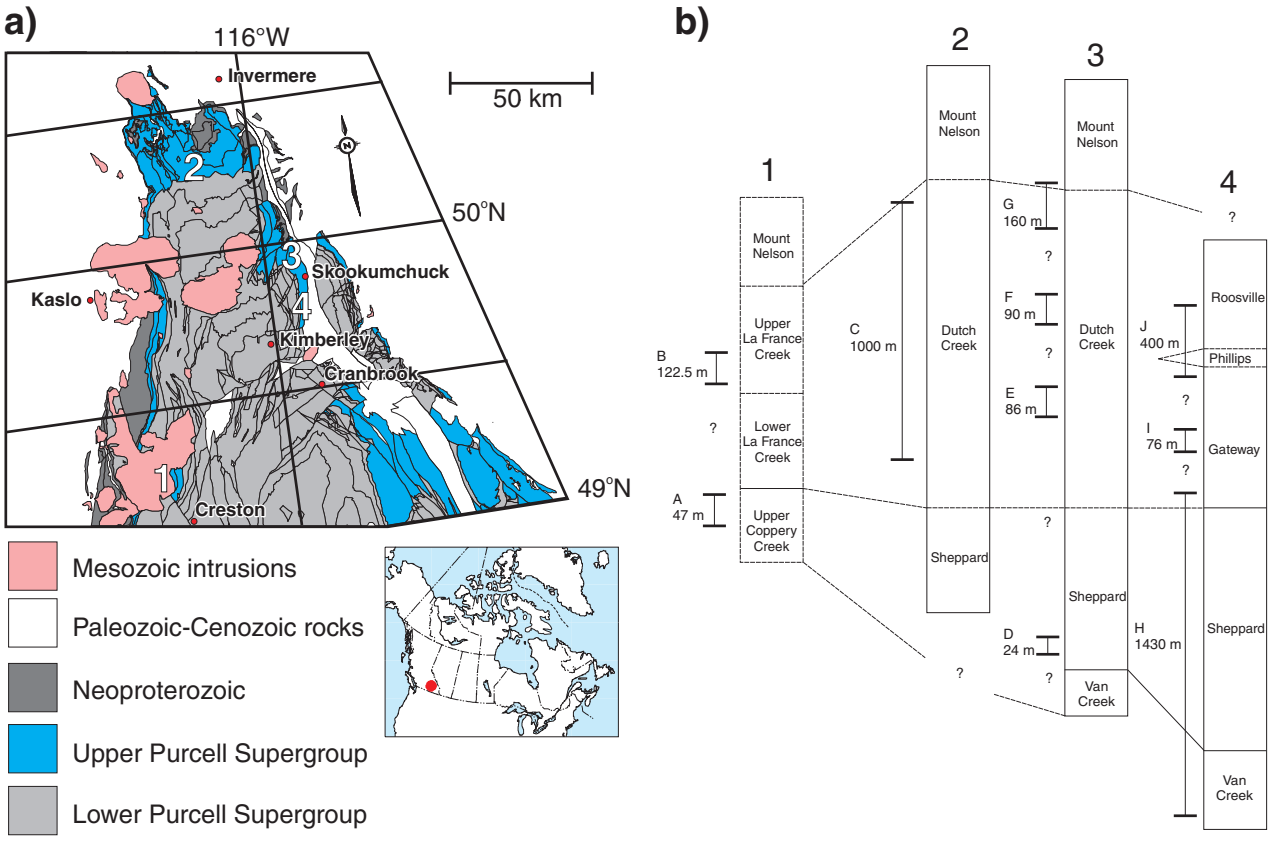

Figure 1. a) Geographical extents of the Belt Basin–Purcell Basin (U.S.A. and Canada, respectively) and the upper Purcell Supergroup (Canada). Locations 1 to 4 mark sections illustrated in Figure 1b and described in Tables 2–12. **b)** The approximate sequential location and size of mapped and measured sections from 2006 summer field data (A-J) and their corresponding basin location (1 to 4) illustrated in Figure 1a.

Supergroup is commonly split into four successions: the basal, the lower, the middle carbonate, and the upper. For the purpose of this paper the present authors are concerned with only the upper Purcell Supergroup. The upper Purcell Supergroup consists of the Nicol Creek, Sheppard, lower Dutch Creek and/or Gateway, Phillips, upper Dutch Creek and/or Roosville, and Mount Nelson formations. The base of the upper Purcell Supergroup is marked by basaltic flows of the Nicol Creek Formation, which has been dated at 1443 ± 7 Ma (Evans et al., 2000).

SEDIMENTARY FACIES

The stratigraphic nomenclature for the upper Purcell Supergroup is outlined in Table 1 and illustrated in Figure 2. In attempting to elucidate syndepositional changes in the basin architecture and the tectonic setting, it is critical that crossbasin correlations are well constrained. Two important crossbasin changes in nomenclature are: replacement of Gateway and Dutch Creek formations to the west by the La France Creek Group; and replacement to the north of the Gateway, Phillips, and Roosville formations by the Dutch Creek Formation. These changes may reflect real changes in the sedimentology and stratigraphy of the basin, and provide important data regarding the basin evolution. Alternatively, changes in nomenclature may simply reflect different mapping strategies or possible postdepositional changes. To assess these different models, the authors completed detailed mapping and compiled stratigraphic sections in the western, central, and northern Purcell Mountains (Fig. 1).

