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GEOLOGICAL SURVEY OF CANADA
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Measured section data, Mount Clark and Mount Cap formations (Cambrian), eastern Mackenzie Mountains, Northwest Territories

N.M. Handkamer

2020

Canada

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INTRODUCTION

Five stratigraphic sections in the Canyon Ranges of the eastern Mackenzie Mountains (NTS 96D) were measured during July and August 2019, focusing on lower to middle Cambrian strata. Fieldwork was carried out between the Keele River and an area 5 km west of Dodo Creek, about 50 km west-southwest of Norman Wells. This effort was conducted with three main goals, in order to: (1) develop a sedimentological framework for the lower and middle Cambrian formations and elucidate the controls on facies distribution; (2) collect trilobites in order to constrain the biostratigraphy and the timing of deposition; and (3) to describe the paleobiology of the trilobite faunas which display anomalous evolutionary patterns compared to middle Cambrian trilobites from other parts of North America. The present report documents the lithostratigraphy at the studied stratigraphic sections and will form the basis for an analysis of the sedimentology and biostratigraphy that will be published separately.

The Canyon Ranges are part of the eastern extension of the Canadian Cordillera in this region. For an overview of Cambrian deposition in northwestern Canada, see Fritz (1991) and Pyle (2012). Cambrian formations in the eastern Mackenzie Mountains, undeformed Mackenzie Plain, and the Franklin Mountains were deposited in the Colville Basin (Sommers *et al*., in press) (Figure 1). This basin was semi-enclosed and bordered in the modern-day east by the paleoshoreline on the Canadian Shield, the north by the Aklavik Arch Complex, and the west by the Mackenzie and Peel arches, which separated it from the ocean-facing Selwyn Basin farther west (Dixon and Stasiuk, 1998; Pyle, 2012). The basin was likely open to southwest (Dixon and Stasiuk, 1998) and its boundaries to the northeast are debated (Sommers *et al*., in press).

The oldest formations in the Canyon Ranges are Neoproterozoic strata that form the core of the Mackenzie Arch (Aitken and Cook, 1974; Fallas and MacNaughton, 2012; Fallas and MacNaughton, 2014). Overlying Cambrian strata were deposited onlapping the Mackenzie Arch, and in turn are overlain by younger Paleozoic strata (Aitken and Cook, 1974) (Figure 2). Tectonic activity of the arch was intermittent during the latest Neoproterozoic and Cambrian and influenced the distribution of Cambrian formations (Aitken and Cook, 1974).

STRATIGRAPHIC FRAMEWORK

Proterozoic Units

Cambrian strata documented in the present report overlie formations belonging to the Katherine Group and Little Dal Group (Long and Turner, 2014). These two groups are part of the larger Mackenzie Mountains Supergroup which is late Mesoproterozoic to middle Neoproterozoic in age (Jefferson and Parrish, 1989; Leslie, 2009). The Katherine Group is composed of seven formations of alternating sandstone-dominated packages and heterolithic packages of sandstones, mudstones and carbonates (Long and Turner, 2014). The Little Dal Group is composed of seven formations of alternating carbonate with minor evaporite packages and packages of fine-grained clastics with minor evaporites and sandstones (Turner and Long, 2012).

Early and Middle Cambrian Units

Mount Clark Formation

The Mount Clark Formation was first described by Williams (1922) in the Franklin Mountains (see also Aitken *et al*., 1973). Early workers documented a basal sandstone unit within the Mount Cap Formation in the Canyon Ranges of the eastern Mackenzie Muntains (Aitken *et al*., 1973). Serié *et al*.

(2013) hypothesized that this basal sandstone was the Mount Clark Formation; this was confirmed by Fallas and MacNaughton (2012) and MacNaughton *et al.* (2013). Fallas and MacNaughton (2012) described the Mount Clark Formation as white, orange, pink and brown quartz arenites and quartzites, with planar-bedding, cross-bedding and cross-lamination, and with abundant vertical and horizontal burrows. Minor glauconitic, bioturbated arenites and thin, dark-weathering shale interbeds and partings are present. The base of the Mount Clark Formation is marked by an erosional unconformity, locally overlain by a maroon conglomerate. The presence of significant bioturbation in the Mount Clark Formations suggests an early to middle Cambrian age, though the Mount Clark Formation is poorly constrained biostratigraphically. Trilobites were collected in sandstones of the Mount Clark Formation by R.B. MacNaughton in 2012 from a locality close to the Little Bear River section of this report. These trilobites are under study by the present author and will help constrain the depositional age of the Mount Clark Formation.

Mount Cap Formation

The Mount Cap Formation was first described by Williams (1922) in the Franklin Mountains. In the Mount Cap Formation of the eastern Mackenzie Mountains, lithology is controlled by the geographic distribution of sections relative to the Mackenzie Arch. In sections distal to the arch, in the MacDougal Anticline (Figure 3), the Mount Cap Formation is the basal Cambrian formation (Aitken *et al*., 1973). This succession is composed of micritic limestone; dark-weathering grey and black mudstone; and bioturbated, glauconitic or arenaceous sandstone. This succession fines upwards into mudstone with minor micritic limestones. Trilobites from distal sections represent the latest early Cambrian *Bonnia-Olenellus* Zone through middle Cambrian *Albertella* and *Glossopleura* zones (Fritz, 1969).

In sections proximal to the Arch, in the Foran and Stony anticlines (Figure 3), the Mount Cap Formation conformably overlies the Mount Clark Formation, and is composed of mudstones with lesser lime mudstones. Trilobites from proximal successions represent the *Albertella* Zone followed by the *Glossopleura* Zone (MacNaughton *et al*., 2013; Serié *et al*., 2013). The missing *Bonnia-Olenellus* Zone, and evidence that the lower part of the distal successions appear to be facies controlled, suggest that the Mount Clark Formation is partially laterally equivalent to the basal Mount Cap Formation of distal areas (MacNaughton *et al*., 2013). In this report, the lower Mount Cap Formation in the lower part of the distal section (Dodo Canyon) is referred to as the heterolithic Mount Cap Formation, and the Mount Cap Formation in the proximal sections and upper part of the distal section is referred to as the mudstone-dominated Mount Cap Formation.

Saline River Formation

The Saline River Formation was first described by Williams (1922). This formation unconformably overlies the Mount Cap Formation, and is composed of red and green, gypsum-rich mudstones with minor interbeds of brown, brecciated and stromatolitic dolostones and bedded and nodular evaporites (Aitken and Cook, 1974; Dixon and Stasiuk, 1998). This formation is poorly constrained biostratigraphically, but the age constraints on the overlying Franklin Mountains Formation suggest an age of middle to late Cambrian (Aitken *et al*., 1973; Norford and Macqueen, 1975).

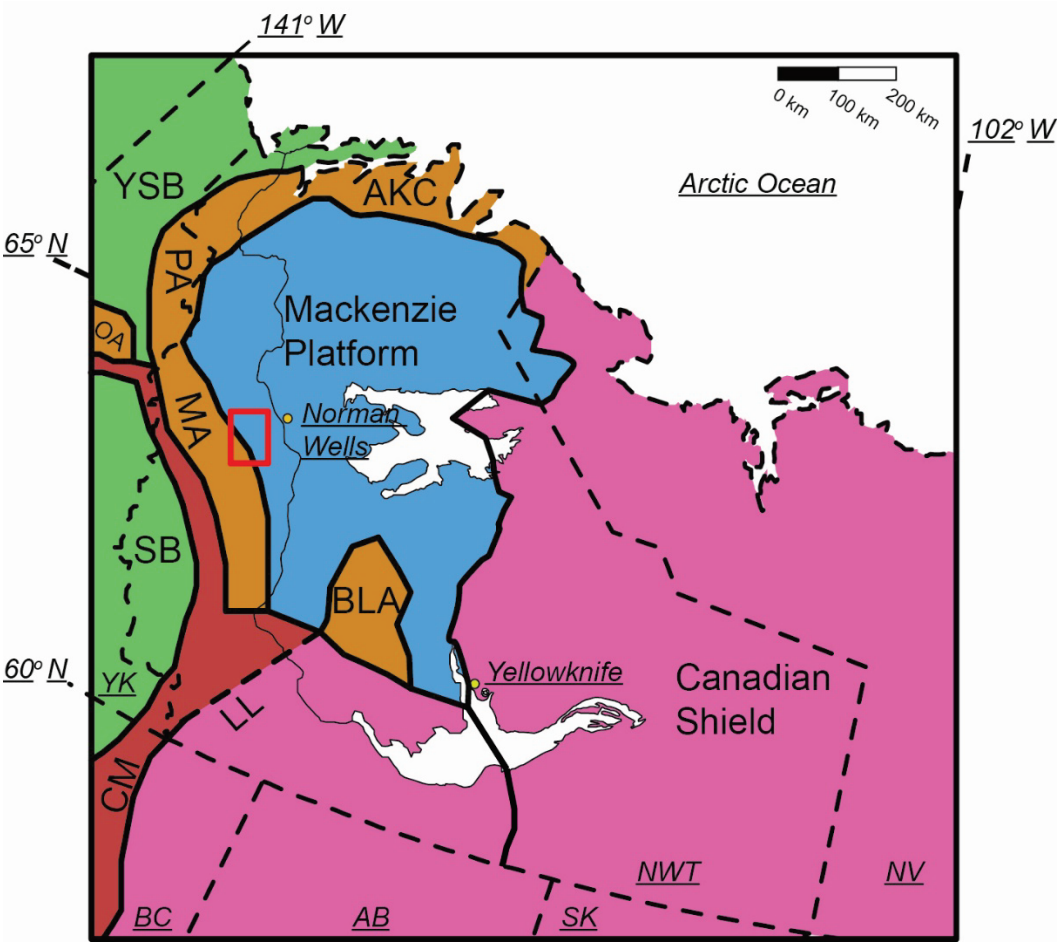

Figure 1: Distribution of Cambrian tectonic elements and sedimentary basins across the Northwest Territories. Field site locations are indicated by the red box. Modern communities indicated by yellow dots. MA=Mackenzie Arch, PA=Peel Arch, SB=Selwyn Basin, BLA=Bulmer Lake Arch, LL=Liard Line, AKC=Aklavik Arch Complex, CM=Cordilleran Miogeocline, OA=Ogilvie Arch, YSB=Yukon Stable Block. Material Sourced from Aitken (1993) and Pyle (2012).

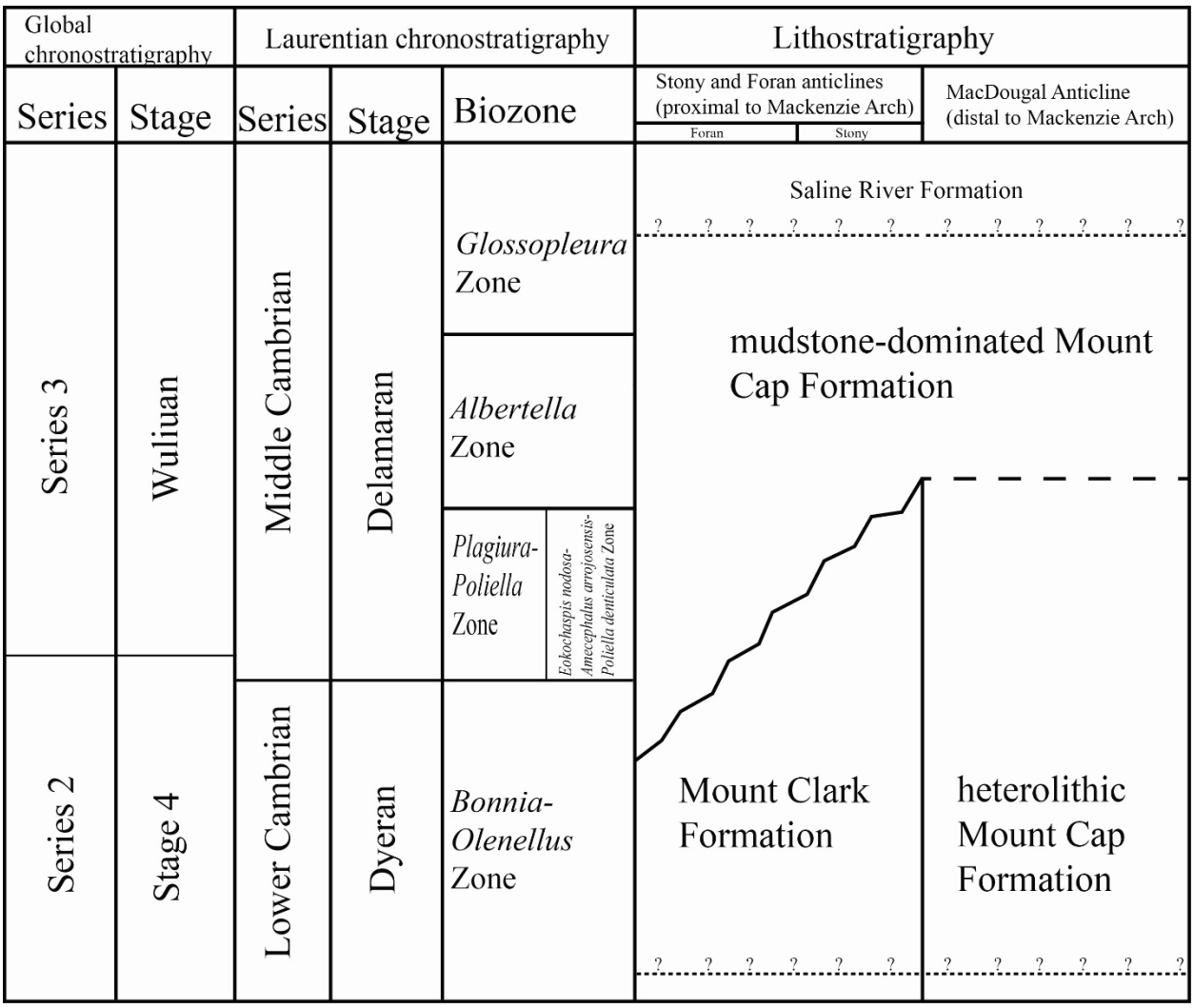

Figure 2: Chronostratigraphic and previously interpreted biostratigraphic subdivisions of Cambrian formations. Lithostratigraphic divisions based off Aitken *et al*. (1973) and MacNaughton *et al*. (2013). Biostratigraphic zones are based on traditional zones used by Lochman-Balk and Wilson (1958), modified with zones from Sundberg and McCollum (2000; 2003), Pratt and Bordonaro (2014) and Sundberg *et al.* (2020). ?=poorly constrained boundary.

MEASURED SECTIONS

The following descriptions tabulate the stratigraphic data from each field site. The geographic location of each site is in Figure 3, with NAD83 as the map datum. The legend for the graphic logs is in Figure 4. Figures 5–14 are the graphic logs and outcrop photographs for each section. In all graphic logs, formation names are placed to the left of the logs, aligned with the lowest unit(s) of the named interval. In the following notes, coordinates given are for the base of each section.

In all sections, sandstone compositions are classified as either arenitic or argillaceous sandstone. The term argillaceous sandstone is equivalent to "wacke", which will not be used in this report. This refers to the ratio of mud and silt particles to sand grains, though the mineralogy of sand-sized grains in both lithologies is entirely composed of quartz. Thus, sandstones are either quartz arenite or quartz argillaceous sandstone, unless glauconite is present in which case these are glaucarenites or glauconitic argillaceous sandstones. The lithology of the matrices of the sandstones are currently unknown.

In all five sections ichnological data was collected, and herein the terms "epichnial" will refer to traces casted on the upper surface of a bed, "hypichnial" will refer to traces casted on the lower surface of a bed and "endichnial" will refer to traces casted within a bed that are visible in cross section. Bioturbation index (BI) was recorded using the classification model developed by Taylor and Goldring (1993). This simply refers to the degree in which primary sedimentary fabric has been destroyed by bioturbation. Trilobites were collected at each site and the collection number will be listed in the unit(s) they were collected from. The first number will refer to the site, while the second number refers to the collection horizon: the greater the horizon number, the higher up in the section. A letter following the collection number indicates that the collection spans multiple units, reflecting a common fossil assemblage. Trilobites are identified at the order level here, and further taxonomic identification will be published later.

Figure 15 shows the correlation of measured sections along the line A-A' from Figure 3. This figure reveals the variable thickness of the Mount Clark Formation across the Canyon Ranges, thicker in the northwest part of the ranges and thinner in the southeast part.

