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ABSTRACT

A composite reference section for the upper Ediacaran and lower Cambrian is documented for a location near Moose Horn River in Wrigley Lake map area (NTS 95-M), Mackenzie Mountains, Northwest Territories. Four measured stratigraphic sections cover, in ascending order: the uppermost Sheepbed Formation; the informal Sheepbed carbonate; the lower, middle, and upper members of the Backbone Ranges Formation; the Sekwi Formation; and the lowermost beds of the Rockslide Formation. The uppermost Sheepbed Formation is dominated by dark-weathering shale and siltstone. The Sheepbed carbonate (440 m) lies conformably on the Sheepbed Formation and consists of limestone, dolostone, and dolomitic siltstone, including several horizons of rudstone with clasts up to boulder size. The upper surface of the Sheepbed carbonate has been eroded and the unit thins to a zero edge to the east. The lower member of the Backbone Ranges Formation (253 m) is heterolithic, including interbedded quartzose siltstone and quartzose sandstone, quartz arenite (locally with horizons of quartz pebbles), and dolostone to dolomitic sandstone. The middle member of the Backbone Ranges Formation (93 m) consists mainly of pink to grey-weathering limestone with red mudstone partings. The upper member (501.5 m) is dominated by quartz arenite, but also contains intervals of siltstone. Partway through the upper member there is a marker unit of dolostone to dolomitic sandstone that previous work suggests is a tongue of the Ediacaran Risky Formation. Based on regional correlations, the top of this marker may approximate the Ediacaran-Cambrian boundary in this section. The Sekwi Formation lies abruptly upon the Backbone Ranges Formation. The contact is unconformable at this locality and mapping in the area indicates eastward erosional removal of the upper member of the Backbone Ranges Formation beneath the Sekwi Formation. The Sekwi Formation here consists of variegated siltstone with lesser dolostone, limestone, and quartz sandstone. An abrupt contact with nodular limestone and grey shale of the overlying Rockslide Formation approximates the base of Cambrian Series 3.

Introduction

This report documents an upper Ediacaran– lower Cambrian stratigraphic reference section in the Wrigley Lake map area (NTS 95-M) of the Mackenzie Mountains, Northwest Territories. The Ediacaran-Cambrian transition is widely preserved across the Mackenzie Mountains and in the Wernecke Mountains of eastern Yukon, where research has focused on key localities identified during the 1960s, 1970s, and 1980s (Figure 1). In the Mackenzie Mountains, these include: Shale Lake (a.k.a., Palmer Lake) region (NTS 106-A: Aitken, 1989; Macdonald et al., 2013); east limb of the June Lake anticline (NTS 105-P: Fritz et al., 1982; Aitken, 1989; MacNaughton and Narbonne, 1999; Carbone and Narbonne, 2014); Sekwi Brook structural panel (NTS 105-P: Aitken, 1989; Narbonne and Aitken, 1990; MacNaughton et al., 2000; Macdonald et al., 2013; Carbone et al., 2015); and the type area of the Sheepbed and Backbone Ranges formations (near Sheepbed Creek in NTS 95-L: Gabrielse et al., 1973a; Fritz, 1982; MacNaughton et al., 1999). These areas offer excellent exposure of Ediacaran-Cambrian units, in some cases are fossil bearing (e.g., Ediacaran macrofossils at Sekwi Brook and earliest Cambrian ichnofossils near June Lake; see references above), and have proven amenable to multiple methods of investigation, importantly including carbon-isotope chemostratigraphy in recent years (Macdonald et al., 2013).

Since the mid-2000s, the Geological Survey of Canada has published descriptions of Ediacaran-Cambrian sections in areas not previously documented in detail (Figure 1), including localities in northeastern NTS 105-P near Godlin River (MacNaughton et al., 2008b; MacNaughton, 2020a), the Natla structural panel in western NTS 95-M (MacNaughton and Fallas, 2019a), and archival sites near Sheepbed Creek in NTS 95-L and Sekwi Brook in NTS 105-P (MacNaughton, 2020b). These contribute to ongoing reassessment of the stratigraphy of the Backbone Ranges Formation (Gabrielse et al., 1973a), a widespread unit with a controversial relationship to the Ediacaran-Cambrian boundary (Figure 2; Turner et al., 2011; MacNaughton et al., 2018; MacNaughton and Fallas, 2019a). Correlation of the formation from proximal localities (i.e., its easternmost and northernmost occurrences, including its type area near Sheepbed Creek, as well as the Natla structural panel) to better-documented, more distal localities (e.g., the Sekwi Brook and June Lake structural panels) is problematic (Figure 2).

In proximal localities, the Backbone Ranges Formation preserves a characteristic tripartite organization of members, as originally documented by Gabrielse et al. (1973a) and since confirmed at many localities (e.g., Fritz, 1982; Aitken, 1989; MacNaughton et al, 1999, 2008, 2018; Turner et al., 2011; MacNaughton, 2020a, 2020b). The lower member is dominated by siliciclastic strata, albeit with varying proportions of quartz arenite, quartz wacke, siltstone, and shale. Dolostone to dolomitic sandstone are also present, as are lesser beds of quartz-pebble conglomerate. The middle member forms distinctive cliffs of brightly weathering (pink, maroon, orange, and pale grey) limestone and dolostone. The upper member is dominated by cliff-forming, thick-bedded quartz arenite with lesser quartz-pebble conglomerate and mudstone. The three members can be traced in outcrop from NTS 95-L to NTS 106-B and NTS 106-C (Figure 1). Recent work by MacNaughton et al. (2018; 2019b) suggests that in the latter two areas the upper member can be subdivided further into four informal units (Figure 2). These units are mappable and of formation scale but effectively constitute submembers as the formation is currently defined. In ascending order, they are: unit A (generally a resistant succession of sandstone, including cliff-forming quartz arenite, siltstone, and lesser quartz-pebble conglomerate); unit B (recessive, dark-weathering shale, brown sandstone, with a capping dolostone marker); unit C (recessive, brown to grey siltstone and sandstone, locally intensely bioturbated); and unit D (dominated by resistant quartz arenite).

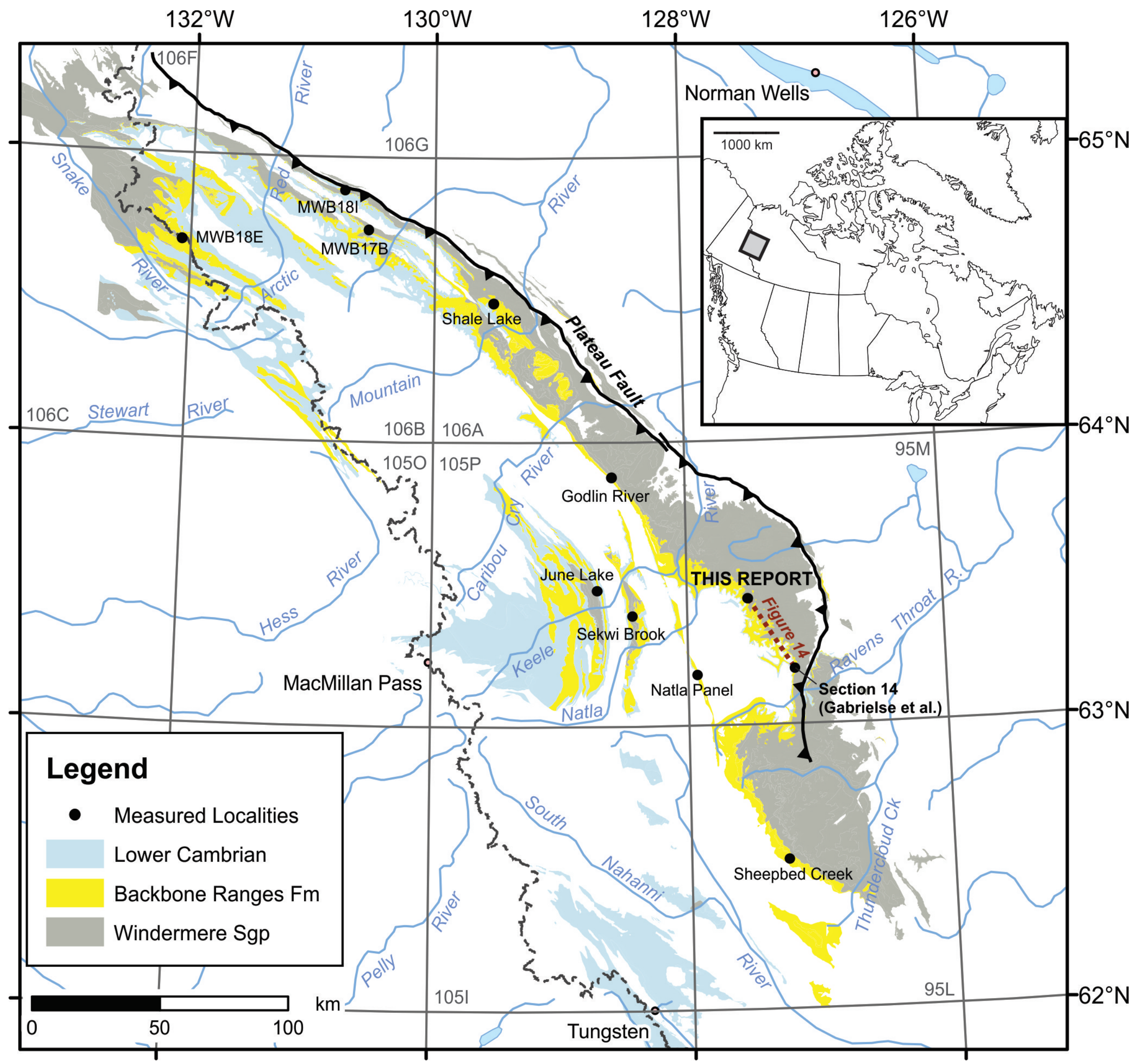


***Figure 1:** Location map showing the distribution of Backbone Ranges Formation and related strata in the Mackenzie Mountains, along with detailed study localities referred to in the text. Localities in NTS 106-B and 106-C are unpublished (R.B. MacNaughton, work in progress). Line of section of stratigraphic cross-section shown in Figure 14 is labelled. Inset shows study area location (grey box) within Canada. Abbreviations: "Fm" = Formation; "Sgp" = Supergroup.*

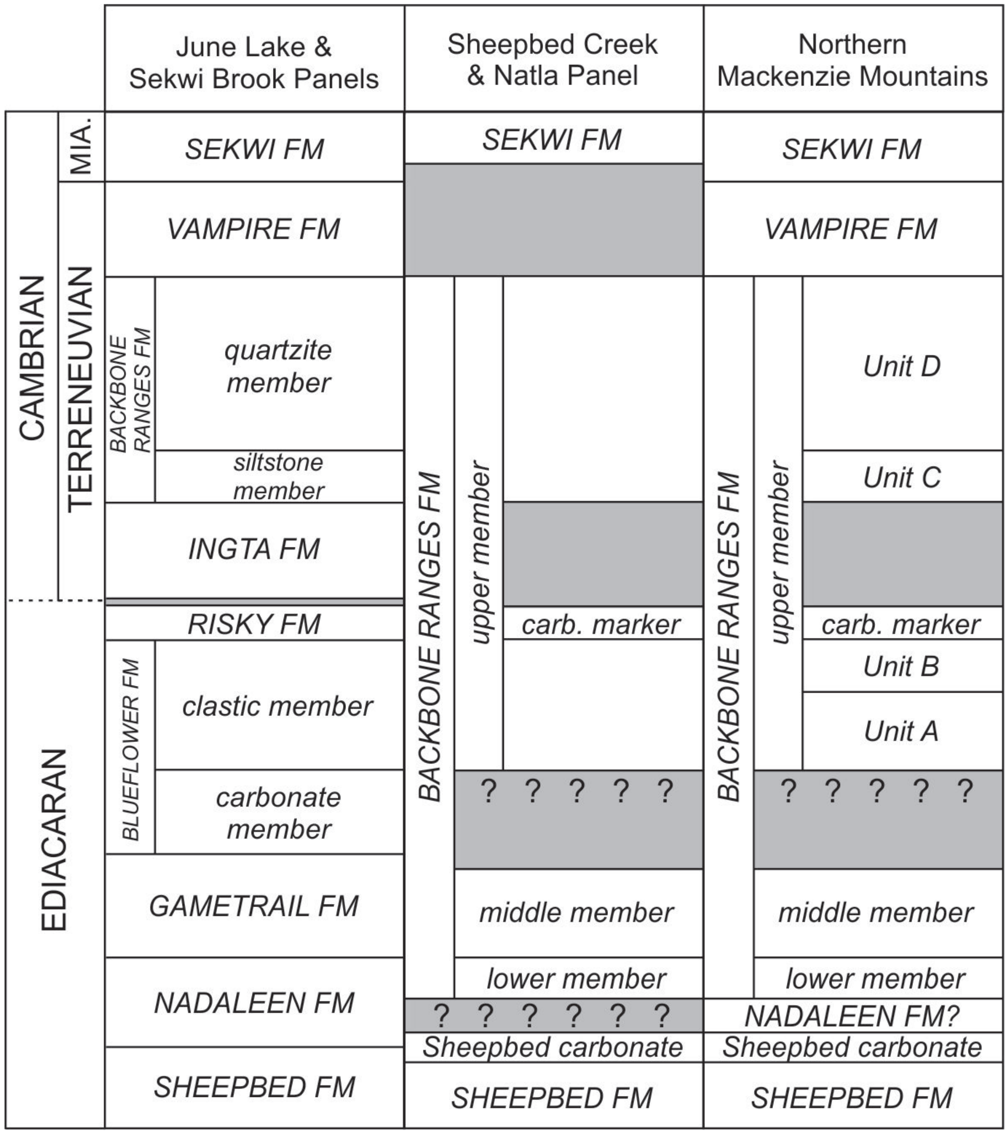


Figure 2: *Stratigraphic chart comparing current lithostratigraphic understandings of the Ediacaran-Cambrian interval in distal (June Lake and Sekwi Brook structural panels) and proximal (Sheepbed Creek and Natla structural panel; northern Mackenzie Mountains) locations. Stratigraphy for June Lake and Sekwi Brook panels is based on Aitken (1989), MacNaughton and Narbonne (1999), MacNaughton et al. (2000), and Macdonald et al. (2013), and accepts the identification of the "June beds" of Macdonald et al. (2013) with the Nadaleen Formation (Moynihan et al., 2019). The stratigraphy of the Sheepbed Creek area and the Natla panel also applies along the hanging-wall of the Plateau Fault, including the present study area; for these regions, see Gabrielse et al. (1973a,b), Fritz (1981), MacNaughton et al. (1999), and MacNaughton and Fallas (2019a). Stratigraphy below the upper member of the Backbone Ranges Formation is not present in the Natla panel. The Nadaleen Formation is preserved only locally in proximal areas (see text). Stratigraphy for the northern Mackenzie Mountains is preliminary, based on Fritz (1979) and MacNaughton et al. (2018). Vampire Formation may be only locally present in northern Mackenzie Mountains (see Fritz, 1979, in which it is referred to as "map unit 13"). Abbreviations: "FM" = Formation; "MIA." = Miaolingian (formerly unnamed Cambrian Series 2); "carb." = carbonate.*

As noted above, difficulties arise when correlating the Backbone Ranges Formation from proximal locations, where its characteristic tripartite organization is well developed, to more distal areas, where the three members cannot be recognized and parts of the succession are shale-dominated. For example, in the well-studied Sekwi Brook and June Lake areas (Figure 2), the interval between the Sheepbed and Sekwi formations contains at least seven units currently treated as formations (Aitken, 1989; MacNaughton et al., 1997; MacNaughton et al., 2000; Macdonald et al., 2013). In ascending order, these are: Nadaleen Formation (shale, sandstone, carbonate), Gametrail Formation (well-bedded carbonate, locally with presquilite dolomitization), Blueflower Formation (lower carbonate member and upper shale-rich member), Risky Formation (particulate dolostone and quartz arenite), Ingta Formation (variegated shale), Backbone Ranges Formation (quartz arenite, but probably not correlative with the entire unit as expressed further east), and Vampire Formation (mudrock and lesser sandstone). Ediacaran macrofossils have been recovered from the Nadaleen, Gametrail, and Blueflower formations (e.g., Narbonne and Aitken, 1990; MacNaughton et al., 2000; Carbone et al., 2015), and ichnofossils, including *Treptichnus pedum*, suggest the base of the Cambrian is within or at the base of the Ingta Formation (MacNaughton and Narbonne, 1999; Carbone and Narbonne, 2014). Correlation of the proximal and distal successions is controversial (compare Aitken, 1989, 1991, to Fritz et al., 1991; also see review in Turner et al., 2011). The lack of clear correlations hampers modelling of the Ediacaran-Cambrian evolution of the present-day northwestern margin of Laurentia. Similar difficulties arise in correlations with successions preserved further outboard in the ancestral Selwyn Basin (Ediacaran to earliest Cambrian Hyland Group, and overlying units; e.g, Gordey and Anderson, 1993; Cecile, 2000; MacNaughton et al., 2016). Solving these difficulties is beyond the scope of the present report, which focuses on documenting a particularly useful locality in the proximal outcrop belt of the Backbone Ranges Formation. These data will be incorporated into future reports that will deal more extensively with regional correlations. For discussions of Ediacaran-Cambrian stratigraphy in the Mackenzie Mountains and adjacent regions, see Gabrielse et al. (1973a), Fritz (1982), Fritz et al. (1983, 1991), Aitken (1989, 1991), Gordey and Anderson (1993), Narbonne and Aitken (1995), Cecile (2000), Turner et al. (2011), Macdonald et al. (2013), Moynihan et al. (2019), and MacNaughton and Fallas (2019a).

The Study Locality

The Backbone Ranges Formation is extensively exposed in the hanging-wall panel of the Plateau Fault in NTS 95-M (Wrigley Lake map area). However, with the exception of a single measured section provided by Gabrielse et al. (1973a; their section 14), little has been published on the Ediacaran-Cambrian transition along the Plateau Fault in this area. In 2008, the authors documented four measured sections that span from the upper part of the Ediacaran to the base of the middle Cambrian (unnamed Cambrian Series 3) in the hanging-wall of the Plateau Fault near Moose Horn River. The sections include (ascending order) the uppermost part of the Sheepbed Formation, the informal Sheepbed carbonate, the Backbone Ranges Formation, the Sekwi Formation, and the basal beds of the Rockslide Formation, providing a composite reference section for the Ediacaran-Cambrian transition in western NTS 95-M (as shown in the middle column of Figure 2). The Backbone Ranges Formation preserves the tripartite organization into members that characterizes it in its type section (Gabrielse et al., 1973a; MacNaughton et al., 1999). Figure 3 provides a photographic overview of the succession at the study locality.