Table 1. Description of upper Purcell Supergroup formations.

Formation	Depositional environment	Description
Mount Nelson	Shallow marine	Thick, well bedded sequences of white orthoquartzite, buff-weathered dolomite, purple dolomite, and argillite
Upper Dutch Creek and Roosville	Intertidal	Dark grey to dark green argillite and siltstone interbedded with fine- to medium-grained dolomitic sandstone
Philips	Subaerial to shallow marine	Thin to massively bedded pink-purple micaceous sandstone and siltstone
Lower Dutch Creek and Gateway	Lagoonal	Light to dark, green-grey succession of siltstone to sandstone, desiccation cracks, symmetrical ripples
Sheppard	Intertidal	Calcareous light green-grey to buff, fine- to medium-grained sandstone and siltstone interspersed with stromatolitic and oolitic dolomatized limestone beds and massive medium-grained noncalcareous sandstone beds

MAPPED AND MEASURED SECTIONS

Creston area sections (upper Coppery Creek and La France Creek groups)

Section A

Thirty-nine and three-quarter metres of section were measured (Table 2) across the upper Coppery Creek Group (Fig. 1b). The section consists of massively bedded, medium-grained, purple-grey dolomitic sandstone interbedded with fine-bedded green siltstone.

Section B

One hundred and twenty-two metres of section were measured (Table 3) across the upper La France Creek Group (Fig. 1b). The section is characterized at the base by green-bedded siltstone with rare beds of purple-grey dolomitic sandstone. Subtle fining upward of grain size results in green siltstone being interbedded with dark grey argillite at the top of the section.

Depositional environment

Sedimentary facies of the Coppery Creek Group described in 'Section A' are characteristic of an intertidal depositional environment evident by interlayered dolomitic sandstone and green siltstone. Siltstone and minor dolomite and argillite of the La France Creek Group described in 'Section B' are characteristic of an intertidal depositional environment. Transition between the two groups illustrates a shoreward shift in depositional environments, evident in a subtle fining upward through both sections; however, sedimentary facies of both sections are indicative of an intertidal environment.

Coppercrown Creek mapped section (Dutch Creek Formation)

Section C

Approximately 1000 m of section were mapped (Table 4) across the Dutch Creek Formation (Fig. 1b). The section consists of dark grey argillite and light green siltstone that broadly coarsen upward to dolomitic purple-grey sandstone.

Depositional environment

Sedimentary facies of the Dutch Creek Formation described in 'Section C' are characteristic of a lagoonal to intertidal depositional environment. Evidence of sporadic subaerial exposure is evident in desiccation cracks observed in unit 3 of section C. The section gradually coarsens upward from dominantly argillite (units 1 to 4) to dolomitic sandstone (unit 5).