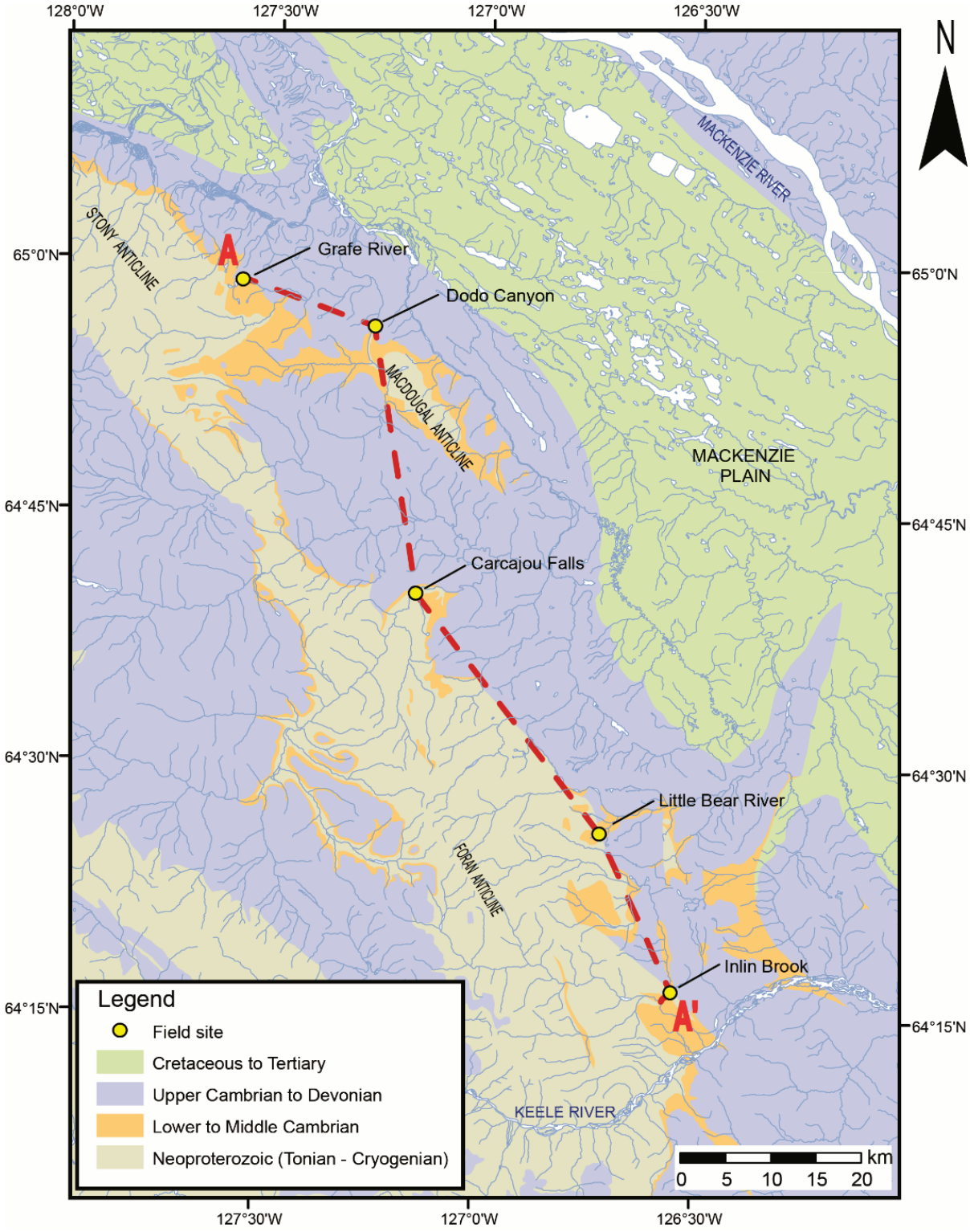

Figure 3: Field sites visited as part of the 2019 season. Eastern limit of the Mackenzie Arch is delineated by the Stony and Foran anticlines. Data for distribution of Paleozoic and Mesozoic formations and tectonic structures sourced from Aitken *et al*. (1974). Correlation A-A' in Figure 15 (modified from MacNaughton *et al*., 2013).

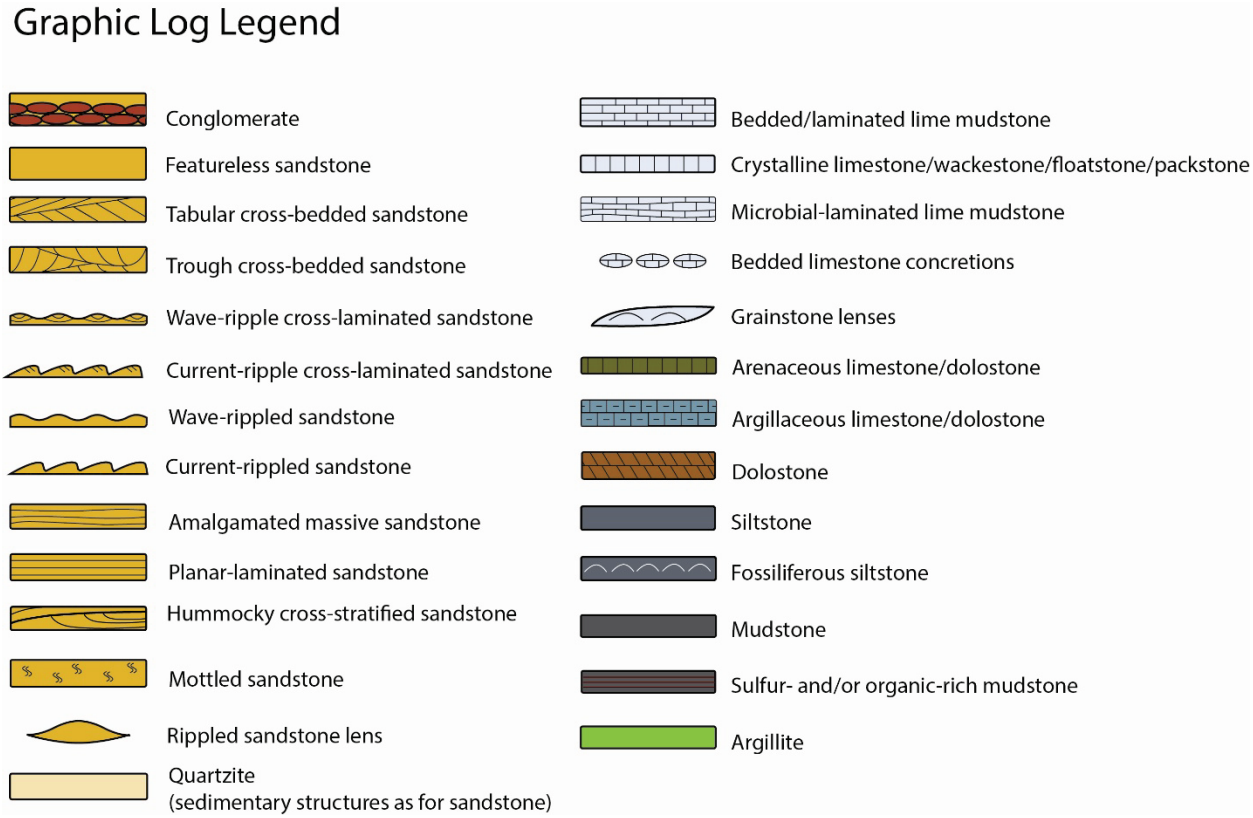

Figure 4: Graphic log legend for figures 5A, 5B, 7A, 7B, 9, 11A, 11B, 13A, 13B, 13C and 15.

Section 1: Dodo Canyon: (NTS 96D, 64.937525° N, 127.265209° W)

This section (figures 5A, 5B and 6) is exposed along the north side of Dodo Creek in Dodo Canyon, a few kilometres north of the junction with Echo Creek. Dodo Canyon is a reference section for the Cambrian stratigraphy of the MacDougal Anticline and has been measured several times previously (Aitken *et al.,* 1973; Serié *et al*., 2013; Bouchard and Turner, 2017) (see also MacNaughton *et al*., 2013). The lowest Cambrian strata, which are upriver from the measured section, could not be visited, though they were previously reported to overly the Stone Knife Formation of the Little Dal Group (Aitken *et al.,* 1973; Serié *et al*., 2013). Thus, the log of the heterolithic Mount Cap Formation is incomplete. The Saline River Formation overlies the Mount Cap Formation downriver in a poorly exposed section, but this could not be correlated to section 1 (roughly 4–6 m above the top of the section). Normal faulting is present in the middle of the outcrop, where a talus cone has formed along the fault plane. This was adjusted for in the measured section.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
	mudstone-dominated Mount Cap Formation		
21	Light grey, tan-weathering, variably dolomitic lime mudstone interbedded with black, dark grey-weathering mudstone. Beds are laterally continuous, 50% lime mudstone and 50% mudstone, grading upwards into 40% lime mudstone and 60% mudstone. Minor beds of wackestone and packstone are present at the base of the unit. Lime mudstone beds and laminae are 5–12 mm thick, planar bedded, thinly laminated and composed of microspar. Wackestone and packstone beds are wavy bedded, wave-rippled and consist of peloids in a micrite and microspar matrix. Some peloids have dark, micritic rims. Mudstone beds and laminae are 5–20 mm thick, featureless, composed of clay-sized particles and variably calcareous. Trace fossils are absent. Corynexochids and ptychoparioids are present in mudstone beds, particularly at the base of this unit, and rare in lime mudstone beds. Collection 1.7. Internal contacts are sharp. Basal contact is sharp.	6.8	73.9
20	Tan, brown-weathering carbonate breccia and wackestone interbedded with black, dark grey-weathering mudstone. Carbonate breccia and wackestone beds are 15–30 mm thick, wavy bedded and deformed with syn-sedimentary folds and faults. Carbonate clasts are 5–15 cm in diameter. Wackestone beds are composed of peloids in a micrite matrix. Mudstone beds are 25–50 cm thick, featureless, composed of clay-sized particles and organic-rich with minor deformed carbonate laminae and carbonate clasts. *Palaeophycus* is present on hypichnial surfaces of wackestone beds. BI=0–1. Body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	1.5	67.1
19	Black, dark grey-, red- and green-weathering mudstone with minor pale blue, tan-weathering limestone beds. This unit is fissile and	3.9	65.6

	composed of clay-sized particles with horizons that are sulfur- and organic-rich. Limestone beds are 5–10 cm thick, planar bedded and composed of microspar. Trace fossils are absent. Corynexochids are present in mudstone beds. Collection 1.6. Internal contacts are sharp. Basal contact is sharp.		
18	Black, dark grey-weathering mudstone with minor pale blue, tan-weathering lime mudstone. Mudstone beds are 5–18 cm thick, fissile and composed of clay-sized particles with minor sulfur- and organic-rich horizons. Lime mudstone beds are 3–8 cm thick, planar bedded and consist of micrite. Trace fossils are absent. Corynexochids, hyoliths and linguliformean brachiopods are present in mudstone beds. Collection 1.5B. Internal contacts are sharp. Basal contact is gradational	1.9	61.7
17	Black, dark grey-, red- and green-weathering mudstone with minor pale blue, tan-weathering lime mudstone beds. Mudstone beds are fissile and consist of clay-sized particles with sulfur- and organic-rich horizons. Limestone beds are 5–10 cm thick and composed of microspar. *Planolites* is rare on endichnial and hypichnial surfaces of mudstone beds. BI=0–1. Corynexochids and linguliformean brachiopods are present. Collection 1.5A. Internal contacts are sharp. Basal contact is sharp.	18.1	59.8
16	Dark brown, grey- and reddish brown-weathering, bedded and laminated crystalline limestone. Beds and laminae are 1–5 cm thick, wavy and rippled and composed of sparite with minor siliciclastic grains. Trace and body fossils are absent. Internal contacts are erosional. Basal contact is sharp	1.4	41.7
15	Pale brown, orange- and brown-weathering, laminated lime mudstone with minor beds of black, dark grey-weathering mudstone. Lime mudstone beds are planar bedded and laminated and composed of micrite and microspar. Mudstone beds are 10–20 cm thick, fissile, consist of clay-sized particles and are organic-rich. Trace and body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	0.4	40.3
14	Pale brown, orange-weathering limestone. Beds are 10–50 cm thick, planar and wavy bedded and composed of micrite. *Palaeophycus* and *Phycodes* are rare on hypichnial surfaces. BI=1–2. Body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	3.7	39.9
13	Green, greyish green-weathering siltstone interbedded with pale blue, buff-weathering carbonate concretions. This unit is 75% siltstone and 25% carbonate. Siltstone beds and laminae are 5–16 mm thick, fissile and composed of silt with minor clay. Concretions are 1–30 mm thick, occur in beds and consist of microspar. Trace fossils are absent. Corynexochids, ptychoparioids, hyoliths and linguliformean brachiopods are present in siltstone beds. Collection 1.4. Internal contacts are sharp. Basal contact is gradational.	2.1	36.2

heterolithic Mount Cap Formation

12	Green, greenish brown-weathering sandstone interbedded with green, greenish brown-weathering siltstone. This unit is planar bedded, 60% siltstone and 40% sandstone. Siltstone beds are 3–14 cm thick, fissile and composed of silt-sized particles with minor clay. Sandstone beds are 5–10 cm thick, internally featureless, argillaceous sandstones in composition with minor glauconite and consist of fine sand-sized grains. *Teichichnus* is present on hypichnial surfaces of sandstone beds. BI=1–2. Linguliformean brachiopods are present in siltstone beds. Internal contacts are sharp. Basal contact is gradational.	2.0	34.1
11	Green, greenish grey-weathering mudstone. This unit is massive, fissile and composed of clay-sized particles. Trace fossils are absent. Ptychoparioids, corynexochids, linguliformean brachiopods and hyoliths are present. Collection 1.3B. Basal contact is sharp.	2.5	32.1
10	Green, greyish green-weathering siltstone interbedded with pale blue, buff-weathering lime mudstone. This unit is 75% siltstone and 25% lime mudstone. Siltstone beds are 8–20 mm thick, fissile and composed of silt-sized particles. Lime mudstone beds and laminae are 1–37 mm thick, commonly nodular or consist of beds of concretions and composed of microspar. Trace fossils are absent. Ptychoparioids are present in siltstone lithology. Collection 1.3A. Internal contacts are sharp. Basal contact is sharp	1.8	29.6
9	Green, greenish grey-weathering mudstone interbedded with pale blue, tan-weathering lime mudstone. Beds are laterally continuous, with lime mudstone beds and laminae present in the middle of the unit. Mudstone beds are 3–20 cm thick, fissile and composed of clay-sized particles. Lime mudstone beds are 1–8 cm thick, planar bedded and composed of microspar. Trace and body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	0.5	27.8
8	Green, greyish green-weathering siltstone and pale blue, tan-weathering lime mudstone. This unit is 75% siltstone and 25% lime mudstone. Siltstone beds and laminae are 5–20 mm thick, featureless, fissile and consist of silt-sized particles. Lime mudstone beds and laminae are 1–45 mm thick, nodular, or consist of beds of concretions and are composed of microspar. Trace fossils are absent. Linguliformean brachiopods and hyoliths are present in siltstones. Internal contacts are sharp. Basal contact is gradational.	3.5	27.3
7	Light grey, orange-weathering sandstone interbedded and interlaminated with green, greyish green-weathering siltstone. This unit is 50% sandstone and 50% siltstone. Sandstone beds and laminae are 2–35 mm thick, planar and wavy bedded and internally featureless with minor current-ripple cross-laminated beds.	2.0	23.8

	Sandstones are argillaceous sandstones in composition and consist of very- fine to fine sand-sized grains. Siltstone laminae are 1–3 mm thick, fissile, composed of silt-sized particles and variably calcareous. Trace fossils are absent. Ptychoparioids, linguliformean brachiopods and hyoliths are present in siltstone beds. Collection 1.2 Internal contacts are sharp. Basal contact is sharp.		
6	Light grey, orange- and dark grey-weathering sandstone. Beds are 2–10 cm thick, wavy bedded, amalgamated, internally featureless or mottled with minor wave-rippling. Sandstones are arenitic in composition and consist of fine sand-sized grains. The top-most 15 cm is composed of laminated siltstone. *Planolites*, *Palaeophycus, Teichichnus* and rare *Rusophycus* are present on hypichnial and endichnial surfaces of mottled beds. BI=3–4 for mottled beds. No body fossils are present. Internal contacts are sharp. Basal contact is sharp.	3.6	21.8
5	Brown, orange-weathering sandstone. This unit is wavy bedded, wave-ripple cross-laminated, arenitic in composition and consists of coarse to very- coarse sand-sized grains. *Teichichnus* and *Palaeophycus* are present on endichnial surfaces. BI=0–1. Linguliformean brachiopods are rare. Basal contact is erosional.	0.2	18.2
4	Light grey, orange brown-weathering arenaceous wackestone interbedded and interlaminated with pale green, pale grey-weathering argillaceous lime mudstone. Beds and laminae are planar and wavy, 50% arenaceous and 50% argillaceous. Arenaceous wackestone beds and laminae are 1–150 mm thick and are wave-rippled and wave-ripple cross-laminated with minor gutter casts and current ripples. Wackestones consist of very fine siliciclastic grains and trilobite bioclasts in a micrite matrix with blocky sparite. Argillaceous lime mudstone beds and laminae are <1–30 mm thick, laminated and composed of micrite with minor argillaceous particles. *Planolites* and *Palaeophycus* are present on endichnial and hypichnial surfaces of arenaceous wackestone beds and laminae. BI=0–1. Olenellid trilobites are present in arenaceous wackestone beds and laminae. Collection 1.1. Internal contacts are sharp. Basal contact is sharp.	1.8	18.0
3	Brown grey, orange-weathering sandstone interbedded with pale grey, dark grey-weathering argillaceous lime mudstone. This unit is planar and wavy bedded, 70% sandstone and 30% lime mudstone. Sandstone beds are 25–105 cm thick, internally featureless or mottled with minor wave-rippling. Sandstones are arenitic in composition and consist of very fine to medium sand-sized grains. Argillaceous lime mudstone beds are 5–10 cm thick, laminated and composed of micrite with minor argillaceous material. *Palaeophycus*, *Planolites*, *Skolithos* and *Diplocraterion* are present on endichnial and hypichnial surfaces of sandstone beds. BI=1–3.	4.6	16.2

