



**GEOLOGICAL SURVEY OF CANADA  
OPEN FILE 6148**

**Seventeen Measured Sections of Cambrian Mount Clark  
and Mount Cap formations, northern Mackenzie Mountains  
and Franklin Mountains, Northwest Territories**

**C. Serié, C. L. Bergquist, and L. J. Pyle**

**2009**



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**C. Serié<sup>1</sup>, C. L. Bergquist<sup>2</sup>, and L. J. Pyle<sup>3</sup>**

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## INTRODUCTION

Study of Lower to Middle Cambrian stratigraphy in the northern Mackenzie Mountains, Mackenzie Plain, and Franklin Mountains ([Figure 1](#)) was undertaken during a three-year field programme (2005-2007) carried out by Devon Energy Corporation, Talisman Energy, and the Geological Survey of Canada. This programme was conducted in response to a growing interest in hydrocarbon prospectivity of the area with recent discoveries of gas in Colville Hills and the prospect of the Mackenzie Valley Pipeline. Lower to Middle Cambrian strata occur throughout the Northern Interior Plains which are bordered by the Canadian Shield and the Cordillera to the east and the west respectively. A general stratigraphic framework for Cambrian strata in Mackenzie Plain is mainly known from outcrops along the Mackenzie Mountains to the west, and the Franklin Mountains to the east (Aitken et al., 1973; [Figure 2](#)). Correlation of Mount Clark, Mount Cap and Saline River formations in the subsurface by Dixon and Stasiuk (1998) refined this framework.

New field work on these rocks has expanded the geological database and improved geological understanding of the area. The purpose of this report is to: 1) review the regional stratigraphic framework of the Lower to Middle Cambrian succession and 2) describe 17 measured sections ([Figure 3](#)) based on field studies.

## STRATIGRAPHIC FRAMEWORK

### Mount Clark Formation

Mount Clark Formation, also known as Old Fort Island Formation (Norris, 1965; Balkwill, 1971) was first defined by Williams (1922) from outcrop near Cap Mountain in the southern Franklin Mountains ([Figure 3](#)). The defined type section consists of more than 200.0 m of massive, thick bedded, very fine to fine-grained quartzite, with granules and pebbles near its base, prominent cross-bedding that decreases upward, and abundant *Skolithos* burrows (Aitken et al., 1973). In the subsurface, Mount Clark Formation consists entirely of quartzose sandstone and local conglomerate with the exception of minor amounts of shale and siltstone, with a maximum known thickness of 88.0 m in Good Hope A-40 well (Dixon and Stasiuk, 1998). Mount Clark Formation unconformably overlies Proterozoic and Archaean rocks (i.e., Little Dal Group, upper Katherine Group, Lone Land Formation), and its upper contact is marked by a conformable lithological change to glauconitic sandstone, shale, and dolostone of Mount Cap Formation (Aitken et al., 1973; Pugh, 1993). The formation has been relatively dated to Early Cambrian, as constrained by overlying trilobite-bearing shale and limestone units of late Early Cambrian *Bonnia-Olenellus* Zone (Aitken et al., 1973; Fritz, 1974; [Figure 2](#)). It has been suggested to be of fluvial origin (Maccauley, 1987); however, thorough bioturbation and marine fossils also suggest a shallow marine origin (Hamblin, 1990). Differentiation between Proterozoic and Cambrian units was often problematic, especially where rocks were primarily quartzitic with no trace fossils or bioturbation. *Skolithos* or presence of trilobites was taken as a clear indicator of Cambrian age, however, fluvial facies would not contain either and could well be Mount Clark facies. Correlation of the underlying Little Dal Group units was critical in understanding stratigraphy, tectonics and facies distribution within the Cambrian section.

### Mount Cap Formation

Mount Cap Formation was defined by Williams (1922, 1923) from a succession located on the flanks of Mount Clark in the McConnell Range southern Franklin Mountains ([Figures 1, 3](#)). The formation is made up of glauconitic sandstone, quartzose and glauconitic dolostone and limestone, and noncalcareous, sandy or silty, red, green, dark grey and black shale (Aitken et al., 1973). It is up to 783.0 m thick in the K'Alo B-62 well, located in the Mackenzie Plain ([Figures 1, 3](#)). The lower contact is conformable with underlying Mount Clark Formation and unconformable with underlying Proterozoic and Archean rocks at the basin margins where it overlaps Mount Clark Formation. The upper contact is characterized by an unconformable contact with overlying Saline River Formation (Dixon, 1997; Dixon and Stasiuk, 1998); however, the scale of the unconformity is poorly documented. Fossiliferous intervals containing trilobites indicate that Mount Cap Formation spans the lower-Middle Cambrian boundary and ranges into Middle Cambrian *Bonnia-Olenellus* to *Glossopleura* zones (Aitken et al., 1973; Fritz, 1970, 1971). It is suggested to have been deposited in a low energy marine setting based on extensive bioturbation, carbonate lithologies, and shelly material (Dixon and Stasiuk, 1998).

### Saline River Formation

Saline River Formation was first described by Williams (1923) as red and green shale with salt casts and gypsum beds. It was divided into three members by Meijer Drees (1975) and adopted by Dixon and Stasiuk (1998) as: Lower clastic, Evaporite, and Upper clastic member. The Evaporite member mainly consists of salt with interbedded shale, dolostone and anhydrite, whereas the two clastic members consist of interbedded shale, dolostone, and anhydrite. The formation was likely deposited in a restricted marine basin, with evaporites formed under subtidal conditions in relatively shallow water (Meijer Drees, 1986; Dixon and Stasiuk, 1998).

### DESCRIPTION OF MEASURED SECTIONS

A total of 17 measured stratigraphic sections containing Mount Clark and Mount Cap formations are described ([Table 1](#), [Figure 3](#)).

Location	Name	Latitude	Longitude
1	Inlin Brook	64.2888497	-126.5444104
2	Little Bear River	64.4791568	-126.7894765
3	Carcajou Canyon	64.6713602	-127.1613386
4	Dodo Canyon	64.8966694	-127.2522608
5	Sheep River	64.8551624	-126.9551056
6	Mirror Lake	64.8050213	-126.9745565
7	Clark Mountain	64.43467530	-124.2307016
8	Blackwater Lake	64.046585	-123.45511
9	Cap Mountain	63.408714	-123.23529
10	Fan Creek	65.16602390	-128.3584991
11	Imperial River Canyon	65.1063221	-128.0315875
12	Loretta Canyon	65.0897419	-127.9392029
13	"Jennifer Canyon"	65.0502582	-127.7834975
14	Graffe River	64.9926143	-127.6452914
15	Katherine Creek	64.9297967	-127.5677209
16	"Pete Creek"	64.9420946	-127.5736459
17	Echo Falls	64.900297	-127.3123156

**Table 1.** List of measured sections of Mount Clark and/or Mount Cap formation(s).

## Section 1 Inlin Brook

**Section Description:** Section includes Mount Clark(?) and Mount Cap formations unconformably overlying Proterozoic Little Dal Group ([Figure 4](#), [Photos 4a to 4f](#)). Measurement began at the base of Mount Clark Formation(?), on the western side of Inlin Brook (~3 km upstream of confluence with Keele River) where the full section is exposed in an overturned fold and thrust complex. Little Dal Group is thrust over Saline River Formation, with an overturned fold in the hanging wall of the thrust, which does not extend through Keele River fault zone. The fold is cored by Little Dal Group (red nodular and red-banded, grey “Dead End Shale” of Aitken et al., 1973) and a white banded interval of quartzite (tentatively assigned to Mount Clark Formation) which cuts down about 15-20 m into Little Dal Group. The footwall consists of Mount Cap black shales juxtaposed against Saline River Formation by a poorly exposed through-going thrust fault. Trilobite specimens (C-518658) were collected from outcrop and identified by R. Ludvigsen (pers. comm., 2008) as *Olenellus gilberti* (Meek), *Syspacephalus* sp., *Zacanthoides* sp., *Olenellus* Zone (Dyeran Stage, late Early Cambrian). The section is located in Carcajou Canyon map area (96D/07), and was measured by C. Bergquist and assistants in July, 2006.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b>Mount Cap Formation (incomplete)</b>			
4	Shale: black, interbedded with grey sandstone that weathers orange; very fine-grained. Fossil hash is concentrated at top of siltstone/sand intervals. Shale covered by scree from slump block and adjacent fault zone.	18.0	38.2
3	Sandstone: greyish-green, fine-grained, 20.0-45.0 cm thick bed, increasingly bioturbated upwards to scree-covered contact with overlying black shale.	8.7	20.2
2	Quartzite: as below, some cross-bedding; hardground with numerous borings at uppermost contact.	1.5	11.5
<b>Mount Clark Formation (?)</b>			
1	Quartzite: dark grey to white, very fine-grained, well cemented (similar to down-cutting outcrop across river). Basal 2-3 m across river contains well-rounded cobbles up to 20 cm in diameter. Unit is a white band in between Little Dal Group and Mount Cap Formation; it could be Mount Clark Formation or thickened Mount Cap quartz sand as seen in Dodo Canyon and Mirror Lake sections. Mount Cap is regionally thin here.	10.0	10.0