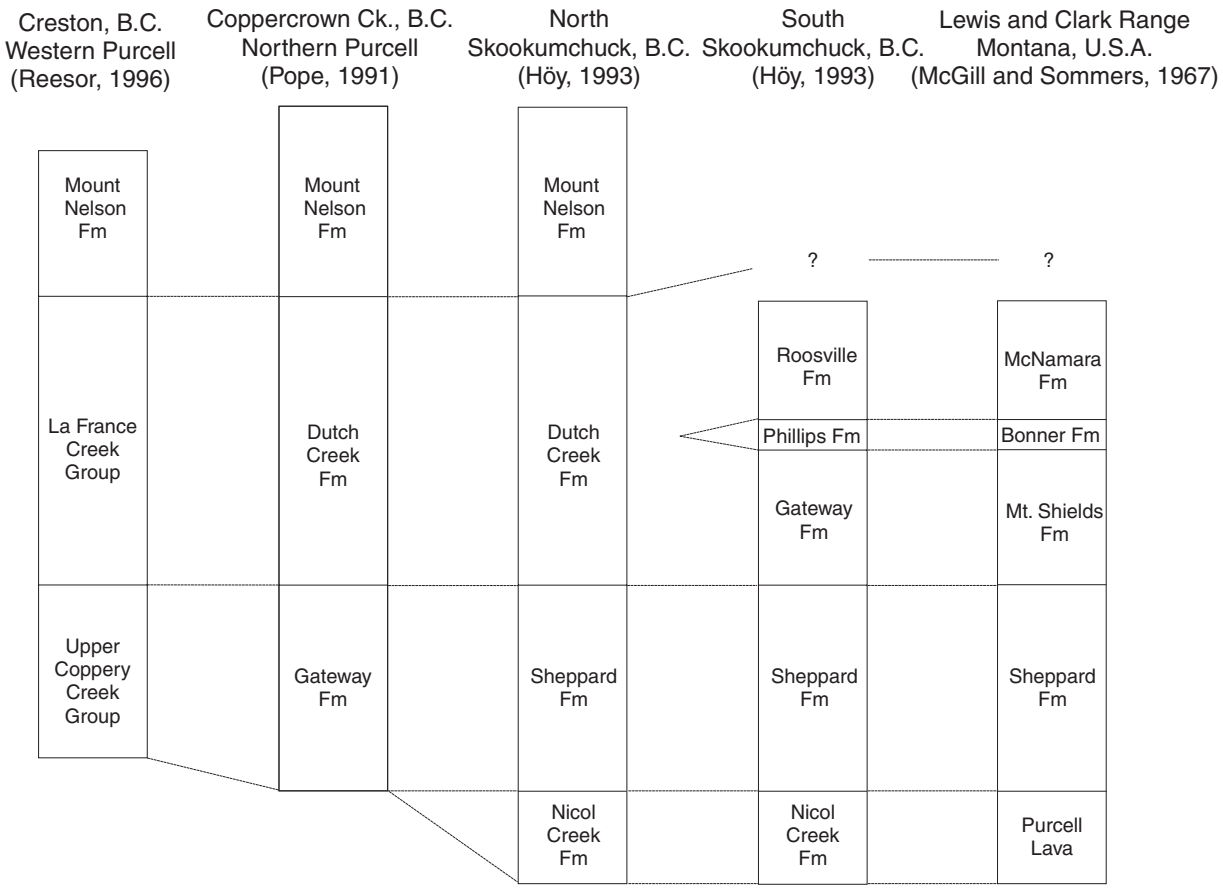

Figure 2. Nomenclature for the formations of the upper Belt Supergroup–Purcell Supergroup (*after* McMechan, 1981; Höy, 1993).

North Skookumchuck sections (Sheppard, Dutch Creek, and Mount Nelson formations)

Section D

Twenty-four metres of section were measured (Table 5) across the Sheppard Formation (Fig. 1b). The section consists of fine- to medium-bedded, green siltstone interbedded with medium-grained, grey, dolomitic, algal-laminated sandstone beds. The section gradually coarsens upward from siltstone dominant to sandstone dominant.

Section E

Eighty-six metres of section were measured (Table 6) across the Dutch Creek Formation (Fig. 1b). The section consists of medium-dark grey, finely bedded argillite. Dolomitic purple-grey sandstone is interbedded with argillite through the bottom one third of the section.

Section F

Ninety metres of section were measured (Table 7) across the Dutch Creek Formation (Fig. 1b). The section consists of medium-dark grey argillite-siltstone.

Section G

One hundred and sixty metres of section were measured (Table 8) across the Dutch Creek and Mount Nelson formations (Fig. 1b). The section is divided into three units: dark green argillite and purple-grey dolomitic sandstone in two broad, fining-upward sequences; purple-grey dolomitic sandstone and green argillite that coarsens upward to be dominated by dolomitic sandstone facies; and well sorted, white quartzite.

Depositional environment

Sedimentary facies of the Sheppard Formation described in 'Section D' are characteristic of an intertidal shallow-marine depositional environment. Sedimentary facies of the

Table 2. Detailed description of section A (UTM 5447845N, 531823E).

Unit	Description	Unit (m)	Total (m)
9	Sandstone and siltstone: sandstone: purple-grey, medium-grained, dolomitic, individually bedded (15.0–20.0 cm thick); siltstone: green, fine-grained, thinly bedded (0.3–2.0 cm thick)	7.50	39.75
8	Sandstone: purple-grey, medium-grained, dolomitic, massive bed, minor crossbedding	1.50	32.25
7	Siltstone: medium green, fine-grained, interbedded massive (10.0–15.0 cm thick) beds and finely bedded sections (0.5–1.0 cm thick)	7.95	30.75
6	Sandstone: purple-grey, medium-grained, dolomitic, massive bed, minor crossbedding	1.05	22.80
5	Siltstone: medium green, fine-grained, finely bedded (0.5–1.0 cm thick)	1.50	21.75
4	Sandstone and siltstone: Sandstone: purple-grey, medium-grained, dolomitic; siltstone: green, fine-grained, thinly bedded	3.60	20.25
3	Siltstone: medium green, fine-grained, finely bedded (0.5–3.0 cm thick)	2.10	16.65
2	Sandstone: purple-grey, medium-grained, dolomitic, massive beds (0.4–0.6 m thick), interbedded with occasional fine-grained bed (1.0–3.0 cm thick), minor crossbedding	5.10	14.55
1	Sandstone: green-red, fine-grained, bedded, interbedded with local medium green siltstone bed	9.45	9.45

Table 3. Detailed description of section B (UTM 5448556N, 530959E).

