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Distribution of Cambrian formations in the eastern Mackenzie Mountains, Northwest Territories

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Abstract: New bedrock mapping in the eastern Mackenzie Mountains (NTS 96 D and 96 E) has clarified the distribution of Cambrian formations northeast of the Mackenzie arch, notably by confirming the presence of the Lower Cambrian Mount Clark Formation. Mount Clark Formation is resistant weathering, dominated by quartz arenite, and commonly burrowed. It lies unconformably upon the Proterozoic Mackenzie Mountains Supergroup and is gradationally overlain by the Early Cambrian Mount Cap Formation. Numerous exposures previously mapped as Mount Cap Formation have been reassigned to Mount Clark Formation. Distinction between Mount Clark Formation and Proterozoic quartz sandstone units is aided by differences in colour and cementation, and particularly by the presence of burrows in the younger unit, a feature not present in older rocks. Mount Clark Formation is a hydrocarbon reservoir facies elsewhere in the Mackenzie Corridor. Improved understanding of its regional distribution may contribute to improved exploration success.

Résumé : De nouveaux travaux de cartographie du substratum rocheux dans la partie est des monts Mackenzie (feuillets 96 D et 96 E du SNRC) ont permis de clarifier la répartition des formations du Cambrien au nord-est de l'arche de Mackenzie, notamment en confirmant la présence de la Formation de Mount Clark du Cambrien inférieur. La Formation de Mount Clark, à prédominance de quartzarénite, est résistante à altération météorique et on y observe couramment des traces de terriers. Elle repose en discordance sur le Supergroupe de Mackenzie Mountains du Protérozoïque et est recouverte en contact progressif par la Formation de Mount Cap du Cambrien précoce. De nombreux affleurements, antérieurement représentés sur les cartes comme appartenant à la Formation de Mount Cap, ont été réattribués à la Formation de Mount Clark. La distinction entre la Formation de Mount Clark et les unités de grès quartzeux du Protérozoïque est facilitée par les différences de couleur et de cémentation, et particulièrement par la présence de terriers dans l'unité plus récente, une caractéristique absente des roches plus anciennes. Ailleurs dans le corridor du Mackenzie, la Formation de Mount Clark présente un faciès de réservoir d'hydrocarbures. Une meilleure compréhension de sa répartition à l'échelle régionale pourrait contribuer à améliorer les chances de succès des activités d'exploration.

INTRODUCTION

As part of the Geo-Mapping for Energy and Minerals Program (GEM), the Mackenzie Delta and Corridor Project is producing new bedrock geology maps for the region around Norman Wells and Tulita, Northwest Territories. The area under study includes NTS map areas 96 C, 96 D, 96 E, and 96 F, encompassing parts of the Mackenzie Mountains, Mackenzie Plain, Franklin Mountains, and westernmost Great Bear Plain (Fig. 1). In this region, Lower to Middle Cambrian map units include, in ascending order, Mount Clark, Mount Cap, and Saline River formations (Fig. 2). Mount Cap and Saline River formations are preserved widely in the region, except over the Mackenzie and Mahony arches (Dixon and Stasiuk, 1998; MacLean, 2011). Both are present in outcrop in the eastern Mackenzie Mountains and the Franklin Mountains (Aitken et al., 1973). By contrast, Mount Clark Formation has been thought to outcrop only in the Franklin Mountains (Aitken et al., 1973; Aitken and Cook, 1974), and its subsurface distribution beneath Mackenzie Plain has been uncertain (Dixon and Stasiuk, 1998). Aitken and Cook (1974, p. 9) reported that Mount Cap Formation locally contained "…a resistant basal unit composed of sandstone and quartzite…" that was up to 15 m thick. They did not comment on similarities between this basal unit and Mount Clark Formation. Serié et al. (2009; *see also* Pyle and Gal, 2009a) documented this basal unit in several measured sections in the eastern Mackenzie Mountains and tentatively assigned it to Mount Clark Formation.