## Section 2 Little Bear River

**Section Description:** Section includes Little Dal Group unconformably overlain by Mount Clark(?) and Mount Cap formations ([Figure 5](#), [Photos 5a to 5f](#)). Contact between Little Dal Group and overlying Mount Clark(?) and Mount Cap formations is covered by faulted rocks with drag distortion. Measurement began in Little Dal Group along north side of Little Bear River and followed downstream to an incomplete section of Mount Cap Formation. Section is located in Carcajou Canyon map area (96D/07), and was measured by C. Bergquist and assistants in July, 2006. Aitken et al. (1973) described this section as their Section U-13, with trilobites indicative of the *Glossopleura* Zone (Middle Cambrian; identifications by W.H. Fritz, GSC internal report C19-1969-WHF).

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b>Mount Cap Formation (incomplete)</b>			
7	Dolostone: thin-bedded (averaging 2.5 cm thick in lower part) interbedded with shale; upper part of the unit is less than 20% dolostone.	7.6	80.7
6	Shale: fissile, layers of aphanitic dolostone; trilobites from this unit reported in GSC internal report (C19-1969-WHF).	24.4	73.1
5	Dolostone: medium-bedded, weathers tan; argillaceous and silty, carbonaceous shale partings, sandstone beds at base.	11.6	48.7
4	Shale: black, poorly exposed.	4.6	37.1
3	Dolostone: very finely crystalline, thick-bedded, silty to finely sandy, abundant pyrite, green-weathering along top 2.5 cm of unit.	2.1	32.5
<b>Mount Clark Formation (?)</b>			
2	Quartzite or quartz sandstone: varies from clean, thick-bedded, fine-grained sandstone, with thin beds of cobble and pebble conglomerate, to <i>Skolithos</i> -burrowed, thin-bedded less well sorted, to silty and argillaceous, unsorted, thin-bedded with argillaceous siltstones.	15.2	30.4
<b>Little Dal Group (incomplete)</b>			
1	Dolostone: massive, stromatolitic dolostone interbedded with grey dolostone.	15.2	15.2

### Section 3 Carcajou Canyon

**Section Description:** Section includes Mount Clark(?) and Mount Cap formations, and lower part of Saline River Formation ([Figure 6](#), [Photos 6a to 6f](#)). Measurement began at base of Mount Clark(?)/Mount Cap formations at a subtle angular unconformity with Proterozoic strata (i.e., Proterozoic strata dip 012°, strike 34° NE, and Cambrian strata dip 008°, strike 36° NE). Measured section extends downstream along south side of river from units 1 to 22, and to north side up a shaley side gully from units 23 to 29. Trilobites (C-518655) were collected from outcrop in the upper part of Mount Cap Formation, identified by R. Ludvigsen (pers. comm., 2008) as *Glossopleura boccar* (Walcott), *Bathyriscus petalus* (Fritz), and *Poliella* sp. of the *Glossopleura* Zone (Late Delamarian Stage, Middle Cambrian). Section is located in Carcajou Canyon map area (96D/11), and was measured by C. Bergquist and assistants in July, 2006.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b>Saline River Formation (incomplete)</b>			
29	Sandstone: medium grey, weathers orange, occurs in 0.7-1.0 m beds; interbedded with algal laminated dolostone.	1.50	86.30
<b>Mount Cap Formation</b>			
28	Shale: brown to black, silty.	8.00	84.80
27	Shale: brown to black, silty, muddier towards the top.	28.00	76.80
26	Shale: black, muddy; with trilobites, especially in fist-sized silty cemented nodules.	5.00	48.80
25	Shale: black, silty.	2.00	43.80
24	Shale: black, silty; with trilobitic horizons.	4.00	41.80
23	Shale: black, silty.	4.00	37.80
22	Dolostone: grey, weathers light brown, massive.	5.00	33.80
21	Shale: brown to black, silty.	1.20	28.80
20	Dolostone: massive, occurs in 3.0-5.0 cm beds.	1.00	28.60
19	Shale: wavy bedded, interbedded with dolomitic siltstone.	4.00	27.60
18	Siltstone: fine-grained, nodular, ripple-bedded, thoroughly bioturbation; grading up into dolostone, dark grey, weathers black to light brown, flaggy thick beds with hummocky cross stratification (HCS).	2.00	23.60



17	Shale: black, interbedded with nodular dolomitic siltstone.	2.00	21.60
16	Siltstone: black, nodular.	1.02	19.60
15	Siltstone: black, 3.0 cm bed with pyrite; conical fossils and trilobite fragments (lag deposit). "Cone" bed marker.	0.03	18.58
14	Siltstone: black, recessive, with multiple 3.0 cm diameter, light brown-weathering nodules.	1.00	18.55
<b><i>Mount Clark Formation (?)</i></b>			
13	Covered: recessive shale.	2.00	17.55
12	Sandstone: grey, weathers light brown, very fine grained, horizontal burrows.	2.00	15.55
11	Sandstone: glauconitic, swaley cross-stratification (SCS).	0.25	13.55
10	Sandstone: bioturbated.	0.60	13.30
9	Sandstone: massive, bioturbated.	1.10	12.70
8	Sandstone: weathers light brown, quartzitic, swaley cross-stratification (SCS).	0.20	11.60
7	Sandstone: quartzitic, swaley cross-stratification (SCS).	3.00	11.40
6	Sandstone: quartzitic, partially covered and recessive into fault zone; section is down-dropped, striking 300°, approximately vertical fault with 10.0 m throw, NE (downstream) side down.	4.00	8.40
5	Sandstone: light grey, weathers light brown, quartzitic, fine-grained, swaley cross-stratification (SCS).	1.00	4.40
4	Sandstone: green, weathers pink, glauconitic, occurs in irregular to planar 2.0-12.0 cm thick, thoroughly bioturbated.	1.00	3.40
3	Sandstone: dark greenish-grey, weathers rusty orange, bioturbated.	0.20	2.40
2	Sandstone: light brown, swaley cross-stratification (SCS).	0.20	2.20
1	Sandstone: glauconitic (?), medium-grained, occurs in 5.0-10.0 cm beds.	2.00	2.00

## Section 4 Dodo Canyon

**Section Description:** Five separate partial sections of Cambrian strata in Dodo Canyon: 1) north side river (~80% exposed); 2) valley immediately opposite (1) on south bank of river (upper ~50% exposed); 3) eastward on north bank (partial and covered, upper ~30% exposed); 4) East down river and south bank (partial, upper ~20% exposed); and 5) westernmost back side of “mesa” (lower ~50% exposed). This section description is (1) above, and includes Mount Clark(?) and Mount Cap formations and incomplete underlying and overlying sections of Proterozoic Little Dal Group and Saline River Formation, respectively ([Figure 7](#), [Photos 7a to 7f](#)). Both lower and upper contacts are covered. Measurement began within Little Dal Group along Dodo Creek, approximately 2 km downstream from junction of Echo Creek and Dodo Creek in the Mackenzie Mountain Front. Trilobites (collections C-518650 and C-518651) were collected from outcrop in the upper part of Mount Cap Formation and identified by R. Ludvigsen (pers. comm., 2008), as *Glossopleura* sp. and *Eoptychoparia* sp. (C-518650 only) of the *Glossopleura* Zone (Late Delamaran Stage, Middle Cambrian). Section is located in Carcajou Canyon map area (96D/14), was measured by C. Bergquist and assistants in July, 2006 and described by Aitken et al. (1973; Section MQ-6).