Unit	Description	Unit (m)	Total (m)
10	Siltstone: light to medium green, fine-grained, fine beds (0.5–3.0 cm thick) interbedded with massive beds (5.0–20.0 cm thick), low-angle crossbedding in thicker massive beds	21.00	122.55
9	Siltstone: green to purple, very fine-grained, very massive, bedding present; unit is very massive compared to unit 8	21.00	101.55
8	Siltstone: light green, fine-grained, massive beds (10.0–20.0 cm thick), rare finely laminated, parallel bed	26.70	80.55
7	Siltstone: medium green to purple, fine-grained, bedded (5.0–10.0 cm thick), parallel to wavy bedding	5.55	53.85
6	Argillite: grey, dull grey, very fine-grained, very finely bedded, hard	1.80	48.30
5	Siltstone: medium green to purple, fine-grained, large-scale wavy beds (swales)	4.80	46.50
4	Siltstone: medium green, fine-grained, massive, oxidation along fracture plains	1.20	41.70
3	Siltstone: medium green, fine-grained, massively bedded, inter-bedded with secondary green, fine-grained, massive sandstone beds (20.0–25.0 cm thick), crossbedding, no sedimentary structures in siltstone; all are in sandstone beds	27.00	40.50
2	Siltstone: light and dark green, very fine-grained, dark green, slightly coarser grained, light green, fine-grained in general, finely bedded (0.5–1.0 cm thick)	1.50	13.50
1	Siltstone: medium green, fine-grained, massively bedded (0.1–10.0 cm thickness, mostly >5.0 cm), oxidized laminations between beds	12.00	12.00

Table 4. Detailed description of section C (UTM 5575176N, 545345E).

Unit	Description	Unit (m)	Total (m)
5	Sandstone: purple-grey, medium- to coarse-grained, finely bedded (0.1–0.3 cm); chalky, weathered appearance; dolomitic, minor argillite beds (about 0.3 cm thick) occur in bottom about 25.0 m	340.00	1000.00
4	Argillite: very dark grey-green, fine-grained, laminated (<1.0 cm thick), subtle coarsening upwards with occurrence of fine-grained, grey sandstone beds, wavy to lenticular bedding	65.00	660.00
3	Argillite and sandstone: argillite: light to medium green, very fine- grained, finely bedded (1.0–3.0 cm); sandstone: grey, medium-grained, crosslaminations, ripples; two lithofacies exhibit wavy bedding; sedimentary structures are observed in sandstone beds and lenses, very turbulent	65.00	595.00
2	Argillite and sandstone: argillite: dark grey, fine-grained, lenticular bedding with siltstone (lighter grey); sandstone: rusty grey, medium- to coarse-grained, bedded (10.0–40.0 cm thick), sand units (2.0–3.0 m thick) very rare only two in entire unit, very obvious	280.00	530.00
1	Argillite: dark grey-green, fine-grained, laminated (<1.0 cm thick), subtle coarsening upwards with occurrence of fine-grained, grey sandstone beds, wavy to lenticular bedding	250.00	250.00

Table 5. Detailed description of section D (UTM 5527691N, 571114E).

Unit	Description	Unit (m)	Total (m)
11	Algal laminates and sandstone: algal laminate: same as unit 7; sandstone: light grey-green, fine-grained, finely bedded (1.0–3.0 cm thick), subtle asymmetric ripples	6.00	24.00
10	Sandstone: grey, medium-grained, poorly sorted, dolomitic, finely laminated (0.2–0.4 cm) fine sandstone laminations, crosslaminations	0.50	18.00
9	Algal laminates: same as unit 7	1.10	17.50
8	Sandstone: light to medium grey, fine- to medium-grained, finely laminated (0.1–0.4 cm thick)	0.35	16.40
7	Algal laminates: like unit 5 with no argillite	1.30	16.05
6	Sandstone: medium grey, coarse-grained, dolomitic, sectioned into thirds by algal laminates	0.35	14.75
5	Siltstone and algal laminates: siltstone: dark grey to black, lenticular to wavy bedding, packages about 20.0–30.0 cm thick; algal laminates: rusty to buff, wavy and lumpy laminations, dolomitic; algal laminate beds are separated by siltstone beds	10.50	14.40
4	Siltstone: light to medium grey, fine-grained, finely laminated (0.1–0.3 cm thick)	0.30	3.90
3	Argillite: medium grey, fine-grained, laminated with light grey, slightly coarser beds (light grey), ripples, crosslaminations, and wavy to lenticular styles of bedding	2.55	3.60
2	Sandstone: grey (salt and pepper), coarse-grained, angular clasts, massive bed (20.0 cm thick), calcareous and/or dolomitic	0.20	1.05
1	Sandstone: light green to buff, medium-grained, finely laminated (0.1–0.3 cm thick), minor algal laminations	0.85	0.85

Table 6. Detailed description of section E (UTM 5535977N, 576775E).

Unit	Description	Unit (m)	Total (m)
10	Argillite: dark grey, very fine-grained, massive, homogeneous	21.75	86.30
9	Sandstone: light grey-green, medium-grained, chalky weathered nature, dolomitic (reacts to acid)	0.75	64.55
8	Interbedded argillite and silt-sandstone: argillite: dark grey, fine-grained, laminated (0.1–0.2 cm thick); sandstone: dark green-grey, fine-grained, bedded (0.0–15.0 cm thick); thin sandstone beds occur in top two-thirds of unit, sandstone beds increase in thickness from zero to 15.0 cm at unit top, sandstone beds pinch and swell	12.00	63.80
7	Sandstone: light grey-green, medium-grained, chalky weathered nature, dolomitic (reacts to acid)	0.30	51.80
6	Siltstone: dark grey, fine-grained, bedded (10.0–30.0 cm thick), graded beds that subtly fine upwards and darken in colour	14.00	51.50
5	Interbedded sandstone and argillite: sandstone: medium grey, fine-grained; argillite: dark grey, very fine-grained; bedded (4.0–10.0 cm thick, both lithofacies), wavy nature to beds, sand clasts occur at tops of some argillite beds	1.00	37.50
4	Sandstone: very dark grey, very fine-grained (near siltstone), thickly bedded (20.0–30.0 cm thick), beds are subtly fin upwards from very fine sandstone to siltstone, subtle ripple (symmetrical) to bed tops	23.25	36.50
3	Silt-argillite: medium-dark grey, fine-grained, finely bedded (0.5–2.0 cm thick), beds are in couplets (1.0–4.0 cm thick) of silt-argillite (slightly lighter colour) and argillite	0.50	13.25
2	Argillite: very dark grey, very fine-grained, laminated (~0.1–0.2 cm thick), symmetrical ripples on exposed planar surfaces (plunging 320° north)	9.75	12.75
1	Siltstone: dark grey, finely bedded (~0.5 cm thick), silt grain size, symmetrical ripples on exposed planar surfaces (plunging ~350° north)	6.00	6.00