	Body fossils are absent. Internal contacts are sharp. Basal contact is sharp.		
2	Grey, orange-weathering sandstone interbedded with pale green, green-weathering mudstone. This unit is planar bedded, 50% sandstone and 50% mudstone. Sandstone beds are 3–50 cm thick, internally featureless, argillaceous sandstones in composition and consist of fine sand-sized grains. Mudstone beds are 3–10 cm thick, fissile and composed of clay-sized particles with minor silt. *Diplocraterion* is rare on endichnial and epichnial surfaces. BI=0–1. Body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	1.6	11.6
1	Greenish-grey, orange-, red- and green-weathering sandstone with minor pale green, dark green-weathering mudstone beds. Sandstone beds are 5–10 cm thick, wavy bedded, amalgamated and wave-rippled with minor wave-ripple and tabular cross-lamination. Sandstones are argillaceous sandstones in composition with minor arenites and glauconite and consist of fine sand-sized grains. Mudstone beds are 5–20 cm thick, featureless, fissile and composed of clay-sized particles with minor silt. *Palaeophycus*, *Planolites* and *Monocraterion* are present on hypichnial surfaces of sandstones. BI=1–2. Body fossils are absent. Internal contacts are sharp or erosional. The basal contact is covered.	10.0	10.0

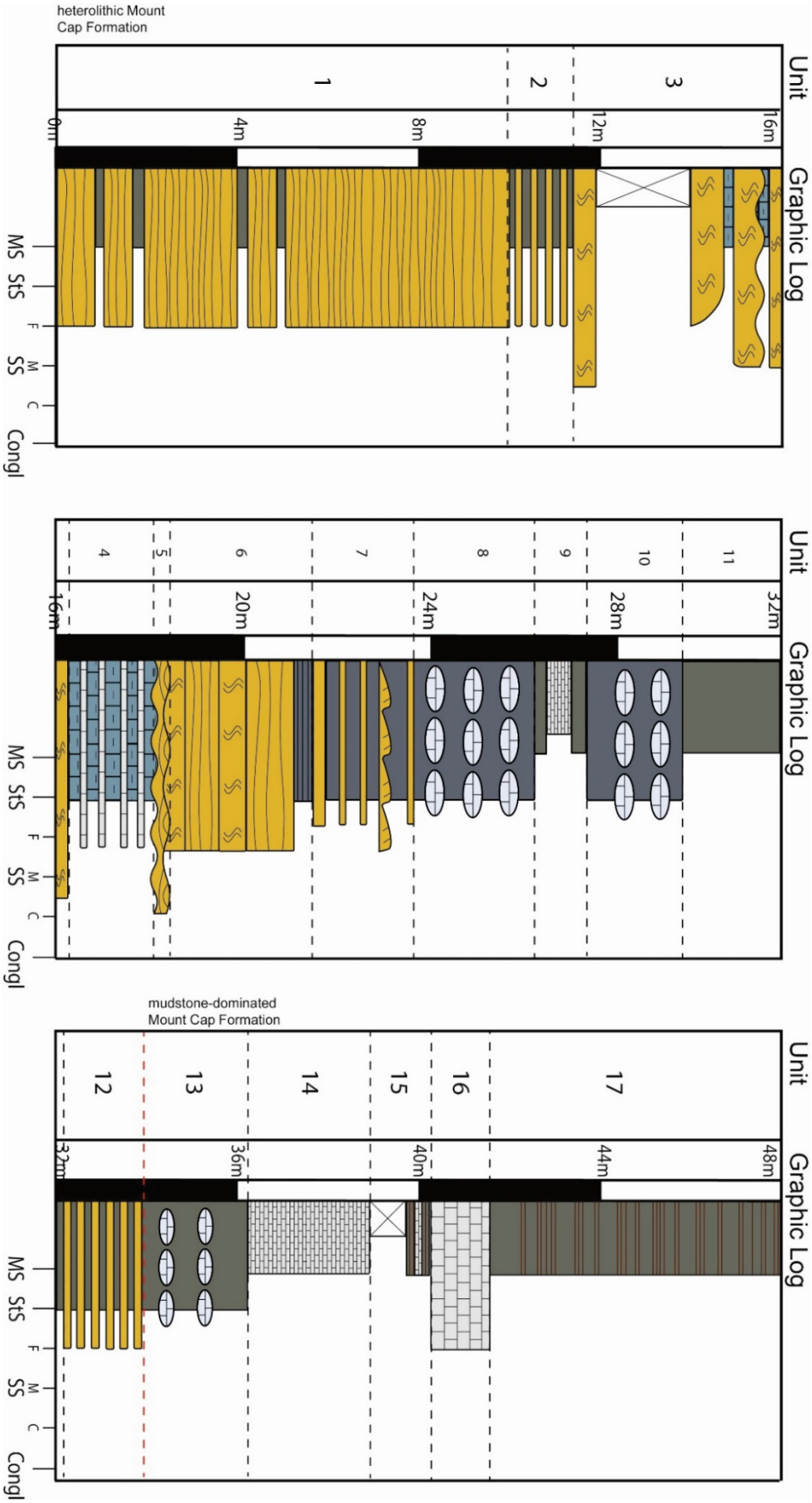

Figure 5A: Graphic log of the section at Dodo Canyon, showing unit divisions; 0–48.0 m. Red dashed line indicates a lithostratigraphic boundary.

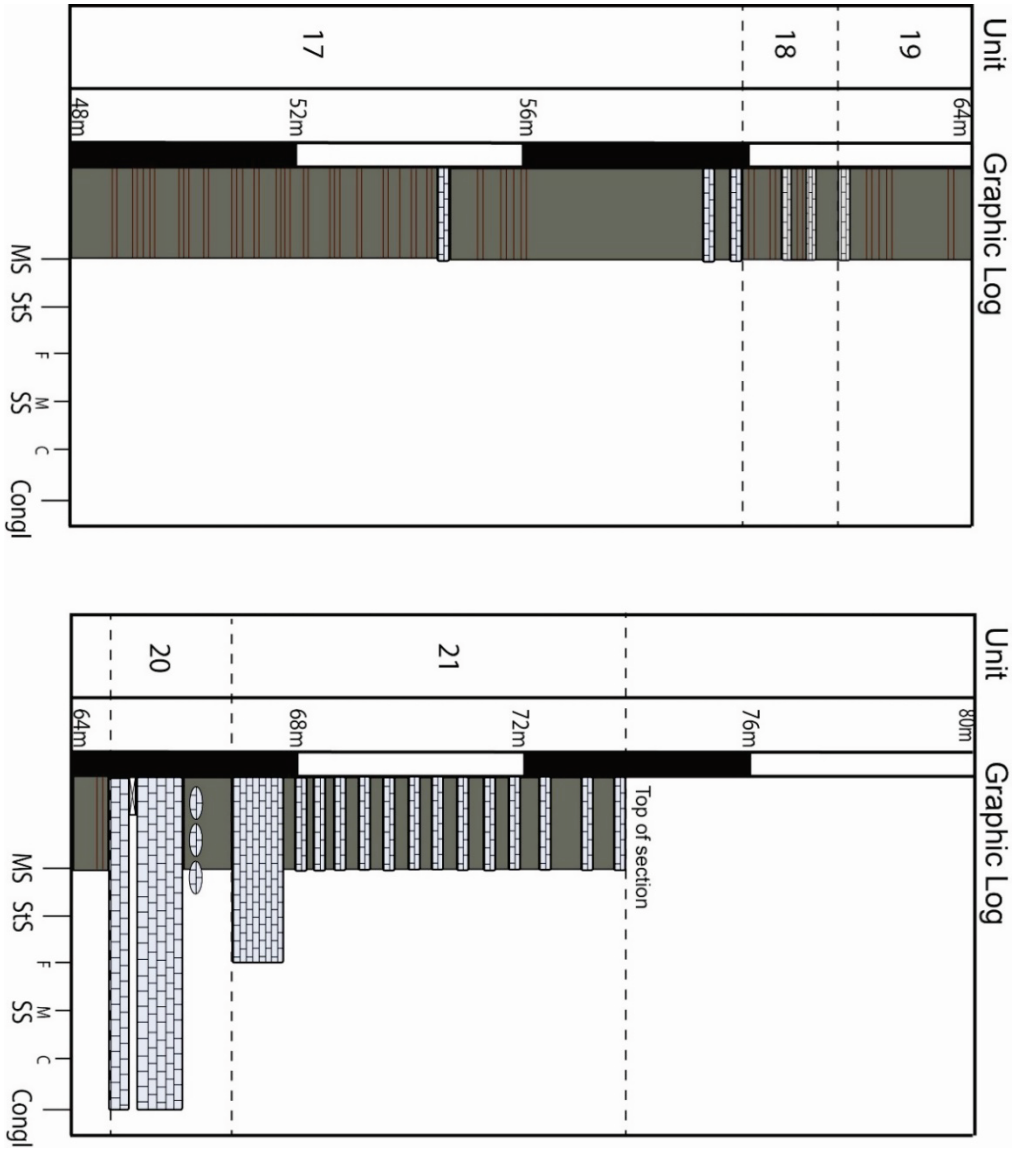

Figure 5B: Graphic log of the section at Dodo Canyon, showing unit divisions; 48.0–73.9 m.

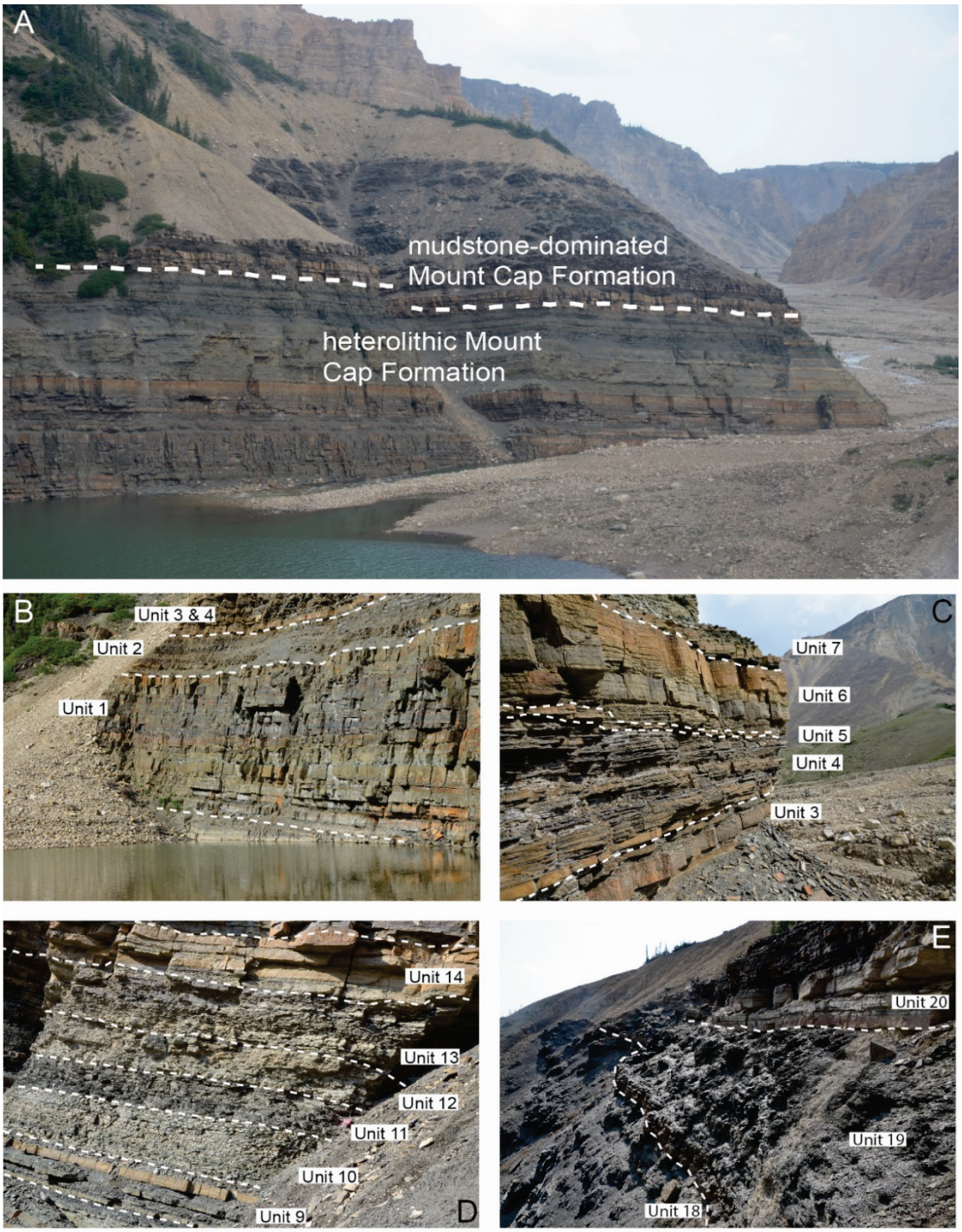

Figure 6: Outcrop views at Dodo Canyon. All photographs by N.M. Handkamer. **A**) Lithostratigraphic divisions at Dodo Canyon. Upper, pale beige talus slope likely indicates the approximate position of the Mount Cap Formation-Saline River Formation contact. Outcrop thickness = 73.9 m. NRCan Photo 2020-245. **B**) Basal heterolithic Mount Cap Formation. Stratal thickness = ~18 m. NRCan Photo 2020-246. **C**) Middle heterolithic Mount Cap Formation. Stratal thickness = 7.2 m. NRCan Photo 2020-247. **D**) Upper heterolithic Mount Cap Formation and lower mudstone-dominated Mount Cap Formation. Stratal thickness = 13.5 m. NRCan Photo 2020-248. **E**) Middle mudstone-dominated Mount Cap Formation. Stratal thickness = ~4.5 m. NRCan Photo 2020-249.

Section 2: Little Bear River: (NTS 96D, 64.479199° N, 126.794262° W)

This section (figures 7A, 7B and 8) exposes the Mount Clark and Mount Cap formations on the south side of the Little Bear River. This section has been previously measured by Aitken *et al*. (1973) and by Butterfield and Nicholas (1996), and studied by Serié *et al*. (2013). The underlying strata (Unit 1 in this section) are part of the Stone Knife Formation (Little Dal Group) (Serié *et al*., 2013), which has been thrust upwards to form a deep canyon upriver (to the west) of where the section was measured. The Stone Knife Formation-Mount Clark Formation contact is covered in this locality, as is the upper contact of the Mount Cap Formation. Significant thrust faulting is observed throughout this section and was accounted for during measuring.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
	mudstone-dominated Mount Cap Formation		
14	Dark grey, pale grey-weathering mudstone interbedded and interlaminated with buff, beige-weathering, dolomitic lime mudstone. This unit is planar bedded, 50% lime mudstone and 50% mudstone which grades upwards into 10% lime mudstone and 90% mudstone. Lime mudstone beds and laminae are 4–80 mm thick, thin upwards and nodular. Lime mudstones are composed of minor trilobite and linguliformean brachiopod bioclasts in a microspar matrix that is partially dolomitized. Mudstone beds and laminae are <1–60 mm thick, fissile and fossiliferous. Mudstones consist of clay-sized particles with minor silt. Thin sections show that burrows are present in lime mudstones. Dolomitization is greater within burrows. Corynexochids, ptychoparioids and hyoliths are present in mudstones. Collection 2.9. Internal contacts are sharp. Basal contact is sharp.	7.4	61.0
13	Dark grey, pale grey-weathering mudstone interbedded with buff, beige-weathering dolomitic lime mudstone. This unit is planar bedded, 60% lime mudstone and 40% mudstone, grading upwards into 10% lime mudstone and 90% mudstone. Lime mudstone beds are 4–80 mm thick, thinning upwards and nodular. Lime mudstones are composed of minor trilobite and linguliformean brachiopod bioclasts in a matrix of microspar that is partially dolomitized. Mudstone beds are <1–60 mm thick, fissile and fossiliferous. Mudstones consist of clay-sized particles with minor silt. Thin sections show that burrows are present in lime mudstones. Dolomitization is greater within burrows. Linguliformean brachiopods, corynexochids and hyoliths are present in mudstones. Collection 2.8. Internal contacts are sharp. Basal contact is sharp.	4.7	53.6
12	Dark grey, pale grey- and yellowish orange-weathering mudstone. This unit is massive, fissile, poorly exposed and has discontinuous horizons rich in both sulfur and large concretions. This unit is composed of clay-sized particles with minor silt and rare pyrite	5.3	48.9

	crystals. Trace fossils are absent. Ptychoparioids are rare. Collection 2.7. The base is poorly exposed due to faulting.		
11	Black, dark grey-weathering mudstone. This unit is poorly exposed, fissile and composed of clay-sized particles with minor pyrite crystals. Trace fossils are absent. This unit is mostly unfossiliferous except for rare fossiliferous horizons. Corynexochids and hyoliths are present. Collection 2.6. Base is not exposed.	4.1	43.6
10	Dark grey, pale grey- and yellowish orange-weathering mudstone. This unit is massive, fissile, poorly exposed and has discontinuous sulfur-rich horizons. This unit is composed of clay-sized particles with minor silt and rare pyrite crystals. Trace fossils are absent. Corynexochids and ptychoparioids are present. Collections 2.4 and 2.5. Base is gradational	4.7	39.5
9	Pale blue, pale yellow-weathering dolomitic lime mudstone interbedded with black, dark grey-weathering mudstone. The unit is planar bedded, 80% mudstone and 20% lime mudstone. Mudstone beds are 10–150 cm thick, fissile and composed of clay-sized particles with minor silt and pyrite crystals. Lime mudstone beds are 5–12 cm thick, nodular and composed of micrite, microspar and sparite that is partially dolomitized with variable, but minor if present, argillaceous material. Thin sections show that burrows are present in lime mudstone beds. Dolomitization is greater within burrows. The basal part of this unit contains olenellids within both mudstones (Collection 2.1) and lime mudstones (Collection 2.2). Above this, ptychoparioids are present, though only in mudstone beds. Collection 2.3. Linguliformean brachiopods and hyoliths are present in mudstone beds throughout. Internal contacts are sharp. Base is sharp.	3.2	34.8
	Covered	3.0	31.6
8	Brownish grey, tan-weathering arenaceous dolostones. This unit is wavy bedded, amalgamated and beds are 5–10 cm thick. Beds are composed of non-planar dolomite (dolomite with non-planar crystal boundaries) and siliciclastic grains. Thin mudstone laminae and partings are present between dolostone beds and are <1mm thick. *Teichichnus*, *Palaeophycus*, *Planolites*, *Skolithos* and *Cruziana* are present on endichnial and hypichnial surfaces. BI=2–3. Linguliformean brachiopods are rare. Internal contacts are sharp. Basal contact is gradational.	1.3	28.6
7	Brownish grey, tan-weathering dolostone interbedded with dark grey, light grey-weathering mudstone. This unit is planar and wavy bedded. Dolostones are 2.5–15 cm thick, wave-rippled and composed of non-planar dolomite with minor siliciclastic grains. Mudstone laminae are <1–5 mm thick, featureless and composed of clay-sized particles with minor silt. *Planolites*, *Palaeophycus* and	4.3	27.3