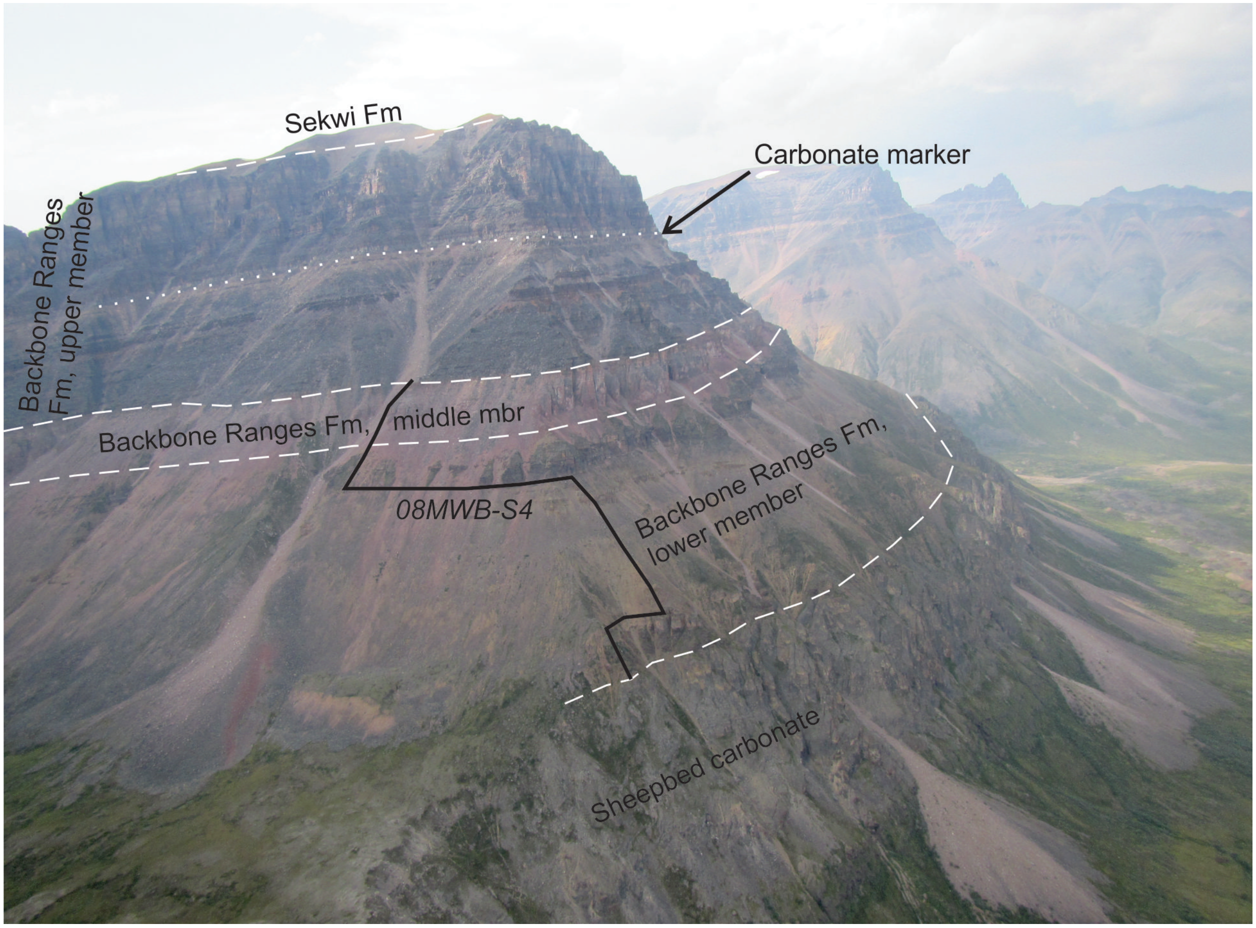


Figure 3: *Aerial view of Ediacaran-Cambrian stratigraphy exposed in south-facing cirque wall at study site, looking northwest. Dark-weathering shale of Sheepbed Formation underlies the recessive, grassy slope at lower right. Carbonate marker labelled within upper member of Backbone Ranges Formation corresponds to unit 16 in measured section 08MWB-S2. Approximate route of measured section 08MWB-S4 (lower and middle members, Backbone Ranges Formation) is shown; see section notes in text for geographic coordinates. Other sections presented in this report also were measured in this cirque (Figure 4). Photograph by R.B. MacNaughton. NRCan photo 2021-150.*

These section data have not been published, with the exception of a graphic log covering the upper member of the Backbone Ranges Formation, which was included in Turner et al. (2011; their Figure 3.4.1-7). The present report is essentially descriptive and provides graphic logs, descriptive notes, and selected photographs for these sections. A discussion of the relationship between these sections and a previously reported a section from further south and east in NTS 95-M (section 14 of Gabrielse et al., 1973a) is included, and comparisons are made with the upper member subdivisions of MacNaughton et al. (2018); i.e., their units A to D as applied in NTS 106-B (see Introduction). However, detailed discussions of regional correlations, depositional processes, or sequence stratigraphy are reserved for future work. In particular, this report is intended as a data source to support reports on the Sheepbed carbonate and Backbone Ranges Formation that are being prepared by the authors.

The most recent geological compilation for NTS 95-M is that of Gabrielse et al. (1973b), except for the NW quarter of the map area, for which see Fallas et al. (2011). Information on the geology of NTS 95-M can be found in reports by Eisbacher (1981), Aitken (1989, 1991), Jefferson and Parrish (1989), James et al., (2001), Day et al. (2004), MacNaughton et al. (2008a), and MacNaughton and Fallas (2019a).

Summary of the Succession

The sections were measured using a jacob's staff, in exposures around a glacial cirque. In the following text, the measured sections are referred to in ascending stratigraphic order; numbers assigned to the sections in the field reflect the sequence in which they were measured. For a detailed map of measured section routes, see Figure 4. Measured section notes are included at the end of the report.

Underlying units

The stratigraphic succession in the hanging-wall panel of the Plateau Fault in NTS 95-M includes units from Neoproterozoic to Devonian age (Gabrielse et al., 1973b). The Neoproterozoic units that underlie the stratigraphy documented in this report include the upper part of the Little Dal Group, the Coates Lake Group, the Rapitan Group, and the Hay Creek Group. The Hay Creek Group consists (ascending order) of the dark, recessive-weathering, shale-dominated Twitya Formation, the resistant, pale-weathering, mixed carbonate and sandstone succession of the Keele Formation, and the thin, regionally extensive carbonates of the informal Ravensthroat and Hayhook formations (Fallas et al., 2011; Turner et al., 2011). These latter two units comprise a characteristic "cap carbonate" associated with the Marinoan glacial event (James et al., 2001) and mark the base of the Ediacaran succession in the region (Knoll et al., 2006). None of these units is included in the measured sections presented in this report.

Sheepbed Formation

Above the "cap carbonate" interval lies the Sheepbed Formation (Gabrielse et al., 1973a), a regionally extensive, shale-dominated unit that is the basal unit of the Rackla Group (Moynihan et al., 2019; formerly the unnamed "upper group" of the Windermere Supergroup, see Turner et al., 2011). The Sheepbed Formation is nearly 900 m thick at its type section in NTS 95-L (reported thickness of 2900 feet in Gabrielse et al., 1973a) and can be nearly 800 m thick in NTS 106-A (Baudet et al., 1989; Macdonald et al., 2013). Measured section 08MWB-S5 (Figure 5) includes the uppermost 5 m of the Sheepbed Formation, consisting of dark grey, thinly laminated shale and siltstone (Figure 6A). This is in keeping with the general character of the unit in NTS 95-M as documented by Gabrielse et al. (1973a).

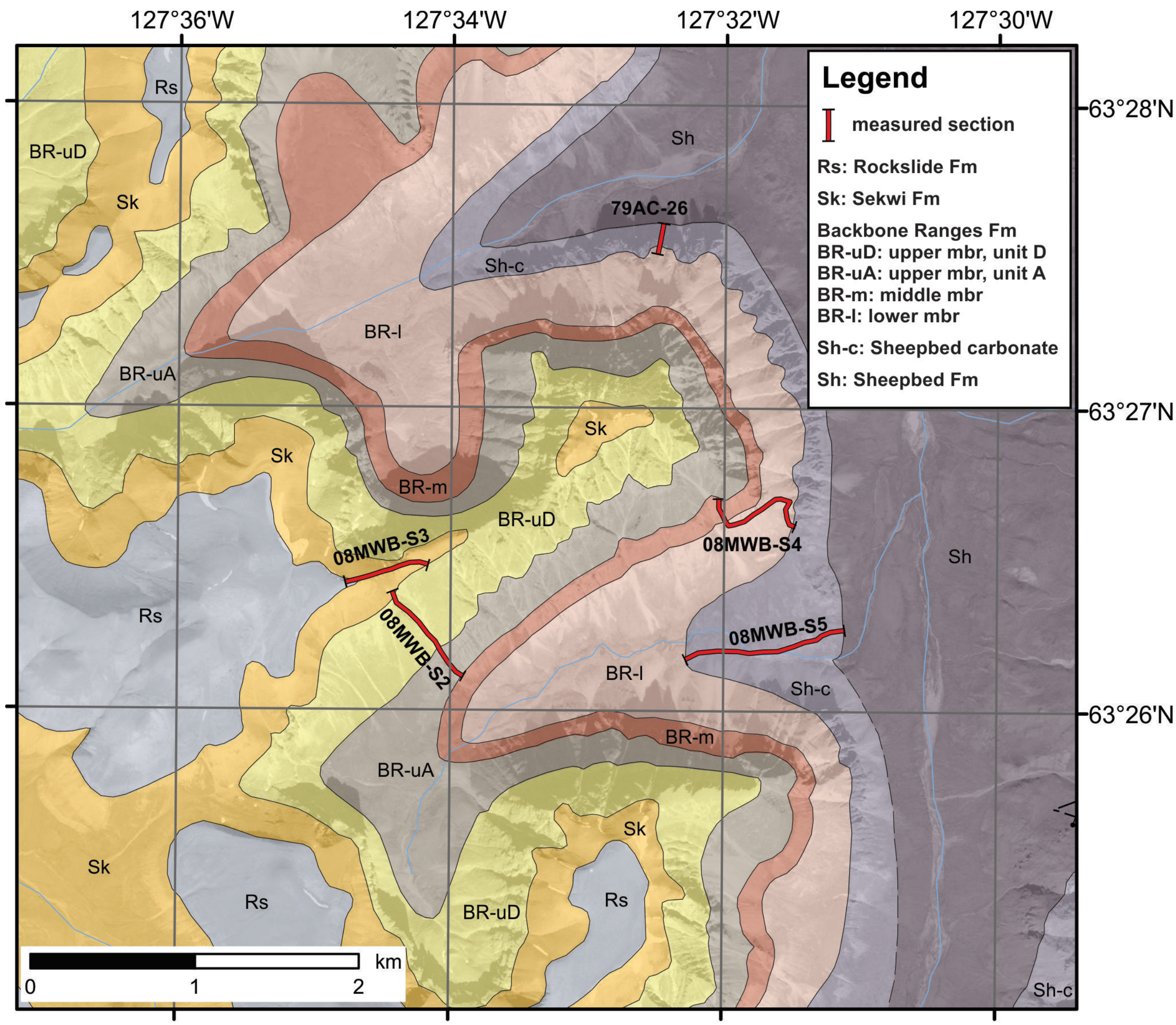


Figure 4: *Detailed location map showing the mapped geological units, overlain on satellite imagery (© 2012 CNES, Licenced by Planet Labs Geomatics Corp.). Traces of each measured section described in this report (08MWB-S2, 08MWB-S3, 08MWB-S4A, 08MWB-S4B, and 08MWB-S5) are labelled. (For clarity, note that 08MWB-S1 was measured elsewhere in the Mackenzie Mountains and is not included in this report). Also shown is the trace of an unpublished section by J.D. Aitken (79AC-26), referred to in the text. Units A and D of the upper member of the Backbone Ranges Formation are informal subdivisions recently proposed in the northern Mackenzie Mountains (MacNaughton et al., 2018); see text for discussion. Abbreviations: "Fm" = Formation; "mbr" = member.*

Sheepbed carbonate

Section 08MWB-S5 (Figure 5) documents the entire thickness of the Sheepbed carbonate, a total measured value of 440 m. This is significantly greater than the measured thickness of 199 m in section 79AC-26, which was measured 2.5 km to the north by the late J.D. Aitken (unpublished data). Observations by the authors in 2006, 2008, and 2018 documented that the thickness of the Sheepbed carbonate is highly variable in the area south of Moose Horn River, including eastward thinning to an erosional zero edge beneath the Backbone Ranges Formation.

The contact with the underlying Sheepbed Formation is well exposed, abrupt, and apparently conformable (Figure 6A). In keeping with its name, the Sheepbed carbonate consists mainly of dolostone and limestone. Limestone dominates the lower part of the formation (units 2-10; 123.5 m). Much of the limestone is apparently particulate, very finely to finely crystalline, in various shades of grey on fresh and weathered surfaces, with fresh surfaces generally being darker. Quartz sand or silt is locally present. Beds generally are very thin to thin (Figure 6B, 6C), and variably massive, parallel-laminated, or current-ripple cross-laminated; in some beds, massive, laminated, and cross-laminated intervals are arranged vertically to form partial Bouma sequences. In the basal part of the formation, scattered alteration zones contain very finely to medium crystalline dolostone that is grey to tan on fresh surfaces and weathers in shades of tan, orange, and cream. Within such zones, primary sedimentary structures are obscured and vuggy porosity locally is well developed, as are dolomite veins distributed parallel to bedding or as cross-cutting presquilite (“zebra rock”) fabrics. Along the section, unit 4 consists of limestone with local zones of dolomitization; in exposures just north of the section this interval is completely dolomitized.

In section 08MWB-S5 the upper part of the Sheepbed carbonate is dominated by dolostone, divisible into two large-scale packages. The lower (units 11-19; 207 m) consists of medium- to thick-bedded, finely to very coarsely crystalline dolostone; the contact with underlying, thin-bedded strata makes an abrupt change in weathering profile (Figure 6C). Fresh surfaces are tones of grey; beds commonly weather to pale shades of grey, with lesser pale tan, cream, orange, or brown. Units 11, 12, and 17 consist in large part of chaotic slump masses with soft-sediment folds, and breccia beds, up to 6 m thick, consisting of carbonate blocks up to boulder size (Figure 6D). Breccia fabrics are common throughout units 11-19, even where they do not dominate. Where undisturbed primary sedimentary structures can be discerned, these include parallel lamination, microbial lamination (including local development of stromatolites), thin-bedded dolomicrite, and carbonate sand grains. Tan siltstone is locally present as lenses and layers in unit 12. Vuggy porosity is present through much of this part of the succession; locally, vugs are up to 5 cm along the longest axis and contain crystals of white calcite or clear quartz.

The upper dolostone-dominated succession (units 20-23; 109.5 m) consists of very thin- to medium-bedded, very finely crystalline dolostone that is light grey on fresh surfaces and weathers in pale tones of grey, cream, tan, or brown. Parallel lamination and current-ripple cross-lamination are common. Unit 20 contains up to 20 percent dolomitic siltstone as partings between the carbonate beds, with thin zones of convolute layering (Figure 6E). At some levels in unit 21 the layering resembles cross-bedding in a large-scale bedform (i.e., layering is steeper than regional dip; Figure 6F). Small-scale soft-sediment folds are locally present in unit 23, and the uppermost 30 cm of unit 23 is brecciated to a (probably karstic) rudstone with abundant quartz sand in the matrix. In the adjacent section 08MWB-S4A, the uppermost beds of the Sheepbed carbonate preserve relict grainstone textures, including dolomitized intraclasts that may have originated as lime mudstone.

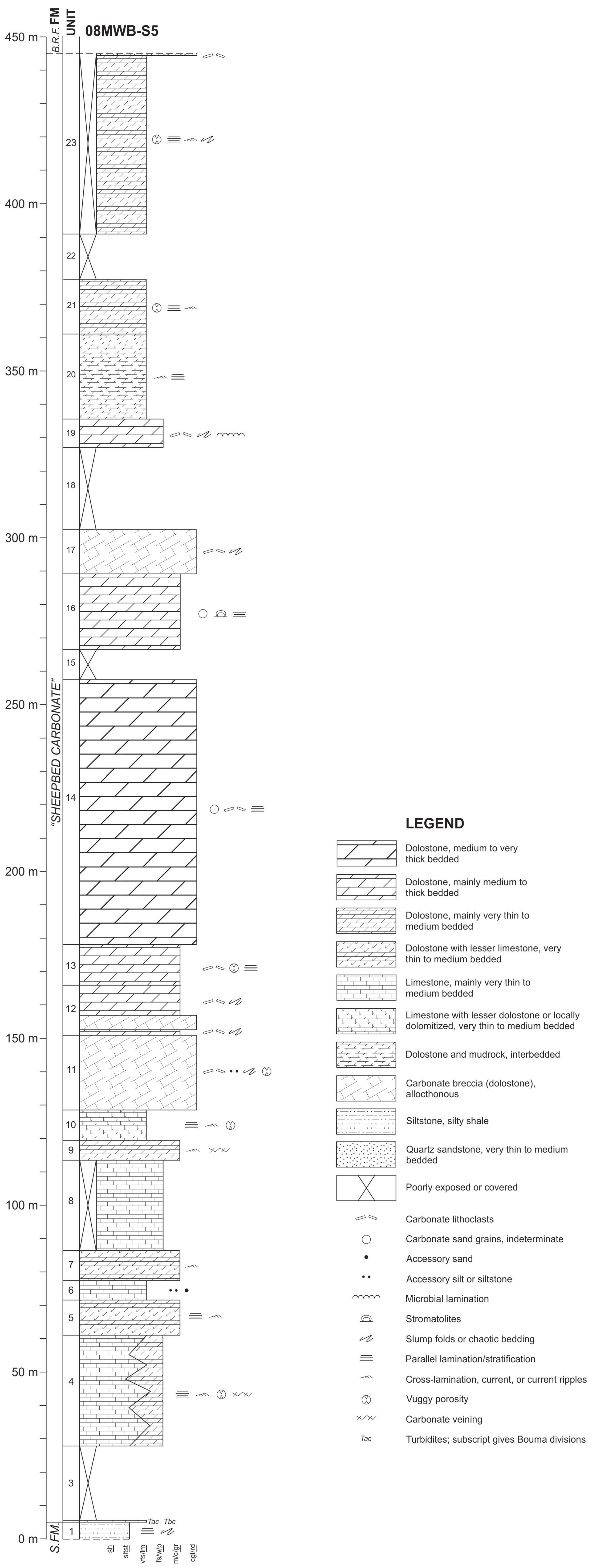
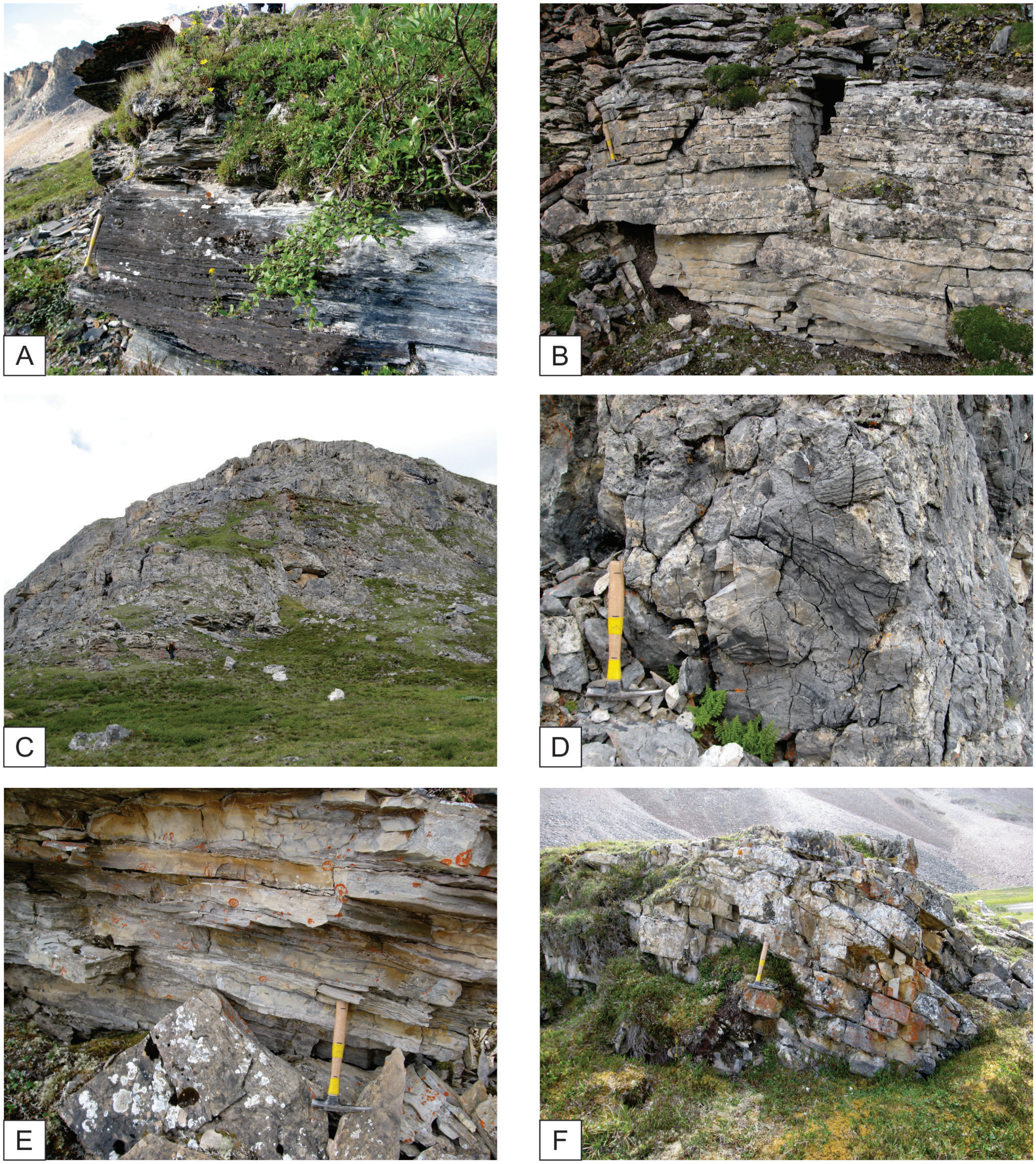