Dutch Creek Formation described in 'Section E' and 'Section F' are characteristic of a shallow-water lagoonal depositional environment.

South Skookumchuck sections (Van Creek, Sheppard, Gateway, Phillips, and Roosville formations)

Section H

Approximately 1430 m of section were mapped (Table 9) across the Van Creek, Sheppard, and Gateway formations (Fig. 1b). The transect is divided into three units: bedded, light green siltstone containing good ripple surfaces (Van Creek Formation); light green, sandy siltstone, rusty dolomitic sandstone, buff-rusty sandy algal laminates and stromatolite beds, and purple quartz-rich sandstone (Sheppard Formation); and light and dark green, bedded siltstone (ripples, desiccation cracks, and rip-up clast beds) (Gateway Formation).

Section I

Seventy-six metres of section was measured (Table 10) across the Gateway Formation (Fig. 1b). The section consists of alternating light to medium green silt and very fine-grained sandstone. Both sharp and graded beds occur, with local subtle ripples.

Section J

Fifty-nine metres of section were measured (Table 11) and 340 m were mapped (Table 12) across the Gateway, Phillips, and Roosville formations (Fig. 1b). The total combined transect and measured section is divided broadly into three units: finely bedded green siltstone, purple micaceous interbedded massive sandstone and finely bedded siltstone, and grey-green argillite-siltstone interbedded with occasional rusty dolomitic sandstone beds (~10.0 cm thick).

Depositional environment

Depositional facies grade from the intertidal sandstone of the Van Creek and Sheppard formations described in 'Section H', to shallow-water lagoonal siltstone and argillite of the Gateway Formation described in 'Section H' and 'Section I', to subaerial, shallow-water sandstone of the Phillips Formation described in 'Section I'. Rocks of the Phillips Formation are generally characterized by sedimentary structures like crossbedding and ripple crosslaminations, and mud cracks (Price, 1964). The distinct lack of these structures in the Phillips Formation near Skookumchuck indicates a change in depositional environment. The Rossville Formation, overlying the Phillips Formation, exhibits very similar sedimentary characteristics to those of a lagoonal tidal-flat environment observed in rocks of the Dutch Creek

Table 7. Detailed description of section F (UTM 5536288N, 578769E).

Unit	Description	Unit (m)	Total (m)
13	Argillite: dark grey, fine-grained, laminated (0.1–0.4 cm thick) in 7.0–15.0 cm thick packages, 1.0–2.0 cm thick, sandstone beds commonly are continuous, but locally occur as lenses	9.75	90.75
12	Argillite: medium grey, thinly bedded (0.5–3.0 cm), slightly coarser compared to unit 11, interbedded light grey, fine-grained dolomitic sandstone beds (about 1.0 cm thick)	2.25	81.00
11	Argillite: dark grey, fine-grained, bedded (10.0–15.0 cm thick), interbedded with occasional hemitized medium-grained sandstone bed (1.0–2.0 cm thick), 90% argillite through unit	2.60	78.75
10	Interbedded argillite and sandstone: argillite: grey, fine- grained, laminated (about 0.1 cm thick); sandstone: medium grey, very finely bedded (about 1.0–4.0 cm thick), no reaction to acid, thick sand bed (about 15.0 cm thick) with a few purple lenses of sand 3–4 cm thick and mark the unit top; unit grades from 25% argillite at base to 75% argillite at top, beds pinch and swell, load casts of sandstone into argillite, bedding is mildly turbulent	3.40	76.15
9	Interbedded argillite and sandstone: argillite: medium-dark grey, finely laminated (0.1–1.0 cm thick), mild waviness to bed tops, but mainly parallel; sandstone: medium grey, fine- to medium-grained, mild graded beds (about 5.0–10.0 cm thick); sandstone beds are spaced about 1.0 m through the unit, subtle load casts occur at base of sandstone beds into argillite	18.00	72.75
8	Argillite: medium grey, thickly bedded (about 1.0–1.5 m thick), large argillite beds separated by fine-grained hemitized sandstone beds (10.0–20.0 cm thick), sandstone beds are dolomitic (react to acid). Unit grades from about 60% argillite dominate at base to about 40% argillite at top.	13.10	54.75
7	Siltstone: light green-grey, coarse grained silt, finely bedded to laminated (0.5–1.0 cm thick), thin argillite beds occur rarely through unit and are of similar thickness, mild symmetrical ripples occasionally at tops of beds	2.90	41.65
6	Quartz vein: milky white, brecciated with hemitized sandstone fragments (angular to subangular)	0.50	38.75
5	Argillite: medium grey, fine-grained, higher silt-size grain content that unit 3, bedded (5.0–20.0 cm thick), thin hemitized drapes separate beds commonly	4.50	38.25
4	Argillite: light green-grey, fine-grained, bedded (4.0–15.0 cm thick), mild colour grading in beds lightening upwards; rare dolomitic fine- to medium-grained sandstone beds (0.5–5.0 cm thick, very rarely about 25.0 cm)	6.75	33.75
3	Overburden	6.00	27.00
2	Argillite: light green-grey, fine-grained, bedded (4.0–15.0 cm thick), mild colour grading in beds lightening upwards; rare dolomitic fine- to medium-grained sandstone beds (0.5–5.0 cm thick, very rarely about 25.0 cm)	7.00	21.00
1	Interbedded siltstone and sandstone: siltstone: light green-grey, fine-grained, finely bedded (1.0–10.0 cm thick); sandstone: pink-grey, fine-grained, finely bedded (about 0.75 cm thick); beds are in couplets of sandstone and siltstone, beds are obvious and sharp, slight rippling to sandstone bed tops (reasonably symmetrical)	14.00	14.00