	Teichichnus are present on endichnial and hypichnial surfaces of dolostones. BI=0–2 (lowest in the middle of the unit). Body fossils are absent. Internal contacts are sharp. Basal contact is sharp.		
	Mount Clark Formation		
6	Brownish grey, pale brown-weathering sandstone. Beds are 10–35 cm thick, planar and wavy, amalgamated and internally featureless. Sandstones are arenitic in composition and consist of medium to fine sand-sized grains. Thin mudstone laminae and partings are present between sandstone beds. *Teichichnus* and *Planolites* are present on endichnial and hypichnial surfaces. BI=1. Body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	2.2	23.0
5	Brownish grey, pale brown-weathering sandstone. This unit is mottled, argillaceous sandstone in composition and consists of fine to very fine sand-sized grains. The top 10 cm of this unit is featureless mudstone composed of clay-sized particles with minor silt. *Teichichnus*, *Palaeophycus*, *Planolites*, *Skolithos* and rare *Cruziana* are present on endichnial and hypichnial surfaces of sandstones. BI=3–4. Body fossils are absent. Internal contacts are gradational or sharp. Basal contact is gradational.	1.3	20.8
4	Brownish grey, pale brown-weathering sandstones. This unit is planar and wavy bedded. Beds are 10–35 cm thick, amalgamated and internally featureless. Sandstones are arenitic in composition and consist of fine sand-sized grains. Thin mudstone laminae and partings are present in between sandstone beds. *Skolithos* and *Palaeophycus* are present on hypichnial, epichnial and endichnial surfaces. BI=1. Body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.	0.5	19.5
3	Brownish grey, pale brown-weathering sandstone. This unit is mottled, argillaceous sandstone in composition and consists of fine to very fine sand-sized grains. The top 5 cm of this unit is featureless mudstone composed of clay-sized particles with minor silt. *Teichichnus* and *Planolites* are present on endichnial and hypichnial surfaces. BI= 3–4. Body fossils are absent. Internal contacts are gradational or sharp. Basal contact is sharp.	1.6	19.0
2	Pale grey, reddish brown-weathering sandstone. This unit is tabular and trough cross-bedded and cross-laminated with minor wave-ripple cross-laminations. Sandstones are arenitic in composition and consist of medium sand-sized grains. Thin mudstone laminae are present between sand beds. *Skolithos*, *Arenicolites* and *Diplocraterion* are present on endichnial surfaces and *Palaeophycus* is present on hypichnial surfaces. BI=0–1. Body fossils are absent. Internal contacts are sharp. Basal contact is covered.	2.1	17.4

	Covered	5.0	15.3
	Stone Knife Formation		
1	Brown, orange-weathering dolostone. This unit is featureless or planar bedded with minor brecciated horizons and stromatolites. This unit is composed of crystalline dolomite. Trace and body fossils are absent. Basal contact is covered.	10.3	10.3

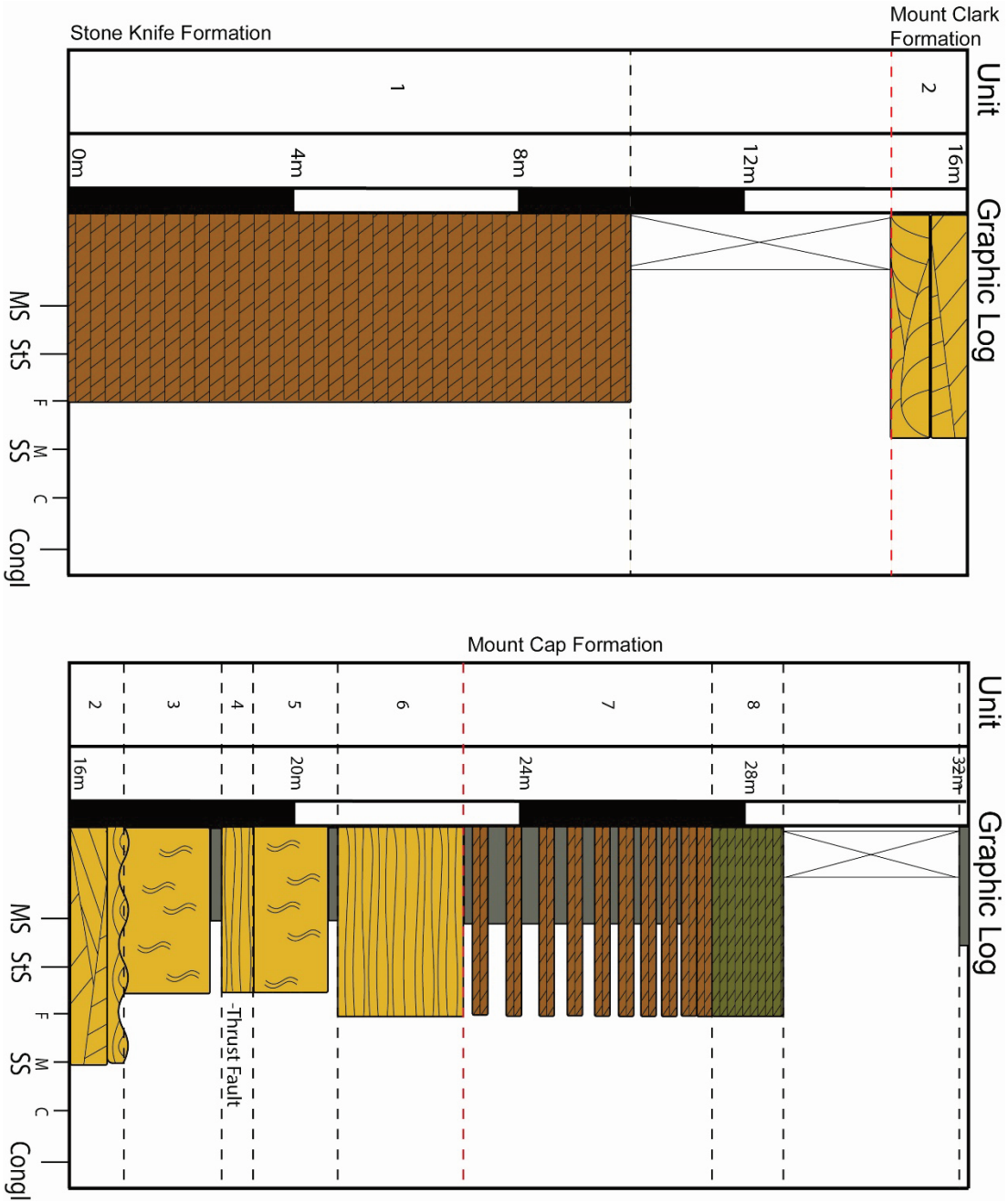

Figure 7A: Graphic log of the section at Little Bear River, showing unit divisions; 0–32.0 m. Red dashed line indicates lithostratigraphic boundaries.

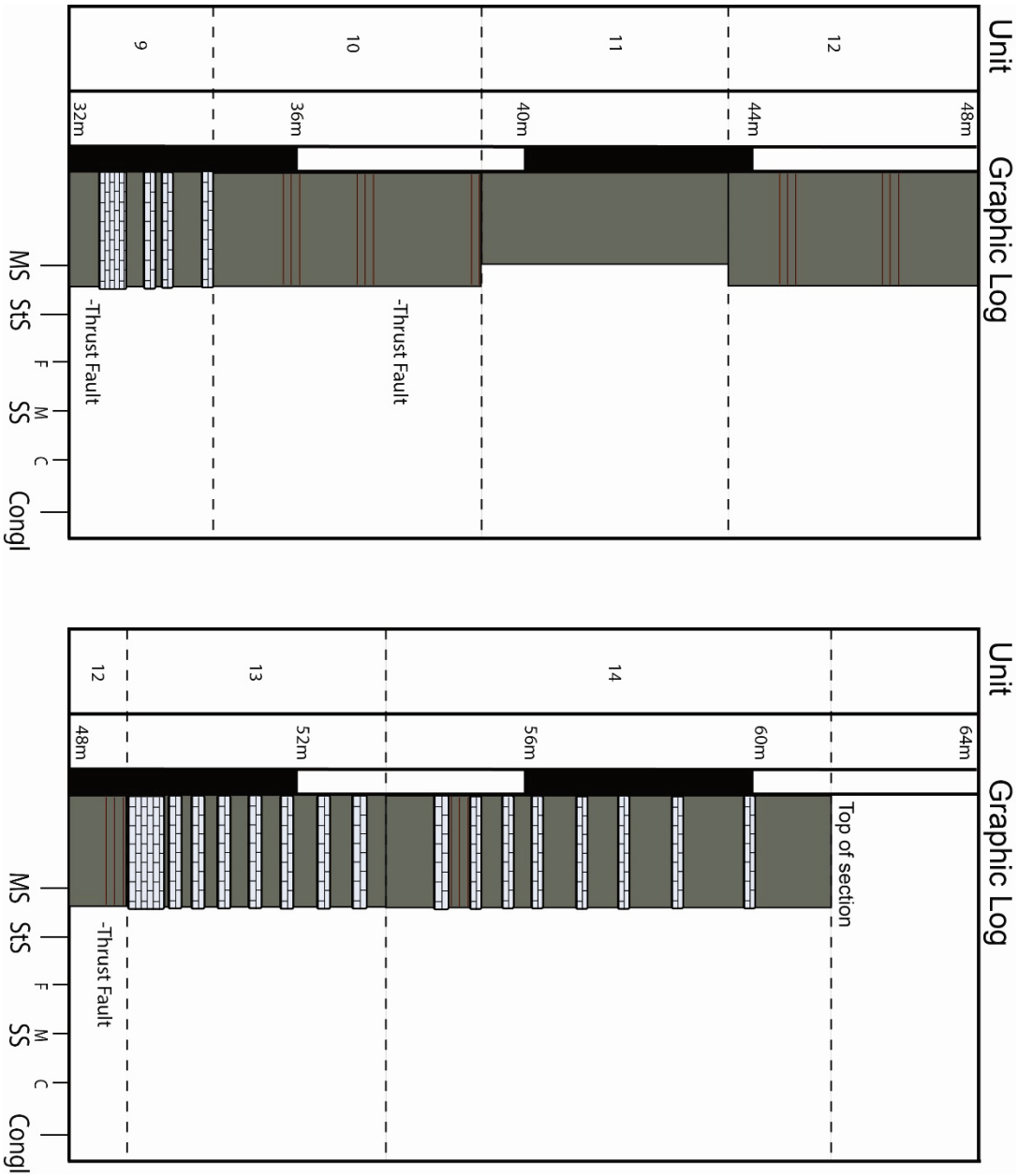

Figure 7B: Graphic log of the section at Little Bear River, showing unit divisions; 32.0–61.0 m.

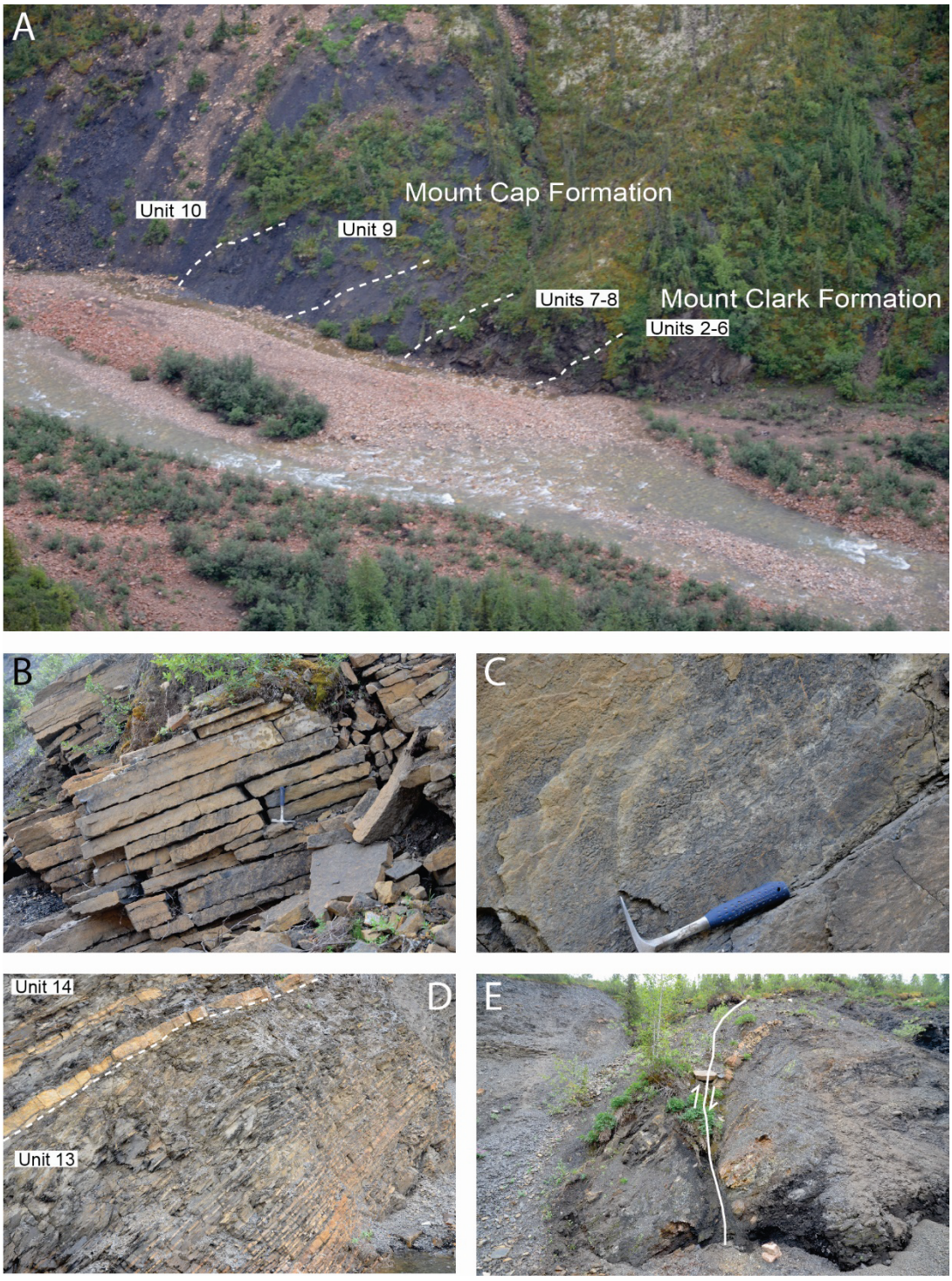

Figure 8: Outcrop views at Little Bear River. All photographs by N.M. Handkamer. **A**) Unit divisions of the Mount Clark and lower Mount Cap formations. Outcrop thickness = ~40 m . NRCan Photo 2020-250. **B**) Unit 8: interbedded arenaceous dolostone with thin mudstone laminae and partings. Hammer length = 27.5 cm. NRCan Photo 2020-251. **C**) Unit 3: mottled sandstone. Hammer length = 27.5 cm. NRCan Photo 2020-252. **D**) Contact between units 13 and 14 showing decreasing carbonate upwards in each unit. Stratal thickness = ~5.2 m. NRCan Photo 2020-253. **E**) Thrust fault cross-cutting unit 12. Stratal thickness of hanging wall block = ~2 m. NRCan Photo 2020-254.