Figure 5: *Graphic log for measured section 08MWB-S5 (Sheepbed carbonate). Abbreviations used in grain-size scale: sh = shale; sltst = siltstone; vfs = very fine-grained sandstone; fs = fine-grained sandstone; m = medium-grained sandstone; c = coarse and very coarse-grained sandstone; cgl = conglomerate (siliciclastic); lm = lime mudstone or microcrystalline carbonate; w = wackestone; p = packstone; gr = grainstone; rd = rudstone. Other abbreviations: "S.FM." = Sheepbed Formation; "B.R.F." = Backbone Ranges Formation (in this case, the lower member); "FM" = Formation.*

Figure 6 (on next page): *Photographs of Sheepbed Formation and Sheepbed carbonate, measured section 08MWB-S5; unit numbers refer to this section. See section descriptive notes in text for geographic coordinates. All photos by R.B. MacNaughton. A. Dark grey shale and siltstone, uppermost Sheepbed Formation (unit 1). Hammer is approximately 32 cm long. NRCan photo 2021-151. B. Very thin- to thin-bedded dolostone (pale weathering) and limestone (dark-weathering, at top of photograph, and as very thin interbeds in basal part of photograph), basal part of Sheepbed carbonate (unit 5). Hammer (at left edge of outcrop) is approximately 30 cm long. NRCan photo 2021-152. C. Transition from thin-bedded lower interval of Sheepbed carbonate into resistant-weathering, thick-bedded carbonate. Base of exposure is base of unit 9; base of cliffs corresponds to base of unit 11. Person in foreground is 1.75 m tall. NRCan photo 2021-153. D. Thick bed of dolorudstone, consisting of variously sized, irregularly shaped clasts of locally derived carbonate (unit 11). Black marks on hammer handle are 10 cm apart. NRCan photo 2021-154. E. Very thin- to thin-bedded dolostone with dolomitic siltstone as partings between beds (unit 20). Black marks on hammer handle are 10 cm apart. NRCan photo 2021-155. F. Thin- to medium-bedded dolostone (unit 21). The main layering visible is steeper than regional dip, which roughly corresponds to the bounding surface at the top of the outcrop. Hammer handle is approximately 30 cm long. NRCan photo 2021-156.*


A
B
C
D
E
F

Along the route of the section, the overlying basal beds of the Backbone Ranges Formation are not exposed. However, the topmost exposures of the Sheepbed carbonate can be projected along strike to exposures of the contact in the cirque wall.

As an informal unit (Aitken, 1982, 1984; Macdonald et al., 2013), the Sheepbed carbonate lacks a type section. For a time, the unit was treated as a proximal, “platformal facies” of the Ediacaran Gametrail Formation, which was defined further west in NTS 105-P (Aitken, 1989; Turner et al., 2011), but this correlation was subsequently falsified based on data from stable isotopes (Macdonald et al., 2013). Descriptions of the “platformal facies” by Aitken (1989) emphasize the presence of particulate carbonates, rudstone, soft-sediment deformation, and microbial/stromatolitic facies as characteristic features, as well as an upward transition within the unit from thin-bedded to thick-bedded carbonates. These features all were seen in 08MWB-S5. The Sheepbed carbonate extends, at minimum, from northern NTS 95-L (Aitken, 1989) northwest to the Wernecke Mountains (Aitken, 1984; Macdonald et al., 2013), although its distribution is not continuous along the outcrop belt (e.g., MacNaughton, 2020a).

Backbone Ranges Formation, lower member

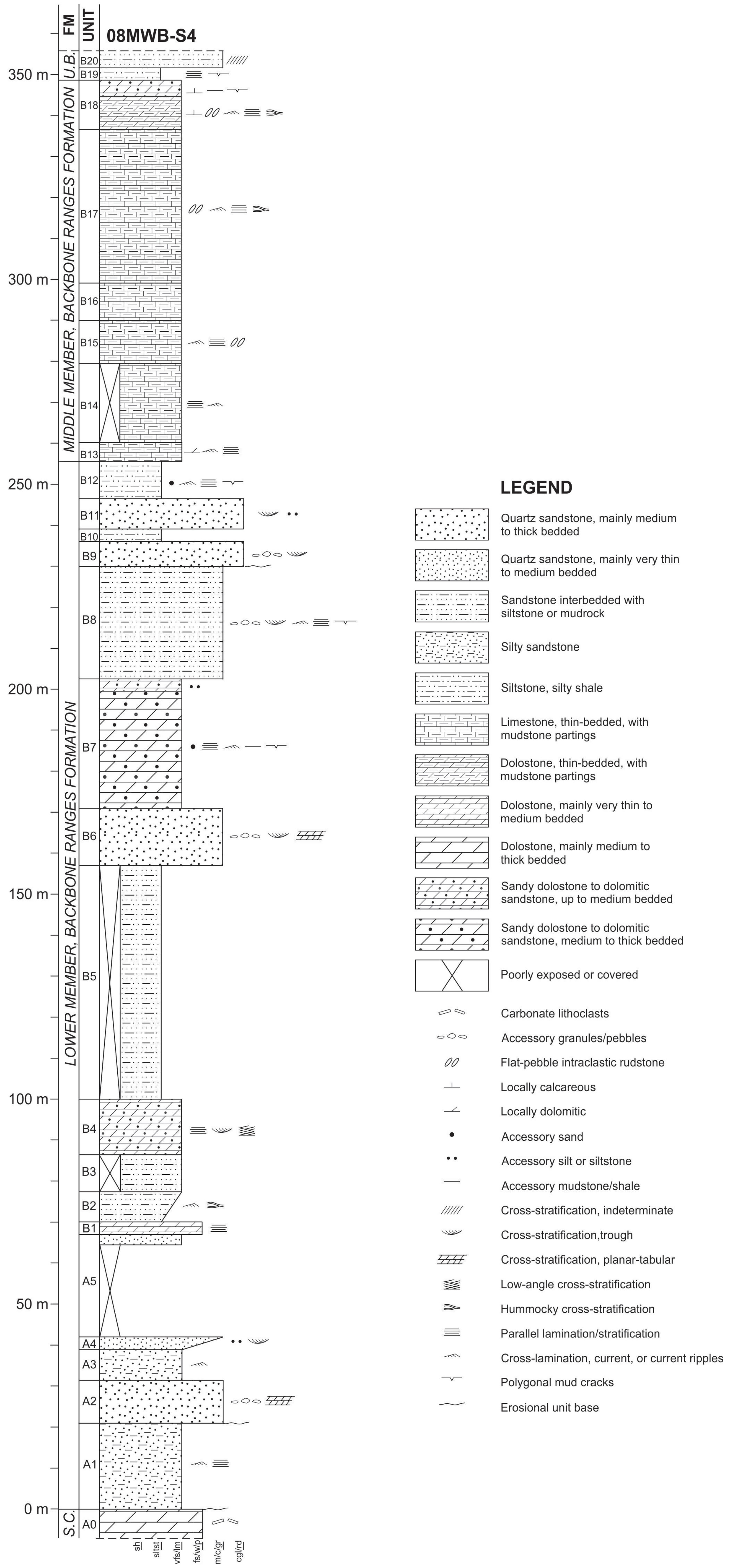
The lower member of the Backbone Ranges Formation was measured in two overlapping section legs; the lowermost 107 m in 08MWB-S4A, and the balance in 08MWB-S4B. (Notes for the two legs are presented separately but the two are combined as a composite graphic log in Figure 7. There is 42.5 m of stratigraphic overlap between the two legs.) Total measured thickness of the lower member is 253 m. The contact with the underlying Sheepbed carbonate is well-exposed adjacent to measured section 08MWB-S4A, where it is abrupt and shows metre-scale, probably erosional relief (Figure 8A).

The lower member here is heterolithic, including sand-, gravel-, and mud-sized siliciclastic facies, as well as carbonates. Several intervals, including the basal part of the member in 08MWB-S4A (Figure 8A), consist of very thin- to thin-bedded quartzose sandstone to silty sandstone interbedded with siltstone and, less commonly, shale (Figure 8B). Such intervals are generally recessive, can be organized in upward-coarsening packages, and weather to shades of brown. Sedimentary structures commonly include parallel-lamination and current-ripple cross-lamination. Trough cross-bedding and possible hummocky cross-stratification are present locally. In 08MWB-S4B, unit 8 and several overlying units consist of interbedded sandstone and siltstone but differ from those lower in the section by containing up to 20 percent by volume of pale-weathering quartz arenite and by displaying a pronounced maroon colour on most fresh and weathered surfaces. Sandstone in unit 8 is locally pebbly, trough cross-bedding is more prevalent, and polygonal mud cracks are present in the siltstone.

The member contains several units of sandstone, up to very coarse-grained and locally conglomeratic with quartz granules and small pebbles of quartz or quartzite. Such units are thick bedded (up to very thick bedded) and resistant, tending to form cliffs. These units contain trough and planar-tabular cross-bedding (Figure 8A, 8C) and weather in pale shades of grey, cream, white, tan or yellowish grey. Examples include unit 2 in 08MWB-S4A (Figure 8A) and units 6, 9, and 11 in 08MWB-S4B. Along the route of the section, quartz sandstone in unit 8 of 08MWB-S4B is similar but thinner-bedded; however, this unit passes laterally into thick-bedded sandstone much like the units just described.

In 08MWB-S4B, there are three intervals of dolostone, sandy dolostone, and dolomitic sandstone (units 1, 4, and 7) that are semi-resistant to resistant and weather in shades of grey, tan, brown, or orange. These units are up to medium bedded, and beds are variously massive, parallel laminated, ripple cross-

Figure 7 (on next page): *Graphic log for measured section 08MWB-S4 (lower and middle members, Backbone Ranges Formation). Abbreviations used in grain-size scale: sh = shale; sltst = siltstone; vfs = very fine-grained sandstone; fs = fine-grained sandstone; m = medium-grained sandstone; c = coarse and very coarse-grained sandstone; cgl = conglomerate (siliciclastic); lm = lime mudstone or microcrystalline carbonate; w = wackestone; p = packstone; gr = grainstone; rd = rudstone. Other abbreviations: "S.C." = Sheepbed carbonate; "U.B." = upper member, Backbone Ranges Formation; "FM" = Formation. Use of "A" or "B" with unit numbers indicates which segment of the measured section has been used in plotting that portion of the log.*



FM
UNIT
08MWB-S4
U.B.
MIDDLE MEMBER, BACKBONE RANGES FORMATION
LOWER MEMBER, BACKBONE RANGES FORMATION
S.C.
350 m
300 m
250 m
200 m
150 m
100 m
50 m
0 m
B20
B19
B18
B17
B16
B15
B14
B13
B12
B11
B10
B9
B8
B7
B6
B5
B4
B3
B2
B1
A5
A4
A3
A2
A1
A0
sh
sltst
vfs/lm
fs/w/p
m/c/gr
cgl/rd
LEGEND
Quartz sandstone, mainly medium to thick bedded
Quartz sandstone, mainly very thin to medium bedded
Sandstone interbedded with siltstone or mudrock
Silty sandstone
Siltstone, silty shale
Limestone, thin-bedded, with mudstone partings
Dolostone, thin-bedded, with mudstone partings
Dolostone, mainly very thin to medium bedded
Dolostone, mainly medium to thick bedded
Sandy dolostone to dolomitic sandstone, up to medium bedded
Sandy dolostone to dolomitic sandstone, medium to thick bedded
Poorly exposed or covered
Carbonate lithoclasts
Accessory granules/pebbles
Flat-pebble intraclastic rudstone
Locally calcareous
Locally dolomitic
Accessory sand
Accessory silt or siltstone
Accessory mudstone/shale
Cross-stratification, indeterminate
Cross-stratification,trough
Cross-stratification, planar-tabular
Low-angle cross-stratification
Hummocky cross-stratification
Parallel lamination/stratification
Cross-lamination, current, or current ripples
Polygonal mud cracks
Erosional unit base

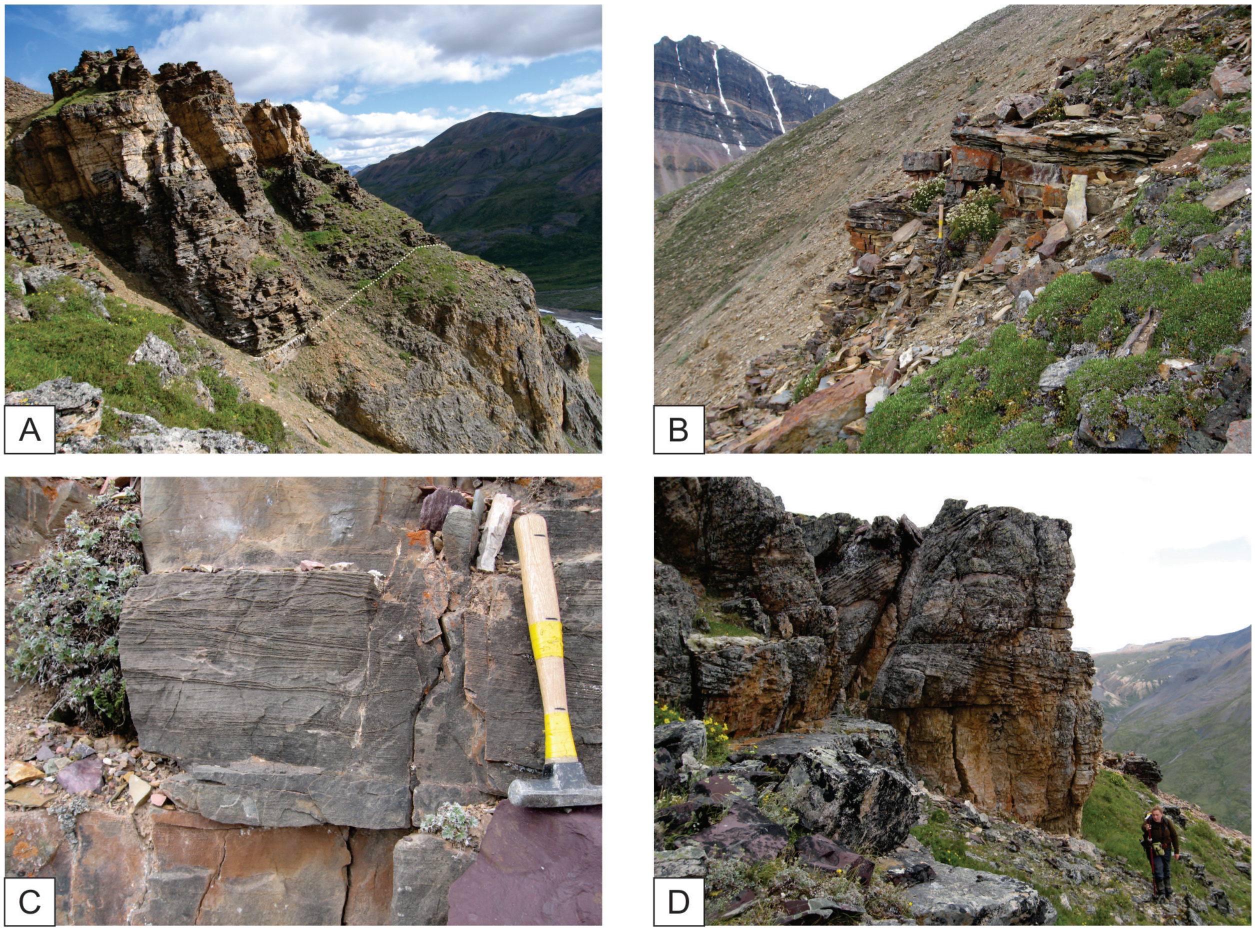


Figure 8: *Photographs of lower member, Backbone Ranges Formation, measured sections 08MWB-S4A and 08MWB-S4B. Unit numbers include letter "A" or "B" to indicate which leg of section is referred to. See section descriptive notes in text for geographic coordinates. All photos by R.B. MacNaughton. A. Contact between grey-weathering, resistant carbonate of Sheepbed carbonate and basal, silty sandstone of lower member, Backbone Ranges Formation (unit A1). Note relief on contact (dotted line) and onlap of silty sandstone against the contact. Above silty sandstone is a cliff-forming, sharp- to erosionaly based package of thick-bedded sandstone to pebbly sandstone with well-developed planar-tabular cross-bedding (unit A2), overlain in turn by additional, recessive siltstone and sandstone (unit A3). Stratigraphic thickness of unit A2 is approximately 10 m. NRCan photo 2021-157. B. Brown-weathering, interbedded sandstone and siltstone (unit B2). Hammer is approximately 32 cm long. NRCan photo 2021-158. C. Sandy dolostone with current-ripple cross-lamination and possible hummocky cross-stratification (unit B7). Black marks on hammer handle are 10 cm apart. NRCan photo 2021-159. D. Thick- to very thick-bedded coarse-grained to pebbly quartz arenite with well-developed cross-bedding (unit B9). Person is 1.75 m tall. NRCan photo 2021-160.*

laminated, trough cross-bedded, or low-angle cross-stratified, i.e., possible hummocky cross-stratification or swaley cross-stratification (Figure 8D). Unit 7 is notable also for the presence of recognizable allochems (carbonate intraclasts and possible ooids) and of mudstone to siltstone partings with polygonal mud cracks. The sand-rich carbonate facies strongly resemble those described from measured sections of the lower member in northeastern NTS 105-P (MacNaughton, 2020a)

The heterolithic but relatively sand-rich character of the lower member in 08MWB-S4A and 08MWB-S4B is consistent with its reported lithology in the type section (Gabrielse et al., 1973a; Fritz, 1982) and other localities (Turner et al., 2011; MacNaughton et al, 2018; MacNaughton, 2020a, 2020b) at least as far northwest as the region of the Yukon-Northwest Territories border in NTS 106-B and 106-C.