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b><i>Saline River Formation (incomplete)</i></b>			
21	Covered: light grey gypsum talus.	12.2	121.5
<b><i>Mount Cap Formation/ Mount Clark Formation at bottom (?)</i></b>			
20	Shale: non-calcareous, greyish-black to black, papery, in bands 13.0 mm to 15.0 cm thick. Interbedded with limestone, dolomitic, micritic, dark grey, weathering brownish grey, pelloidal grains, abundant pyrite replacing grains. Unit is recessive; contains about 70% shale, 30% limestone. Top 4.5 m mostly limestone, partly dolomitized.	13.7	109.3
19	Shale: dark grey, weathers medium to dark grey, recessive; minor interbeds of dolostone, calcareous, grey, weathers yellowish brown. Unit approximately 90% shale, 10% carbonate.	9.4	95.6
18	Limestone: light to medium grey, weathers rusty to medium grey to yellowish brown, micritic, slightly dolomitic; interbedded with shale, calcareous, dark grey, weathers dark grey to rusty yellowish brown, platy.	1.5	86.2

17	Shale: non-calcareous, very dark grey, papery, recessive; rare interbeds of micritic limestone, argillaceous, dark grey.	18.6	84.7
16	Limestone: dark grey, weathers rusty yellowish orange, micritic, dolomitic, laminated; argillaceous laminae burrowed.	2.7	66.1
15	Shale: dark brownish grey, weathers rusty yellowish orange, recessive, thin interbeds of dolostone.	1.8	63.4
14	Dolostone: dark grey, weathers rusty yellowish-orange, calcareous, abundant silt-size to very fine sand-size quartz; evenly laminated (1.0-2.0 mm), a few thin argillaceous partings.	3.0	61.6
13	Shale: greyish green, recessive, interbedded with limestone, grey, weathers greenish grey, nodular.	4.0	58.6
12	Sandstone: fine- to medium-grained, greyish green fresh and weathered surfaces; contains abundant very fine to coarse-grained glauconite grains or pellets, and limestone grains; burrows and bottom markings preserved on basal bed, which erodes into underlying shale unit.	1.5	54.6
11	Shale: greyish green, recessive; interbedded with limestone, micritic, grey, weathers greenish grey, nodular.	4.0	53.1
10	Sandstone: very fine- to medium-grained, calcareous, argillaceous, greyish green, in part nodular; interbedded with shale, greyish green, recessive. Top 2.0 m of unit consist predominantly of micritic limestone, greyish green, argillaceous, quartzose.	5.2	49.1
9	Sandstone, fine-grained, greyish green, weathers rusty yellowish brown, argillaceous; reworking by infauna; bottom markings on base of sandstone units that downcut shales; thin- to thick-bedded. Minor interbeds of shale, greyish green, recessive; and micritic limestone, grey, containing trilobites. Top 2.0 m of this unit are resistant, massive, rusty weathering sandstone.	4.9	43.9
8	Limestone: micritic, dark greyish green, weathers greyish green, recessive; contains abundant very fine to fine-grained glauconitic grains, and "floating" well-rounded fine- to coarse-grained quartz sand (mud supported). Glauconite is closely associated with, and partly replaced by, small pyrite	4.3	39.0

euhedra; unit contains trilobites. Interbedded with shale, greyish green, quartzose, calcareous, recessive. Unit is 40% limestone, 60% shale. Unit forms recessive notch on cliffside.

7	Limestone: dolomitic, argillaceous, greyish olive-green, glauconitic and with scattered well-rounded, fine- to medium- grained quartz grains; thin-bedded; interbedded with sandstone, fine- to medium-grained, calcareous, weathers rusty yellowish orange, thin-bedded; minor interbeds of shale, calcareous, papery weathering. Unit is about 85% limestone/sandstone, 15% shale.	10.4	34.7
6	Limestone, micritic, dark grey, weathers rusty brownish grey to light yellowish grey, thin bedded; basal 30 cm contains abundant fine quartz grains, well rounded. Skeletal fragments (trilobite?) in upper part; euhebral dolomite crystals.	4.0	24.3
5	Covered.	8.5	20.3
4	Sandstone: generally coarse-grained, pale olive to greyish olive; locally rusty weathering; abrupt changes vertically in grain size from fine- to coarse-grained; sharp contacts. Quartz arenite with well-rounded quartz grains; rare glauconitic grains.	0.6	11.8
3	Dolostone: very finely crystalline, calcareous, argillaceous, dark grey, weathering greyish orange; very thin to thin-bedded; minor interbeds of shale, calcareous, dark grey, papery. Unit is 80% dolostone.	2.1	11.2
2	Covered: talus suggests similarity with overlying unit. Contact with underlying unit is covered.	7.6	9.1

***Proterozoic Little Dal Group (incomplete)***

1	Mudstone: poor fissility; moderate red to dark reddish-brown; abundant calcareous nodules.	1.5	1.5
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## Section 5 Sheep River

**Section Description:** Section includes part of underlying Proterozoic Little Dal Group unconformably overlain by Mount Cap Formation ([Figure 8](#), [Photos 8a to 8f](#)). Measurement began within Proterozoic shale within a narrow gully in one of several creeks on the west side of Sheep Mountain. The section is located in Carcajou Canyon map area (96D/15), and was measured by C. Bergquist and assistants in July, 2006.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b><i>Mount Cap Formation (incomplete)</i></b>			
22	Shale: pale greenish, interbedded with laminated siltstones.	10.00	109.80
21	Shale: black, recessive.	1.00	99.80
20	Siltstone: dolomitic, well cemented; massive, cliff-forming.	0.25	98.80
19	Shale: black, recessive.	1.75	98.55
18	Siltstone: grey, weathers orange, dolomitic, laminated, mm-scale laminae.	1.95	96.80
17	Shale: black, recessive.	0.30	94.85
16	Siltstone: grey, dolomitic, irregular cm-scale bedding, recessive.	0.80	94.55
15	Same as below, but more massive in upper part.	4.50	93.75
14	Shale: silty, laminated; interbedded with dark grey to olive green siltstones, weathers light brown to orange; generally 20.0-25.0 cm thick beds, wavy-laminated in upper part.	1.05	89.25
13	Dolostone, dolomitic siltstone: dark grey, weathers orange and flaggy; wavy-laminated (algal); massive, cliff forming.	1.60	88.20
12	Shale: greenish to black, recessive; fossiliferous (trilobites and brachiopod). Unit varies in thickness as part of small channel deposit down-cutting into underlying nodular siltstone and shale.	0.80	86.60
11	Siltstone: dolomitic, up to 12.0 cm thick, with an average of 2.0-3.0 cm thick beds.	0.80	85.80

10	Dolosiltstone: interbedded with siltstone, argillaceous, dark green to grey; load casts interbedded with mudstone.	3.00	85.00
9	Mudstone and siltstone: organic-rich, laminated, recessive.	2.50	82.00
8	Sandstone: weathers orange, fine-grained, some coarse siltstone bed; 20.0-40.0 cm thick beds, thin-bedded intervals with mudstone interbeds upwards, thoroughly bioturbated.	4.50	79.50
7	Basal channel complex lag: 20.0-45.0 cm thick, accretion surface, trough cross-bedding.	0.20	75.00
6	Siltstone: glauconitic, fissile, recessive.	3.80	74.80
5	Siltstone: greenish brown, thin-bedded, thoroughly bioturbated.	4.00	71.00
4	Siltstone: bioclastic, calcareous, nodular; interbedded with coarse siltstone and bioturbated, very fine-grained sandstone.	4.50	67.00
3	Mudstone: silty, fissile, green to grey; interbedded with sandstone, glauconitic?, medium-grained with some pebble lag layers, thin-bedded. Basal light brown-weathering dolostone. (Unit begins below waterfall, about 10 cm thick beds, very fine to medium-grained sandstone, thoroughly bioturbated).	3.50	62.50
2	Sandstone: fine-grained, interbedded with siltstone; capped by bright lime green, glauconitic? sandstone, very fine- to fine-grained, bioturbated (interpreted as part of basal section above sub-Cambrian unconformity, exposed mid-cliff).	9.00	59.00

***Proterozoic Little Dal Group (incomplete)***

1	<p>Siltstone: uppermost 10.0 m is grey, nodular, massive, interbedded with shale, highly fractured.</p> <p>Note: Major fault zone in north canyon wall is about 1.5-2.0 m wide, striking 130°-310° and vertical, beds dipping 47° NE, striking 44°, with slickensides dipping 80° NE and striking 200°, clear rhombohedral fracturing indicating a reverse fault (i.e., Cambrian side up, interpreted as original normal fault reversed during Laramide compression, similar to the fault on Carcajou Canyon). Bedding in Proterozoic unit at contact with Mount Cap dipping 28° NE, striking 040°. About 200.0 m downstream of sub-Cambrian unconformity, a series of small extensional faults in siltstone interval trending 037°.</p>	50.00	50.00
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## Section 6 Mirror Lake