The present report summarizes field observations on Lower and Middle Cambrian formations made in the eastern Mackenzie Mountains in 2009 and 2010. The present work confirms the presence of a basal Cambrian sandstone unit (Aitken and Cook, 1974; Serié et al., 2009; Pyle and Gal, 2009a). The present authors summarize its outcrop character, demonstrate that it can be mapped in the eastern Mackenzie Mountains, assign it provisionally to Mount Clark Formation, and offer suggestions for distinguishing it from lithologically similar Neoproterozoic strata. Mount Clark Formation is a known hydrocarbon reservoir in northern Canada, with discoveries of natural gas, condensate, and oil (Hamblin, 1990; Dixon and Stasiuk, 1998; Janicki, 2004; Price and Enachescu, 2009) in the Colville Hills. Thus, knowledge of its distribution is of economic significance. The present authors also comment on the outcrop distribution of Mount Cap and Saline River formations in the study area. Deposition and preservation of Cambrian formations was influenced by Cambrian and younger tectonic features (Fig. 3) and a clearer understanding of map-unit distribution will elucidate the region's tectonostratigraphic evolution (e.g. Aitken et al., 1973).

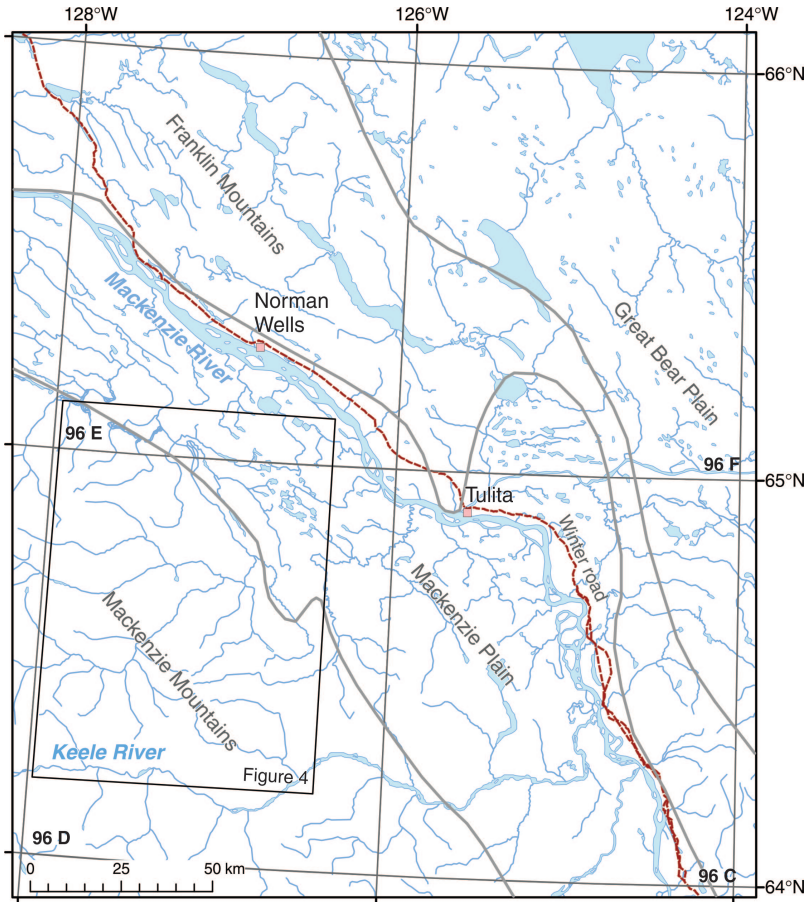

Figure 1. Location map, showing geomorphic regions (delineated by solid, grey lines) and NTS map areas being remapped during this study. Red dashed line is winter road.

Age	Mackenzie Mountains, Mackenzie Plain, and Franklin Mountains	Great Bear Plain
Ordovician	Franklin Mountain Fm	Franklin Mountain Fm
Cambrian	Saline River Fm	Saline River Fm
	Mount Cap Fm	Mount Cap Fm
	M.A. Mount Clark Fm	Mahony, Bulmer arches — Mount Clark Fm
Proterozoic	Mackenzie Mountains SG	Hornby Bay–Dismal Lakes

Figure 2. Table of Cambrian formations in the study area (*modified from* MacLean, 2011). Abbreviations: M.A. = Mackenzie arch; SG = supergroup.