Backbone Ranges Formation, middle member

The middle member of the Backbone Ranges Formation was included in measured section 08MWB-S4B (Figure 7), where its measured thickness is 93 m. With the exception of its lowermost and uppermost intervals, the middle member at this locality is dominated by microcrystalline to very finely crystalline limestone that is grey to pink on fresh surfaces and weathers grey, pink, or brick red. Stratification varies from thickly laminated through to medium bedded, but is mainly very thin to thin bedded. Through most of the member, beds of carbonate are separated by partings to thin beds of maroon to red siltstone or mudstone (Figure 9A). Limestone beds preserve parallel lamination, small-scale current-ripple cross-lamination, and, in unit 17, planar bedding, undulatory bedding, and low-angle cross-lamination that resembles micro-hummocky cross-stratification. Units 16 and 17 preserve intraclastic rudstone (“flat-pebble conglomerate”), locally with the clasts strikingly arranged in fans (Figure 9B). The basal 4.5 m of the middle member (unit 13) is much as just described, but contains both limestone and dolostone, with grey and tan fresh and weathered colours, albeit with the characteristic red siltstone partings. At the top of the member, unit 18 consists of 8 m of interbedded dolostone and lesser limestone that differs from underlying units mainly in composition and in weathering pale orange to cream, overlain by 4 m of cream to tan weathering sandy dolostone that contains green shale partings with polygonal mud cracks. The uppermost part of the middle member exposed at the base of 08MWB-S2 likewise consists of sandy dolostone, and here contains both flat-clast rudstone and poorly exposed microbial textures that may indicate the presence of small stromatolites.

The prevalence of pink, red, and orange weathering tones, combined with a generally resistant and cliff-forming weathering profile, makes the middle member an important marker for mapping and regional stratigraphic correlation (Turner et al., 2011). It has been traced from its type area in NTS 95-L (Gabrielse et al., 1973a; Fritz, 1982) to the region of the border between the Northwest Territories and Yukon in the northern Mackenzie Mountains (MacNaughton et al., 2018), and its characteristics are remarkably consistent throughout its regional extent.

Backbone Ranges Formation, upper member

Measured section 08MWB-S2 documents the entire upper member of the Backbone Ranges Formation (Figure 10), which here has a thickness of 501.5 m. In this part of the Mackenzie Mountains, the upper member is dominated by quartz arenite, producing a resistant weathering character that commonly forms steep cliffs and castellated peaks. This is true of the present section, in which the majority of the sandstone beds are compositionally mature quartz arenite (quartz sandstone) or, less commonly, silty quartz sandstone that may locally contain enough silt to qualify as quartz wacke. In the studied

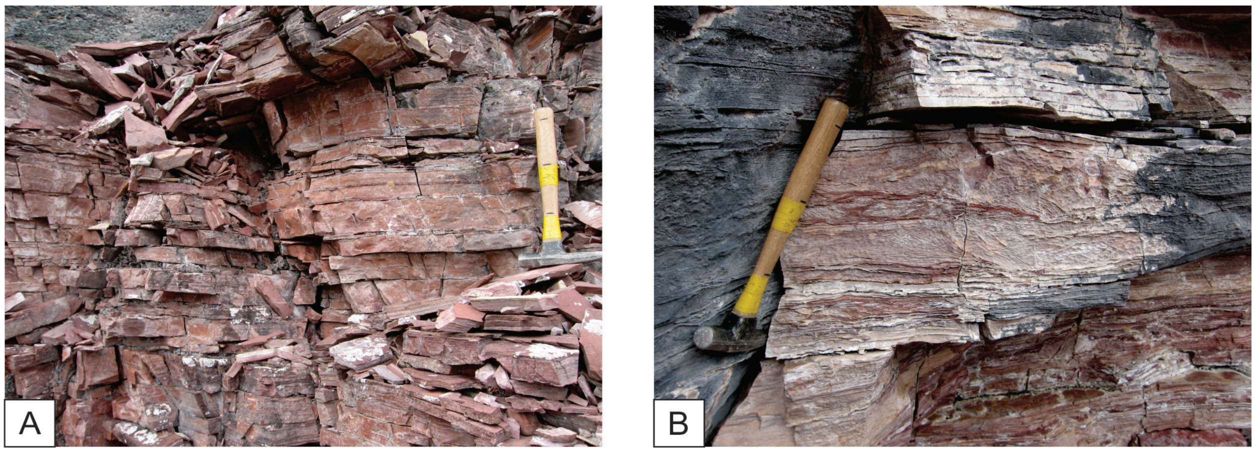


Figure 9: *Photographs of middle member, Backbone Ranges Formation, measured section 08MWB-S4B. See section descriptive notes in text for geographic coordinates. All photos by R.B. MacNaughton. A. Pink-weathering, very thin to thin beds of limestone (unit 15B); red mudstone partings can be seen adhering to bedding surfaces of broken slabs below hammer, and as dark partings or very thin interbeds between beds of limestone. Black marks on hammer handle are 10 cm apart. NRCan photo 2021-161. B. Pink limestone with beds of intraclast rudstone (flat-pebble conglomerate) to right of hammer handle (unit 16B). Black marks on hammer handle are 10 cm apart. NRCan photo 2021-162.*

exposures the contact with the middle member is irregular, with several centimetres of relief, but lacks clear evidence for erosion; the relief may reflect the presence of possible stromatolites in the uppermost beds of the middle member. Regionally, however, this contact is considered to be a significant karstic unconformity (e.g., Fritz, 1982; MacNaughton et al., 1999, 2018).

In section 08MWB-S2, the upper member is divided into two thick successions (units 1-15: 196.5 m; units 17-25: 299 m) by a carbonate marker (unit 16: 6 m). In the lower succession, several intervals (units 1, 3, 4, 6, 11, 13, 14) are dominated by quartz arenite that is up to very coarse grained. Horizons of quartzose pebbles and granules are common, as are layers of mudstone intraclasts. These units are generally medium to very thick bedded, with well-developed trough and planar-tabular cross-stratification as well as less common parallel bedding (Figure 11A). Individual beds are sharp to erosionally based, and probable channel forms ("cut-and-fill stratigraphy") are present at numerous levels. Fresh surface colours are white or pale shades of grey, pink, or tan; beds generally weather light grey or light grey with tones of tan or green. Maroon and purple fresh and weathered colours are less common but are prominent in units 11 and 13. The sandstone-dominated units locally contain mudstone partings up to a few millimetres thick between beds, or sporadic thin intervals of very fine-grained, current-rippled quartz sandstone. White mica (probably detrital) is prevalent on bedding planes at a number of levels. Minor amounts of feldspar are present in a few beds.

The lower succession also contains intervals of quartzose sandstone or silty sandstone interbedded with siltstone and mudstone (Figure 11B). Fresh and weathered surfaces commonly are maroon, greenish-grey, or tan. These units are very thin to medium bedded, and sandstone beds commonly preserve parallel lamination and current-ripple cross-lamination; the latter locally is developed as climbing ripples (ripple-drift cross-lamination). Wave ripples are locally present and polygonal mud cracks are common in the silty/muddy facies. Despite their finer grain size, these intervals tend to be well-exposed. An exception is the poorly exposed unit 15 (13.5 m, immediately below the carbonate marker; float suggests it consists of green to tan siltstone and current-rippled very fine-grained sandstone).

The carbonate marker (unit 16: 6 m) consists of dolostone, sandy to silty dolostone, and dolomitic sandstone that is pale creamy tan on fresh surfaces and weathers tan to creamy tan (Figure 11C). Bedding is very thin to thin, wavy, and enhanced by green shale partings and stylolites. Beds are massive, current-ripple cross-laminated, low-angle cross-laminated, or parallel laminated.

The upper member above the carbonate marker is dominated by quartz arenite, albeit finer-grained overall than units 1-15. Sandstone grain size in this part of the succession is mainly very fine to medium, and rarely coarse. Quartz granules and pebbles are absent, although horizons with mudstone intraclasts are present in some units. Sandstone fresh and weathering colours generally are white, light grey to light tan, or pale tones of pink, orange, or red. However, in unit 19, parts of unit 18, and locally elsewhere, fresh and weathering colours tend to deep tones of red, orange, maroon, pink, or purple (Figure 11D). Bedding thicknesses up to very thick are common in units 17-22 and the lower part of unit 24, but above that level the succession is markedly thinner bedded and fines upward. Trough and planar-tabular cross-bedding are common in sandstones throughout the upper part of the upper member, as are planar bedding and current-ripple cross-lamination (Figure 11D). In some units, green and maroon mudstone partings are present between sandstone beds and commonly contain polygonal mud cracks. White mica (probably detrital) is present locally but no feldspar grains were observed.

Figure 10 (on next page): *Graphic log for measured section 08MWB-S2 (upper member, Backbone Ranges Formation). Abbreviations used in grain-size scale: sh = shale; sltst = siltstone; vfs = very fine-grained sandstone; fs = fine-grained sandstone; m = medium-grained sandstone; c = coarse and very coarse-grained sandstone; cgl = conglomerate (siliciclastic); lm = lime mudstone or microcrystalline carbonate; w = wackestone; p = packstone; gr = grainstone; rd = rudstone. Other abbreviations: "n.m." = not measured; "M.B.R." = Backbone Ranges Formation, middle member; "SK" = Sekwi Formation. Placement of symbols for channelling on units is schematic.*

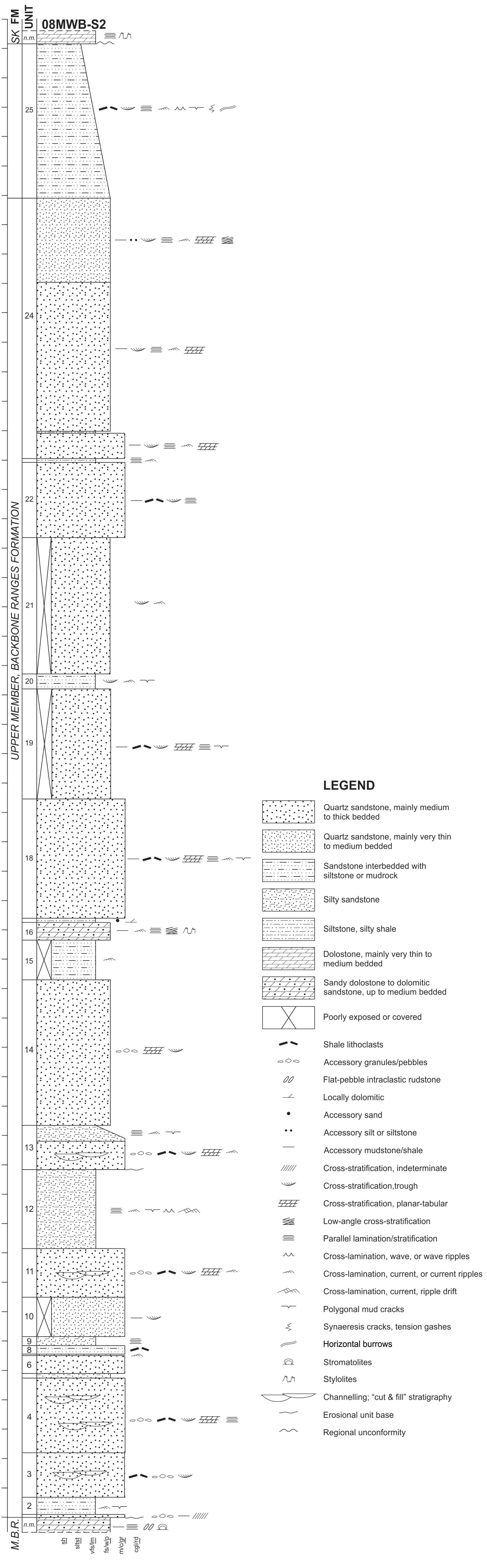
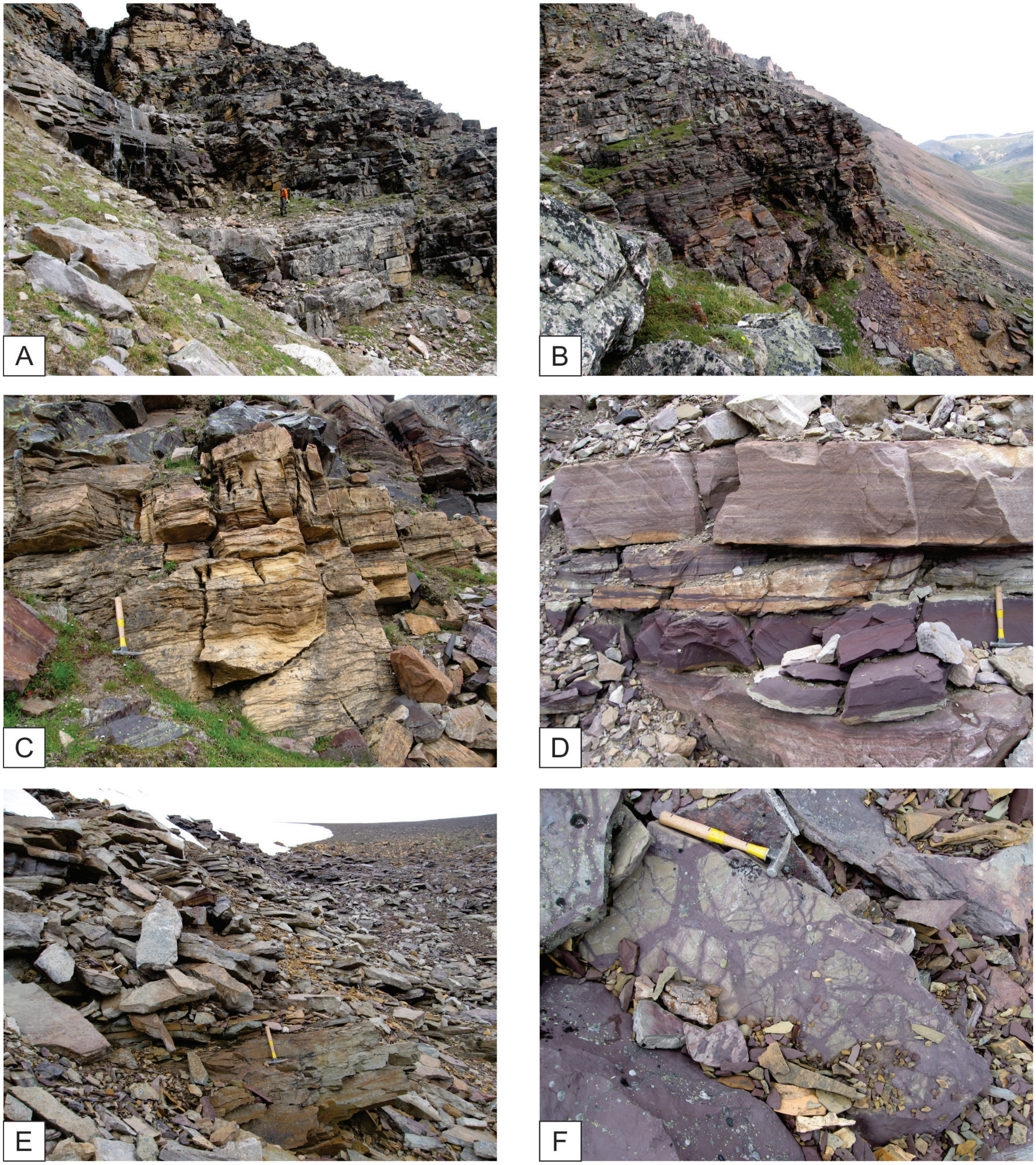

08MWB-S2
SK FM
UNIT
n.m.
500 m
25
450 m
24
400 m
350 m
22
21
300 m
20
19
250 m
18
200 m
16
15
14
150 m
13
12
100 m
11
10
9
8
6
50 m
4
3
2
0 m
n.m.
M.B.R.
UPPER MEMBER, BACKBONE RANGES FORMATION
sh
slt/st
vfs/lm
fs/w/p
m/c/gr
cgl/rd
LEGEND
Quartz sandstone, mainly medium to thick bedded
Quartz sandstone, mainly very thin to medium bedded
Sandstone interbedded with siltstone or mudrock
Silty sandstone
Siltstone, silty shale
Dolostone, mainly very thin to medium bedded
Sandy dolostone to dolomitic sandstone, up to medium bedded
Poorly exposed or covered
Shale lithoclasts
Accessory granules/pebbles
Flat-pebble intraclastic rudstone
Locally dolomitic
Accessory sand
Accessory silt or siltstone
Accessory mudstone/shale
Cross-stratification, indeterminate
Cross-stratification,trough
Cross-stratification, planar-tabular
Low-angle cross-stratification
Parallel lamination/stratification
Cross-lamination, wave, or wave ripples
Cross-lamination, current, or current ripples
Cross-lamination, current, ripple drift
Polygonal mud cracks
Synaeresis cracks, tension gashes
Horizontal burrows
Stromatolites
Stylolites
Channelling; "cut & fill" stratigraphy
Erosional unit base
Regional unconformity

Figure 11 (on next page): *Photographs of upper member, Backbone Ranges Formation, measured section 08MWB-S2. See section descriptive notes in text for geographic coordinates. All photos by R.B. MacNaughton except where noted. A. Blocky, resistant-weathering cliffs of thick to very thick-bedded quartz arenite with cross-bedding at numerous levels (unit 4). Person in centre of photograph is 1.85 m tall. Photo by K.M. Fallas. NRCan photo 2021-163. B. Maroon siltstone and very thin beds of quartz arenite (unit 12). Measured stratigraphic thickness of dark maroon-weathering package, from base of exposure to base of overlying, grey-weathering quartz arenite, is 27 m. NRCan photo 2021-164. C. Tan- to cream-weathering dolostone and sandy dolostone (unit 16), identified by MacNaughton and Fallas (2019a) as a possible tongue of the Risky Formation. Hammer is approximately 32 cm long. NRCan photo 2021-165. D. Maroon silty sandstone interbedded with pink to tan, cross-bedded quartz arenite; contact between units 20 and 21 is at base of thick bed of sandstone at top of photograph. Black marks on hammer handle are 10 cm apart. NRCan photo 2021-166. E. Thin-bedded sandstone interbedded with siltstone, uppermost part of unit 25. Tan to orange talus to right of snow patch higher on slope is dolostone at the base of the Sekwi Formation. Hammer is approximately 32 cm long. NRCan photo 2021-167. F. Polygonal mud cracks in maroon and green siltstone (unit 25). Black marks on hammer handle are 10 cm apart. NRCan photo 2021-168.*


A
B
C
D
E
F

Through most of the upper part of the upper member, packages of siltstone or interbedded siltstone and very fine-grained sandstone (units 17, 20, and 23) are thin and very similar to those seen below the carbonate marker, with two exceptions. Unit 17, immediately above the carbonate marker, is 1.5 m of interbedded siltstone, mudstone, and very fine-grained sandstone, and is unusual in being partly dolomitic. Unit 25, which caps the succession, is a thick, fining-upward succession of interbedded quartz arenite, siltstone, and mudstone; sandstone comprises of 70 percent of the rock at the base of the unit but 40 percent near the top (Figure 11E). The sandstone is like that seen in the sandstone-dominated units but is thin bedded and locally contains wave ripples. The muddy facies are maroon or green, and are present as laminae to medium beds, with polygonal mud cracks (Figure 11F) and synaeresis cracks. Possible examples of simple, horizontal trace fossils (probably *Planolites* or *Palaeophycus*) are present at some levels, the only ichnofossils observed in the Backbone Ranges Formation at this site.