<u>Section 3: Inlin Brook</u>: (NTS 96D, 64.282846° N, 126.543348° W)

This section (figures 9 and 10) is exposed on the west side of Inlin Brook, about 8 km upriver from the junction with Keele River. This section was previously measured by Serié *et al*. (2013). Limited time was available for measuring the upper part of this section, and these observations should be considered to be at reconnaissance level. The section is within an overturned anticline that has been thrust onto the Saline River and Franklin Mountains formations. The Mount Clark Formation reportedly overlies the Stone Knife Formation of the Little Dal Group (Serié *et al*., 2013). Only the basal part of the mudstone-dominated Mount Cap Formation is accessible in this section. Some faulting was observed at the base of the Mount Clark Formation, but the sense of movement is unknown.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
	mudstone-dominated Mount Cap Formation		
7	Dark grey, grey-, red- and yellow-weathering mudstone. This unit is massive, fissile and composed of clay-sized particles with sulfur-rich horizons. Trace fossils are absent. Olenellids and hyoliths are present at the top, but overall, the unit is unfossiliferous. Collection 3.1. Basal contact is sharp.	4.8	18.9
6	Black, dark grey-weathering arenaceous dolostone. Beds are 1–15 cm thick, wave-rippled and composed of non-planar dolomite with minor siliciclastic grains. Trace and body fossils are absent. Internal contacts are sharp. Basal contact is poorly exposed but appears to be sharp.	1.3	14.1
	Mount Clark Formation		
5	Beige, tan- and brown-weathering sandstone. Beds are 3–14 cm thick, wavy bedded, amalgamated and internally featureless with minor wave-rippling and with siltstone laminae between the sandstone beds. Sandstones are argillaceous sandstones in composition and consist of coarse to medium sand-sized grains. Bioturbated horizons are present, but overall bioturbation is low. *Teichichnus*, *Palaeophycus* and *Planolites* are present on endichnial and hypichnial surfaces. BI=0–4. Body fossils are absent. Internal contacts are sharp. Basal contact is poorly exposed	2.9	12.8
4	Beige, tan- and brown-weathering sandstone. This unit is wavy bedded and mottled with minor trough cross-lamination and mudstone laminae. Sandstones are argillaceous sandstones in composition and consist of fine to medium sand-sized grains. *Palaeophycus*, *Teichichnus*, *Planolites* and rare *Cruziana, Skolithos*, *Arenicolites* and *Diplocraterion* are present on endichnial surfaces. BI=3–4. Body fossils are absent. Basal contact is sharp.	0.8	9.9

3	Grey and pale blue, beige-weathering sandstone. This unit is normally graded and trough and tabular cross-laminated. Sandstones are arenitic in composition and consist of coarse to fine sand-sized grains with minor granules at the base. Trace and body fossils are absent. Internal contacts are sharp or erosional. Basal contact is gradational.	7.8	9.1
2	Beige and pale blue, pale blue-weathering conglomerate. This unit is lenticular and wavy, clast supported at the base (70% clasts, 30% matrix) and gradually becomes matrix supported upwards (50% sand, 50% matrix). Clasts are 0.5–7 cm in size, subangular to subrounded, equant and composed of quartzite. Matrix is trough and tabular cross-laminated or featureless sandstone, composed of coarse sand-sized grains and is arenitic in composition. Trace and body fossils are absent. Basal contact is erosional.	0.7	1.3
	Stone Knife Formation		
1	Brown, orange-weathering dolostone. This unit is massive or thick bedded with minor mudstone beds. Dolostone is composed of crystalline dolomite. Trace and body fossils are absent. Basal contact was not observed.	0.6	0.6

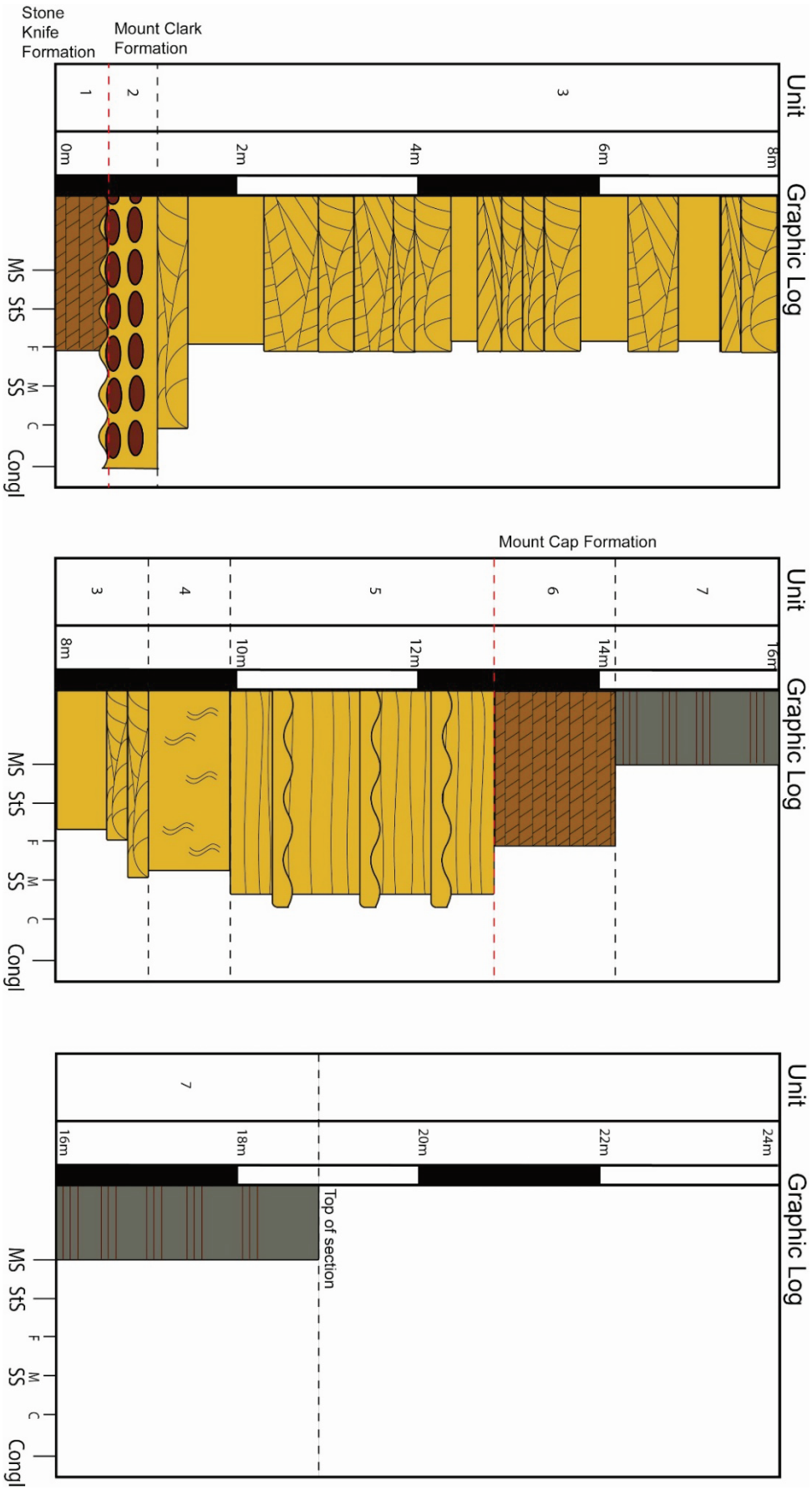

Figure 9: Graphic log of the section at Inlin Brook, showing unit divisions; 0–18.9 m. Red dashed line indicates lithostratigraphic boundaries.

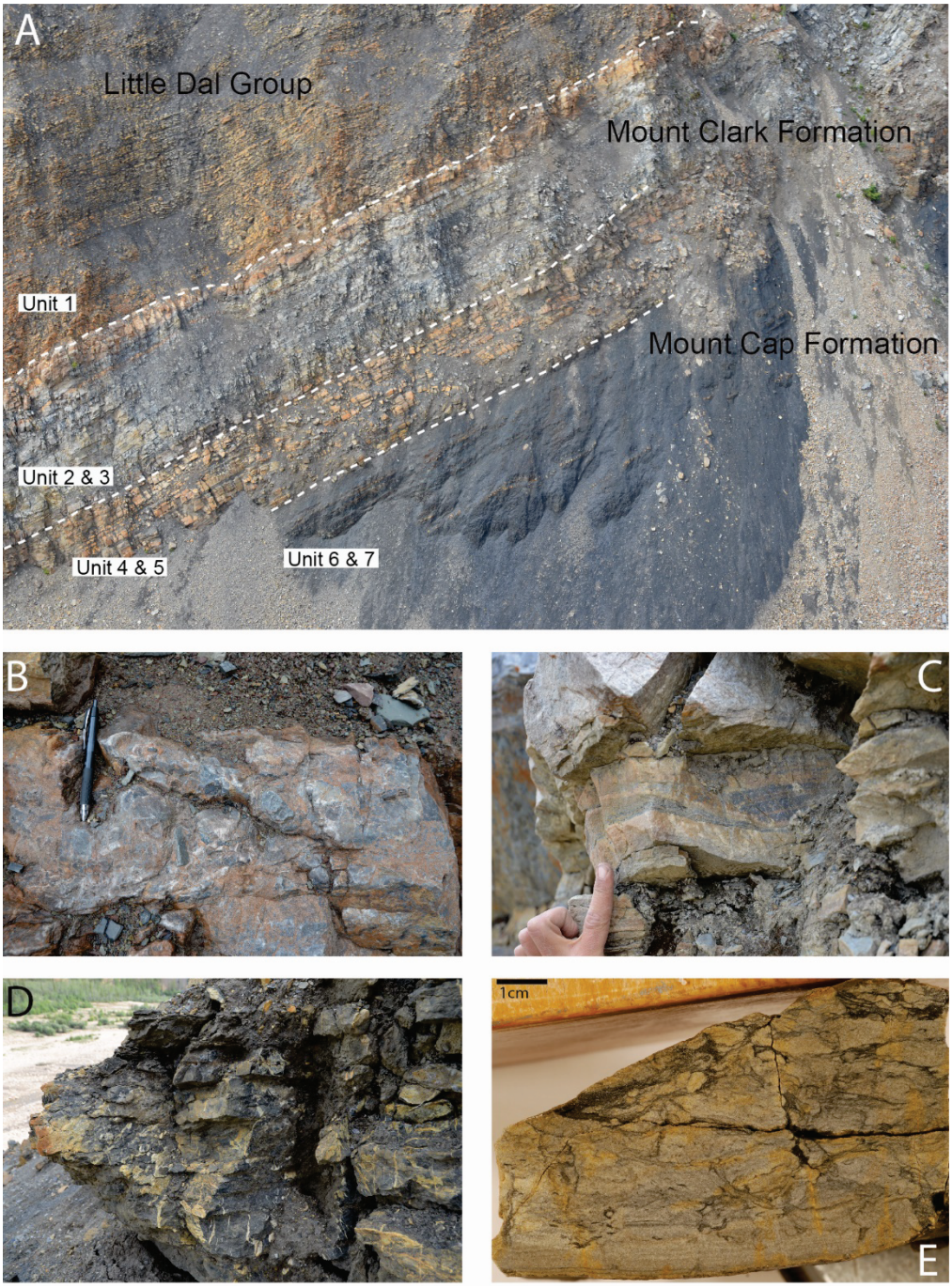

Figure 10: Outcrop views at Inlin Brook. All photographs by N.M. Handkamer. **A**) Lithostratigraphic and unit divisions at Inlin Brook. Beds are overturned. Outcrop thickness = 18.9 m. NRCan Photo 2020-255. **B**) Unit 2: conglomerate. This bed is overturned, and the base is visible. Pen length = 12 cm. NRCan Photo 2020-256. **C**) Unit 3: trough cross-lamination. Cross-beds are overturned. Finger length = 7 cm. NRCan Photo 2020-257. **D**) Unit 6: dolostone. Beds are overturned. Stratal thickness = 1.3 m. NRCan Photo 2020-258. **E**) Cut and polished sample of an endichnial surface of the bioturbated sandstone of unit 4. NRCan Photo 2020-259.

<u>Section 4: Carcajou Falls</u>: (NTS 96D, 64.670639° N, 127.1616.82° W)

This section (figures 11A, 11B and 12) was measured on the south side of Carcajou River, between the first and second set of falls. This section is a reference section for the Cambrian stratigraphy of the Foran Anticline. It has previously been studied by Serié *et al*. (2013; see also MacNaughton *et al*., 2013). The upper part of the section is well exposed in a canyon upstream from the second set of falls (Figure 12A), while the lower part was measured farther upstream from the second set of falls. The lower part of the section was compared to another exposure downriver by the second set of falls to the north in order to understand the lateral thickness of the basal units. The entire succession is exposed in a very open syncline. Basal Mount Clark Formation and Precambrian strata were not accessible, but the Mount Clark Formation has been reported to overlie the Stone Knife Formation of the Little Dal Group (Serié *et al*., 2013). The upper contact of the Mount Cap Formation with the Saline River Formation is not exposed at this section.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
	mudstone-dominated Mount Cap Formation		
31	Black, dark grey-weathering mudstone with minor buff, beige-weathering bioclastic lime mudstone and rare minor bioclastic floatstones. Mudstone beds are fissile, fossiliferous and composed of clay-sized particles with minor calcareous material. Limestone beds and laminae are 2–50 mm thick, planar bedded, featureless and composed of trilobite bioclasts in a micrite and microspar matrix. Floatstones have higher concentrations of bioclasts. Trace fossils are absent. Identifiable corynexochids are present in outcrop. Collection 4.6F. Internal contacts are sharp. Basal contact is sharp.	1.1	38.3
30	Dark grey, brownish green-weathering mudstone. This unit is planar-bedded, thinly laminated, fissile, fossiliferous and composed of clay-sized particles. Trace fossils are absent. Corynexochids are present. Collection 4.6E. Internal contacts are sharp. Basal contact is sharp.	0.9	37.2
29	Black, dark grey-weathering mudstone with minor buff, beige-weathering bioclastic lime mudstone with rare bioclastic floatstones. Mudstone beds are fissile, fossiliferous and composed of clay-sized particles with minor silt and calcareous material. Limestone beds are 2–50 mm thick, nodular and composed of trilobite bioclasts in a micrite and microspar matrix. Floatstones have higher concentrations of bioclasts. Trace fossils are absent. Identifiable corynexochids are present in outcrop. Collection 4.6D. Internal contacts are sharp. Basal contact is gradational.	3.4	36.3
28	Black, dark grey-weathering mudstone interbedded with pale blue, yellowish beige-weathering lime mudstone and minor wackestones. This unit is 60% mudstone, 40% lime mudstone and wackestone and planar bedded. Mudstone beds are 20–50 mm thick, fissile,	0.7	32.9

	fossiliferous and composed of clay-sized particles with minor calcareous material. Lime mudstone and wackestone beds are 10–20 mm thick, nodular and composed of trace linguliformean brachiopod and trilobite bioclasts in a matrix of micrite with microspar. Thin sections reveal that burrows are present in lime mudstone. Identifiable corynexochids and linguliformean brachiopods are present in outcrop. Collection 4.6C. Internal contacts are sharp. Basal contact is sharp.		
27	Pale beige, orange- and beige-weathering bioclastic grainstone. This unit is lenticular, featureless and composed trilobite and minor linguliformean brachiopod bioclasts in sparite. Bioclasts have bladed calcite rinds, and pores are infilled by blocky sparite and minor micrite and microspar. Trace fossils are absent. Identifiable corynexochids are present in outcrop. Collection 4.7B. Basal contact is sharp.	0.1	32.2
26	Black, dark grey-weathering mudstone interbedded with pale blue and yellow beige-weathering lime mudstone and minor wackestones. This unit is 60% mudstone, 40% lime mudstone and wackestone and planar bedded. Mudstone beds are 20–50 mm thick, fissile, fossiliferous and composed of clay-sized particles with minor calcareous material. Lime mudstone and wackestone beds are 10–20 mm thick, nodular and composed of trace linguliformean brachiopod and trilobite bioclasts in a matrix of micrite and microspar. Thin sections reveal that burrows are present in lime mudstone beds. Identifiable corynexochids are present in outcrop. Collection 4.6B. Internal contacts are sharp. Basal contact is sharp.	1.8	32.1
25	Pale beige, orange- and beige-weathering bioclastic grainstone. This unit is lenticular, featureless and composed of trilobite and minor linguliformean brachiopod bioclasts in sparite. Bioclasts have bladed calcite rinds, and pores are infilled by blocky sparite with minor micrite and microspar. Trace fossils are absent. Identifiable corynexochids are present in outcrop. Collection 4.7A. Basal contact is sharp.	0.1	30.3
24	Black, dark grey-weathering mudstone interbedded with pale blue, yellow beige-weathering lime mudstone and minor wackestone. This unit is 60% mudstone, 40% lime mudstone and wackestone and planar bedded. Mudstone beds are 20–50 mm thick, fissile, fossiliferous and composed of clay-sized particles with minor calcareous material. Lime mudstone and wackestone beds are 10–20 mm thick, nodular and composed of trace linguliformean brachiopod and trilobite bioclasts in a matrix of micrite and microspar. Thin sections reveal that burrows are present in lime mudstone beds. Identifiable corynexochids are present in outcrop. Collection 4.6A. Internal contacts are sharp. Basal contact is sharp.	0.6	30.2