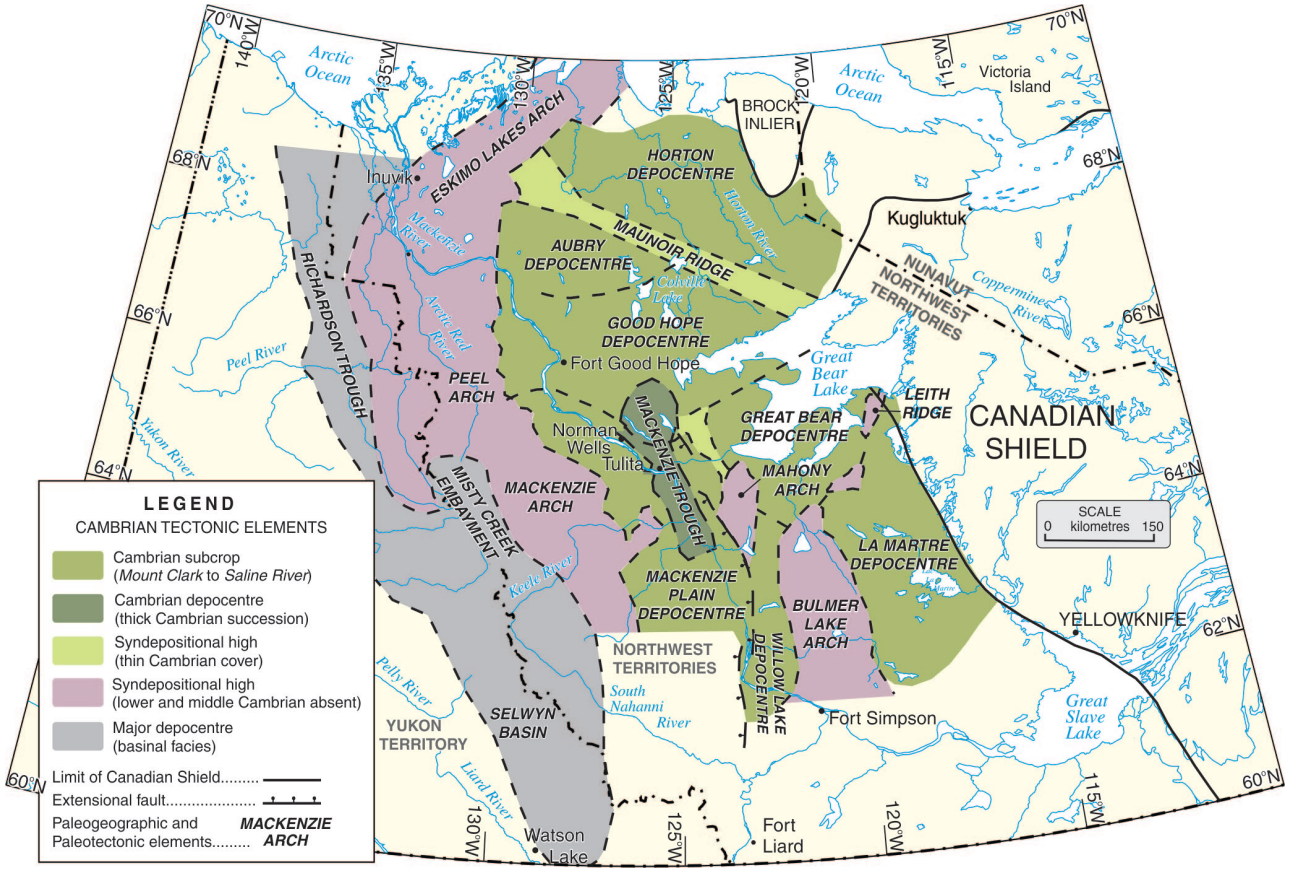

Figure 3. Tectonic elements that influenced Cambrian deposition in mainland Northwest Territories (*modified from* Hannigan et al., 2011).

STRATIGRAPHIC SETTING

Preservational patterns of Cambrian formations (Fig. 3) define a number of paleogeographic highs (arches and ridges) and lows (depocentres and troughs). Mackenzie Plain and the Franklin Mountains are largely underlain by the Mackenzie Plain depocentre, which locally deepens into the Mackenzie Trough (MacLean, 2011) and opens to the north into additional depocentres (Dixon and Stasiuk, 1998). The southwestern limit of the Mackenzie Plain depocentre is defined by the Mackenzie arch (Aitken et al., 1973) and lies partly within the present study area. To the northeast, Mahony arch was a region of little or no deposition during the Cambrian. The present study area also encompasses parts of the Good Hope and Great Bear depocentres.

In the eastern Mackenzie Mountains, Cambrian strata (Fig. 2) lie unconformably upon the informal Mackenzie Mountains supergroup (Neoproterozoic). This unit includes, in ascending order, map unit H1, Tsezotene Formation, Katherine Group, and Little Dal Group (Aitken et al., 1973; Aitken and Cook, 1974; Long et al., 2008).