**Section Description:** Section includes upper part of Proterozoic Little Dal Group unconformably overlain by Mount Cap Formation ([Figure 9](#), [Photos 9a to 9f](#)). Measurement began within Proterozoic Little Dal Group and followed downstream (up section) along a small creek west of Mirror Lake, up to a slump block that represents the highest exposed Mount Cap Formation. Trilobites (C-518657) were collected from Unit 13 and identified by R. Ludvigsen (pers. comm., 2008) as *Eoptychoparia* cf. *piochensis* (Palmer) of the *E. piochensis* Subzone (Basal Delamarian Stage, early Middle Cambrian). Section is located in Carcajou Canyon map area (96D/15), and was measured by C. Bergquist and assistants in July, 2006.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b>Mount Cap Formation (incomplete)</b>			
16	Brecciated dolosiltstones and black shale: upper part contains phosphatic hardgrounds(?), fine-grained glauconitic sand; burrows enhanced by dolomitization. Interbedded with light greenish-grey shale and siltstone, contains abundant brachiopods.	12.5	122.5
15	Black shale: laminated; dark grey dolosiltstone, weathers orange, thin- to medium-bedded.	30.5	110.0
14	Shale: grey, finely laminated, soft, silty; with 30.0 cm thick silty laminated dolostone at top; weathers orange, thinner bedded at top.	15.0	79.5
13	Shale: black, silty, recessive, trilobite-rich; 30.0 cm thick light grey siltstone bed at 73.5 m; small trilobites in upper part of section, with 0.75 m thick sandstone beds interbedded with greenish shales. Laminated silty dolostone at top of unit, orange/black alternating pinstripes in weathering (similar to those in uppermost Mount Cap at Dodo Canyon); rare ripple-laminated sand.	19.5	64.5
12	Sandstone: light grey, glauconitic, fine-grained; 5.0-10.0 cm thick in base of unit; overlain by dark grey to black siltstone and shale with abundant, bedded 2.0-3.0 cm load cast nodules in discreet beds at the base with green clay between nodules. Nodular dolostone interbeds weather orange; some thin, fine-grained sandstone interbeds.	10.5	45.0
11	Siltstone: recessive, covered.	6.0	34.5

10	Sandstone: thin-bedded, glauconitic, fossiliferous with bioclasts concentrated in burrows; large trace fossils ( <i>Thalassinoides</i> , <i>Chondrites</i> ). Shale interbeds are friable. 40% siltstone overall, in 10.0-20.0 cm thick beds, burrow mottled with black mud chips. Burrow mottled dolosiltstone beds, medium grey, weathers orange, interbedded with glauconitic sandstone.	2.5	28.5
9	Sandstone: medium-grained, white, quartz-rich, dense; series of stacked channels (although small-scale thrust fault is possible, based on E-W trending slickensides on the base of upper "channel" sand).	2.0	26.0
8	Siltstone and sandstone: coarse silt, fine-grained sand; friable, thoroughly bioturbated.	2.0	24.0
7	Siltstone and sandstone: weathers brilliant green, shaley siltstone to fine-grained sand, massive.	0.5	22.0
6	Sandstone, siltstone, and shale: interbedded in 20.0-40.0 cm intervals; massive overall (section cut by several normal faults trending both ~N-S and ~E-W).	3.8	21.5
5	Sandstone: green (glauconite?), 20.0 cm thick, medium- to coarse-grained, small scale ripples and mud cracks (syneresis?), mud chip breccia; basal lag sand, sits unconformably on underlying Proterozoic unit with about 5° angularity.	0.2	17.7
<b><i>Proterozoic Little Dal Group (incomplete)</i></b>			
4	Siltstone and limestone: laminated, fine-grained siltstone; upper 3.0 to 4.0 m contains thin lime mudstone beds, weather light grey.	8.5	17.5
3	Siltstone and limestone: flaggy beds up to 20.0-30.0 cm thick; interbedded, laminated calcareous siltstone at top of unit.	1.5	9.0
2	Limestone: weathers tan and flaggy; soft-sediment deformation and slump structures.	1.5	7.5
1	Limestone and siltstone: grey, massive, very fine-grained siltstone, some red-banding; overlies nodular shale, beds 5.0-25.0 cm thick, weathers brown-orange-grey.	6.0	6.0



## Section 7 Mount Clark

**Section Description:** Section includes Mount Clark and Mount Cap formations ([Figure 10, Photos 10a to 10f](#)). Section was measured by Aitken et al. (1973; Section U-15) as the type section of Mount Cap Formation, located on the north flank of Mount Clark in the McConnell Range, southern Franklin Mountains. Section is located in Fort Norman map area (96C/08), and was measured by C. Bergquist and assistants in July, 2006. Details of the section as are reported in Aitken et al. (1973, p. 116-119). An additional section of Little Dal Group to Mount Clark bioturbated sandstone (~50 m total thickness) is located in a south-facing valley south of the crest of Clark Mountain and is not detailed herein.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b>Mount Cap Formation</b>			
26	Siltstone: grey, weathers blocky in alternating deep brown and yellowish-brown colours; slightly argillaceous; coarse-grained; very thin-bedded, bottom markings and burrows(?).	2.5	213.7
25	Shale: dark grey; micaceous; very crumbly to poorly fissile.	1.5	211.2
24	Siltstone: grey, weathers blocky in alternating deep brown and yellowish-brown colours; slightly argillaceous; coarse-grained; very thin-bedded, bottom markings and burrows(?).	3.0	209.7
23	Shale: dark grey; micaceous; very crumbly to poorly fissile.	1.5	206.7
22	Siltstone (or very fine-grained sandstone): argillaceous, thin-bedded, recessive in lower half; topmost 90.0 cm contains very thin beds, with interbeds of silty, greenish, non-calcareous shale and a 30.0 cm thick calcareous bed at base.	7.0	205.2
21	Shale or mudstone: grey, weathers rusty brown, very crumbly; silty; non-calcareous.	6.4	198.2
20	Shale or mudstone; dolomitic(?); weathers rusty brown, very crumbly.	12.8	191.8
19	Shale or mudstone: grey, weathers rusty brown, very crumbly; silty; non-calcareous.	6.1	179.0
18	Limestone: alternating beds of grey, nodular, cliff forming limestone and thinner bedded, nodular, argillaceous limestone and thin-bedded, silty limestone.	20.2	172.9

17	Siltstone: dark grey; argillaceous, calcareous; blocky bedding; very crumbly.	4.6	152.7
16	Limestone: grey; micritic; nodular; basal 120.0 cm interbedded lithology as in unit below.	3.0	148.1
15	Sandstone: thinly (<2.5 cm) and very regularly bedded; extensively burrowed; argillaceous; bedding planes covered by a network of interwoven black organic matter (algal?); top 2.7 m thicker bedded, much more argillaceous, more blocky weathering.	8.0	145.1
14	Siltstone: argillaceous, dolomitic; dirty dark brownish green; organic black markings on bedding planes; some sandy laminated layers.	9.2	137.1
13	Shale: silty; non-calcareous; weathering rusty to dark ochre, greyish brown.	4.0	127.9
12	Shale: grey, weathers grey; silty, calcareous.	1.5	123.9
11	Limestone: micritic; dark grey; massive; conchoidal fracturing; dolomitic ribs in top 90.0 cm, weathers light brown; top 90.0 cm weathers brown and grey with brown dolomitic ribs and grey pock-like depressions.	5.7	122.4
10	Shale: dark grey; micaceous; crumbly; weathers dark silvery grey.	2.7	116.7
9	Shale: silty; crumbly, non-fissile; weathers dark silvery grey.	22.9	114.0
8	Mudstone: weathers reddish brown; very silty; crumbly.	2.1	91.1
7	Siltstone: weathers dark greyish brown to blackish brown; argillaceous with numerous layers of siltstone, laminated; abundant fine mica.	10.5	89.0
6	Sandstone: weathers dark rusty to orange brown, medium-grained at top, grading to very fine grained at bottom; medium brown and grey; thinly bedded, and colour banded, limonitic at top; basal 90.0 cm argillaceous.	3.0	78.5
5	Siltstone: dark green, weathers blocky and dark brownish-green; dolomitic; thin- to thick-bedded; bedding planes with organic markings, silty to very finely sandy; in lower few feet interbedded with shale, silty, dark grey, thin, rubbly.	20.0	75.5