23	Pale blue, beige-weathering lime mudstone. This unit is planar and wavy bedded and laminated; beds and are laminae 2–20 mm thick, composed of microspar that is partially dolomitized. Trace and body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	0.4	29.6
22	Black, dark grey-weathering mudstone. This unit is laterally continuous, thinly laminated, fissile and composed of clay-sized particles with minor silt, calcareous material and pyrite. Trace fossils are absent. Corynexochids are rare. Collection 4.5C. Internal contacts are sharp. Basal contact is sharp.	1.1	29.2
21	Blue, beige-weathering lime mudstone. This unit is planar bedded and laminated, beds and laminae 2–20 mm thick and composed of microspar that is partially dolomitized. Trace and body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	0.4	28.1
20	Grey, light grey- and rusty-weathering siltstone and mudstone. This unit is laterally continuous, fissile and composed of silt-sized particles at the base grading upward into clay-sized particles with minor calcareous material. Trace fossils are absent. Corynexochids are rare. Collection 4.5B. Internal contacts are gradational. Basal contact is sharp.	1.1	27.7
	Covered	2.2	26.6
19	Pale blue, greenish beige-weathering lime mudstone. Beds are 2–24 cm thick, nodular and composed of microspar with trace argillaceous particles. Trace and body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	4.9	24.4
18	Grey, pale grey- and rusty-weathering mudstone. This unit is laterally continuous, fissile, composed of clay-sized particles and is sulfur-rich with minor calcareous material. The middle of this unit is lenticular, weakly fissile and composed of silt-sized particles. Trace fossils are absent. Corynexochids are rare. Collection 4.5A. Internal contacts are gradational. Basal contact is sharp.	1.0	19.5
17	Pale blue, greenish beige-weathering lime mudstone. This unit is planar bedded. Beds are 2–20 cm thick, nodular and composed of microspar that is partially dolomitized. Trace and body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	0.6	18.5
16	Grey, pale grey- and rusty-weathering mudstone. This unit is laterally continuous, fissile, composed of clay-sized particles and is sulfur-rich with minor calcareous material. The middle of the unit is lenticular, weakly-fissile and composed of silt-sized particles. Trace fossils are absent. Corynexochids and linguliformean brachiopods are rare. Collection 4.4. Internal contacts are gradational. Basal contact is sharp.	1.6	17.9

15	Pale blue, greenish beige-weathering lime mudstone. Beds are 2–20 cm thick, nodular and composed of microspar that is partially dolomitized. Trace and body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	0.3	16.3
14	Grey, pale grey- and rusty-weathering mudstone. This unit is laterally continuous, fissile, composed of clay-sized particles and is sulfur-rich. The middle of the unit is lenticular, weakly-fissile and composed of silt-sized particles. Trace fossils are absent. Corynexochids are rare. Collection 4.3. Internal contacts are gradational. Basal contact is covered.	1.6	16.0
	Covered	1.2	14.4
13	Pale blue, orange-weathering dolomitic lime mudstone with minor mudstone beds. Lime mudstone beds and laminae are 1–80 mm thick, planar and wavy bedded and composed of microspar that is partially dolomitized with minor argillaceous particles. Minor wave ripples, hummocks and swales are present. Mudstone beds are 2–15 cm thick, fissile and composed of clay-sized particles with minor silt. Trace and body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	2.9	13.2
12	Dark grey, pale grey-weathering siltstone with pale blue, beige-weathering limestone concretions. This unit is 65% siltstone, 35% limestone concretions and wavy bedded. Siltstone beds and laminae are 1–20 mm thick, featureless, fissile and composed of silt-sized particles with minor clay. Limestone concretion beds are 4–20 mm thick and composed of micrite and microspar with trace argillaceous material and linguliformean brachiopod bioclasts. *Planolites, Teichichnus, Cruziana* and other unidentified trace fossils are present on hypichnial and epichnial surfaces of limestone concretions. BI=0–2. Corynexochids and ptychoparioids are present in siltstone beds. Collection 4.2B. Internal contacts are sharp. Basal contact is gradational.	0.7	10.3
11	Dark grey, pale grey-weathering mudstone. This unit is laterally continuous, fissile and composed of clay-sized particles with minor silt. *Planolites* are rare on endichnial surfaces. BI=0–1. Corynexochids and ptychoparioids are present. Collection 4.2A. Basal contact is gradational.	0.8	9.6
10	Dark grey, light grey-weathering siltstone with pale blue, beige-weathering limestone concretions. This unit is 65% siltstone, 35% limestone concretions and wavy bedded. Siltstone beds are 1–20 mm thick, featureless, fissile and composed of silt-sized particles with minor clay. Limestone concretion beds are 4–20 mm thick and composed of micrite and microspar. Trace and body fossils are absent. Internal contacts are sharp. Basal contact is covered.	0.1	8.8

	Covered	0.2	8.7
9	Black, dark grey-weathering mudstone. This unit is laterally consistent, fissile and composed of clay- and silt-sized particles. A thin, well-cemented and fossiliferous bed composed of silt-sized particles is present close to the top of this unit. Above and below the fossiliferous bed are horizons rich in large phosphatic concretions. Trace fossils are absent. Hyoliths and trace ptychoparioids are present in the fossiliferous bed. Hyoliths, ptychoparioids and corynexochids are present in mudstone beds. Collection 4.1. Internal contacts are sharp. Basal contact is covered.	0.6	8.5
	Covered	0.8	7.9
8	Pale blue, orange- and grey-weathering calcareous dolostone interbedded with pale blue, grey-weathering arenaceous dolostone. This unit is 70% calcareous dolostone, 30% arenaceous dolostone and is wavy bedded. Calcareous dolostone beds are 2–10 cm thick, wave-rippled and composed of planar and non-planar dolomite with minor microspar and argillaceous particles. Arenaceous dolostone beds and laminae are 0.5–2 cm thick and composed of planar and non-planar dolomite with minor siliciclastic grains. *Skolithos* is rare. BI=0–1. Body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	2.0	7.1
	Mount Clark Formation		
7	Pale green, greenish red-weathering sandstone. Beds are wavy with trough cross-laminations at the base and wave-ripple cross-laminations at the top. Sandstone is arenitic in composition with minor glauconite and consists of coarse sand-sized grains. Unidentified horizontal burrows are present at the base. BI=0–1. Body fossils are absent. Internal contacts are erosional. Basal contact is erosional.	0.4	5.1
6	Pale blue, pale grey-weathering sandstone. This unit thickens towards the north. Beds are wavy, amalgamated and internally featureless with minor tabular and trough cross-laminations. Sandstones are arenitic in composition and consist of coarse to medium sand-sized grains. The top 3 cm of this unit contains glauconite and minor phosphatic concretions. *Skolithos* and *Arenicolites* are present on endichnial surfaces. BI=1–2. Body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	0.6	4.7
5	Pale blue, pinkish white-weathering sandstone. This unit is not present to the north. Beds are 5–15 cm thick, the basal bed is wave-rippled and overlain by trough and tabular cross-stratified beds. Sandstones are arenitic in composition and consist of coarse to medium sand-sized grains. Trace and body fossils are absent. Internal contacts are sharp. Basal contact is erosional.	0.5	4.1

4	Yellowish brown, maroon-weathering sandstone. This unit thins towards the north. Beds are 1–15 cm thick, wavy and lenticular, amalgamated and wave-rippled with minor swales. Sandstones are argillaceous sandstones in composition and consist of fine to very-fine sand-sized grains. *Teichichnus*, *Planolites*, *Cruziana*, *Rusophycus, Palaeophycus, Skolithos, Diplocraterion* and *Monocraterion* are present on endichnial and hypichnial surfaces. BI=3–4. Body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.	0.5	3.6
3	Pale blue, pinkish white-weathering sandstone. This unit thickens to the north. Beds are 5–13 cm thick, the basal bed is wave-rippled and overlain by trough cross-stratified beds. Sandstones are arenitic in composition and consist of coarse to medium sand-sized grains. *Skolithos* and *Bergaueria* are rare on endichnial surfaces. BI=0–1. Body fossils are absent. Internal contacts are sharp. Basal contact is erosional.	0.5	3.1
2	Yellowish brown, maroon-weathering sandstone. This unit thins towards the north. Beds are 1–15 cm thick, wavy and lenticular, amalgamated and wave-rippled with minor swales. Sandstones are argillaceous sandstones in composition and consist of fine to very-fine sand-sized grains. *Skolithos*, *Diplocraterion*, *Techichnus*, *Planolites*, *Palaeophycus* and minor escape traces are present on endichnial and hypichnial surfaces. BI=1–3. Body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.	1.5	2.6
1	Pale-blue, pinkish white-weathering sandstone. Beds 2–18 cm thick, planar and wavy, amalgamated and internally featureless. Beds are arenitic in composition and consist of fine sand-sized grains. *Skolithos*, *Arenicolites* and rare *Planolites* and *Palaeophycus* are present on endichnial surfaces. BI=1. Body fossils are absent. Internal contacts are sharp. Basal contact is covered.	1.1	1.1

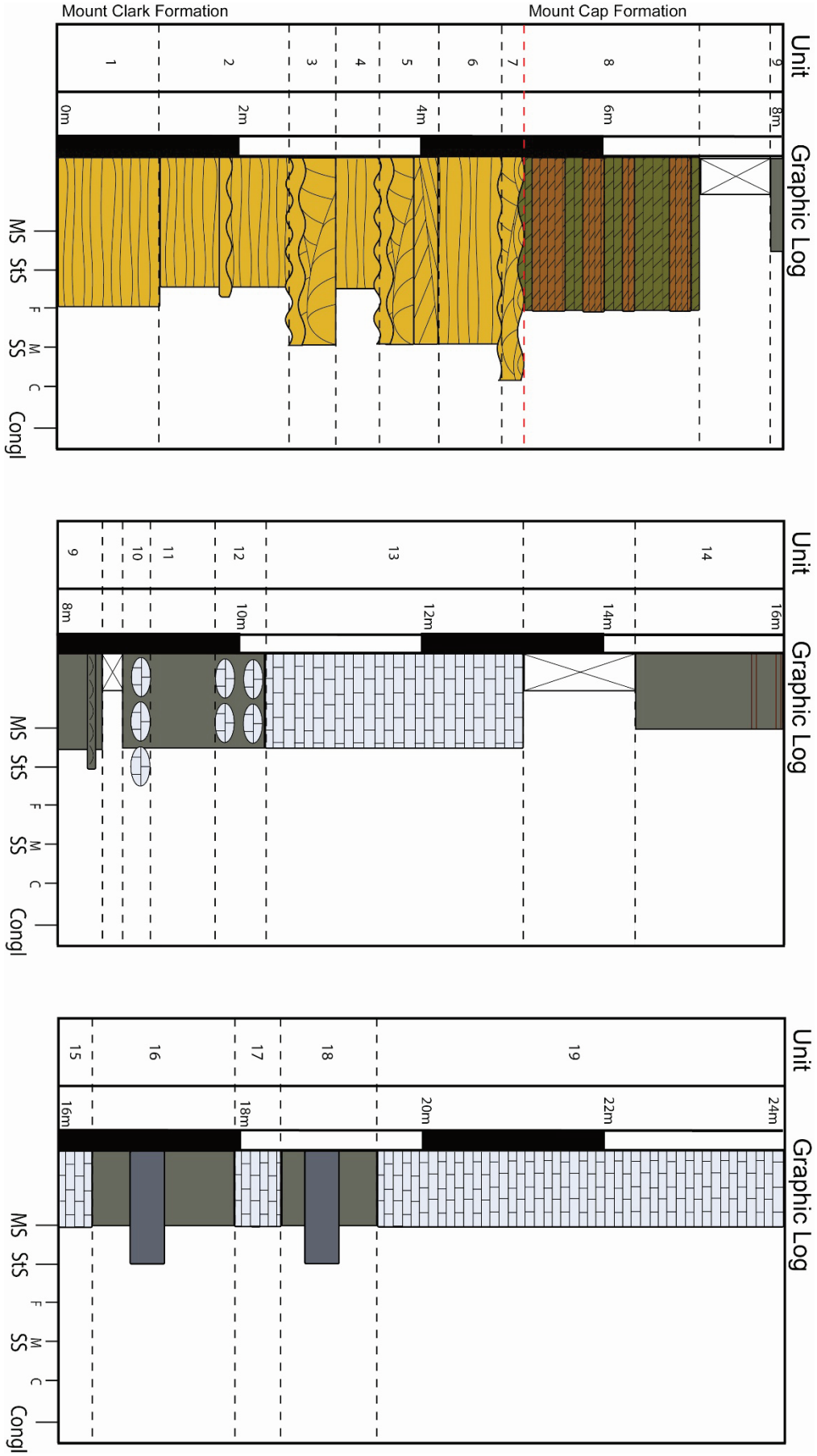

Figure 11A: Graphic log of the section at Carcajou Falls, showing unit divisions; 0–24.0 m. Red dashed line indicates the lithostratigraphic boundary.

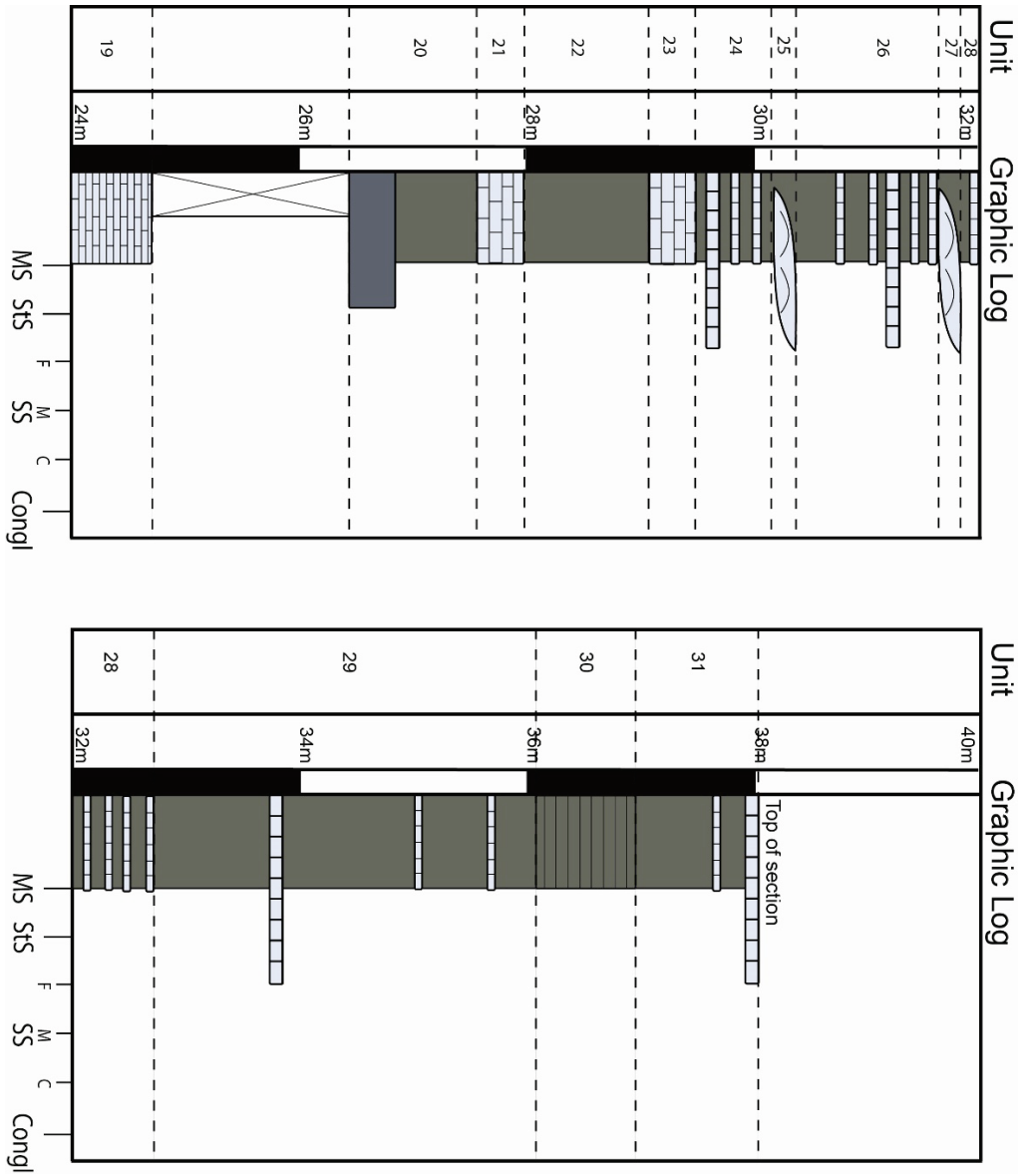

Figure 11B: Graphic log of the section at Carcajou Falls, showing unit divisions; 24.0–38.3 m.