Mount Clark Formation was defined by Williams (1922, 1923); the type area is near Mount Cap. In the subsurface and in outcrops east of the Mackenzie River, Mount Clark Formation is dominated by quartz arenite, commonly crossbedded, with lesser conglomerate and minor volumes of wacke and siltstone (Dixon and Stasiuk, 1998). Trace fossils are common. Some beds are intensely bioturbated and, where dominated by the vertical burrow *Skolithos*, constitute a classic "pipe rock". Body fossils are absent, with the possible exception of rare *Olenellus* and *Salterella* at or near the top of the formation (Williams, 1923; Tassonyi, 1969). The report of these taxa by Williams (1923, p. 76B) was not clearly written, and could indicate that the fossils come from the basal part of the overlying Mount Cap Formation.

Mount Cap Formation was defined by Williams (1922, 1923), with a type area at Mount Clark. Where Mount Cap Formation overlies Mount Clark Formation, the contact is gradational (Dixon and Stasiuk, 1998). Mount Cap Formation is more widely preserved than Mount Clark Formation and overlaps it, lying unconformably upon Proterozoic strata in some areas. Mount Cap Formation is heterolithic (Aitken et al., 1973; Dixon and Stasiuk, 1998; Serié et al., 2009), containing variegated shale or siltstone, limestone, sandstone, and dolostone. Glauconite is common in sandstone and carbonate lithofacies. Bioturbation is common and trilobites indicate a late Early to Middle Cambrian age (*Bonnia-Olenellus* to *Glossopleura* zones; *see* Fritz, 1970, 1971; Aitken et al., 1973; Serié et al., 2009). Organic-rich intervals within the Mount Cap Formation lend it importance as a possible hydrocarbon source rock (Dixon and Stasiuk, 1998).

Saline River Formation, originally described by Williams (1923), lies unconformably upon Mount Cap Formation (Dixon and Stasiuk, 1998) and can be subdivided into three members (Meijer-Drees, 1975; Dixon and Stasiuk, 1998). These are: a lower member of shale, dolostone, and anhydrite; a medial member dominated by salt and containing lesser shale, dolostone, and anhydrite; and an upper member of comparable composition to the lower member. Most outcrop exposures of Saline River Formation are poor and the members generally can be recognized only in the subsurface. It is overlain by the Late Cambrian to Middle Ordovician Franklin Mountain Formation (*see* review by Pyle and Gal (2009b)) with a contact that is variously gradational (Aitken et al., 1973), abrupt (Dixon and Stasiuk, 1998), or at least locally erosional (Pyle and Gal, 2009a). Fossils have not been reported from Saline River Formation, but stratigraphic position constrains its age as Middle or Late Cambrian.

The stratigraphic succession from Mount Clark to Mount Cap formations is considered to record ongoing transgression. Mount Clark Formation records mainly marginal-marine to shallow-marine deposition (Hamblin, 1990; Dixon and Stasiuk, 1998). Some workers have suggested that it also preserves fluvial deposits (Macauley, 1987; Serié et al., 2009). Caution is necessary regarding this point, because it commonly is difficult to distinguish Mount Clark Formation from fluvial-dominated strata of the Katherine Group where these units are in superposition. Lithofacies in Mount Cap Formation record deposition in open-marine settings (Dixon and Stasiuk, 1998). Saline River Formation was deposited in a restricted marine basin, as indicated by the prevalence of evaporite units (Meijer-Drees, 1975; Dixon and Stasiuk, 1998).

BASAL CAMBRIAN SANDSTONE IN EASTERN MACKENZIE MOUNTAINS

Description of basal Cambrian sandstone

Within the present study area in the eastern Mackenzie Mountains, Serié et al. (2009) reported eight measured sections where the basal interval of the Paleozoic consisted of quartz arenite that they assigned, with varying confidence, to Mount Clark Formation. The work of the present authors in 2009 and 2010 confirmed the presence of these strata at several of those sites and documented an additional fifteen outcrop localities (Fig. 4). Further sites have been viewed at a distance or identified in helicopter fly-pasts.