The upper member can be compared to the type section of the Backbone Ranges Formation (Gabrielse et al., 1983; Fritz, 1982; MacNaughton et al., 1999). Although the upper member is roughly 350 m thicker in the type section than in 08MWB-S2 (compare Fritz, 1982), both successions are dominated by quartz arenite, with lesser siltstone, and both include a basal succession that is relatively rich in conglomeratic facies. Comparison with the preliminary stratigraphic subdivisions of the upper member reported in NTS 106-B and 106-C (see above) by MacNaughton et al. (2018; 2019b) is aided by the presence of a carbonate marker in both successions. The marker in 08MWB-S2 (unit 16) was identified by MacNaughton and Fallas (2019a) as a possible proximal tongue of the Risky Formation (Aitken, 1989), which in the Mackenzie Mountains is the uppermost unit of the Windermere Supergroup (Narbonne and Aitken, 1995) and the youngest entirely Ediacaran unit (MacNaughton and Narbonne, 1999; Carbone and Narbonne, 2014). This correlation implies that in 08MWB-S2 the Ediacaran-Cambrian boundary is within the upper member, at or above the top of the carbonate marker. In the northern Mackenzie Mountains, the carbonate marker that caps upper member unit B (MacNaughton et al., 2018) also probably correlates with the Risky Formation, based on fossil assemblages that place the Ediacaran-Cambrian boundary at or near its top (MacNaughton et al., 2019b). Additional lithostratigraphic comparisons with the northern Mackenzie Mountains suggest that in 08MWB-S2 the succession below the carbonate marker is best assigned to the sandstone-rich, locally conglomeratic unit A. The recessive-weathering, shale dominated unit B is either absent, or represented only by the poorly exposed, recessive unit 15 that lies immediately beneath the carbonate marker. The recessive, grey-weathering, siltstone-rich unit C also is absent. Essentially the entirety of the succession above the carbonate marker can be assigned to unit D based on the abundance of resistant, pale-weathering quartz arenite.

Sekwi Formation

Strata now assigned to the early Cambrian Sekwi Formation in the hanging-wall of the Plateau Fault were originally included as part of the upper member of the Backbone Ranges Formation by Gabrielse et al. (1973a). However, Fritz (1981) reassigned them based on their lithology and associated trilobite fauna. Measured section 08MWB-S3 (Figure 12) included the entirety of the Sekwi Formation and was measured late on the same day as 08MWB-S2. For this reason, and because the succession is not well exposed (Figure 13A), the section was measured quickly, focusing on gross lithology and weathering colours. Unless otherwise recorded in the section notes, all carbonates were very finely crystalline or finer; on the graphic log, they have been shown as very finely crystalline for the most part.

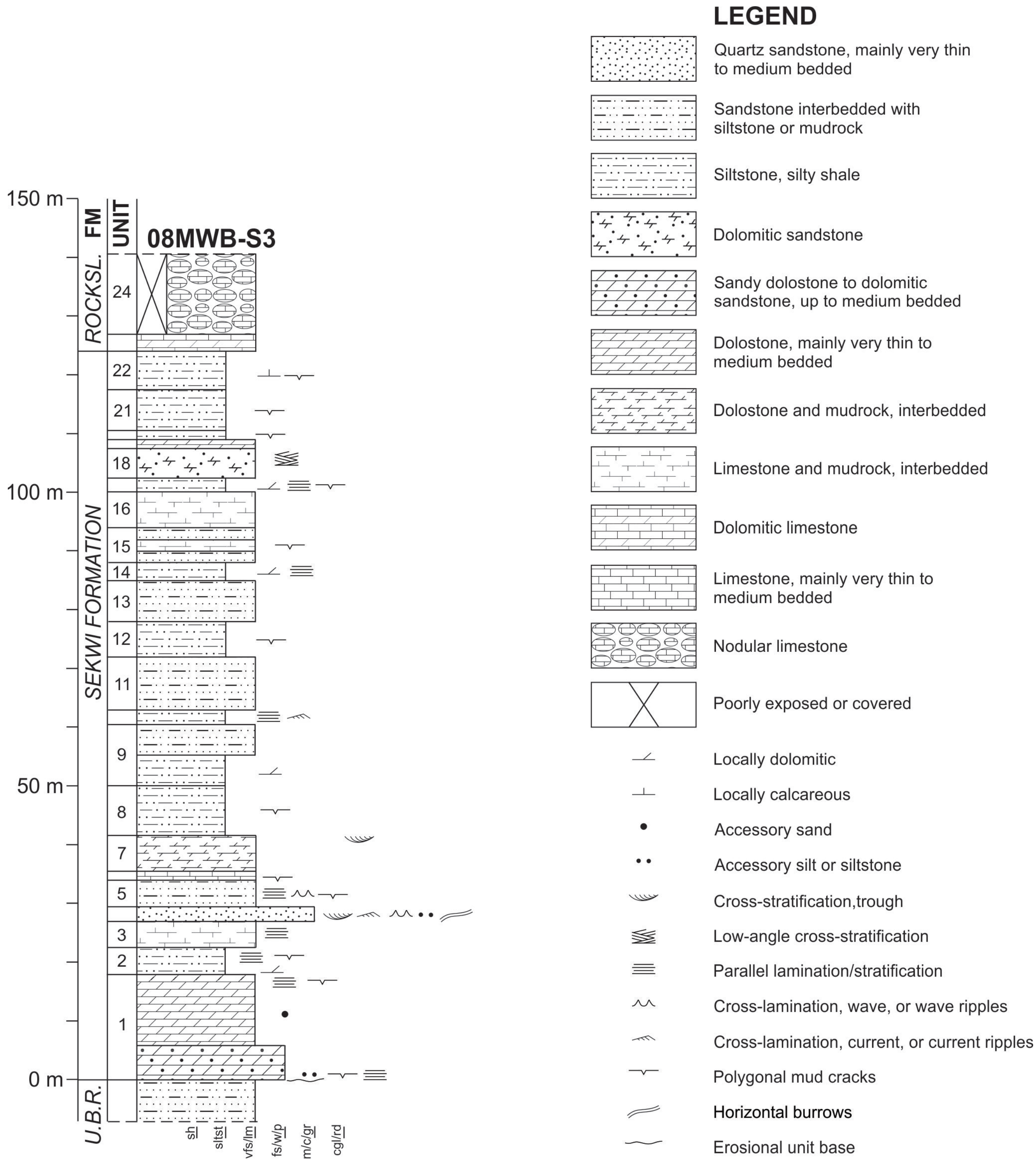


Figure 12: *Graphic log for measured section 08MWB-S3 (Sekwi Formation). Abbreviations used in grain-size scale: sh = shale; sltst = siltstone; vfs = very fine-grained sandstone; fs = fine-grained sandstone; m = medium-grained sandstone; c = coarse and very coarse-grained sandstone; cgl = conglomerate (siliciclastic); lm = lime mudstone or microcrystalline carbonate; w = wackestone; p = packstone; gr = grainstone; rd = rudstone. Other abbreviations: "U.B.R." = Backbone Ranges Formation, upper member; "ROCKSL." = Rockslide Formation. Trilobites found in float (see text) are probably from unit 1 but are not shown, as they were not collected along the route of the section.*

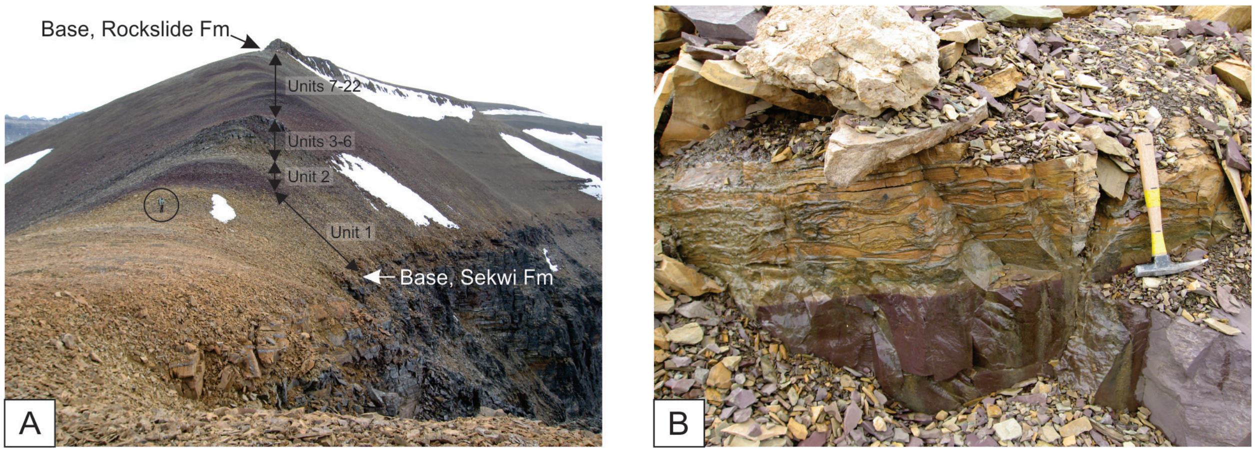


Figure 13: *Photographs of Sekwi Formation, measured section 08MWB-S3. See section descriptive notes in text for geographic coordinates. All photographs by R.B. MacNaughton. A. Overview of section 08MWB-S3. Line of section follows the relatively better exposures along the crest of the ridge as it rises away from the photographer. Base of Sekwi Formation (arrowed) corresponds to upward change from grey, cliff-forming quartz arenite to tan and pale orange, recessive-weathering dolostone and siltstone (unit 1 of section). Semi-resistant knob partway up the section includes units 3-6. Base of Rockslide Formation (arrowed) is at base of resistant limestone outcrop rib (unit 23) at top of photograph. Person (circled) is 1.75 m tall. Note prevalence of maroon-weathering siltstone at numerous levels in Sekwi Formation (e.g., unit 2 and various horizons in interval of units 7-22). NRCan photo 2021-169. B. Abrupt contact between orange dolostone of basal Sekwi Formation and underlying maroon siltstone of uppermost Backbone Ranges Formation; top of unit 25, section 08MWB-S2. Uppermost few centimetres of the siltstone are greenish-grey, probably reflecting reduction of iron. NRCan photo 2021-170.*

The base of the Sekwi Formation is placed beneath the first bed of orange-weathering dolostone that abruptly overlies the Backbone Ranges Formation (Figure 13A, 13B). Although the presence of quartz sandstone and maroon siltstone in the basal unit of the Sekwi Formation gives the contact the appearance of being gradational by appearance of carbonate, regional stratigraphic correlations and bedrock mapping demonstrate that the contact in NTS 95-M is unconformable (see below, "Discussion"; also see MacNaughton et al., 2017). Additionally, the basal part of the Sekwi Formation in NTS 95-M contains trilobites of the *Bonnia-Olenellus* Zone (Gabrielse et al., 1973a), whereas further west the Sekwi Formation preserves the earlier *Fallotaspis* and *Nevadella* zones beneath the *Bonnia-Olenellus* Zone (Fritz et al., 1991). During reconnaissance of the present study locality in 2006, RBM observed olenelloid trilobites in locally derived float near the base of the Sekwi Formation. These have been identified as *Nephrolenellus* cf. *multinodus*, suggesting a position in the upper part of the *Bonnia-Olenellus* Zone (C.A. Morgan, personal communication, 2020). Thus, the base of the Sekwi Formation at 08MWB-S3 is almost certainly within the *Bonnia-Olenellus* Zone, similar to other localities in NTS 95-M.

In 08MWB-S3, the Sekwi Formation is dominated by siltstone, locally calcareous or dolomitic, that weathers maroon with greenish-grey reduction zones, or tan (Figure 13A). In some intervals, the siltstone is interbedded with maroon-weathering, very fine-grained sandstone to silty sandstone. Parallel-lamination, current-ripple cross-lamination, and polygonal mud cracks are common in the sandy facies. Unit 4 consists of 2.5 m of thin-bedded, fine-to-medium-grained sandstone, with trough cross-bedding and both wave and current ripples. Orange-weathering dolomitic sandstone is present in the basal 6 m of unit 1 and in unit 18. Unit 18 has possible hummocky or swaley cross-stratification. Orange-weathering dolostone and dolorudstone, and greenish-grey-weathering limestone are present locally throughout the succession. The measured thickness of the Sekwi Formation in 08MWB-S3 is 124 m.

Overlying strata

In 08MWB-S3 (Figure 12), siltstone and calcareous siltstone of the Sekwi Formation is overlain abruptly by 3 m of grey, very thin-bedded, rubbly dolomitic limestone (unit 23) of the Rockslide Formation (Figure 13A). This is overlain by 13.5 m of greenish-grey siltstone with limestone nodules, above which exposure is lost in talus of dark grey to grey shale and limestone nodules. These facies characterize the Rockslide Formation in NTS 95M, and the unit contains middle Cambrian trilobites (Gabrielse et al., 1973a). For overlying units as young as Devonian, see Gabrielse et al. (1973b) and Fallas et al. (2011).

Discussion

A previously published section spanning the Ediacaran-Cambrian boundary in NTS 95-M provides a useful comparison for the present work. Section 14 of Gabrielse et al. (1973a) lies 9.7 km north of Ravens Throat River in the hanging-wall of the Plateau Fault (Figure 1). It is sufficiently detailed to be reinterpreted in terms of current lithostratigraphy, and Figure 14 compares its stratigraphy (Gabrielse et al., 1973a) with that documented in the present report. In the following discussion, thicknesses have been converted from values in feet given by Gabrielse et al. (1973a), rounded to the nearest metre.

Unit 1 in section 14 consists of medium- to thick-bedded, light grey-buff dolostone. It is 14 m thick, overlies the Sheepbed Formation, and was included in the lower member of the Backbone Ranges Formation by Gabrielse et al. (1973a). We assign it to the Sheepbed carbonate based on its lithology and

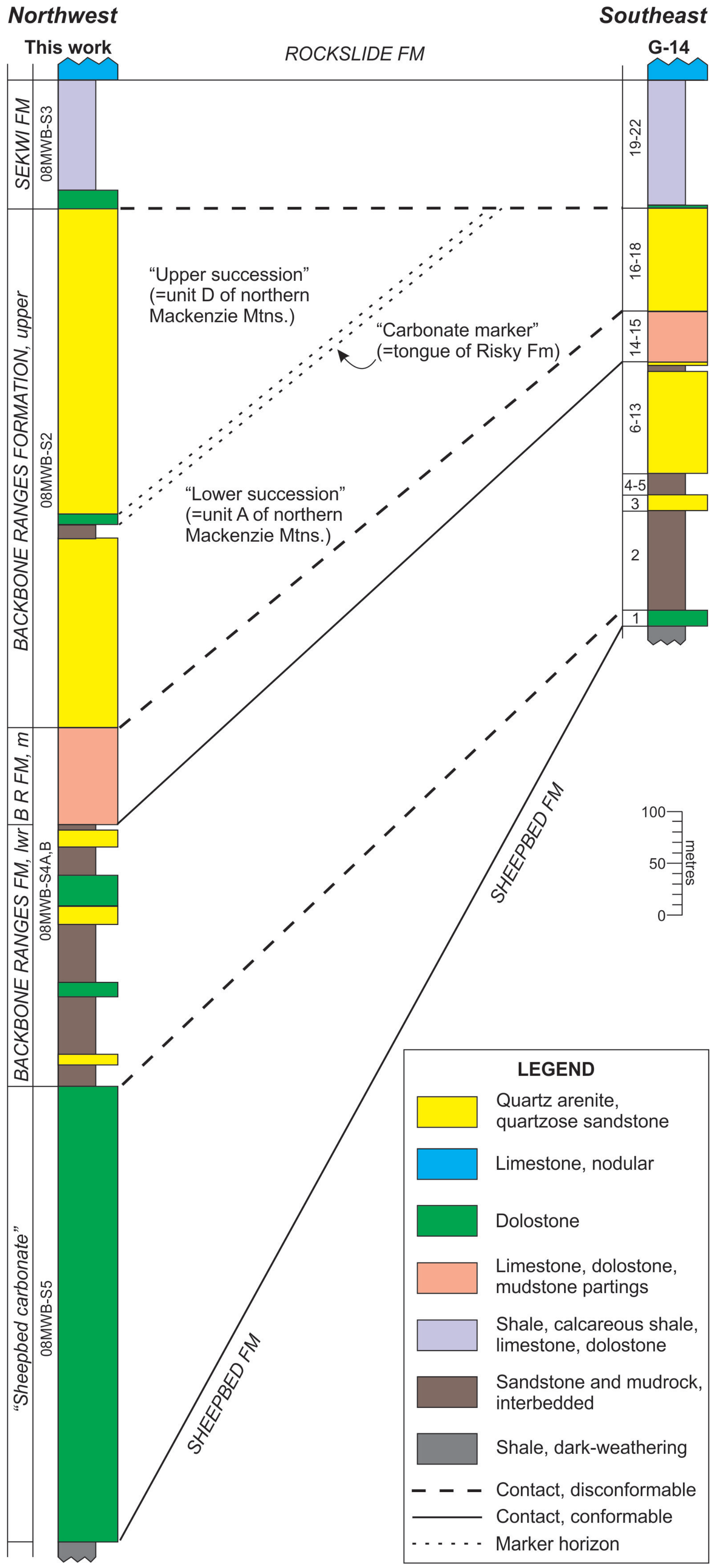


Figure 14: *Simplified stratigraphic cross-section, showing correlation between measured section 14 (labelled G-14) of Gabrielse et al. (1973a) with a summary column of the present work. See text for explanation; see Figure 1 for locations of sections. Numbers to left of G-14 column refer to unit numbers in the published description (Gabrielse et al., 1973a), whereas those to left of column for this work designate the measured sections described herein. Note large thickness changes in Sheebed carbonate and upper member of Backbone Ranges Formation. See Figure 15 for documentation of erosional removal of the latter unit beneath the Sekwi Formation.*

stratigraphic position. It is thin, in keeping with the variable thickness of the Sheepbed carbonate, but its presence emphasizes that the Sheepbed carbonate is a regionally mappable unit. As noted previously, Aitken (1989) included the Sheepbed carbonate in the Gametrail Formation and it appears on 1:100 000 scale maps under that name (e.g., Fallas et al., 2011). The Sheepbed carbonate will be formalized under a new name in a future publication (R.B. MacNaughton, K.M. Fallas, and E.C. Turner, work in progress).