4	Mudstone and sandstone: From 33.5 m above base, to top of unit: sandstone, very fine-grained; top 1.5 m thin-bedded; with black burrow markings distorting laminations; organic debris(?); top 1.5 m weathers nodular, deep brown; from 22.3 m to 22.6 m above base, a bed of sandstone, very fine-grained, greenish-brown, argillaceous and silty, with black chert granules and fine pebbles (<6.0 mm), and thin layers of limonitic nodules. Mudstone is greyish green; dolomitic; silty in upper portion of unit; non-fissile; with interbedded dolomite, argillaceous, green, with carbon markings(?) on bedding planes; above 9.8 m from base interbedded with finely sandy, finely laminated zones; from 19.2 to 22.3 m above base, mudstone is greenish, more fissile; mudstone weathers brown to dark brown, locally rusty or grey.	49.5	55.5
3	Quartzite: purple, medium-grained; one massive bed; abundant oxidized iron and some pyrite at the top; quartz grains rounded; fresh surface with porosity from leaching of iron-rich cement.	3.0	6.0
2	Dolostone: argillaceous, green, in beds 10.0 to 15.0 cm thick; interbedded with green shale. Unit appears to thicken rapidly on west side of gully and to pinch out downdip, as though Mount Cap basal units overlapped northward or eastward onto underlying Mount Clark Formation quartzites; disconformable contact(?).	1.5	3.0
<b><i>Mount Clark Formation (incomplete)</i></b>			
1	Quartzite: thick-bedded, resistant.	1.5	1.5

## Section 8 Blackwater Lake

**Section Description:** Section includes Proterozoic upper Katherine Group unconformably overlain by Mount Clark Formation and Mount Cap Formation which was not measured because it is too recessive ([Figure 11](#), [Photos 11a to 11f](#)). Section is located in Blackwater Lake map area (96B/03) and was measured by C. Bergquist and assistants in July, 2006.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b>Mount Clark Formation</b>			
8	Sandstone: weathers dark brown to orange to greenish (possibly glauconitic), medium-grained, cm-scale beds; erosional base contains hummocky cross-stratification (HCS). Overlain by covered interval of black shale containing trilobites and brachiopods, in two small gullies at 16.5 m. Uppermost surface of sandstones covered with flowing black bitumen/tarry substance.	16.5	145.5
7	Sandstone: quartzitic, weathers orange-light brown with white patches, occurs in massive beds thinning toward top from 1.5-2.0 to 0.3 m; bioturbated with long <i>Skolithos</i> burrows whiter than host rock (cementation?)	12.0	129.0
6	Covered.	31.5	117.0
5	Sandstone: quartzitic, weathers orange-light brown, occurs in massive beds of 1.5 to 2.0 m thick, thoroughly bioturbated with long, <i>Skolithos</i> burrows.	12.0	85.5
4	Covered.	33.0	73.5
3	Sandstone: quartzitic, weathers pale- to greyish-red and white, partly covered between 22.5 to 39.0 m; thick-bedded to massive between 39.0 to 40.5 m, extensively bioturbated with extremely long and large <i>Skolithos</i> with a central "core" (i.e., >75.0 cm in length and up to 5.0 cm in diameter). Beds striking 120°, dipping 45°W.	19.5	40.5
2	Sandstone: quartzitic, reddish-white, medium- to thick-bedded, dune cross-bedded. Basal red bed contains clasts of sandstone and has a scoured base; upper unit covered with loose talus blocks, no burrows in this interval.	9.0	21.0

***Proterozoic upper Katherine Gp. (incomplete)***

1	Quartzite: white, hard, cemented, weathers very pale orange and white; fine-grained, massive, cross-bedded; liesegang lines, orange flecks and iron-speckled spots of concentrated red weathering are common; no bioturbation.	12.0	12.0
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**Section 9 Cap Mountain**

**Section Description:** Section is the type section of Mount Clark Formation described by Aitken et al. (1973; Section AC 541; [Figure 12](#), [Photos 12a to 12f](#)). Section is located on the north-facing scarp of Cap Mountain in the Franklin Mountains, Wrigley map area (95O/06), and was measured by C. Bergquist and assistants in July, 2006.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b><i>Mount Clark Formation</i></b>			
17	Sandstone: deep red to purple; fine-scale trough cross-bedding, with decimetre- scale beds. Lacks <i>Skolithos</i> .	4.0	134.3
16	Covered.	12.5	130.3
15	Sandstone: dominantly horizontal/planar-bedded, fine-grained, cm-scale flaggy beds, some trough cross-bedding.	13.0	117.8
14	Sandstone: Beds are thicker, but still flaggy overall and fine-grained, bright maroon.	10.0	104.8
13	Sandstone: Red, fine-grained, flaggy, trough cross-bedded.	9.0	94.8
12	Sandstone: trough cross-bedded, fine-grained, cm-scale beds. Rare <i>Skolithos</i> in upper half of interval.	4.0	85.8
11	Quartzitic sandstone: low angle cross-bedding.	5.3	81.8
10	Sandstone: Massive, less flaggy, decimetre-scale, sub-horizontal beds.	12.0	76.5
9	Sandstone: Cross-bedded to planar-bedded, fine-grained, non-pervasive burrows restricted to thinner beds.	8.0	64.5
8	Sandstone: Transition to flaggy facies, flaggy-weathering, thinner bedded, fine- to medium-grained, trough cross-bedding with rare climbing ripples. Beds are 5.0 cm thick;	5.0	56.5

rare pipestone, some mm-scale *Skolithos* burrows.

7	Sandstone: medium-grained, decimetre/centimetre-scale bedsets, low angle trough cross-beds, scour surfaces, low relief gutter casts. Metre-thick piperock intervals alternate with cross-bedded intervals that lack <i>Skolithos</i> .	7.0	51.5
6	Sandstone: medium- to coarse-grained, flat bedded pipestone overlying bi-directional trough cross-beds at the base. Overall a continued repetition (4-5 times) of trough cross-beds overlain by planar beds overlain by massive pipestone. At 31.0 m, well-developed pipestone underlying another cycle of trough cross-bedding. Massive <i>Skolithos</i> piperock is mostly medium-grained, all decimetre scale beds (average 20.0 cm).	16.5	44.5
5	Sandstone: coarse-grained, planar tabular cross-beds with trough cross-beds at base. Higher energy base of channel at 112.0 m capped by bioturbated pipestone. In lower part an elongate 2.0 m by 10.0 cm straight to curved cementation relic has appearance of massive horizontal burrow trace.	14.0	28.0
4	As below: coarse-grained, orthoquartzite to tight sandstone, some porous lenses especially in coarser fraction, all <i>Skolithos</i> piperock, beds are sub-horizontal, some down-cut and average 10.0 cm thickness.	3.0	14.0
3	Sandstone: stained purple to pink, clean quartz sandstone, medium- to coarse-grained. <i>Skolithos</i> piperock is visible at top of outcrop, burrows cemented and resistant, and protrude above the top surface at 9.0 m. Below this, if burrows are present, their infill is difficult to differentiate and obscured by lichen-cover. Typically burrows are not stained, perhaps due to early cementation, and are therefore clearly discernable from background matrix.	9.0	11.0
2	Quartzite: pink; medium- to coarse-grained; locally conglomeratic; lichen covered, planar and trough cross-bedding, unidirectional, decimetre-scale bedsets with wavy surfaces, some planar lamination and common channels. Unconformably overlies Proterozoic.	2.0	2.0

***Proterozoic Lone Land Fm. (incomplete)***

1	Underlying sand-shale sequence previously defined as Proterozoic "Lone Land" formation; multi-coloured, grading upwards to black shale, recessive in outcrop.	Not measured	
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## Section 10 Fan Creek

**Section Description:** Section includes Proterozoic upper Katherine Group unconformably overlain by Mount Clark(?), Mount Cap and Saline River formations ([Figure 13](#), [Photos 13a to 13f](#)). Measurement began in upper Katherine Group within a gully west of the main canyon. Upper Mount Cap Formation is exposed in the main canyon, but its lower part is best seen in the west gully. Section is located in Sans Sault Rapids map area (106H/01) and was measured by C. Bergquist and assistants in July, 2006 and also by Pyle and Gal (2007).