The most common lithofacies is fine- to coarse-grained quartz arenite or orthoquartzite (Fig. 5). Bedding is thin to thick, but most commonly medium (*see* Ingram, 1954). These strata contain parallel bedding, crossbedding, including trough crossbedding, and crosslamination. Channel cross-sections can be recognized locally. Colours on fresh surfaces include white, cream, and pale tones of orange, brown, or pink, as well as greyish-brown or medium grey. Beds weather to white, beige, cream, or pale tones of grey, brown, orange, and pink. Body fossils have not been found. Many beds contain abundant horizontal

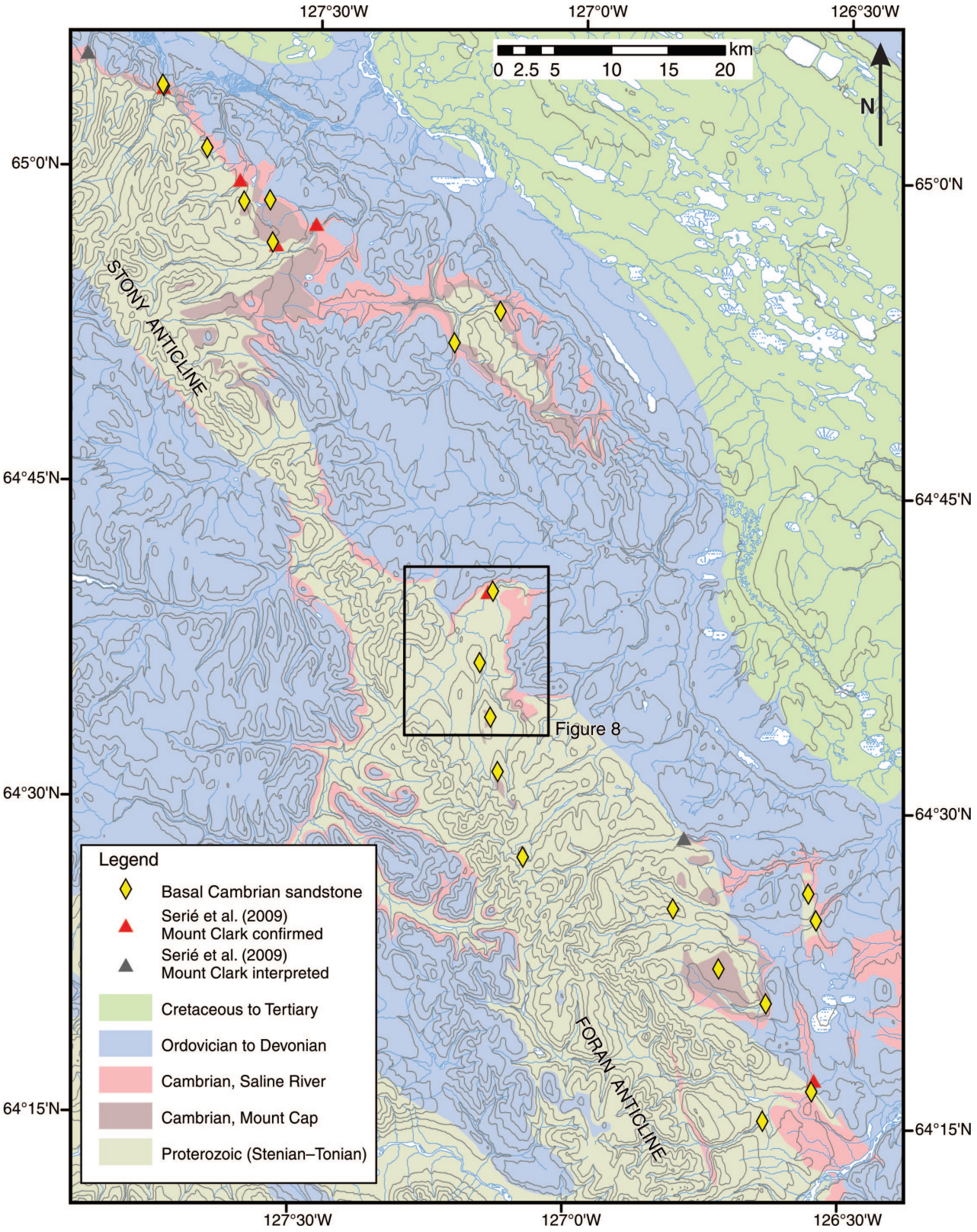

Figure 4. Map of part of eastern Mackenzie Mountains showing sites with probable Mount Clark Formation. Red triangles are sites visited by Serié et al. (2009) and confirmed by the present work. Grey triangles are sites visited only by Serié et al. (2009). Yellow diamonds are sites newly documented during the present work. Geology simplified *after* Aitken et al. (1974) and Aitken and Cook (1976).

and vertical burrows, including *Skolithos*, and such beds can be intensely bioturbated (Fig. 6). Other beds are entirely unburrowed. Aside from rare traces of glauconite, quartz is the only grain mineralogy noted in hand samples.