Units 2-13 of section 14 are assigned to the lower member of the Backbone Range Formation, in agreement with the original report. The description of these strata provided by Gabrielse et al. (1973a) is very similar to the succession documented in 08MWB-S4. Similarities include a reported thickness of 259 m (253 m in 08MWB-S4) and a rough division into a lower, generally recessive interval, probably of interbedded sandstone and shale (units 2-4 in section 14: thickness 135 m) that is somewhat thicker than an upper interval with abundant quartz arenite that includes purple and red beds (units 5-13 in section 14: thickness 123 m). A notable difference is the apparent lack of carbonate facies in section 14.

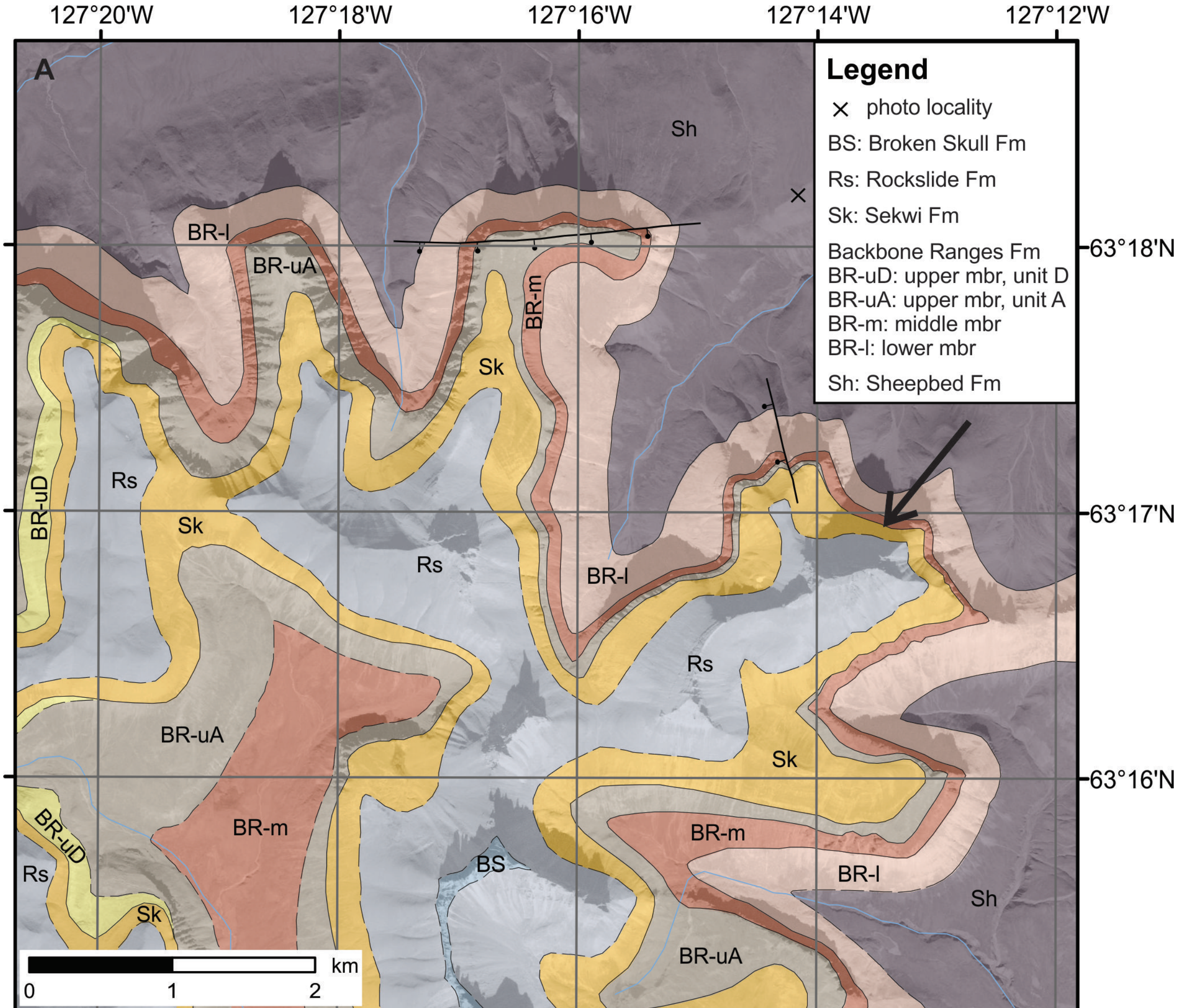
In section 14, the middle member of the Backbone Ranges Formation (units 14-15) has a similar character to that seen in 08MWB-S4. It is a cliff-forming unit that consists of light orange to red-orange weathering, thin- to medium-bedded, finely crystalline dolostone. The reported thickness (52 m) is significantly less than that recorded in 08MWB-S4 (93 m), and may reflect erosion related to the regional unconformity that caps the unit (e.g., Fritz, 1982; Fritz et al., 1991).

Gabrielse et al. (1973a) assigned units 16-22 of their section 14 to the upper member of the Backbone Ranges Formation. However, due to a strong contrast between units 16-18, which are sandstone-dominated, and units 19-22, which are dominated by siltstone and shale and contain trilobites, we follow Fritz (1981) by reassigning units 19-22 to the Sekwi Formation. We thus treat only the sandstone-dominated units as part of the upper member. Units 16-18 resemble the upper member in 08MWB-S2, being dominated by grey to red-weathering quartz arenite that is in part coarse-grained and thick bedded. However, in section 14 the upper member is only 100 m thick, one-fifth the thickness in 08MWB-S2 (501.5m). This variation reflects erosion at an unconformity beneath the *Bonnia-Olenellus* Zone (MacNaughton et al., 2016; Busch et al., 2021), strongly expressed in NTS 95-M (MacNaughton et al., 2017). The upper member thins southeastward from 08MWB-S2, reaching a zero edge at 63°16’56”N, 127°13’11”W (Figure 15), then reappearing and thickening southward to section 14. The mapped, sub-Sekwi truncation of upper member unit D west of the zero edge shows that the upper member thins due to erosion rather than depositional thinning. Absence of the carbonate marker (unit 16 in 08MWB-S2) from the upper member at section 14 is also likely due to erosional removal.

The succession reassigned to the Sekwi Formation in section 14 (units 19-22) is 122 m thick, virtually identical to the thickness of 124 m at 08MWB-S3. The succession also is similar, with a basal unit of dolostone and quartz sandstone (unit 19: 8 m) overlain by a succession of variegated, locally calcareous siltstone and shale with some sandstone. Gabrielse et al. (1973a) reported trilobites of the *Bonnia-Olenellus* Zone from horizons 15 m and 88 m above the base of the Sekwi Formation in section 14.

Absent from both sections is the Ediacaran-aged, shale-dominated Nadaleen Formation (Moynihan et al., 2019; “June beds” of Macdonald et al., 2013). This unit is best developed further to the west (Macdonald et al., 2013; Moynihan et al., 2019) but also is found in the hanging-wall of the Plateau Fault to the northwest in NTS 106-A (Macdonald et al., 2013), preserved between the Sheepbed carbonate and the lower member of the Backbone Ranges Formation. It is not documented in measured sections along the Plateau Fault in the intervening region of northeastern 105-P (MacNaughton, 2020a).

Figure 15 (on next page): *Zero edge of the upper member of the Backbone Ranges Formation. A. Map showing eastward thinning of units of the upper member of the Backbone Ranges Formation beneath Sekwi Formation, overlain on satellite imagery (© 2012 CNES, Licenced by Planet Labs Geomatics Corp.). Annotated mountainside in B indicated by black arrow. B. Photo taken at locality X by K.M. Fallas, looking south-southeast, showing Sekwi Formation strata directly (unconformably) overlying the middle member of the Backbone Ranges Formation. Abbreviations in photo as in legend of map A; "Fm" = Formation; "mbr" = member. NRCan photo 2021-171.*



127°20'W
127°18'W
127°16'W
127°14'W
127°12'W
63°18'N
63°17'N
63°16'N
A
Legend
photo locality
BS: Broken Skull Fm
Rs: Rockslide Fm
Sk: Sekwi Fm
Backbone Ranges Fm
BR-uD: upper mbr, unit D
BR-uA: upper mbr, unit A
BR-m: middle mbr
BR-l: lower mbr
Sh: Sheepbed Fm
Sh
BR-l
BR-uA
BR-m
Sk
BR-uD
Rs
BS
km
0
1
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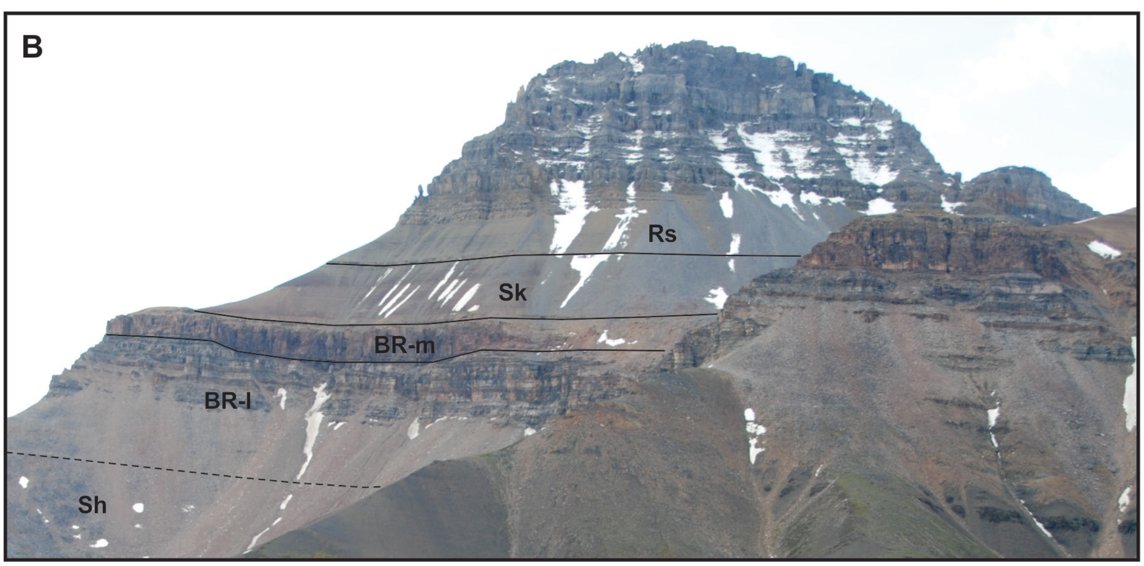

B
Rs
Sk
BR-m
BR-l
Sh

Interestingly, the unpublished notes by J.D. Aitken for section 79AC-26 (referred to above) record the presence of 23 m of grey siltstone and shale between the top of the Sheepbed carbonate and the thick-bedded quartz granule to pebble conglomerate that probably marks the base of the Backbone Ranges Formation. As noted above, 79AC-26 is 2.5 km north of 08MWB-S5. If the package of grey siltstone and shale is assignable to the Nadaleen Formation, then that unit may be locally present in the study area, perhaps preserved in depressions on the original upper surface of the Sheepbed carbonate. Delineating the eastern extent of the Nadaleen Formation will be an important part of deciphering stratigraphic relationships between proximal and distal expressions of the Ediacaran-Cambrian succession.

Conclusions

Four measured sections in the hanging-wall of the Plateau Fault near Moose Horn River in NTS 95-M provide a composite reference section for the Ediacaran-Cambrian transition in this part of the Mackenzie Mountains. The informal Sheepbed carbonate (440 m) conformably overlies dark-weathering siltstone and shale of the Sheepbed Formation, and displays a tripartite internal organization: a basal succession, mainly of thin-bedded limestone; a medial succession of thick-bedded dolostone, including dolorudstone; and an upper succession of dolostone with dolomitic siltstone. Metre-scale relief on the unit's upper contact, and drastic thickness variations in NTS 95-M, reflect erosion prior to deposition of the overlying Backbone Ranges Formation. The shale-dominated Nadaleen Formation, found between these two units in some areas, is not preserved at the study site but may be locally present nearby.

The Backbone Ranges Formation displays its characteristic three members. The lower member (253 m) consists of thick-bedded, locally pebbly, quartz arenite, interbedded siltstone and sandstone, and dolostone to dolomitic sandstone. The middle member (93 m) is dominated by pink to grey, thin-bedded limestone with red mudstone partings and beds of intraclastic rudstone, forming distinctive, pink, red, and orange cliffs. The upper member (501.5 m) contains thick-bedded quartz arenite, and intervals of siltstone or interbedded siltstone and sandstone. At 196.5 m above its base, a dolostone marker unit divides the upper member into a lower interval with abundant conglomeratic horizons and recognizable channels, and a finer-grained upper interval that lacks such features. The dolostone is probably a tongue of the Risky Formation, the top of which corresponds to the Ediacaran-Cambrian boundary.

The Backbone Ranges Formation is unconformably overlain by the Sekwi Formation, consisting of variegated siltstone with lesser dolostone, limestone, and quartz sandstone. Trilobites of the *Bonnia-Olenellus* Zone are present in these strata in NTS 95-M (Gabrielse et al., 1973a), including float low in the Sekwi Formation at the study site. The Sekwi Formation is overlain abruptly by nodular limestone and grey shale of the Rockslide Formation (Cambrian Series 3, i.e., traditional Middle Cambrian).

Comparison with an older measured section in southern NTS 95-M (Gabrielse et al., 1973a) shows the thicknesses of the lower member of the Backbone Ranges Formation and the Sekwi Formation to be strikingly constant. The thicknesses of the Sheepbed carbonate, and the middle and upper members of the Backbone Ranges Formation are much more variable, reflecting regional unconformities beneath the lower and upper members of the Backbone Ranges Formation and the Sekwi Formation. Absence of the Nadaleen Formation may also reflect influence of the sub-Backbone Ranges Formation unconformity.

Measured Section Descriptions

For ease of reference, sections are presented in the numerical order of their field numbers rather than in stratigraphic order.

Measured Section 08MWB-S2: Section measured through upper member of Backbone Ranges Formation. Measured in western NTS 95-M (Wrigley Lake map area) by R.B. MacNaughton and K.M. Fallas on 19 July 2008. Weather cool, unsettled, overcast, with intermittent rain showers later in day. Coordinates of base of section: 63.4352°, -127.5651° (NAD83). Section measured through steep, cliffy exposures on northern wall of cirque valley. Coordinates of top of section: 63.4399°, -127.5738°.			
Unit	**Description**	**Thickness (m)**	**Cumulative (m)**
not measured	**Dolostone and siltstone.** Base abrupt. Recessive. Dolostone, very finely crystalline; fresh surface light greyish tan, weathers creamy orange; very thin to thin bedded; parallel lamination and irregular lamination; bedding planes enhanced by stylolites. Passes upward into talus of dolostone and maroon siltstone, with minor grey nodular limestone. (Not measured.)		
	Contact with Sekwi Formation is placed at base of first bed of carbonate, and corresponds to a marked upward change from a resistant, sandstone-dominated succession to a recessive succession dominated by siltstone and carbonate.		
25	**Sandstone and siltstone.** Resistant. Base gradational. Notably orange-weathering along strike to SW. Interbedded quartz arenite and siltstone to mudstone. Quartz arenite, very fine to medium grained; fresh and weathered surfaces pale grey, pale pink to mid pink, pale greyish-white, pale tan; thin-bedded; trough cross-bedding extensively developed at numerous levels, some parallel lamination, some massive beds, current and wave ripples preserved on bedding planes. Siltstone; fresh and weathered surfaces mainly maroon with lesser green; thickness from laminated (as partings) up to medium beds; massive to laminated, with polygonal mud cracks, synaeresis cracks. Siltstone also present as mud chip horizons. Unit fines upward: sandstone accounts for approximately 70% of volume near base, but only 40% near top. Possible simple horizontal trace fossils, resembling *Planolites* or *Palaeophycus,* are present on bedding surfaces at a few levels.	52.5	501.5

24	**Sandstone.** Base abrupt. Resistant. Quartz arenite, fine to very coarse grained, mainly fine to medium grained; very coarse grained dominates basal 10 m; fresh and weathered surfaces pale orange-pink, pale pink, pale greyish white; thin to very thick bedded, mainly medium to thick, thick beds dominant near base; trough cross-bedding, parallel lamination, current-ripple cross-lamination, minor planar-tabular cross-bedding (less prevalent than in underlying units). Green and maroon mudstone drapes/partings common on bedding planes. At 8.5 m above base of unit is 50 cm of maroon-weathering siltstone to silty sandstone. Lower part of unit lacks obvious packaging but bedding may be subtly thinner up section. Unit is siltier and thinner bedded from 60 m above base upward, with up to 20% green-weathering, very fine-grained silty sandstone and the appearance of low-angle trough cross-bedding. Liesegang banding locally present throughout.	88.5	449.0
23	**Silty sandstone.** Base abrupt. Recessive to semi-resistant. Silty sandstone, quartzose, very fine grained; maroon on fresh and weathered surfaces, locally with pale greenish-grey reduced horizons; thickly laminated to very thin bedded; parallel lamination, current-ripple cross-lamination.	1.5	360.5
22	**Sandstone.** Base abrupt. Resistant, blocky. Quartz arenite, very fine to medium grained; fresh and weathered surfaces white, pale grey, pale pink, pale orange-red; thin to thick (mainly medium) bedded; trough cross-bedding, parallel bedding. Green and maroon mudstone as drapes, chips.	25.5	359.0
21	**Sandstone.** Base sharp. Interval is frost-shattered, rubbly, not well-exposed. Quartz arenite, very fine to fine grained; fresh and weathered surfaces pale orange, pale pink; thin to very thick bedded, mainly medium to thick; trough cross-bedding, current-ripple cross-lamination.	46.5	333.5
20	**Sandstone and silty sandstone.** Base abrupt. Semi-resistant, blocky. Two interbedded lithofacies, in roughly equal proportions. (1) Silty quartzose sandstone, very fine grained; micaceous; maroon on fresh and weathered surfaces, some bedding-parallel zones weather pale greenish tan; thin to medium bedded; massive, compact; polygonal mud cracks. (2) Sandstone, quartzose, variably micaceous; very fine to fine grained; fresh surfaces deep purplish-red, light grey, weathers purplish-red with rusty patches, tan; thin to thick (mainly medium) bedded; trough cross-bedding, current ripple cross-lamination. Bases and tops of beds sharply defined.	5.0	287.0