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b><i>Saline River Formation (incomplete)</i></b>			
7	Shale and gypsum: recessive interval, weathers medium grey-pink-yellow, interbedded on cm-scale.	40.0	91.7
6	Shale: weathers black, recessive; interbedded with sandstone, medium-grained; unconformable lower surface.	3.0	51.7
<b><i>Mount Cap Formation</i></b>			
5	Siltstone: interbedded with shale and fine-grained sandstone; flaggy, weathers ochre-coloured, rare stromatolitic layers.	20.0	48.7
4	Sandstone: quartzitic, glauconitic, weathers medium-grey to green, fine-grained; 20.0-30.0 cm thick beds, cross-bedded; interbedded green siltstones. At upper waterfall, small outcrop of medium- to coarse-grained sandstone filled with large leached vugs; horizontal and vertical burrows. Porous and permeable weathered, pale green sandstone.	19.0	28.7
<b><i>Mount Clark Formation (?)</i></b>			
3	Shale and sandstone: grey-green, cross-bedded sandstone (contact zone). Interpreted as basal Mount Clark facies that abruptly overlie Proterozoic "red beds" and black shale.	0.2	9.7
<b><i>Proterozoic upper Katherine Group (?) (incomplete)</i></b>			
2	Siltstone: weathers red, laminated on mm- and cm-scale; a few extensively developed mudcracks within ripple laminated interval.	5.5	9.5
1	Shale: black, fissile, interlaminated/interbedded with siltstone, weathers greenish-grey and flaggy; siltstones pinch and swell. Beds dipping 29°E and striking 134°NE.	4.0	4.0

## Section 11 Imperial River Canyon

**Section Description:** Section includes Proterozoic upper Katherine Group unconformably overlain by Mount Clark(?) and Mount Cap formations and an incomplete section through Saline River Formation ([Figure 14](#), [Photos 14a to 14f](#)). Section is located in Sans Sault Rapids map area (106H/01) and was measured by C. Bergquist and assistants in July, 2006.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b><i>Saline River Formation (incomplete)</i></b>			
9	Sandstone: medium- to coarse-grained, quartz arenite; weathers red and green, thin to thick beds; gypsum cemented; separated by 2.5 cm to 60.0 cm thick beds of red, green, and grey shale, sandy shale, siltstone, dolostone, and thin white gypsum; all very finely laminated.	6.0	44.0
<b><i>Mount Clark (?) / Mount Cap Formation</i></b>			
8	Shale: red, green, grey, and black; thin-bedded. Interbedded with dolostone, sandstone, siltstone, and (?)diagenetic gypsum; basal 90.0 cm contains limestone and dolostone, dark grey, weathers orange. Unit thins to the west along strike (unconformity).	4.0	38.0
7	Sandstone: greyish brown; very fine-grained; lamination, cross-lamination, slump or flow structures, wavy bedding, brecciated bedding; sandy dolostone beds in top 120.0 cm, partings, laminae, and thin beds of dark grey to black silty shale; black chert abundant in large, coarse lenses greater than 1.0 m and 15.0-20.0 cm thick; unit weathers orange-brown. Unit characterized by slumped bedding and black and rusty orange banding.	5.0	34.0
6	Sandstone: brown, weathers light brown to dark grey or black, glauconitic, argillaceous, finely laminated; cross-bedded; organic markings on bedding planes; silt and claystone conglomerates present; 5.0 m from top is a 30.0 cm thick bed of argillaceous siltstone or very fine sandstone; unit massive, cliff forming.	7.5	29.0
5	Sandstone, siltstone, and shale: top 60.0 cm of shale, silty to finely sandy, black, pyritic, covered with sulphur bloom; below this, 90.0 cm of siltstone, sandy, pale green, iron-stained (rusty yellow); underlain by 30.0 cm of silty-sandy	2.5	21.5



shale and 90.0 cm of quartzite, whitish-brownish- yellow, intensely cross-bedded; weathers rusty yellow and red.

4	Partly covered; shale and sandstone weathers rusty; top 150.0 cm contains shale, silty, dark grey and brown; underlain by 150.0 cm of sandstone, soft, crumbly; deeply iron stained.	4.0	19.0
3	Quartzite: white, grey, and mauve, fine- to medium-grained; beds 15.0 to 90.0 cm thick, with thinner laminated bands within thicker units; poorly sorted; massive, hard; laminated. Interbeds of black, very argillaceous, recessive sandstone; abundant <i>Skolithos</i> beds. Unconformity clearly seen here (northwest side of the creek) and again on cliff on south-east side where it cuts a deep channel into dolostone of unit below and has a thick, red, coarse conglomerate and red hematitic sandstone filling the channel and occupying about 150.0 m of strike along outcrop. Red, conglomeratic channel-fill of unknown age, possibly Mount Clark? or possibly Little Dal Group, extends to the south to at least “Jennifer” Canyon.	6.0	15.0

***Proterozoic upper Katherine Group (incomplete)***

2	Dolostone: aphanitic, dull soft purple to pale maroon and grey, weathers pinkish-buff, locally pale orange-buff and pinkish-purple in irregular 5.0-10.0 cm thick beds; argillaceous.	5.0	9.0
1	Dolostone: grey, argillaceous and slightly silty, recessive; grades downward to shale, dolomitic, dark grey, slightly calcareous; conchoidal fracture.	4.0	4.0

## Section 12 Loretta Canyon

**Section Description:** Incomplete section includes Proterozoic upper Katherine Group abruptly overlain by Mount Clark(?), Mount Cap and Saline River formations ([Figure 15](#), [Photos 15a to 15f](#)). Lower Mount Cap is not accessible along the canyon floor. Section is located in Sans Sault Rapids map area (106H/01) and was measured by C. Bergquist and assistants in July, 2006.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b><i>Mount Cap Formation (incomplete)</i></b>			
11	Covered: recessive silty shales to base of overlying Saline River Formation.	11.00	29.45
10	Dolostone: silty; wavy-bedded; nodular black patches (phosphate?) occur in upper part of unit.	1.10	18.45
9	Siltstone and dolosiltstone: black, weathers light brown; irregular-bedded with beds thinning upwards; brecciated into small clasts in places.	2.00	17.35
8	Siltstone: dark grey to green, weathers light brown, fine-grained; fine laminae of very coarse siltstone, horizontal burrows.	1.90	15.35
7	Siltstone: black, weathers light brown, argillaceous, coarse-grained.	5.20	13.45
6	Dolosiltstone: weathers pink, thoroughly bioturbated, cm-scale burrows.	0.80	8.25
5	Siltstone.	2.55	7.45
4	Sandstone: glauconitic, ripple-laminated.	0.85	4.90
3	Shale: black, recessive.	0.45	4.05
2	Mudstone: silty, glauconitic; thoroughly bioturbated.	1.60	3.60
1	Sandstone: medium-grained grades to fine-grained upward; shale interbeds.	2.00	2.00

***Mount Clark (?) Formation***

4	Sandstone: medium-grained to conglomeratic (red-stained, iron-rich regolith), well-cemented, high angle cross-beds (similar to the questionable portion of “Mount Clark” at Imperial River Canyon).	1.4	20.4
3	Sandstone: quartzitic, coarse-grained, well-rounded grains, deep red iron stain. Interbedded with thin, ooidal ironstone.	3.0	19.0

***Proterozoic upper Katherine Group (incomplete)***

2	Dolostone: weathers light to golden brown, “chicken wire” veins of calcite, stromatolitic, massive; black shale interbeds weather orange; black shale laminae.	6.0	16.0
1	Shale: two units of black shale, west side of stream; syneresis cracks; wavy, thin- to thick-bedded, light grey dolostone upsection, weathers golden brown, wave rippled, burrowed, massive, cliff-forming.	10.0	10.0

**Section 13 “Jennifer Canyon”**

**Section Description:** Incomplete section of Mount Clark and Mount Cap formations overlying Proterozoic Little Dal Group ([Figure 16](#), [Photos 16a to 16f](#)). Section is well exposed along north face of informally named canyon at the front of the Mackenzie Mountains, located in Norman Wells map area (96E/04). Section was measured by C. Bergquist and assistants in July, 2006.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b><i>Mount Cap Formation (incomplete)</i></b>			
18	Siltstone: dolomitic, bioturbated.	13.00	77.95
17	Siltstone: coarse-grained, glauconitic, thicker-bedded.	1.60	64.95
16	Siltstone: weathers orange to light brown and flaggy, dolomitic, bioturbated in middle of unit; 1.0 cm clasts, trace of glauconite and biotite (?) grains.	3.20	63.35
15	Siltstone: light grey, fine- to medium-grained, grading upwards to irregular 3.0-5.0 cm beds; few red/purple mm-	1.70	60.15

scale interbeds of mudstone.