At some localities, the sandstone-dominated succession also contains very fine- to medium-grained glauconitic arenite to glauconitic wacke. Both are quartzose, with silt and clay as matrix, and some beds are dolomitic. Bedding varies from very thin to thick and from parallel to irregular. Sedimentary structures include crossbedding and parallel lamination. Colours on fresh surfaces include medium green, medium brown, and dark grey; the rocks weather medium greenish-grey, orange-brown, or dark grey-brown. Body fossils have not been observed, but bioturbation can be pervasive. Horizontal burrows are most common, but vertical traces are also present. Minor, dark-weathering shale can be present as very thin interbeds or partings. Glauconitic arenite and glauconitic wacke are much less common than quartz arenite in the sandstone-dominated succession, and are present mostly in a transition zone (Fig. 7) between the quartz arenite and overlying, recessive facies of the Mount Cap Formation (*see* below).

Locally, the base of the sandstone package is marked by a clast-supported conglomerate of quartz pebbles and cobbles in a matrix of coarse quartz sand. The conglomerate is maroon on fresh and weathered surfaces. It probably is a basal lag at the sub-Cambrian unconformity.

All these strata are resistant weathering and form cliffs where quartz arenite is sufficiently thick. Quartz arenite rubble generally is blocky and coated with grey lichen.

Comparison with Mount Cap Formation

On published GSC maps for the eastern Mackenzie Mountains, Mount Cap Formation is shown as the oldest Paleozoic map unit (Aitken and Cook, 1974, 1976). The sandstone-dominated strata described herein differ markedly from Mount Cap Formation. In the eastern Mackenzie Mountains, Mount Cap Formation is semiresistant to recessive. Relative to the underlying sandstone, Mount Cap Formation tends to be darker weathering, is much richer in mudrock, contains a significant volume of carbonate rocks, and yields fossils at numerous levels. In contrast with the quartz arenite–dominated Mount Clark Formation, sandstone in Mount Cap Formation is generally quartz wacke, glauconitic wacke, or glauconitic arenite, with lesser quartz arenite. To emphasize these differences, the present authors summarize the lithofacies of the Mount Cap Formation observed in outcrop during mapping. *See also* summaries by Aitken et al. (1973) and Serié et al. (2009), based on measured sections.

Mudrock facies of Mount Cap Formation include medium to dark grey or brown, laminated to thin-bedded shale, mudstone, and siltstone that locally are calcareous or dolomitic, and rarely pyritic. Bioturbation (horizontal and vertical burrows) is prevalent and trilobites and brachiopods are present.

Carbonate beds are medium to dark grey or, rarely, black, weathering to tones of grey. Limestone (wackestone, lime mudstone, crystalline limestone) and dolostone (including dolomudstone and stromatolitic doloboundstone) are both present. Very fine to fine crystalline facies dominate, but beds can range from cryptocrystalline to medium crystalline. Beds can be silty, sandy, or muddy; rarely, beds are cherty, gypsiferous, pyritic, or petroliferous. Bedding is very thin to thin, rarely medium, and beds can be nodular, wavy, or parallel bedded. Parallel lamination can be present. Microbial structures include microbial lamination and stromatolites. Horizontal burrows are common. Body fossils include small brachiopods, fragmentary trilobites, and shell hash.

Glauconitic arenite, glauconitic wacke, and quartz arenite in the Mount Cap Formation are similar to facies observed in the underlying sandstone succession. They are markedly subordinate to, and are interbedded with, the mudrock and carbonate facies. Mount Cap Formation is more commonly glauconitic than is Mount Clark Formation.

Mapping boundaries of the basal Cambrian sandstone succession

In the eastern Mackenzie Mountains, the lower contact of the basal Cambrian sandstone succession is unconformable upon rocks of the informal Mackenzie Mountains supergroup. Where Cambrian sandstone lies upon carbonate of the Little Dal Group (Aitken et al., 1978; Long et al., 2008), mapping of the contact is straightforward, particularly at numerous sites where weathered quartz arenite presents a strong colour contrast with underlying orange-weathering carbonate. By contrast, mapping the contact can be problematic where superposition upon Katherine Group produces a sandstone-on-sandstone unconformity.

Figure 5. Typical, quart arenite-dominated outcrop of Mount Clark Formation in eastern Mackenzie Mountains. Note sharp, disconformable contact (colour contrast) with underlying upper Katherine Group, immediately below handle of hammer on outcrop. Hammer handle is about 30 cm long. Location 64.256016N, 126.636070W (NAD83). 2011-181.