Table 8. Detailed description of section G (UTM 5542009N, 584425E).

Unit	Description	Unit (m)	Total (m)
13	Sandstone: white, medium-grained, well sorted, well bedded (20.0–75.0 cm thick), ripples (about 10.0 cm wave length, trending 335° and plunging 39°), flume cast–like structures	>20.00	>150.80
12	Sandstone: pink-purple grey, pink-purple grey, medium grain size, 2.0–50.0 cm bed thickness (large range), very rare 2.0–4.0 cm thick green argillite beds and lenses, mud drapes at bed boundaries, flume cast- to ripple-like structures, coarse pyrite crystals	40.50	130.80
11	Sandstone and argillite: medium to grey green, medium grain size, laminated, interbedded with argillite: medium green, very fine-grained (7.0–12.0 cm bed thickness); unit cleans upwards and becomes totally sand dominated near top, with only minor argillite drapes and lenses	16.50	90.30
10	Siltstone to argillite: siltstone: olive green, silt grain size, clean, ripples, crosslaminations (in thicker beds); argillite: black, very fine-grained, with minor silt lenses in thicker beds, finely bedded siltstone grades upwards evenly into argillite, wide range of bed thickness, 1.0–20.0 cm thick, bed thickness is random throughout unit	18.00	73.80
9	Sandstone to argillite: sandstone: grey green, fine-grained; siltstone: green, silt grain size; argillite: black, very fine-grained, sequence is thickly bedded sandstone and siltstone at base (20.0–25.0 cm thick) that gradationally fines upwards to be thinner bedded siltstone and argillite (5.0–7.0 cm thick)	16.50	55.80
8	Interbedded argillite and siltstone: argillite: black, very fine-grained; siltstone: medium green, silt grain size, finely bedded, grades to argillite in two packages in unit; unit splits into four parts: silt finely bedded, graded silt and argillite (15.0 cm thick beds), silt finely bedded, and graded silt and argillite (4.0–6.0 cm thick beds), all parts are even in thickness	9.75	39.30
7	Argillite: very dark grey to black and olive green, black facies: silt-mud grain size, massive, 24.0–25.0 cm thick beds, green facies: silt grain size, rare very fine laminations, mild colour grading (darkening upwards), 20.0–25.0 cm thick beds (2.0–4.0 cm with laminations)	6.00	29.55
6	Argillite: medium and dark green, finely laminated to mildly graded, thin beds (0.5–5.0 cm thick), minor crosslaminations (shallow angle), interbedded with grey-green, medium grain sized sandstone beds (25 cm thick), massive beds, sandstone appears every 1.5–2.0 m, clean sharp contacts between beds	0.90	23.55
5	Interbedded argillite and sandstone: argillite: medium to dark green, mud-silt grain size, parallel laminations; sandstone: grey, very fine to fine grain size, parallel bedded, minor fining upwards in grain size with in individual beds (8.0–12.0 cm thick)	5.85	22.65
4	Sandstone: grey to green-grey to green, medium- to coarse-grained, massive bed, interbedded with argillite, dark green, finely laminated, 15 cm thick every 1.5–2.0 m	7.50	16.80
3	Argillite: medium and dark green, finely laminated to mildly graded thin beds (0.5–5.0 cm thick), minor crosslaminations (shallow angle), interbedded with grey-green, medium-grained sandstone beds (25.0 cm thick), massive beds, sandstones appear every 1.5–2.0 m, clean sharp contacts between beds	1.80	9.30
2	Sandstone: grey to green, medium- to coarse-grained, massive bed	1.50	7.50
1	Argillite: medium and dark green, finely laminated to mildly graded thin beds (0.5–5.0 cm thick), minor crosslaminations (shallow angle), interbedded with grey-green, medium-grained sandstone beds (25 cm thick), massive beds, sandstones appear every 1.5–2.0 m, clean sharp contacts between beds	6.00	6.00

Table 9. Detailed description of mapped section H (UTM 5522675N, 5877497E).