***Mount Clark Formation (?)***

14	Sandstone: light green, weathers flaggy upwards.	4.00	58.45
13	Sandstone: thoroughly bioturbated.	0.30	54.45
12	Sandstone: coarse-grained to granular at base, fining upwards to fine-grained, blocky to lens-shaped bedsets 20.0-30.0 cm thick, trough cross-bedded.	2.00	54.15
11	Sandstone: weathers light brown, fine-grained, well cemented in beds up to 30.0 cm thick, cross-bedded, bioturbated with horizontal <i>Planolites</i> burrows on underside of resistant beds and minor amount of vertical <i>Skolithos</i> burrows.	0.65	52.15
10	Sandstone: medium- to coarse-grained, glauconitic layers contain abundant horizontal burrows, cross-bedded. Base of unit is erosional.	0.20	51.50
9	Sandstone: medium- to coarse-grained, quartzitic, high angle cross-beds and intersecting planar cross-beds; well-cemented, non-bioturbated, nodular cementation with common zones of black phreatic cements(?).	5.900	51.30
8	Conglomerate: gravelly channel fills, lateral accretion surfaces and abundant cross-bedding; clasts up to pea gravel in size, well sorted in several basal channel lags; coarse-grained ironstone interbed near top.	1.70	45.40

***Proterozoic Little Dal Group (incomplete)***

7	Siltstone: weathers purplish-red, coarse siltstone to fine-grained sand, interbedded with shale; small 3.0-4.0 mm diameter syneresis cracks. Thin-bedded with cross-laminations and wave ripples at base. Grading and coarsening upwards to thicker 3.0-5.0 cm beds with mm-scale shaley interbeds. Upper unit contains more massive beds with high angle cross-bedding and sandier overall with less mudstone. Unit (beds dipping 25°E, striking 018°) is about 20.0 m thick, measured 200.0 m NW upslope from measured section along stream bed.	9.60	43.70
6	Siltstone and shale: black, weathers rusty brown in upper third of section; interbeds of thin, bioturbated siltstone,	17.00	34.10

weathers light brown. Measured 200 m NW upslope from measured section along stream bed.

5	Dolostone: weathers brown, abundant finger-scale stromatolites at top.	3.00	17.10
4	Siltstone: sideritic, weathers red-purple-green, interbedded with dolomitic siltstone, mottled.	8.00	14.10
3	Dolostone: weathers golden brown, finely crystalline, megabreccia, abundant chert replacive nodules; elongate clasts aligned horizontally.	1.800	6.10
2	Dolostone: massive breccia, irregular blocks part of large slump?	2.00	4.30
1	Dolostone: very finely crystalline, non-bioturbated; massive, cliff-forming, stromatolitic (unit overlies the two black shale units as seen at Loretta Canyon).	2.30	2.30

#### Section 14 Graffe River

**Section Description:** Section includes upper part of Proterozoic Little Dal Group overlain by Mount Clark and Mount Cap formations which are unconformably overlain by Saline River Formation ([Figure 17](#), [Photos 17a to 17f](#)). Measurement began within Little Dal Group along the length of Graffe Canyon, up to lowermost Saline River Formation. Well-exposed section of Proterozoic upper Katherine and lowermost Little Dal Groups. Trilobites (collection C-518652) were collected from unit 32 and identified by R. Ludvigsen (pers. comm., 2008), as *Poliella germana* (Resser) of the *Albertella* Zone (Early Delamarian Stage, lower Middle Cambrian). Section is located in Carcajou Canyon map area (96D/13) and was measured by C. Bergquist and assistants in July, 2006.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b><i>Saline River Formation (incomplete)</i></b>			
34	Sandstone, siltstone and shale: weathers light brown, thin-bedded, forms prominent ribs in outcrop. Overlying middle and upper Saline River Formation consists of multi-coloured pink, light green and yellow evaporites, plus upper Saline River siltstone, shale and sandstone. Unit sits with angular unconformity on Mount Cap Formation.	12.0	150.0

***Mount Cap Formation***

33	Siltstone and shale: greenish to grey, thin-bedded, burrowed and rippled just above underlying dolostone, recessive and covered except in near-vertical cliffs on opposite side of creek, dipping 20°, striking 062°NE.	6.0	138.0
32	Shale: black to dark grey, thin-bedded, grading upwards to interbedded shale and light brown-weathering silty dolostone. Interbedded shale and dolostone show pinch and swell and boudinage of dolostones, indicating slumping and small-scale gliding.	6.0	132.0
31	Sandstone: dark grey, weathers light brown, in 20.0-40.0 cm beds, extensive bioturbation with horizontal burrows.	2.0	126.0
30	Sandstone: weathers green (glaucinitic), medium to coarse-grained, trough cross-bedded in regular 10.0-30.0 cm beds, interbedded with very fine-grained sandstone to coarse siltstone; abundant horizontal and vertical burrows. Sands become coarser-grained upwards.	18.0	124.0
29	Sandstone: white, weathers orange, fine-grained, cross-bedded with lateral accretion surfaces.	4.0	106.0
28	Sandstone: extensively iron-stained, weathers dark brown to orange, thick-bedded, glauconitic, blocky fracturing, generally massive with some shaley interbeds.	8.0	102.0
27	Sandstone and siltstone: grey, very fine to fine-grained, generally flat-bedded but some down-cutting. Upper 3.0 m partially covered.	7.0	94.0
26	Siltstone: olive green, thin-bedded, as Unit 24.	1.0	87.0
25	Sandstone: dark brown to black, fine- to medium-grained, cemented, thoroughly bioturbated, erodes into underlying siltstones, thin-bedded at base, more massive upwards.	2.0	86.0
24	Siltstone: olive green and brown, finely laminated; beds 1.0-5.0 cm thick. At 82.0 m on the south wall, a 65° SE-dipping fault, striking 027° NE, with the SE side down 30.0 cm.	6.0	84.0
23	Sandstone: pink to green, 5.0-40.0 cm thick beds, fining upwards, fine- to coarse-grained; limited to no bioturbation in upper two metres; rippled to mega-rippled near top.	6.0	78.0

22	Sandstone: medium to coarse-grained, bioturbated, 25.0-30.0 cm beds thin to 4.0-10.0 cm beds in upper part; 7.0 cm thick granule conglomerate beds, sharp-based with poor sorting.	6.0	72.0
21	Sandstone: dark grey, weathers light brown to dull orange, rusty brown staining cross-cuts bedding; medium-grained, zones of cross-bedding, extensive burrowing, including <i>Planolites</i> in pink-weathering sandstone.	2.0	66.0
20	Sandstone: medium- to coarse-grained, thoroughly bioturbated, horizontal burrows 0.4 m above conglomeratic base of channel.	8.0	64.0
19	Sandstone: channelized, medium- to coarse-grained to cobble conglomerate at base of channel; horizontal and vertical ( <i>Skolithos</i> ) burrow; cross-bedded.	2.0	56.0
18	Dolostone: dark grey, weathers light brown, stromatolitic layering with interbedded sideritic siltstone and dark red granular ironstones 15.0 and 30.0 cm thick.	2.0	54.0
17	Siltstone: black, weathers dull orange, 5.0 to 25.0 cm beds, flat-bedded (dipping 18°, striking 064° NE). Resistant, cliff-forming unit, river cuts narrow slot that is impassable along streambed.	2.0	52.0
16	Siltstone and dolomitic siltstone: grey to dark grey, weathers light brown; flat surfaces extensively mud-cracked; gutter casts at base filled with fine-grained sand. Cm-diameter horizontal burrow-like "concretions". Fault breccia along small 1 m displacement fault, vertical to sub-vertical, trending 292°, very little to no offset of beds, 0.4 m north side down, fault breccia with sparry calcite along fault plane, no slicken-sided surfaces.	4.0	50.0
15	Interbedded black shale, horizontal-burrowed, rippled thin-bedded siltstones and red-green shales, finely laminated and generally flat-bedded.	4.0	46.0
14	Sandstone: light pink to white, two 40.0-60.0 cm beds; bioturbated, trough cross-bedded, fine- to medium-grained. Cross-beds have north-dipping troughs which show east-dipping mega-ripples on upper surface.	1.0	42.0
13	Shale: mottled, greenish grey to red, finely laminated with intercalated fine siltstone interbeds, extensively mud-	2.0	41.0

cracked. Section is faulted in adjacent cliff-face which appears to be syndepositional slumping.