Because the upper contact is a facies boundary (Dixon and Stasiuk, 1998), it is more challenging to pick consistently. For mapping, the present authors have found it most effective to treat the change from sandstone-dominated to heterolithic strata as the contact. This corresponds well to a mappable, upward change in weathering character from resistant to semiresistant or recessive (Fig. 7). Such a contact is in keeping with decisions made by workers in the subsurface (e.g. Tassonyi, 1969; Hamblin, 1990; Dixon and Stasiuk, 1998), who included glauconitic arenite and wacke in Mount Clark Formation, but assigned more shaly, overlying strata to Mount Cap Formation.

In its type section at Cap Mountain, Mount Clark Formation is in excess of 218 m thick (Aitken et al., 1973). In the eastern Mackenzie Mountains, Mount Clark Formation varies from being absent, notably at the well studied section in Dodo Canyon (Aitken et al., 1973; Serié et al., 2009), to thicknesses greater than 40 m in NTS 96 D/13 (Serié et al., 2009). Serié et al. (2009) reported nine localities with measured thicknesses of Mount Clark Formation, of which five had thicknesses greater than 10 m.

Figure 6. Bedding plane view of intensely bioturbated quartz arenite, Mount Clark Formation, eastern Mackenzie Mountains. Marks on hammer handle are 10 cm apart. Location 64.894278N, 127.150861W (NAD83). 2011-179.

Figure 7. Gradational transition between sandstone-dominated upper Mount Clark (foreground) and shalier Mount Cap formations (in distance) along Little Bear River. Location 64.479246N, 126.794043W (NAD83). Note marked contrast in weathering profile. Person is 165 cm tall. 2011–182.

Is the basal Cambrian sandstone succession the Mount Clark Formation?

The authors note the following similarities between the basal Cambrian sandstone and Mount Clark Formation:

1. The rocks are lithologically similar or identical to strata assigned to Mount Clark Formation in the subsurface and in the Franklin Mountains. This is true of the presence of quartz arenite, which almost entirely dominates the type section of Mount Clark Formation (Aitken et al., 1973), but also of glauconitic arenite, which is common in Mount Clark Formation in the subsurface (Tassonyi, 1969; Hamblin, 1990). The presence of intensely bioturbated horizons, including abundant *Skolithos*, is another key point of similarity.
2. The rocks lie unconformably upon Proterozoic strata and are overlain, gradationally and apparently conformably, by Mount Cap Formation. This is the stratigraphic position in which Mount Clark Formation is found regionally (Aitken et al., 1973, Tassonyi, 1969; Pugh, 1983; Dixon and Stasiuk, 1998).
3. Like the Mount Clark Formation, the rocks provide little internal evidence of their age; however, the overlying Early to Middle Cambrian Mount Cap Formation (Aitken et al., 1973; Serié et al., 2009) provides a younger limit on their age. An older limit is given by the presence of *Skolithos* "pipe rocks", a feature not observed in rocks older than Early Cambrian (McIlroy and Garton, 2004). Thus, these strata are broadly of the same age as Mount Clark Formation.

On the basis of these similarities, the present authors assign the Cambrian sandstone package to Mount Clark Formation (Serié et al., 2009), rather than considering it to be a basal facies of Mount Cap Formation (Aitken and Cook, 1974). Because physical continuity with Mount Clark Formation in the subsurface or in the Franklin Mountains cannot be demonstrated at present, the present authors consider this a provisional assignment.

The present authors emphasize that this is a lithostratigraphic correlation. Mount Clark Formation is probably a transgressive, diachronous unit (Pugh, 1983; Hamblin, 1990). Given that the Early Cambrian spans roughly 30 million years, outcrops in the eastern Mackenzie Mountains may not be the same age as those in the Franklin Mountains, or as strata assigned to Mount Clark Formation in the subsurface. Sequence stratigraphic analysis of these strata, incorporating outcrop and subsurface data, is needed to clarify these issues.