19	**Sandstone.** Base abrupt. Semi-resistant, blocky; not well exposed along section route but forms a cliff in exposures on south side of cirque. Quartz arenite, very fine to medium grained; fresh and weathered colours include red, orange, maroon, pink, purple, commonly in deep tones; mainly thick bedded, up to low end of very thick bedded; trough cross-bedding, planar-tabular cross-bedding, well-developed parallel bedding, possible low-angle cross-bedding. Maroon and green mudstone present as millimetre-scale partings between beds, commonly with polygonal mud cracks, and as mud chips in sandstone beds. Largely resembles unit 18 and there is no obvious reason for the upward change in weathering profile.	37.5	282.0
18	**Sandstone.** Base abrupt. Resistant, blocky. Quartz arenite, very fine to fine grained, locally up to coarse grained; as for unit 14; fresh surfaces white, pale grey, pale pinkish grey, pale tan, pale greyish white, weathering tones include white, pale pinkish white, deep pink, light tan, light greenish tan, locally orange-red to brick red, local purple highlights where cross-bedded; medium to very thick bedded; trough cross-bedding (including some oversteepened cross-beds), planar-tabular cross-bedding, parallel-bedding, some beds capped by current ripples. Some bedding planes preserve green or maroon shale drapes, commonly with polygonal mud cracks; green and maroon mud chips present in some sandstone beds. Unit lacks obvious packaging, but there may be an alternation between thicker and thinner bedded lithofacies, and bedding may thicken upward overall, albeit subtly (i.e., very thick beds dominate in uppermost part of unit).	40.5	244.5
17	**Siltstone.** Base abrupt. Resistant. Mixture of siltstone, mudstone, and very fine-grained quartz sandstone, maroon on fresh and weathered surfaces, very thin bedded, as described for unit 12; unit is sandiest in it middle third, which also is dolomitic, orange-weathering.	1.5	204.0
16	**Dolostone to dolomitic sandstone.** Base covered. Resistant. Dolostone, sandy and silty dolostone, and dolomitic quartz sandstone, crystal and grain sizes not recorded; fresh surfaces pale creamy tan, weathers tan to creamy tan; very thin to thin bedded; bedding wavy, enhanced by stylolites, outlined by green shale drapes; irregular partings between beds; massive, current-rippled, possible parallel-lamination, some low-angle cross-lamination.	6.0	202.5

15	**Covered.** Recessive. Float suggests interval is underlain by siltstone to very fine-grained sandstone, green and tan weathering, with current ripples.	13.5	196.5
14	**Sandstone.** Base abrupt. Resistant. Quartz arenite, very fine to fine grained; minor very coarse grains to granules of pink quartz; grains well rounded; fresh surfaces white, pale grey, pale pinkish grey, pale tan, pale greyish white, weathers grey, pale grey, tan; thin to very thick bedded, mainly thick bedded; planar tabular cross-bedding, some sets up to 3 m thick; trough cross-bedding, commonly with foresets defined by layers of very coarse quartz sand with minor granules.	49.5	183.0
13	**Sandstone and siltstone.** Base abrupt to erosional. Resistant to semi-resistant. Upward-fining and thinning package. Lower two-thirds of unit is quartz arenite, thin to thick bedded, as described for unit 11. Quartz arenite passes gradationally upward into a mixture of maroon (fresh and weathered surfaces) siltstone, mudstone, and silty quartz sandstone, generally as described for unit 12, although no ripple-drift cross-lamination or polygonal mud cracks were noted.	15.0	133.5
12	**Siltstone and sandstone.** Base abrupt. Resistant, platy to chippy. Unit consists of three rock types. (1) Siltstone, varying to sandy siltstone and silty mudstone (60%); maroon on fresh and weathered surfaces; laminated. (2) Silty quartz sandstone, very fine grained (30%); fresh and weathered surfaces mainly maroon but also green or tan, including reduction spots and layers; thickly laminated to very thin bedded; parallel lamination, current-ripple cross-lamination to ripple-drift cross-lamination, polygonal mud cracks; abundant white mica. (3) Quartz arenite, fine grained (10%); pale grey to white on fresh and weathered surfaces; very thin bedded; current ripples, wave ripples. Unit is surprisingly resistant, considering its grain size, suggesting it may be very well cemented.	27.0	118.5
11	**Sandstone.** Base covered where measured but abrupt along strike. Resistant, blocky to slabby. Quartz arenite, fine to very coarse grained with minor granules and small pebbles of quartz; rare shale chips; minor potassium feldspar; fresh surfaces medium purplish grey, weathers purple, some thick beds weather pale greenish-grey or rusty; medium to thick bedded; trough cross-bedding, planar-tabular cross-bedding. Bases of some beds preserve erosional relief. Minor very thin beds of fine-grained sandstone, with current ripple cross-lamination.	16.5	91.5

10	**Sandstone.** Base covered. Largely covered or poorly exposed along section. Spot outcrops are of quartz arenite, as described for unit 4; thin to medium bedded; greenish-tan mudstone as partings between beds. Along strike, unit is semi-resistant, with a bedding style suggesting the presence of trough cross-bedding, and forms a minor recessive notch.	13.5	75.0
9	**Silty sandstone.** Base sharp. Semi-resistant. Silty quartz sandstone, very fine grained; maroon on fresh and weathered surfaces, with pale greenish-grey reduction horizons; very thin to medium bedded; parallel lamination. Minor, very thin beds of white quartz sandstone.	3.0	61.5
8	**Sandstone and mudstone.** Base sharp. Resistant to semi-resistant. Unit is mainly quartz arenite, as described for unit 4, but the upper third of the unit contains up to 10% maroon (fresh and weathered) mudstone and silty sandstone as very thin interbeds. Maroon mudchips.	3.0	58.5
7	**Silty sandstone.** Base sharp. Semi-resistant. Silty quartz sandstone, very fine grained; maroon on fresh and weathered surfaces; as described for unit 5; preserves current ripples.	0.5	55.5
6	**Sandstone.** Base sharp. Resistant. Quartz arenite, as described for unit 4, except grain size is very fine to coarse.	6.0	55.0
5	**Silty sandstone.** Base sharp. Semi-resistant, blocky. Silty quartz sandstone, very fine grained; micaceous (white mica); maroon on fresh and weathered surfaces, with greenish-grey reduction spots and horizons; thin to medium bedded; massive to parallel-laminated.	1.5	49.0
4	**Sandstone.** Base sharp. Resistant, blocky. Quartz arenite, as for unit 3 but only trace potassium feldspar; fresh surfaces light greenish grey, weathers light to medium grey, light greenish grey; thick to very thick bedded; trough cross-bedding (some sets very thick), planar-tabular cross-bedding, parallel-bedding; some "cut-and-fill" (channel) stratigraphy but no obvious packaging of bed thickness or grain size. Red and green mudstone partings between some beds. Minor maroon-weathering layers of small pebbles, up to 10 cm thick, with quartz and possible minor feldspar clasts, possible mudstone lithoclasts. Along strike at some levels, there are 10-30 cm thick intervals of siltstone or silty sandstone that resemble unit 2 at a distance (none were encountered along the section route); these probably make up less than 5% of total volume.	25.5	47.5

3	**Sandstone.** Base abrupt. Resistant, blocky to slabby. Quartz arenite, medium to coarse grained with minor granules; sand grains well rounded to angular, granules subangular with poor sphericity; minor rose quartz; minor (less than 5%) pink potassium feldspar, low sphericity, subangular to subrounded; fresh surfaces light greenish grey, weathers light greenish grey but with a stronger green tone; flat pebbles (intraclasts?) of red and green mudstone present in a third to half of the beds; medium to thick bedded; trough cross-bedding; possible channel cross-sections. Lichen cover obscures much of the internal structure but there is no obvious packaging in terms of grain size, thickness, or structures.	15.0	22.0
2	**Silty sandstone and siltstone.** Base abrupt (change in colour and grain size). Resistant, blocky, with plumose fracture surfaces. Silty quartz sandstone, very fine grained, to siltstone; fresh and weathered surfaces are maroon to light greenish grey (the greenish-grey is associated with probable reduction horizons; thin to medium bedded; some beds, especially the thicker ones, are massive; current ripples on some bedding surfaces; polygonal mud cracks; mica concentrated on bedding surfaces.	6.0	7.0
1	**Sandstone.** Base irregular with up to 3 cm relief but no obvious erosional features. Semi-resistant. Quartz arenite; basal bed (20 cm) is very coarse-grained, locally with well-rounded quartz granules and flat, subangular dolostone pebbles, balance of unit is coarse grained; fresh surfaces light grey with orange spots, weathers light greenish grey, locally orange-tan; medium bedded; possible indeterminate, poorly preserved cross-beds; contacts between beds are irregular, in some cases with greenish-grey mudstone partings.	1.0	1.0
	Base of section is at contact with underlying strata of middle member, Backbone Ranges Formation.		
0	**Sandy dolostone.** Sandy dolostone, very finely to finely crystalline, with up to 20 % quartz sand, very fine to fine grained, well rounded; pale tan, weathers light grey to light orange-tan; thin bedded; relict parallel lamination; flat-clast rudstone, with some clasts forming fans; maroon mudstone partings between many of the beds. Possible centimetre-scale stromatolites at top of unit, but these are not well exposed.	not measured	

Measured Section 08MWB-S3: Section measured through Sekwi Formation. Measured in NTS 95-M (Wrigley Lake map area) by R.B. MacNaughton and K.M. Fallas on 19 July 2008. Weather cool, unsettled, overcast, with snow beginning to fall by the time measuring was completed. Section was measured quickly, late in the day, to record succession of lithologies and, as a result, descriptions are brief and only weathering colours were recorded. Unless otherwise noted, weathering profiles are recessive, and carbonates are very finely crystalline or finer. Coordinates of base of section: 63.4413°, -127.5694° (NAD83). Section measured through exposures on the high ground west along the ridge from the top of section 08MWB-S2. Coordinates of top of section: 63.4403°, -127.5796°.

Unit	Description	Thickness (m)	Cumulative (m)
	Exposure lost in talus of dark grey to grey shale and limestone nodules.		
24	**Siltstone with limestone nodules.** Base gradational. Poorly exposed. Mainly float of greenish-grey siltstone and grey limestone nodules. Unit caps the last resistant rib before the section is lost in talus.	13.5	140.5
23	**Dolomitic limestone.** Base abrupt. Semi-resistant. Dolomitic limestone, weathers grey, greyish tan; very thin bedded; rubbly, mottled, with abundant centimetre-scale nodules. Limestone is silty in uppermost 1 m of unit.	3.0	127.0
	Base of Rockslide Formation		
22	**Calcareous siltstone.** Base gradational. Calcareous siltstone; weathers light greenish grey to light orange-brown; thin bedded; polygonal mud cracks.	6.5	124.0
21	**Siltstone.** Base gradational. Siltstone to mudstone; weathers light greenish-grey, tan, light orangish-brown; thinly to thickly laminated; polygonal mud cracks.	7.0	117.5
20	**Siltstone.** Base gradational. Siltstone; weathers tan, light brown; laminated to very thin bedded; polygonal mud cracks; chippy.	1.5	110.5
19	**Dolostone.** Base gradational. Dolostone; weathers orange, cream; thin bedded; platy to wavy bedded.	1.5	109.0

18	**Dolomitic sandstone.** Base abrupt? Dolomitic sandstone, quartzose, very fine grained, silty; weathers orange to light orange-tan; thickly laminated to very thin bedded at base of unit, increasing to thin and medium bedded at top; low-angle cross-lamination and cross-stratification, suggesting presence of hummocky or swaley cross-stratification.	5.0	107.5
17	**Dolomitic siltstone.** Base abrupt. Dolomitic siltstone; weathers tan to beige; very thin bedded; parallel lamination, polygonal mud cracks; chippy to platy.	2.5	102.5
16	**Limestone.** Base abrupt. Limestone to calcareous siltstone; weathers light greenish grey; beds thin, platy to irregular.	6.0	100.0
15	**Siltstone and silty limestone.** Base gradational. Unit dominated by maroon-weathering siltstone and very fine-grained silty sandstone; platy to blocky; polygonal mud cracks. Roughly one-third of unit is calcareous siltstone to silty limestone, weathering light greenish grey. Bedding in both lithofacies irregular, very thin. Unit consists of a basal interval of siltstone, a medial interval of limestone, and an upper band of siltstone, each approximately 2m thick.	6.0	94.0
14	**Siltstone and dolomitic siltstone.** Base abrupt. Variegated unit consisting of roughly 60% tan-weathering siltstone, 20% maroon-weathering siltstone, and 20% tan-weathering, dolomitic siltstone. Parallel-lamination. Blocky.	3.0	88.0
13	**Siltstone and sandstone.** Base gradational. Maroon-weathering siltstone and very fine-grained silty sandstone, as described for unit 5.	7.0	85.0
12	**Siltstone.** Base abrupt. Siltstone; weathers maroon and tan; proportion of maroon siltstone is roughly 20% at base of unit, increases upward to 50% at the top; polygonal mud cracks.	6.0	78.0
11	**Siltstone.** Base gradational. Mainly maroon-weathering siltstone to very fine-grained silty sandstone, as described for unit 5. Up to 20% of unit is tan-weathering siltstone.	9.0	72.0
10	**Siltstone.** Base abrupt? Siltstone as described for unit 3; weathers tan to pale greenish-brown; parallel-lamination, current-ripple cross-lamination.	2.5	63.0

9	**Siltstone.** Base gradational. Lower half of unit consists of roughly equal parts of interbedded maroon-weathering siltstone (as for unit 5 but more chippy) and orange, tan, and brown-weathering dolomitic siltstone (also chippy). Upper half of unit is maroon-weathering siltstone to very fine-grained silty sandstone as described for unit 5; blocky to irregular.	10.5	60.5
8	**Siltstone.** Base gradational. Siltstone, as described for unit 5; weathers maroon, with pale greenish grey reduction horizons; polygonal mud cracks.	8.5	50.0
7	**Siltstone and dolostone.** Base abrupt. Siltstone, as described for unit 5; weathers maroon, with pale greenish grey reduction horizons. Interbedded with up to 30% dolostone; weathers orange; irregularly bedded.	6.0	41.5
6	**Limestone.** Base abrupt. Limestone; weathers pinkish brown; very thin bedded; platy; polygonal mud cracks near base, suggesting presence of mudstone at that level.	1.5	35.5
5	**Silty sandstone and siltstone.** Base abrupt. Silty sandstone, quartzose, very fine grained, and siltstone; weathers maroon; thin bedded; parallel lamination, wavy lamination, polygonal mud cracks, some beds massive.	4.5	34.0
4	**Sandstone.** Base gradational. Sandstone, quartzose, fine to medium grained; weathers light brown; thin-bedded; trough cross-bedding, current ripples, wave ripples, possible simple horizontal burrows. Minor green siltstone as partings.	2.5	29.5
3	**Limestone and siltstone.** Base gradational? Limestone to dolomitic limestone; weathers grey to creamy orange-grey; rubbly (nodular?) bedded. Interbedded with up to 30% siltstone; weathers greenish grey to light greenish brown; platy, parallel laminated.	4.5	27.0
2	**Siltstone and dolostone.** Base gradational, as deduced from talus. Mainly siltstone; maroon-weathering with greenish grey reduction horizons; compact; massive to parallel laminated, irregular partings, polygonal mud cracks. Basal 1 m of unit contains up to 25% orange-weathering dolostone to dolostone-clast breccia (dolorudstone).	4.5	22.5

1	**Dolostone, siltstone, sandstone.** Base approximate, covered. Interval largely talus covered. Lower 6 m of unit is dolostone, sandy dolostone, and minor dolomitic quartz sandstone; weathers orange to cream; varies from platy and parallel bedded to irregularly bedded, with some massive beds; basal 3 m contains up to 50% maroon-weathering siltstone with polygonal mud cracks. Upper 12 m of unit contains abundant dolostone; weathers creamy grey; less platy than underlying interval and in part rubbly mottled. In uppermost 4.5 m of unit, dolostone more commonly weathers greyish tan, and is blocky, with parallel lamination and polygonal cracks. Prevalence of dispersed quartz sand is greatest in basal 4.5 m of unit, and much less above this level, but minor beds of quartz arenite are present sporadically throughout.	18.0	18.0
	Base of Sekwi Formation. Contact was picked as well as possible in very local float, at lowest bed of orange carbonate that is more or less in place. (Contact is well exposed and abrupt at top of nearby section 08MWB-S2.) .		
not measured	Talus of very fine-grained quartz arenite and maroon-weathering siltstone, as was observed at the top of the Backbone Ranges Formation in section 08MWB-S2.		

Measured Section 08MWB-S4A: Section measured through basal part of lower member of Backbone Ranges Formation. Measured in western NTS 95-M (Wrigley Lake map area) by R.B. MacNaughton and K.M. Fallas on 20 July 2008. Weather cool with high, broken overcast. Coordinates of base of section: 63.4435°, -127.5246° (NAD83). Coordinates of top of section: 63.4440°, -127.5257°.

Unit	**Description**	**Thickness (m)**	**Cumulative (m)**
	Section lost on covered slope; continues as 08MWB-S4B, which begins in next spur to north.		
6	**Sandstone.** Base covered. Semi-resistant. Sandstone, quartzose, fine grained; fresh surface pale tan to pale greyish tan, rusty spots; weathers tan, brown, pale tan, rusty; medium bedded, beds are blocky.	2.0	107.0
5	**Covered.** Mostly a covered interval. Based on exposures in the next spur to the north, this interval probably consists of interbedded siltstone, sandstone, and mudstone. At 22.5 m above base of interval, a 2.5 m thick (estimated) rib of sandstone correlates with a prominent resistant rib in a recessive interval on the next spur to north, providing a tie point to section segment 08MWB-S4B.	63.0	105.0
4	**Sandstone and silty sandstone.** Base gradational; forms an upward-coarsening package with unit 3. Unit is 50% silty very fine-grained sandstone, as for unit 3. Other 50% is quartz sandstone, very coarse grained; fresh surface light grey with rusty spots, weathers brown to greyish brown; thin to medium bedded; beds sharp based with trough cross-bedding.	3.0	42.0
3	**Silty sandstone.** Base sharp. Semi-resistant to recessive. Sandstone, quartzose, very fine grained and silty, as for unit 1; abundant rusty weathering; current ripple cross-lamination very well developed.	7.5	39.0
2	**Sandstone.** Base sharp, plainly erosional along strike to north. Resistant. Sandstone, medium to very coarse grained, to pebbly sandstone (granules and some small pebbles), quartzose, possible trace feldspar; grains well rounded to subangular, sphericity varies from low to very high; fresh surface pale greyish white to white, light tan, with rusty spots, weathers pale grey to pale yellowish grey; medium to very thick bedded; well-developed planar tabular cross-beds.	10.5	31.5

1	**Silty sandstone.** Base not exposed, but adjacent exposures suggest a sharp, meter-scale, erosional contact between Sheepbed carbonate and basal Backbone Ranges Formation, with the latter infilling relief in the upper surface of the former. Semi-resistant to recessive. Sandstone, quartzose and micaceous, very fine grained, silty; fresh surface light to medium grey, weathers light brownish grey to brown, some maroon weathering in uppermost 3 m; mainly thick laminated to very thin bedded, lesser thin beds, minor medium beds; laminae and very thin beds are very regular; parallel-lamination, current-ripple cross-lamination.	21.0	21.0
	Base of lower member, Backbone Ranges Formation.		
0	**Dolostone.** Resistant. Dolostone, finely crystalline, with relict grainstone textures (recrystallized), including possible dolomitized lime mudstone intraclasts; fresh surface medium grey, weathers light grey to light greyish tan; medium bedded. Upper surface shows no direct evidence for karstification, but preserves metre-scale relief.	not measured	
	Section begins within uppermost beds of Sheepbed carbonate, which continues downslope as a resistant, cliff-forming unit.		