Figure 12: Outcrop views at Carcajou Falls. All photographs by N.M. Handkamer. **A**) Unit divisions of the Mount Cap Formation. This was not the outcrop measured due to access issues, but exposure is good. Outcrop thickness = 28.2 m. NRCan Photo 2020-260. **B**) Basal units of the Mount Clark Formation. The bed with the hammer leaning against it represents a preserved 3D dune. Hammer length = 27.5 cm. NRCan Photo 2020-261. **C**) Basal to middle units of the Mount Clark Formation. Note, in unit 4, the thinning of a bed with the pencil leaning on it preserves a swale. Pencil length = 7 cm. NRCan Photo 2020-262. **D**) Hypichnial surface of unit 4. Fingernail length = 1 cm. This bed is located north of the measured outcrop upstream from the second set of falls, where hypichnial surfaces are better exposed. NRCan Photo 2020-263. **E**) Unit 24: interbedded lime mudstone and mudstone. Pencil length = 7cm. NRCan Photo 2020-264.

<u>Section 5: Grafe River</u>: (NTS 96D, 64.988407° N, 127.649351° W)

This section (figures 13 and 14) was measured on both the west and east sides of Grafe River. This section was previously measured by Serié *et al*. (2013). Each side of the canyon walls is on separate fault blocks and the river cuts along the fault plane, forming the canyon. The basal Precambrian units have been reported as the Abraham Plains Formation of the Katherine Group and the Dodo Creek Formation of the Little Dal Group (Serié *et al*., 2013). The upper contact of the Mount Cap Formation was not accessible at this site.

Unit	Description	Unit thickness (m)	Cumulative thickness (m)
	mudstone-dominated Mount Cap Formation		
39	Black, dark grey-weathering mudstone interbedded with pale beige, yellow-weathering dolomitic lime mudstone. This unit is 50% mudstone and 50% dolomitic lime mudstone at the base and proportion of mudstone increases upwards. Mudstone beds are 5–40 cm thick, laterally continuous, fissile and composed of clay-sized particles with minor silt and calcareous material. Dolomitic lime mudstone beds are 10–20 cm thick, nodular and composed of microspar that is partially dolomitized. Trace and body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	4.0	116.2
38	Black, dark grey-weathering mudstone. This unit is laterally continuous and fissile with minor dolomitic limestone concretions. Mudstones are composed of clay-sized particles with minor silt and calcareous material. Dolomitic limestone concretions form beds 2–8 cm thick and are composed of microspar. *Palaeophycus* and *Teichichnus* are present on hypichnial surfaces of limestone concretions and *Planolites* is rare on epichnial surfaces of mudstone beds. BI=0–1. Corynexochids and linguliformean brachiopods are rare. Collection 5.1. Internal contacts are sharp. Basal contact is gradational.	2.6	112.2
37	Black, dark grey-weathering mudstone interbedded with pale beige, yellow-weathering dolomitic lime mudstone. Unit is 50% mudstone and 50% dolomitic lime mudstone at the base and increases in proportion of mudstone upwards. Mudstone beds are 5–40 cm thick, laterally continuous, fissile and composed of clay-sized particles with minor silt and calcareous material. Dolomitic lime mudstone beds are 10–20 cm thick, nodular and composed of microspar that is partially dolomitized. *Palaeophycus* and *Teichichnus* are present on hypichnial surfaces of dolomitic lime mudstone beds. BI=0–1. Linguliformean brachiopods and hyoliths are present in mudstone beds. Internal contacts are sharp. Basal contact is covered.	2.0	109.6
	This unit was inaccessible but appeared to be a brown sandstone or carbonate due to the weathering profile.	6.0	107.6

36	Grey, grey-weathering argillaceous and arenaceous dolostone. Beds are 10–50 cm thick, wavy and lenticular bedded and nodular with minor stylolites. This unit is composed of planar and non-planar dolomite with variable siliciclastic grains and argillaceous particles. Trace fossils are absent. Linguliformean brachiopods are rare, visible only in thin section. Internal contacts are sharp. Basal contact is sharp.	5.4	101.6
	Mount Clark Formation		
35	White, yellow-weathering sandstone. This unit is wavy bedded, wave-ripple cross-laminated, arenitic in composition and consists of medium sand-sized grains. Trace and body fossils are absent. Basal contact is erosional.	0.1	96.2
34	Maroon and white, greenish yellow- and brown-weathering sandstone. Beds are 10–16 cm thick, wavy, amalgamated and internally featureless. Sandstones are argillaceous sandstones in composition and consist of medium to fine sand-sized grains. *Planolites*, *Teichichnus*, *Palaeophycus* and minor *Skolithos* and *Arenicolites* are present on endichnial and hypichnial surfaces. BI= 2–3. The top-most bed (15 cm thick) displays *Skolithos* and *Arenicolites* on endichnial surfaces. BI=1–2. Body fossils are absent. Internal contacts are sharp. Basal contact is covered.	1.4	96.1
	Covered	3.0	94.7
33	Maroon, dark brown-weathering sandstone. This unit is trough cross-bedded and beds are internally featureless with minor wave-rippling and current-rippling. Sandstones are arenitic in composition and consist of fine sand-sized grains. *Skolithos*, *Teichichnus*, *Palaeophycus* and *Planolites* are present on endichnial and hypichnial surfaces. BI=0–1. Body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	3.1	91.7
32	Maroon, brown-weathering sandstone. Beds are wavy, amalgamated and internally featureless with minor wave-rippling. Sandstones are arenitic in composition and consist of fine to very fine sand-sized grains. *Skolithos* is present on endichnial surfaces. BI=0–1. Body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.	0.7	88.6
31	Brown, dark brown-weathering sandstone. This unit is trough cross-bedded and wave-rippled. The basal 30 cm is planar-laminated. Sandstones are argillaceous sandstones in composition and consist of fine to very fine sand-sized grains. *Palaeophycus* is rare on hypichnial surfaces. BI=0–1. Body fossils are absent. Internal contacts are sharp. Basal contact is erosional.	4.0	87.9

30	Brown, dark brown-weathering sandstone interbedded with green, pale green-weathering siltstone. This unit is 80% sandstone and 20% siltstone. Sandstone beds are 2–23 cm thick, planar and wavy bedded and featureless grading into wave-rippling and hummocky cross-stratification. The bases of sandstone beds have gutter casts. Sandstones are argillaceous sandstones in composition and consist of fine to very fine sand-sized grains. Siltstone beds and laminae are <1–20 mm thick, laterally continuous, fissile and composed of silt-sized particles. *Palaeophycus* and *Phycodes* are rare on hypichnial surfaces of sandstones. BI=0–1. Body fossils are absent. Internal contacts are sharp or erosional. Basal contact is erosional.	2.2	83.9
29	Brown, dark brown-weathering sandstone interbedded with green, pale green-weathering siltstone. This unit is composed of 75% sandstone and 25% siltstone. Sandstones form lenses (not observed on the other side of the creek) which are 3–25 cm thick and form large hummocks. Sandstones are argillaceous sandstones in composition and consist of fine to very fine sand-sized grains. Siltstone beds are 2–7 cm thick, laterally continuous, fissile and composed of silt-sized particles. Trace and body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.	0.5	81.7
28	Red, maroon-weathering sandstone. This unit is normally graded with tabular and trough cross-bedding. Sandstones are arenitic in composition and consist of medium to fine sand-sized grains. *Palaeophycus* and *Cruziana* are present on hypichnial surfaces. BI=0–1. Body fossils are absent. Internal contacts are sharp. Basal contact is gradational.	4.9	81.2
27	Pale red, maroon-weathering conglomerate. This unit is planar, clast-supported at the base, gradually becoming matrix-supported upwards. Clasts are 2–50 mm in size, angular to rounded and composed of quartzite and arenite. The matrix is arenitic in composition and consists of coarse to medium sand-sized grains. *Skolithos*, *Diplocraterion*, *Arenicolites* and rare *Planolites* and *Teichichnus* are present on endichnial surfaces. BI=0–1. Body fossils are absent. Basal contact is erosional.	0.7	76.3
26	Maroon and white, pale orange-weathering finer sandstones interbedded with coarser sandstones. This unit is wavy and lenticular bedded. Finer sandstone beds are 10–35 cm thick, amalgamated and internally featureless except for minor wave-rippling. Finer sandstones are arenitic in composition and consist of fine sand-sized grains. Coarser sandstone beds are 10–50 cm thick, internally featureless except for wave-rippling, wave-ripple cross-laminations and trough and tabular cross-laminations. Coarser sandstones are arenitic in composition with minor glauconite and consist of medium sand-sized grains. *Planolites, Teichichnus* and trace *Skolithos* and *Arenicolites* are present on endichnial surfaces of finer sandstone beds. BI=1–2. *Arenicolites* and *Skolithos* are present on endichnial	9.8	75.6

	and epichnial surfaces of coarser sandstone beds. BI=0–1. Body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.		
25	White, pale orange-weathering sandstone. Beds are 7–17 cm thick, planar or wavy and mottled or tabular cross-bedded with minor wave-rippling. Mottled and cross-bedded sandstones are both arenitic in composition and consist of fine sand-sized grains. *Teichichnus*, *Planolites*, *Palaeophycus*, *Rusophycus* and rare *Arenicolites* and *Skolithos* are present on endichnial and epichnial surfaces of mottled sandstones. BI=3–4. *Arenicolites* and *Skolithos* are present on endichnial and epichnial surfaces of cross-bedded sandstones. BI=0–1. Body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	1.8	65.8
24	Pale red, maroon-weathering sandstone. This unit is trough and tabular cross-bedded and wave-rippled. Sandstones are arenitic in composition and consist of medium to fine sand-sized grains. *Arenicolites*, *Skolithos* and rare *Planolites* and *Teichichnus* are present on endichnial surfaces. BI=0–1. Body fossils are absent. Internal contacts are sharp. Basal contact is gradational.	2.6	64.0
23	Pale red, maroon-weathering conglomerate. This unit is planar, clast-supported, gradually becoming matrix-supported upwards. Clasts are 2–50 mm in size, angular to rounded and composed of quartzite and crystalline quartz. The matrix is arenitic in composition and consists of coarse to medium sand-sized grains. *Skolithos*, *Diplocraterion* and *Arenicolites* are present on endichnial surfaces. BI=0-1. Body fossils are absent. Basal contact is erosional.	0.7	61.4
	Dodo Creek Formation		
22	Pale beige, brown-weathering lime mudstone interbedded with green, dark green-weathering argillite. Limestone beds are 10–16 cm thick, planar bedded, microbially laminated with minor thin argillite laminae and composed of micrite that is partially dolomitized. Argillite beds are 4–20 cm thick, fissile and composed of micaceous minerals with minor silt and sulfur-rich horizons. Trace and body fossils are absent. Internal contacts are sharp. Basal contact is covered.	7.1	60.7
21	Light brown, dark brown-weathering quartzite interbedded with red and green, pale green-weathering argillite. Unit is planar bedded, 50% argillite and 50% quartzite at the base fining upward into 80% argillite and 20% quartzite. Argillite beds and laminae are 2–50 mm thick with minor shrinkage cracks and salt pseudomorphs and composed of micaceous minerals with minor silt. Quartzite beds are 10–40 mm thick, wave-ripple cross-laminated, internally featureless or wave-rippled. Quartzites consist of fine to very fine sand-sized	4.2	53.6

	grains with minor granules. Trace and body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.		
20	Brown, dark brown-weathering quartzite. This unit is trough cross-bedded and wave-rippled. Minor palimpsest ripples and linear shrinkage cracks are present at the top of the unit. Quartzites consist of medium sand-sized grains. Trace and body fossils are absent. Internal contacts are sharp. Basal contact is sharp.	2.0	49.4
19	Brown, pale tan-weathering quartzite interbedded with green, pale green-weathering argillite. This unit is planar and wavy bedded, 60% argillite and 40% quartzite. Quartzite laminae and beds are 3–110 mm thick and internally featureless or wave-ripple cross-laminated. Quartzites are composed of fine sand-sized grains. Argillite beds are 10–180 mm thick, fissile and composed of micaceous minerals with minor silt. Trace and body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.	0.2	47.4
18	White, reddish white-weathering quartzite. Beds are 2–12 cm thick, planar and wavy, amalgamated, internally featureless. Quartzites consist of medium sand sized grains. Trace and body fossils absent. Internal contacts are sharp or erosional. Basal contact is sharp.	0.7	47.2
17	Brown, tan-weathering quartzite interbedded with green, pale green-weathering argillite. Syn-sedimentary folds and faults are present. This unit is composed of 70% argillite and 30% quartzite. Quartzite laminae and beds are 3–115 mm thick, internally featureless or wave-ripple cross-laminated and consist of fine sand-sized grains. Argillite beds are 10–180 mm thick, fissile and composed of micaceous minerals with minor silt. Trace and body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.	1.5	46.5
	Covered	6.0	45.0
	Abraham Plains Formation		
16	White, reddish white-weathering quartzite. Beds are 2–8 cm thick, planar and wavy, amalgamated and internally featureless. Quartzite is composed of medium sand-sized grains. Trace and body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.	6.0	39.0
15	Brown, tan-weathering quartzite interbedded with green, pale green-weathering argillite. This unit is planar bedded, 60% argillite and 40% quartzite. Quartzite laminae and beds are 2–40 mm thick, featureless or wave-rippled and consist of fine sand-sized grains. Argillite beds and laminae are 4–60 mm thick, fissile and composed of micaceous minerals with minor silt. Trace and body fossils are	1.0	33.0

	absent. Internal contacts are sharp or erosional. Basal contact is sharp.		
14	White, reddish white-weathering quartzite. Beds are 2–10 cm thick, planar and wavy, amalgamated and internally featureless. Quartzites consist of medium sand-sized grains. Trace and body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.	1.8	32.0
13	White, reddish white-weathering quartzite. This unit is trough cross-bedded. Quartzites consist of medium sand-sized grains. Trace and body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.	0.5	30.2
12	White, reddish white-weathering quartzite. Beds are 2–10 cm thick, planar and wavy, amalgamated and internally featureless. Quartzites consist of medium sand-sized grains. Trace and body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.	1.3	29.7
11	White, reddish white-weathering quartzite. This unit is trough cross-bedded and composed of medium sand-sized grains. Trace and body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.	0.6	28.4
10	White, reddish white-weathering conglomerate. This unit is wavy, clast-supported, gradually becoming matrix-supported upwards. Clasts are 2–80 mm in size, subangular to subrounded and are composed of quartzites, argillites and cherts. The matrix is quartzite in composition and consists of coarse sand-sized grains. Trace and body fossils are absent. Basal contact is erosional.	0.3	27.8
9	Green, pale green-weathering argillite. This unit is laterally continuous, fissile and composed of micaceous minerals. Trace and body fossils are absent. Basal contact is sharp.	0.2	27.5
8	White, reddish white-weathering quartzite. Beds are 2–10 cm thick, planar and wavy, amalgamated and internally featureless. Quartzites are composed of medium sand-sized grains. Trace and body fossils are absent. Internal contacts are sharp or erosional. Basal contact is sharp.	1.5	27.3
7	Maroon, pale red-weathering quartzite. This unit is trough and tabular cross-bedded and cross-laminated with minor wave-rippled beds. Quartzites consist of coarse to medium sand-sized grains. Minor lenses of very- coarse sand-sized grains to granular-sized grains of quartz are present. Trace and body fossils are absent. Internal contacts are sharp or erosional. Basal contact is gradational.	6.2	25.8

6	Maroon, pale red-weathering conglomerate. This unit is wavy, clast-supported, gradually becoming matrix-supported upwards. Clasts are 2–80 mm in size, subangular to subrounded and composed of quartzites, argillites and cherts. The matrix is quartzite in composition and consist of coarse sand-sized grains. Trace and body fossils are absent. Basal contact is erosional.	0.3	19.6
5	Maroon, pale red-weathering quartzite. This unit is trough and tabular cross-bedded and cross-laminated with minor wave-rippled beds. Quartzites are composed of coarse to medium sand-sized grains. Minor lenses of very- coarse sand-sized grains to granular-sized grains of quartz are present. Trace and body fossils are absent. Internal contacts are sharp or erosional. Basal contact is gradational.	13.3	19.3
4	Maroon, pale red-weathering conglomerate. This unit is wavy, clast-supported, gradually becoming matrix-supported upwards. Clasts are 2–60 mm in size, subangular to subrounded and are composed of quartzites and cherts. The matrix is quartzite in composition and consists of coarse sand-sized grains. Trace and body fossils are absent. Basal contact is erosional.	0.2	6.0
3	Maroon, pale red-weathering quartzite. This unit is trough and tabular cross-bedded and cross-laminated with minor wave rippled beds. Quartzites are composed of coarse to medium sand-sized grains. Minor lenses of very coarse sand-sized grains to granular-sized grains of quartz are present. Trace and body fossils are absent. Internal contacts are sharp or erosional. Basal contact is gradational.	4.5	5.8
2	Maroon, pale red-weathering conglomerate. This unit is wavy, clast-supported, gradually becoming matrix-supported upwards. Clasts are 2–80 mm in size, subangular to subrounded and composed of quartzites, argillites and cherts. The matrix is quartzite in composition and consist of coarse sand-sized grains. Trace and body fossils are absent. Basal contact is erosional.	0.5	1.3
	McClure Formation (?)		
1	Tan, brownish orange-weathering dolostone with minor laminae of green argillite. This unit is planar bedded, stromatolitic and composed of dolomite. Argillites are featureless, fissile and composed of micaceous minerals. Trace and body fossils are absent. Basal contact was not measured.	0.8	0.8