Unit	Description	Unit (m)	Total (m)
3	Siltstone and sandstone: siltstone: light green, fine-grained, bedded (0.5–10.0 cm thick), graded beds, rip-up clast beds (tempestites), noncalcareous, minor algal laminate beds, desiccation cracks, dewatering structures	230.00	1430.00
2	Sandstone and siltstone: sandstone: light green to buff, fine- to medium-grained, finely bedded (1.0–4.0 cm thick), stromatolite (10–20 cm diameter) and/or algal mat beds (about 1.0–1.5 m thick), massive sandstone beds (about 1.0 m thick), symmetric ripples (at bed tops), tempestites (fragmented beds), indicative of broad recessive cycles; siltstone: green, coarse-grained, interbedded with sandstone locally	700.00	1200.00
1	Sandstone: light to dark green, fine-grained, graded beds (4.0–10.0 cm thick), fining upwards, (?) proximal turbidites	500.00	500.00

Table 10. Detailed description of section I (UTM 5530950N, 587044E).

Unit	Description	Unit (m)	Total (m)
11	Sandstone: green-grey, fine-grained, bedded (3.0–25.0 cm thick), 0.5 m thick algal laminated bed, beds gradually thicken to the algal bed, and gradually thin to the top of the unit, subtle ripples and crosslaminations	3.00	76.50
10	Sandstone and siltstone: sandstone: grey-green, fine-grained, thickly bedded (about 25.0 cm thick); siltstone: dark green, fine-grained, thinly bedded (3.0–5.0 cm thick); thick sandstone beds are spaced by thin siltstone beds, sharp contacts, subtle parallel laminations in siltstone beds	3.20	73.50
9	Same as units 5 and 7	2.90	70.30
8	Overburden	4.00	67.40
7	Same as unit 5	3.40	63.40
6	Sandstone; green-buff, very fine- to fine-grained, coupled bedding, similar to unit 5, no siltstone, gradational bed thickening upwards from 4.0–5.0 cm to 25.0–30.0 cm at top, grade quickly over about 1.0 m. After about 3.0 m bedding is lost and unit becomes homogenous.	5.50	60.00
5	Sandstone and siltstone: sandstone: green, very fine-grained, individual beds (2.0–4.0 cm thick and rare about 25.0 cm thick beds) dominate lithofacies, beds thicken upwards in unit; siltstone: medium-dark green, fine-grained, thinly bedded (0.5–1.5 cm thick); general coarsening upwards of facies, where fine-grained sandstone becomes very dominate at the unit top, ripples (at bed tops) and crosslaminations (in sand beds)	7.70	54.50

Formation to the north. Perhaps shifts in sedimentary facies mark a northward shift of decreasing depositional energy away from a southwestern sedimentary source (Ross and Villeneuve, 2003).

DISCUSSION

Two major changes in the stratigraphic nomenclature of the Purcell Supergroup are La France Creek Group's replacement of the Dutch Creek Formation to the west, and replacement of the Dutch Creek Formation to the south by the Gateway, Phillips, and Roosville formations. The authors' measured stratigraphic sections suggest that there are real sedimentological differences between the La France Creek Group and Dutch Creek Formation. The La France Creek Group is dramatically thinner and lacks the thick black argillite sequences characteristic of the Dutch Creek Formation (*see* 'Section C', 'Section E', and 'Section F'). The authors interpret these changes as reflecting proximity of the La France Group to the original western margin of the Purcell Basin. Alternatively, absence of argillite may be due to the preferential flow of argillite from the limb to the hinge of the Purcell anticlinorium during late Cretaceous tectonism. Further fieldwork and the measuring of detailed sections around the limb to hinge region of the anticlinorium will test these two opposing theories.

A northward-tapering micaceous sandstone unit, the Phillips Formation, separates the Gateway and Roosville formations. Without this sandstone, the Gateway and Roosville formations cannot be distinguished from the Dutch Creek Formation. According to Ross and Villeneuve (2003), a change to the architecture of the Purcell Basin or of the source terrain explains the origin of the northward-tapering Phillips Formation sandstone. Alternatively, postdepositional faulting may explain its absence to the north. Further mapping is required to test these models. Explanation of the sandstone origin and geometry as products of syndepositional processes has strong implications for SEDEX exploration within the upper Purcell Supergroup.

Table 10. (cont.)