Measured Section 08MWB-S4B: Section measured through most of lower member and entirety of middle member of Backbone Ranges Formation. Upward continuation of section 08MWB-S4A, which covers lower part of lower member. Measured in western NTS 95-M (Wrigley Lake map area) by R.B. MacNaughton and K.M. Fallas on 20 July 2008. Weather cool; high, broken overcast. Coordinates of base of section: 63.4449°, -127.5253° (NAD83). Coordinates of top of section: 63.4451°, -127.5340°.

Unit	**Description**	**Thickness (m)**	**Cumulative (m)**
20	**Siltstone and sandstone.** Continues upsection as maroon siltstone interbedded with medium to thick-bedded, cross-bedded quartz arenite.	not measured	
19	**Siltstone.** Contact covered along section route, but abrupt in spurs to east and west. Semi-resistant. Siltstone; green, tan, maroon on fresh and weathered surfaces; parallel lamination; polygonal mud cracks.	3.0	284.5
	Base of upper member, Backbone Ranges Formation.		
18	**Dolostone and limestone.** Base gradational by colour change. Resistant. Mainly dolostone with lesser limestone but lower two-thirds of unit otherwise is largely as for unit 17; fresh surfaces pale pinkish grey to pink, weathers mainly pale orange and cream. Uppermost third of unit contains sandy dolostone, weathers cream to tan, and lacks flat-clast rudstone; green shale partings with polygonal mud cracks.	12.0	281.5
17	**Limestone.** Base gradational. Resistant. Limestone, microcrystalline to very finely crystalline, some grey beds weather as if particulate; grey to pink on fresh and weathered surfaces, locally creamy and nearly porcellaneous in appearance; thick laminated to medium bedded, mainly very thin to thin bedded; parallel-lamination, current ripples, current-ripple cross-lamination, undulatory and planar bedding, some low-angle cross-lamination resembles micro-hummocky cross-stratification; flat-clast rudstone abundant, locally contains "fans" of flat clasts. Maroon to red mudstone/siltstone partings with reduction spots/zones.	37.5	269.5
16	**Limestone.** Base gradational. Resistant. Limestone, as for interval 15, but weathers a brick-red tone. Some red siltstone as parallel-laminated, very thin to thin beds; beds platy to blocky; flat-pebble conglomerate (intraclast rudstone).	9.0	232.0

15	**Limestone.** Base covered. Resistant. Limestone, microcrystalline to very finely crystalline, silty; grey and pinkish grey and fresh and weathered surfaces; thick laminated to thin bedded, mainly very thin bedded; parallel lamination, poorly developed small-scale current-ripple cross-lamination. Red to maroon siltstone to mudstone partings, with reduction spots/zones on some parting surfaces.	10.5	223.0
14	**Covered.** No outcrop; unit is covered by debris fallen from above but is presumably carbonate as below and above.	19.5	212.5
13	**Limestone and dolostone.** Recessive. Poorly exposed outcrop to subcrop. Basal bed is 20 cm dolostone, very finely crystalline. Balance of unit is limestone to dolostone, very finely crystalline, silty; grey to tan (fresh and weathered); very thin to thin bedded; parallel lamination and small-scale current ripple cross-lamination. Maroon to brick-red siltstone partings are prevalent between beds.	4.5	193.0
	Base of middle member, Backbone Ranges Formation		
12	**Siltstone and sandstone.** Base covered. Recessive, poorly exposed. Siltstone; fresh surfaces mainly dark olive green, weathers medium olive green, some beds dark maroon on fresh and weathered surfaces; thick laminated to very thin bedded; parallel lamination, polygonal mud cracks. Also quartz sandstone, very fine grained; cream on fresh and weathered surfaces; very thin to thin bedded; ripple cross-laminated; makes up less than 20% of unit.	9.0	188.5
11	**Sandstone.** Base sharp. Resistant. Quartz sandstone, medium to very coarse grained; fresh surface grey with rusty spots, weathers cream, light orange-brownish grey; medium to thick bedded; trough cross-bedding. A single, 30 cm bed of maroon siltstone is present approximately 1/4 way up the interval.	7.5	179.5
10	**Siltstone.** Base sharp. Recessive. Siltstone; maroon on fresh and weathered surfaces, with pale greenish-grey reduction horizons; medium bedded; massive to parallel laminated.	3.0	172.0
9	**Sandstone.** Base sharp to erosional. Resistant. Quartz sandstone, very coarse-grained, with some granules and small pebbles of quartz; fresh and weathered surfaces light tan, light greyish white; very thick bedded; trough cross-bedding. [*Followed base of this unit well to west, to a point almost upslope from campsite, to get a measureable section.*]	6.0	169.0

8	**Sandstone and siltstone.** Base sharp. Resistant. Heterolithic unit of sandstone and siltstone; both lithologies are mostly maroon on fresh and weathered surfaces, but up to 20% of volume is white to cream (fresh and weathered) quartz sandstone. Quartz sandstone, very fine to medium grained, locally conglomeratic (quartz granules and pebbles); very well cemented; very thin to medium bedded, mainly thin; trough cross-bedding, current ripple cross-lamination, parallel lamination, some massive beds; layers of granules and small pebbles 1-10 cm thick, or in some cases the thickness of a single grain. Siltstone; massive to parallel-laminated; reduction zones (greenish grey), polygonal mud cracks. Along section route, the proportion of sandstone to siltstone is 60/40, but to the west it is closer to 80/20. Also, following the unit to the west, some intervals are much more sandy, thick-bedded, and conglomeratic (quartzose granules and pebbles), with trough cross-bedding.	27.5	163.0
7	**Dolostone and dolomitic sandstone.** Base sharp. Resistant. Sandy dolostone, dolostone, and dolomitic sandstone, very fine to fine crystalline; sand is very fine quartz; some carbonate intraclasts, possibly rare oolitic beds; fresh surface medium to dark grey, weathers light grey, pale grey, brown, tan; thin to thick bedded, mainly medium; parallel lamination, current ripples, some wavy beds. Rare quartz sandstone, fine-grained; light tan, tan, light grey on fresh and weathered surfaces; has mudstone partings with polygonal mud cracks. Unit overall is sandier upsection. Uppermost 3 m is dolomitic sandstone, very thin bedded, with minor green siltstone.	31.5	135.5
	Followed top of interval 6 to south, to a position roughly above the top of segment 08MWB-S4A.		
6	**Sandstone.** Base covered. Resistant; forms cliffs. Quartz sandstone, fine to very coarse grained, locally has horizons with granules or very small pebbles of quartz; grain roundness and sphericity generally high; fresh surface white, pale greyish-white, weathers pale creamy white, pale greyish-white, pale tan; pockmarked by sub-spherical zones of less resistant cement that weather strongly and preferentially to tan or grey; beds thick to very thick; trough cross-bedding, planar-tabular cross-bedding. Very well cemented; very strongly fractured by joints. Small fault (4 m offset) runs to north of outcrop.	14.0	104.0

5	**Covered.** Spot outcrops viewed at a distance in next gully to the north suggest this interval is dominated by interbedded siltstone and sandstone, as below, probably with additional, upward-coarsening/upward-thickening packages. Some sandstone beds may be up to thick bedded, but most look to be in the thin to medium range.	57.0	90.0
4	**Sandy dolostone.** Base sharp. Semi-resistant. Sandy dolostone and lesser dolomitic sandstone, very fine to fine crystalline, very fine grained; fresh surface medium grey, weathers light grey to orange (much of the orange colour may be due to lichen cover); thin to medium bedded; parallel-lamination, trough cross-bedding, low-angle cross-lamination or cross-stratification (possible swaley cross-stratification).	13.5	33.0
3	**Covered.** Base and top (and view along strike) exposes interbedded very fine-grained sandstone and siltstone, tan to brown weathering, thin bedded, but interval is mainly covered along section route.	9.0	19.5
2	**Siltstone, sandstone, shale.** Base sharp. Recessive. Upward-coarsening succession. At base, siltstone (as in first segment of section), rusty weathering, with some grey mudstone partings; thin to thick laminated; parallel-lamination, synaeresis cracks. Coarsens upward into: 40% sandstone, quartzose, very fine-grained; fresh surface grey, weathers brown, rusty; thin to medium bedded; current ripples and possible hummocky cross-stratification; 40% siltstone as in lower part of unit, with current ripples; and 20% shale; dark grey (fresh and weathered); fissile, very thin laminated.	7.5	10.5
1	**Dolostone.** Base sharp. Semi-resistant. Dolostone, very fine to fine crystalline; fresh surface grey, weathers brown, orange-brown; medium bedded; beds massive or parallel laminated.	3.0	3.0
0	**Sandstone.** Base covered. Semi-resistant. Sandstone, quartzose, very fine-grained. Thickness estimated and not included in running tally for section.	2.5	n/a
	Continuation of 08MWB-S4A, pursued by offsetting to the next spur to the north. Base of section is at top of sandstone measured at 22.5 m above base of interval 5 in 08MWB-S4A.		

Measured Section 08MWB-S5: Section through Sheepbed carbonate map unit. Measured in western NTS 95-M (Wrigley Lake map area) by R.B. MacNaughton and K.M. Fallas on 21 July 2008. Weather cool, unsettled; overcast with sunny intervals, and rain squalls. Coordinates of base of section: 63.4379°, -127.5185° (NAD83). From base, section was first measured tracking roughly to the south, and then roughly west up a stream-cut gully. Coordinates of top of section: 63.4362°, -127.5380°.

Unit	**Description**	**Thickness (m)**	**Cumulative (m)**
	Contact with lower member of Backbone Ranges Formation is not exposed at top of measured section, but the top of unit 23 can be projected into exposures along adjacent valley wall, that correspond to the base of the lower member.		
23	**Dolostone.** Base covered. Semi-resistant; roughly 60% of exposed, as spot outcrops. Dolostone as for unit 21. Local irregular laminae, but no convincing microbialites. Localized, slight contortions of bedding; some beds have small-scale soft-sediment folds, suggesting slumping or creep along layers. Top 30 cm is brecciated to rudstone, with abundant quartz sand in matrix, locally up to very coarse-grained.	54.0	445.0
22	**Covered.**	13.5	391.0
21	**Dolostone.** Base sharp. Semi-resistant. Dolostone, very finely crystalline; fresh surfaces light grey, weathers light grey, light creamy grey; thin to medium bedded; beds parallel-laminated with sharp bases, possible current ripple cross-lamination. At some levels, layering resembles cross-bedding in a large, metre-scale bedform. Some vugs with quartz crystals.	16.5	377.5
20	**Dolostone and dolomitic siltstone.** Base sharp. Semi-resistant. Dolostone, very finely crystalline; fresh surfaces light grey, weathers light creamy brown to orange tan, basal 1 m weathers orange; very thin to thin bedded; parallel-lamination, current ripple cross-lamination, current-rippled tops on some beds. Up to 20% dolomitic siltstone as parallel-laminated partings between beds. Local soft-sediment deformation (convolute bedding) within beds.	25.5	361.0
19	**Dolostone.** Base covered. Resistant. Dolostone, finely crystalline; fresh surfaces medium grey, weathers light grey; thick bedded, bedding well-developed and blocky; confusing mixture of textures, including possible microbial fabrics, thin-bedded dolomicrite, slump folds, and brecciation.	7.5	335.5

18	**Covered.** Blocks and spot outcrops of light grey dolostone.	25.5	328.0
17	**Dolostone, including dolorudstone.** Base sharp. Semi-resistant interval of discontinuous exposure. Dolostone, very finely to finely crystalline; fresh surfaces light grey, weathers light grey, light creamy grey; medium bedded or less commonly thick bedded, bedding blocky; some beds are definitely brecciated, with pebble-size clasts, clast to matrix supported; other beds preserve probable slump folds; some beds may contain transported stromatolites, but dolomitization is too pronounced to be certain of their size or to discern their morphology.	13.5	302.5
16	**Dolostone.** Base covered. Semi-resistant. Dolostone; finely to medium crystalline, local relict carbonate sand textures; fresh surfaces light grey, weathers light grey, light creamy tan; bedding thick, irregular, blocky; generally massive; rare, poorly exposed profiles of possible small (3 cm across), simple domal stromatolites; possible parallel-lamination. Bedding dips are irregular.	22.5	289.0
15	**Covered.**	9.0	266.6
14	**Dolostone.** Base sharp. Resistant, forming cliffs. Dolostone, finely to very coarsely crystalline; fresh surfaces light to medium grey, weathers medium grey to light creamy brown; bedding irregular, medium to very thick bedded, with thick beds most common; generally appears massive; less commonly, breccia textures or relict parallel-lamination can be recognized; some beds preserve textures suggestive of sand-size carbonate grains, particularly on well-exposed faces. Upsection, the weathering colour is increasingly creamy, and there is less evidence of breccia textures or slump masses but carbonate sand textures appear to be more prevalent.	79.5	257.5
13	**Dolostone.** Base sharp. Resistant. Dolostone, finely to medium crystalline; fresh surfaces dark to medium grey, weathers light grey; mainly medium bedded, locally to thick bedded; bedding reasonably well preserved, locally with signs of having begun to brecciate; most beds appear massive (due to dolomitization?) but relict parallel-lamination locally present. Minor vuggy porosity. Bedding dips very irregular.	12.0	178.0

12	**Dolostone, including dolorudstone.** Base sharp. Resistant. Dolostone, medium to coarsely crystalline, as for unit 11, but with zones of light brownish-orange weathering. Brecciation prominent but bedding easier to delineate than in unit 11. Basal 1.5 m is medium-bedded dolostone, overlain by 4.5 m of recognizable slump masses and breccia beds that are 1.5-3.0 m thick. Balance of unit dominated by chaotic bedding. Lenses or layers of non-calcareous, tan siltstone are present between the beds, slump masses, and possible blocks of dolostone.	15.0	166.0
11	**Dolostone, including dolorudstone.** Base sharp. Resistant. Dolostone, medium to coarsely crystalline, as an interval of slump masses and breccia beds in which it is very difficult to recognize primary layering; fresh surfaces medium to dark grey, weathers dark, medium, and light grey. Slump masses up to 6 m thick, most commonly 2-3 m thick. Within slump masses, some intervals retain their original, thin to medium bedded character but bedding is contorted. Brecciated zones common, with clasts from pebble to boulder size in dolostone matrix. Slump folds locally recognizable. Extensive vuggy porosity at some levels, with vugs up to 5 cm long; some vugs open, some partly or completely filled with white calcite or clear quartz crystals. Beds give off sulphur smell when broken.	22.5	151.0
10	**Limestone, locally dolomitized.** Base gradational. Resistant. Limestone, very finely crystalline; fresh surfaces dark grey, weathers light to medium grey; thin bedded, bedding irregular; beds sharp-based, variably with parallel lamination, current-ripple cross-lamination, or massive. Scattered zones of dolomitization appear randomly distributed, with some associated vuggy porosity.	9.0	128.5
9	**Dolostone.** Base covered. Resistant. As for unit 7, but entirely dolomitized; beds very thin to thin; bedding irregular. Some orange-weathering dolomite veins subparallel to bedding.	6.0	119.5
8	**Covered.** Interval is covered along route of section. Cliffs to north expose thin-bedded carbonate in this interval; weathering colour is dark grey, suggesting limestone by analogy with underlying units.	27.0	113.5
7	**Dolostone and limestone.** Base gradational, at level where limestone passes upward into dolostone. Resistant. Dolostone, with lesser limestone, as for unit 5, except that dolostone is very thin to thin bedded. Relict current ripple cross-lamination in some dolostone beds. Bedding irregular.	9.0	86.5

6	**Limestone.** Base gradational by thinning of beds and decrease in dolomitization. Semi-resistant. Limestone, very finely crystalline, with very fine quartz sand or silt; fresh surfaces light to dark grey, weathers medium to light grey; very thin to thin bedded; beds sharp-based; parallel-lamination, current ripple cross-lamination, current-rippled bed tops.	6.0	77.5
5	**Dolostone and limestone.** Base covered. Semi-resistant. Dolostone, medium crystalline; fresh surfaces pale grey to pale tan, weathers creamy tan; thin to medium bedded; bases of beds sharp; primary textures generally destroyed, but some beds have current-rippled tops. Up to 20% limestone, possibly silty, dark grey (fresh and weathered) as very thin beds or thick laminae, parallel-laminated, as drapes and interbeds.	10.5	71.5
4	**Limestone, locally dolomitized.** Base covered. Semi-resistant, as spot outcrops. Limestone, particulate, very finely to finely crystalline; medium to dark grey on fresh and weathered surfaces; very thin to medium bedded (mainly very thin to thin); parallel-laminated, current rippled bed tops, or massive. Locally altered to orange and cream weathering, very finely to finely crystalline dolostone, cut by pink- to orange-weathering dolomite veins, with vuggy porosity containing calcite crystals up to 3 cm wide. Local development of presquilite ("zebra rock") fabric. To north, unit is completely dolomitized.	33.0	61.0
3	**Covered.**	22.5	28.0
2	**Limestone.** Subcrop. Contact covered but abrupt. Limestone, very finely to finely crystalline, particulate; dark grey on fresh surface, weathers dark to medium grey; thin bedded; beds sharp based, commonly with massive lower, medial parallel-laminated, and current-ripple cross-laminated upper divisions (Tabc turbidites), or parallel-laminated lower division and current ripple cross-laminated upper division (Tbc turbidites).	0.5	5.5
	Base of Sheepbed carbonate.		
1	**Shale and siltstone.** Base covered. Semi-resistant. Shale and siltstone in subequal proportions, dark grey fresh and weathered surfaces; thinly laminated; parallel laminated; fissile. Some 10 cm horizons of possible soft-sediment slumps.	5.0	5.0
	Section begins in Sheepbed Formation, which continues downslope as spot outcrops of dark-weathering shale.		

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