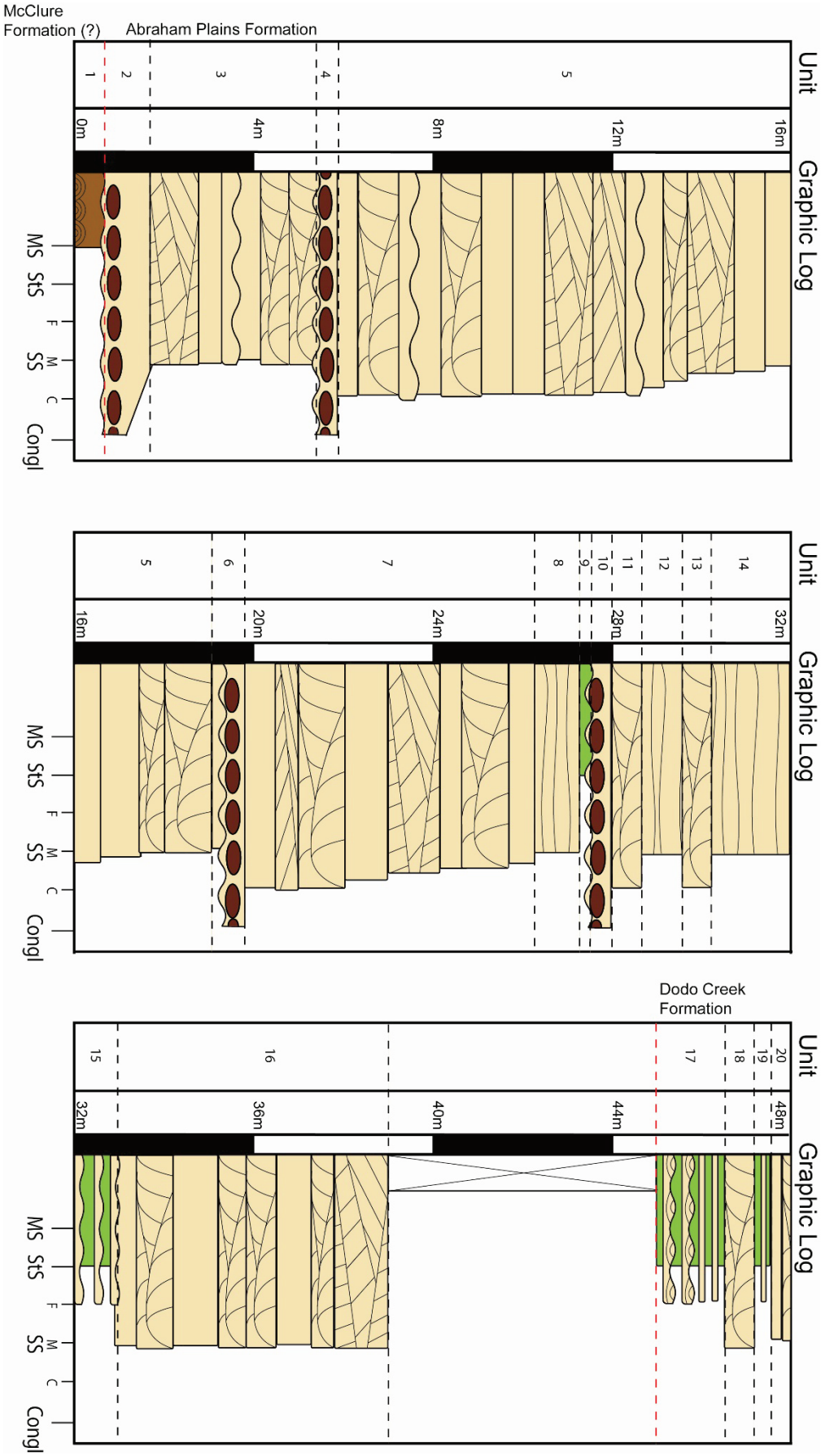

Figure 13A: Graphic log of the section at Grafe River, showing unit divisions; 0–48.0 m. Red dashed lines indicate lithostratigraphic boundaries.

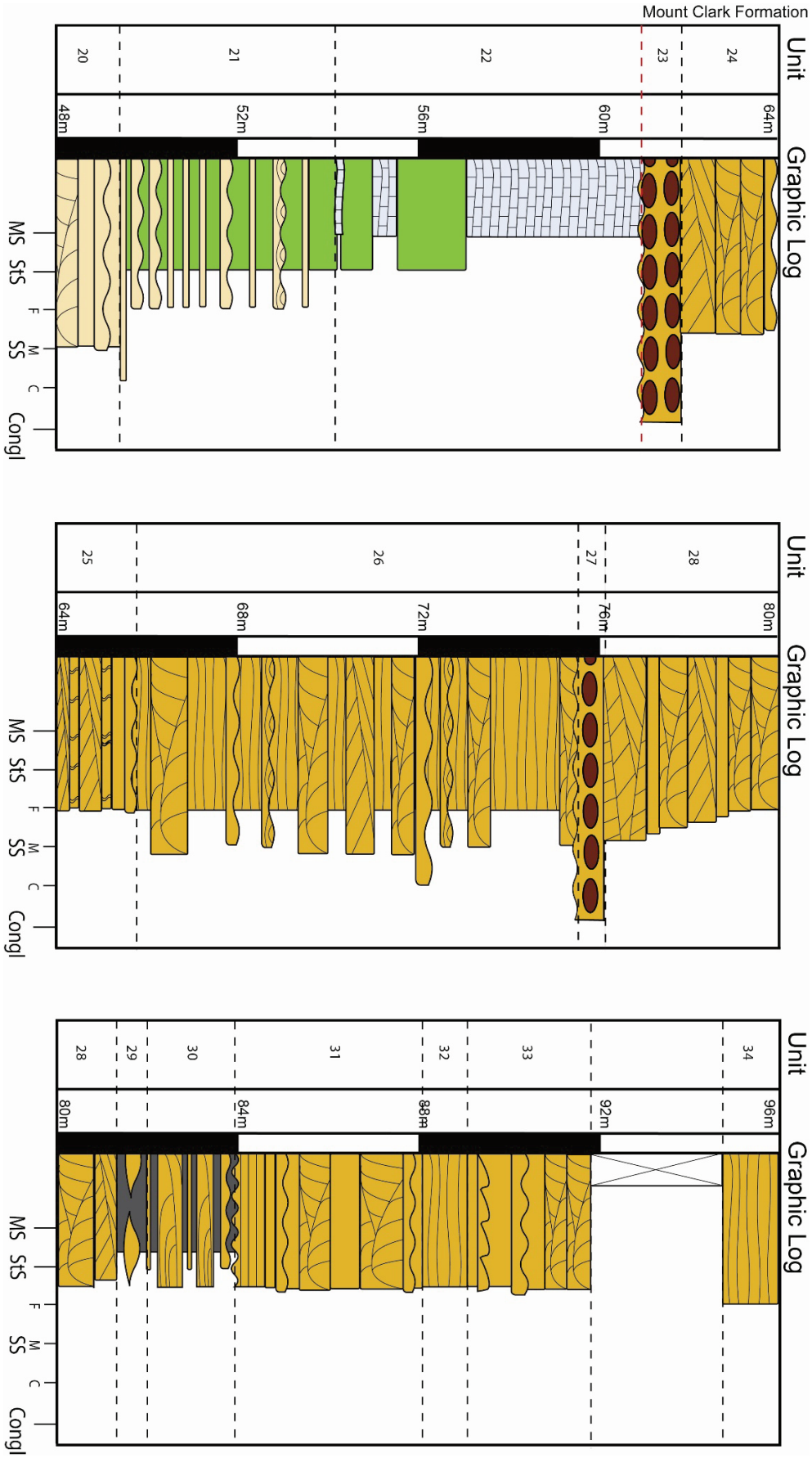

Figure 13B: Graphic log of the section at Grafe River, showing unit divisions; 48.0–96.0 m. Red dashed lines indicate lithostratigraphic boundaries.

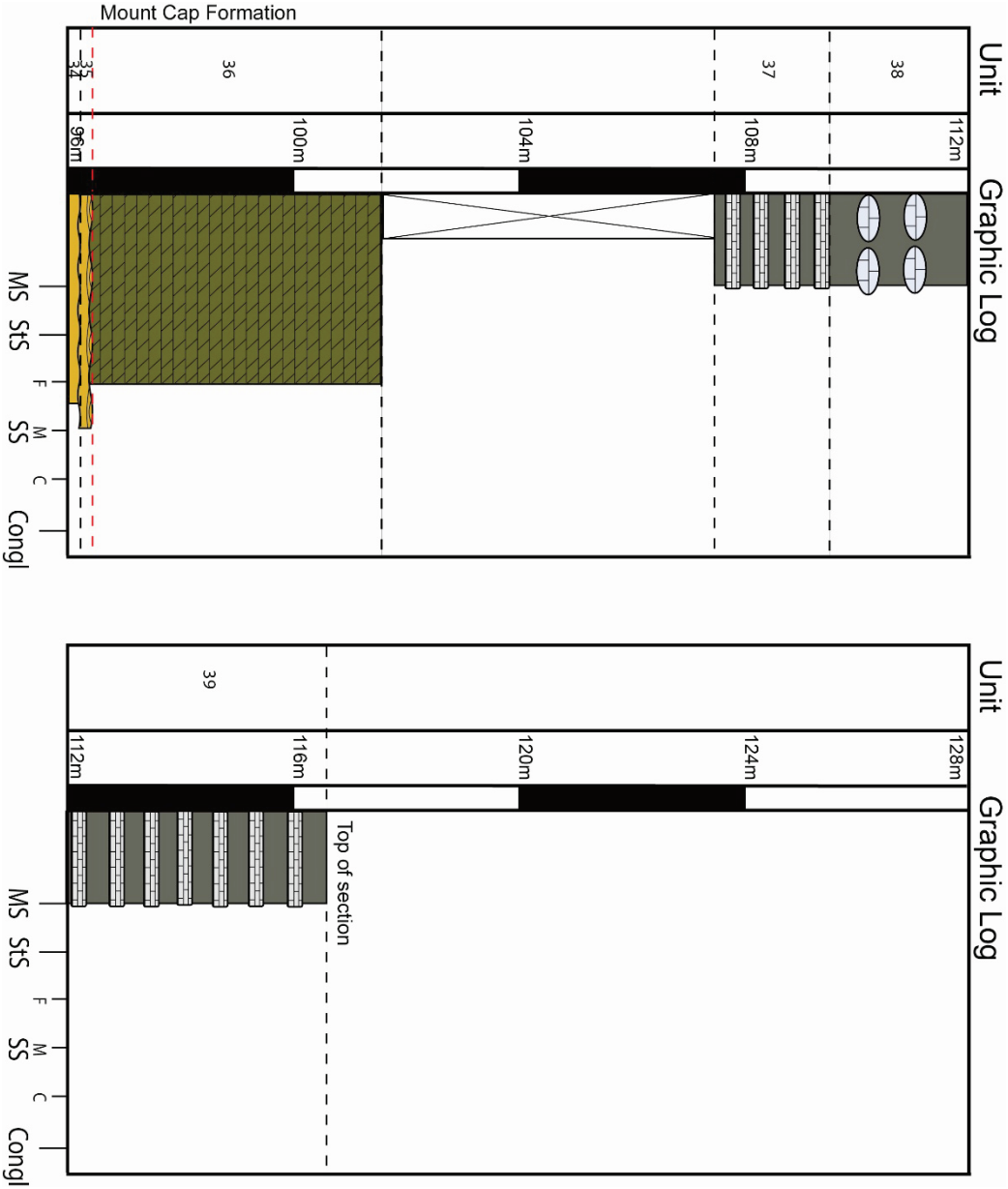

Figure 13C: Graphic log of the section at Grafe River, showing unit divisions; 96.0–116.2 m. Red dashed lines indicate lithostratigraphic boundaries.

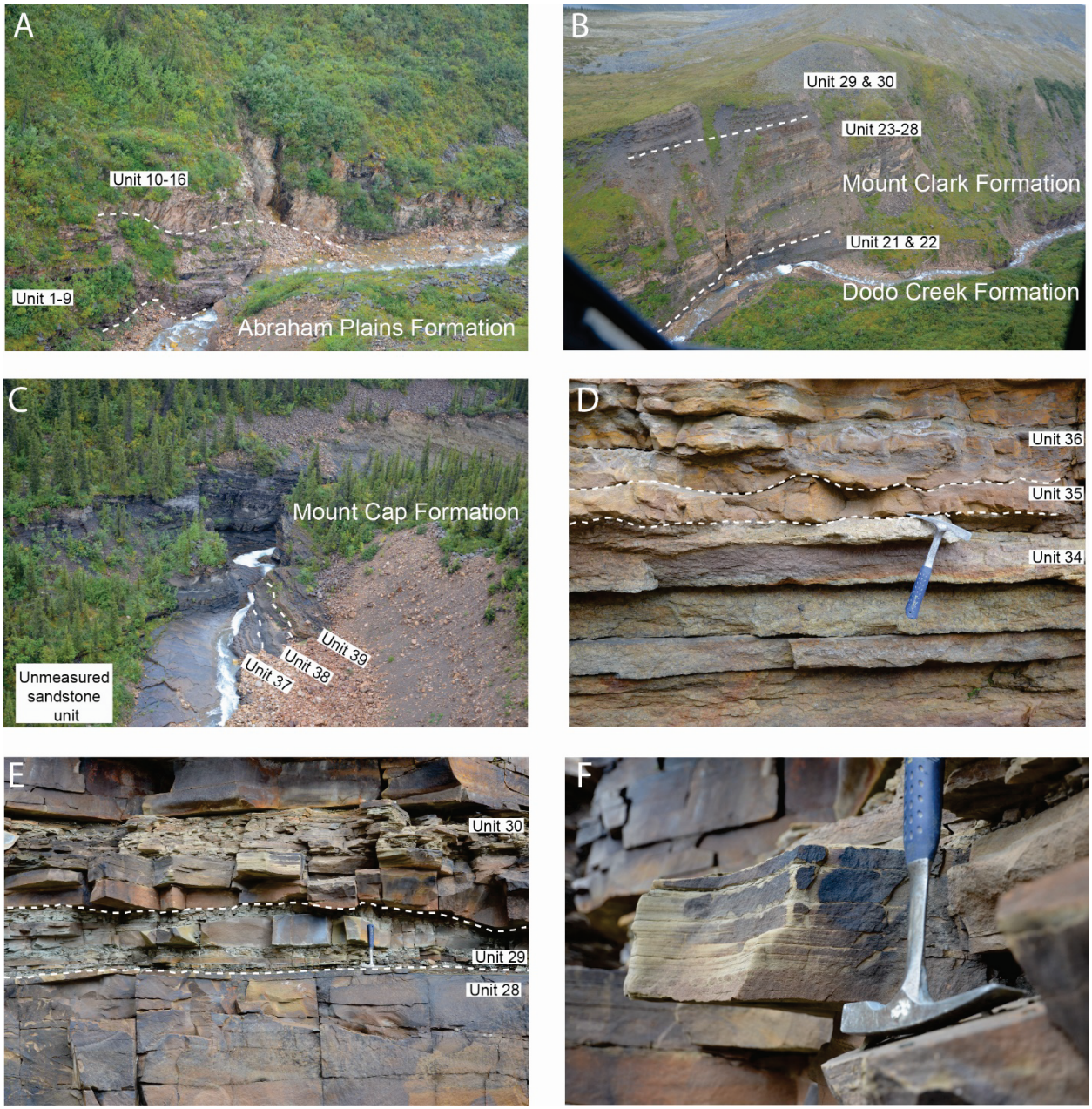

Figure 14: Outcrop views at Grafe River. All photographs by N.M. Handkamer. **A**) Unit divisions of the basal to middle Abraham Plains Formation. Outcrop thickness = 39 m. NRCan Photo 2020-265. **B**) Unit divisions of the Dodo Creek Formation and basal to middle Mount Clark Formation. Outcrop thickness = ~ 50 m. NRCan Photo 2020-266. **C**) Unit divisions of the Mount Cap Formation. Outcrop thickness = 8.6 m. NRCan Photo 2020-267. **D**) Contact of upper Mount Clark Formation and basal Mount Cap Formation between units 35 and 36. Hammer length = 27.5 cm. NRCan Photo 2020-268. **E**) Middle Mount Clark Formation. Note the hammer is lying against a rippled sand lens of unit 29. Hammer length = 27.5 cm. NRCan Photo 2020-269. **F**) Unit 30: hummocky cross-stratified sandstone. Hammer length = 27.5 cm. NRCan Photo 2020-270.

Figure 15: Correlated sections A-A' (Figure 3). Datum (red line) is the Mount Clark Formation/heterolithic Mount Cap Formation contact with mudstone-dominated Mount Cap Formation. In this diagram, heterolithic Mount Cap Formation (Dodo Canyon) is included with the Mount Clark Formation. Purple line indicates the Cambrian-Neoproterozoic contact.

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