Unit	Description	Unit (m)	Total (m)
4	Sandstone: light-medium green, thick bedded (10.0–15.0 cm), couplets of thin, medium-grained sand (2.0–4.0 cm thick) overlain by very fine-grained sand (8.0–11.0 cm thick), symmetrical to subtly asymmetric ripples (lower units of couplets)	9.30	46.80
3	Interbedded sand-siltstone and argillite: sand-siltstone: light green, silt grain size with sand, laminated (0.1–2.0 cm thick), subtle rippling to lamination tops and bottoms; argillite: dark green, very fine-grained with silt laminations, subtle ripples and wavy crosslaminations marked by silt-mud drapes; graded beds (4.0–20.0 cm thick), unit generally coarsens upwards	14.25	37.50
2	Sandstone: green, couplets of fine-grained sandstone and fining upwards sandstone beds (individual beds are 0.75–7.0 cm thick), symmetrical and subtly asymmetric ripples, crosslaminations, and possibly dewatering structures	3.00	23.25
1	Sandy argillite: light-medium green, silt to very fine sand grain size, fining upwards, graded (dark fine to light coarse) beds (7.0–11.0 cm thick), occasional sandstone bed (1.0–3.0 cm thick) with faint crosslaminations, mud drapes commonly separate beds	20.25	20.25

Table 11. Detailed description of measured portion of section J (UTM 5533196N, 586228E).

Unit	Description	Unit (m)	Total (m)
11	Siltstone: light-dark green, fine- to coarse-grained, laminated (0.2–0.4 cm thick, interbedded with rare, light pink, medium- to coarse-grained sandstone (10.0–20.0 cm thick), subtle ripples	3.30	59.85
10	Interbedded siltstone and sandstone: siltstone: purple, fine-grained, laminated (0.2–0.5 cm thick); sandstone: pink-purple, very fine grained; 3.0–6.0 cm thick beds of fine sand and silt with occasional grey, medium- to coarse-grained, individual beds (about 10.0 cm thick)	3.20	56.55
9	Interbedded siltstone and sandstone: siltstone: light green, fine-grained, laminated (0.2–0.5 cm thick); sandstone: pink, coarse-grained, massive beds (10.0–15.0 cm thick); sandstone beds are spaced about every 2 m and spaced by siltstone sediment packages	17.00	53.35
8	Sandstone: pink-grey, medium- to coarse-grained, massive thick bed, very subtle sporadic laminations, quartz-rich, numerous dark green argillite clasts (1.0–2.0 cm)	3.80	36.35
7	Interbedded siltstone and sandstone: siltstone: light green, fine-grained, laminated (0.2–0.5 cm thickness); sandstone: pink, coarse-grained, massive beds (20.0–30.0 cm thick); sandstone beds are spaced about 2 m and spaced by siltstone sediment packages	10.15	32.55
6	Sandstone: pink-grey, medium- to coarse-grained, massive thick bed, very subtle sporadic laminations, quartz-rich	1.00	22.40
5	Interbedded siltstone and argillite: siltstone: green, fine-grained, finely laminated (about 0.2 cm thick), wavy parallel laminations; argillite: light beige, very fine-grained (near mudstone), massive beds (4.0–7.0 cm thick); argillite beds scour down into upper laminations of siltstone, forming asymmetric ripples at lithofacies interface	1.10	21.40
4	Sandstone: pink-grey, medium- to coarse-grained, single massive thick bed	0.40	20.30
3	Siltstone: light green, fine-grained, finely laminated (0.1–0.4 cm thick), dark green mud-silt drapes separate lamina	4.50	19.90
2	Argillite: dark green, fine-grained, bedded (4.0–5.0 cm thick), finely parallel laminated (0.1–0.2 cm) to lenticular bedding, small-scale asymmetric ripples, very fine-grained sand laminations and lenses, argillite more than 60% of facies	13.80	15.40
1	Siltstone: light green, fine-grained, finely laminated (0.1–0.4 cm thick), dark green mud-silt drapes separate lamina	1.60	1.60

Table 12. Detailed description of mapped section J, stratigraphically directly on top of measured section J (UTM 5533402N, 586310E).

Unit	Description	Unit (m)	Total (m)
6	Siltstone and sandstone: siltstone: light-medium grey-green, fine-grained, finely bedded (0.1–0.4 cm thick, similar to siltstone of unit 5; sandstone: grey-rusty, medium-grained, single beds (about 10.0 cm thick), dolomitic	85.00	340.00
5	Siltstone: light-medium green, fine-grained, finely bedded (about 1.0 cm thick), rip-up clast beds (mild imbrication of clasts 176° orientation), ripples, crosslamination	75.00	255.00
4	Argillte and siltstone: argillite: dark grey, fine-grained, laminated (0.1–0.3 cm thick), fissile; siltstone: grey-rusty, finely bedded (<1.5 cm), thin rip-up clast beds (?tempestites)	45.00	180.00
3	Argillite: dark grey, fine-grained, laminated (0.1–0.3 cm thick), fissile	75.00	135.00
2	Siltstone: mauve-green, medium-grained, large percentage of muscovite	40.00	60.00
1	Siltstone: light-medium green, laminated (0.1–0.5 cm thick), dark green mud drapes separate laminations, rip-up clast beds (?tempestites), ripples, crosslaminations	20.00	20.00

FUTURE WORK

Immediate future work will include drafting of detailed measured sections, construction of downplunge projections, and structural data analysis. Work planned for the near future will include: geochronology studies of U/Pb detrital zircon, combined with past studies from the Belt Supergroup–Purcell Supergroup, to further constrain sedimentary provenance of upper Purcell Supergroup rocks; and continued field mapping to further constrain changes in sedimentary facies and to complete stratigraphic columns from focal areas across the Purcell Basin.

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