***Mount Clark Formation***

12	Sandstone: weathers light pink to light brown, thin-bedded, trough cross-bedded and hummocky cross stratification (HCS).	2.0	39.0
11	Sandstone: weathers light brown, high angle cross-beds, 20.0-60.0 cm thick bedsets.	6.0	37.0
10	Sandstone: light brown, weathers orange-brown, medium-grained; 20.0-40.0 cm thick bedsets.	4.0	31.0
9	Sandstone: weathers light pink to white, very fine to fine-grained; mud clasts in layers, coarser grains on inclined 'avalanche' slopes, bi-directional low-angle cross-bedding.	4.0	27.0
8	Sandstone: cross-bedded, topped by conglomerate and bicusate rippled, fine-grained sandstone (dipping 13°, striking 044° NE).	2.0	23.0
7	Sandstone: medium grey with purple-red staining throughout, medium-grained, interbedded conglomerates in beds up to 10.0 cm thick.	2.0	21.0
6	Sandstone: weathers mottled light brown to purplish-pink; channelized cross-bedded, fine-grained.	2.0	19.0
5	Sandstone: weathers pink to red; fine- to medium-grained; channel-form bedding with 2.0 m high accretion surfaces.	2.0	17.0
4	Sandstone: as below, trough cross-bedded.	2.0	15.0
3	Sandstone: weathers pink and purple, interbedded conglomerate up to granule-sized, fine- to coarse-grained, normal grading, trough cross-bedded, some ripples.	6.0	13.0
2	Sandstone: weathers purplish-pink, medium- to coarse-grained, trough cross-bedded, 10.0-30.0 cm beds. Unconformable base in which sandstone erodes into underlying shale.	2.0	7.0

***Proterozoic Little Dal Group (incomplete)***

1	Shale: black-brown.	5.0	5.0
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## Section 15 Katherine Creek

**Section Description:** Section includes upper part of the Proterozoic Katherine Group, unconformably overlain by Mount Clark(?) and Mount Cap formations ([Figure 18](#), [Photos 18a to 18f](#)). Measurement began within the Proterozoic on a side cliff of Katherine Creek Canyon, and up to a covered interval where the contact with overlying Saline River Formation was not observed. Section is located in Carcajou Canyon map area (96D/13), and was measured by C. Bergquist and assistants in July, 2006.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b><i>Mount Cap Formation (incomplete)</i></b>			
9	Covered: recessive.	4.0	42.0
8	Sandstone: weathers light brown, fine-grained, interbedded with dolomitic siltstones; ripple-laminated, with dark grey to black fissile shale.	9.7	38.0
7	Shale/mudstone: dark grey to black, recessive.	6.0	28.3
6	Sandstone: weathers light brown, very fine-grained, glauconitic with coated grains(?), nodular, cross-bedded; shell-hash in basal beds, thin ironstone bed at base sands, monoplacophorans(?) seen in fine-grained sandstones/siltstones near base of section. Below resistant bed is a thin (~5.0-8.0 cm) shale (black), underlain by a thin (~3.0-6.0 cm) horizon of light grey siltstone (dolomitic?) with dark ooids throughout, interbedded with mudstones.	5.0	22.3
5	Shale/mudstone: dark grey to black, recessive.	4.0	17.3
4	Sandstone: weathers light brown, fine-grained, interbedded with dolomitic siltstone, ripple-laminated; capped by algal stromatolitic dolostone. Lateral accretion surfaces at unit base, complex of down-cutting sandstones, load casts in base of the channel.	4.0	13.3
3	Shale: greenish to grey, laminated, recessive.	2.0	9.3
<b><i>Mount Clark Formation (?)</i></b>			
2	Conglomerate: medium- to coarse-grained, contains rounded Katherine Group clasts (basal lag at sub-Cambrian unconformity).	0.3	7.3

***Proterozoic upper Katherine Group***

1	Sandstone: clean, blocky, fine-grained, cross-bedded, beds average 20.0-40.0 cm thickness (Strike 000° and dip 20°E).	7.0	7.0
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**Section 16 “Pete Creek”**

**Section Description:** Section includes part of Mount Clark and Mount Cap formations ([Figure 19, Photos 19a to 19f](#)). Measurement began within lower part of Mount Clark Formation along “Pete Creek”, a small side creek joining Katherine Creek, and terminated in a box canyon where the highest exposed Mount Cap Formation was exposed. Section is located in Carcajou Canyon map area (96D/13), and was measured by C. Bergquist and assistants in September, 2006.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b><i>Mount Cap Formation (incomplete)</i></b>			
8	Sandstone: white to tan, fine to medium-grained, some coarse pebble lag at bed bases; thick-bedded at base of cliff section (average 2.0 m) becoming thinner-bedded upwards (average 20.0 cm). Slab overhangs and fallen slabs on valley floor contain abundant horizontal burrows. Rare glauconite in base of beds. Bioturbation concentrated in upper third of beds. Trough cross-bedding truncates <i>Skolithos</i> burrows.	22.0	98.0
7	Siltstone and sandstone: dark brown, fine-grained, lacks bioturbation.	2.0	76.0
6	Sandstone, siltstone, and shale: weathers orange, parallel-laminated, fine-grained sandstone; thin-bedded; cross-bedded; lacks bioturbation. Unit becomes shalier upwards. upper part partially covered.	14.0	74.0
5	Covered.	10.5	60.0
4	Shale and sandstone: predominately covered; recessive, dark red and grey-green shale interbedded with 10.0 cm thick, coarse-grained, porous sandstone that is wave-rippled on top. Upper part contains 15.0 cm thick, finely-laminated sandstone, and greyish-green mudstone with salt casts.	6.0	49.5

***Mount Clark Formation***

3	Sandstone: cross-bedded, conglomeratic, up to cobble-sized, rounded clasts.	0.5	43.5
2	Sandstone: light brown, beds up to 30.0 cm, cross-bedded, cemented, quartzitic.	8.0	43.0
1	Sandstone: weathers light pink to red and splotchy (iron staining), tightly-cemented to quartzite, ripple laminations and swaley cross-stratification (SCS).	35.0	35.0

**Section 17 Echo Creek**

**Section Description:** Section includes upper part of Proterozoic Little Dal Group overlain by Mount Cap Formation ([Figure 20](#), [Photos 20a to 20f](#)). Measurement began within Little Dal Group along Echo Creek, up to the top of waterfalls representing the highest exposed Mount Cap Formation. Section is located in Carcajou Canyon map area (96D/14), and was measured by C. Bergquist and assistants in July, 2006.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
<b><i>Mount Cap Formation (incomplete)</i></b>			
13	Dolostone: interbedded with siltstone, resistant section (waterfall).	1.90	40.15
12	Sandstone: very fine-grained sandstone beds, glauconitic, recessive. Interbedded with dolosiltstone.	3.00	38.25
11	Sandstone: fine-grained, thin-bedded.	4.00	35.25
10	Sandstone: argillaceous, fine-grained, bioturbated, beds 3.0-5.0 cm thick.	4.00	31.25
9	Sandstone: white, medium-grained, quartzitic, well-cemented.	0.25	27.25
8	Siltstone: dolomitic, recessive.	0.80	27.00
7	Siltstone: dolomitic, thoroughly bioturbated, horizontal burrows.	2.00	26.20
6	Siltstone: black.	0.40	24.20

5	Siltstone: weathers dark green to black, flaggy, thoroughly bioturbated.	1.80	23.80
4	Siltstone: dolomitic, weathers orange to light brown, wave-rippled.	2.00	22.00
<b><i>Proterozoic Little Dal Group</i></b>			
3	Dolostone: stromatolitic mounds typically 0.5-1.0 m but up to 3.0-4.0 m in diameter. Overlying thin-bedded dolostone, pinch and swell, thinning over top of mounds.	2.00	20.00
2	Dolostone: weathers light brown to orange, microcrystalline, includes mud chip layer. Planar ripples with slickensides (striking 222°, dipping 10° NE).	2.00	18.00
1	Dolosiltstone: grey, thin-bedded, overlying nodular red shales	16.00	16.00

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