DISTRIBUTION OF CAMBRIAN FORMATIONS IN EASTERN MACKENZIE MOUNTAINS

The present work suggests that distribution of Cambrian formations in the eastern Mackenzie Mountains is somewhat different from what was shown on previous maps (Aitken et al., 1974; Aitken and Cook, 1976). An example is provided by the area around Carcajou Falls and Pyramid Mountain (Fig. 8). In addition to modifying the structural interpretation, new mapping has delineated a belt of Mount Clark Formation that is uniformly present at the sub-Cambrian unconformity (Fig. 8b). In the central and south-central part of the illustrated area, Mount Clark Formation caps hills of Little Dal Group. Mount Cap Formation is present more continuously in outcrop than was suggested by previous mapping. Immediately west of Pyramid Mountain, Aitken et al. (1974) showed Saline River Formation truncating the underlying Mount Cap Formation (Fig. 8a). Although such a relationship would be consistent with the regional unconformity that separates these formations, present mapping does not support this map-pattern truncation of Mount Cap Formation (Fig. 8b).

In the eastern Mackenzie Mountains, previous workers (Aitken et al., 1974) considered the eastern edge of the Mackenzie arch to coincide approximately with the structural culmination delineated by the Stony and Foran anticlines (Fig. 4). Saline River Formation was shown to be present in both limbs of these structures, whereas Mount Cap Formation was mapped only in the eastern limbs. Mount Clark Formation was considered to be absent entirely. The present authors' work suggests that all three formations are widespread in the eastern limbs of these structures, and that numerous localities previously mapped as Mount Cap Formation are better assigned to Mount Clark Formation. In 2008 and 2009, mapping in the western limbs of these structures documented only a few exposures of Saline River Formation lying directly on Proterozoic strata.

DISTINCTION BETWEEN CAMBRIAN AND PROTEROZOIC SANDSTONE

Distinguishing between Cambrian sandstone of Mount Clark Formation and Proterozoic sandstone of Katherine Group is a problem commonly encountered by industry geologists (Serié et al., 2009; N. Wilson, pers. comm., 2011). Where the two units are in superposition, it can require close study to recognize the subtle sandstone-on-sandstone contact. Here, the present authors describe one such locality and discuss the features that permitted the contact to be documented during mapping.

The locality is on the south-facing wall of an unnamed canyon at the front of the Mackenzie Mountains, and was included in a measured section by Serié et al. (2009; their Section 13). They documented 43.7 m of siltstone and dolostone, which they assigned to the Proterozoic Little Dal Group (incomplete), overlain by 14.7 m of quartz sandstone, tentatively assigned to Mount Clark Formation, and a further 19.5 m of siltstone (Mount Cap Formation, incomplete).

These stratigraphic assignments require revision. During fieldwork in 2009, the present authors examined the succession along the length of the unnamed canyon and found that the succession of siltstone and dolostone is the upper part of the K6 division of the Katherine Group (Aitken et al., 1978), which was shown as upper Katherine Group on the Carcajou Canyon map (Aitken et al., 1974). The lower part of the sandstone package (7.6 m; units 8–9 of Serié et al. (2009)) contains abundant high-angle crossbedding and several conglomerate-filled channels. These strata are intensely cemented; the rocks are hard, with abundant, closely spaced joints (Fig. 9). Weathering tones are grey to pinkish grey, and locally maroon. The contact with the underlying, finer grained facies is not well exposed, but appears to be gradational by upward coarsening. No bioturbation was noted. The balance of the sandstone-dominated succession (~7.3 m; units 10–14 of Serié et al. (2009)) lacks conglomerate, contains abundant bioturbated beds, and is much less thoroughly cemented, with joints that are more widely spaced than those in the underlying strata (Fig. 9). Weathering colour is mainly shades of tan. The contact between these two intervals is sharp (Fig. 9), locally erosional, and locally iron stained.

The upper sandstone package is best assigned to Mount Clark Formation, based on its lithology and prevalence of bioturbation, as well as its position immediately beneath Mount Cap Formation. The lower package should be assigned to the upper (K7) division (Aitken et al., 1978) of the Katherine Group, based on the presence of several conglomerate beds and cut-and-fill stratigraphy associated with maroon weathering colours, the absence of burrowing, and the apparently conformable contact with underlying strata of the Katherine Group (Aitken et al., 1973). The contrast in cementation between the two packages may also point to different geological histories. The contact between these two sandstone packages is a subtle disconformity representing more than 200 million years of missing time.

These characteristics provide a means to distinguish between Mount Clark Formation and sandstone-dominated intervals of Katherine Group. The presence of burrowing is particularly diagnostic (*see also* Aitken et al. (1973)), the Katherine Group predating the first appearance of burrowing infaunal organisms. Contacts such as this one are challenging to recognize at a distance or in aerial photographs. Particular care is required when mapping Mount Clark Formation in regions where the sub-Cambrian unconformity has cut down to the level of the Katherine Group.

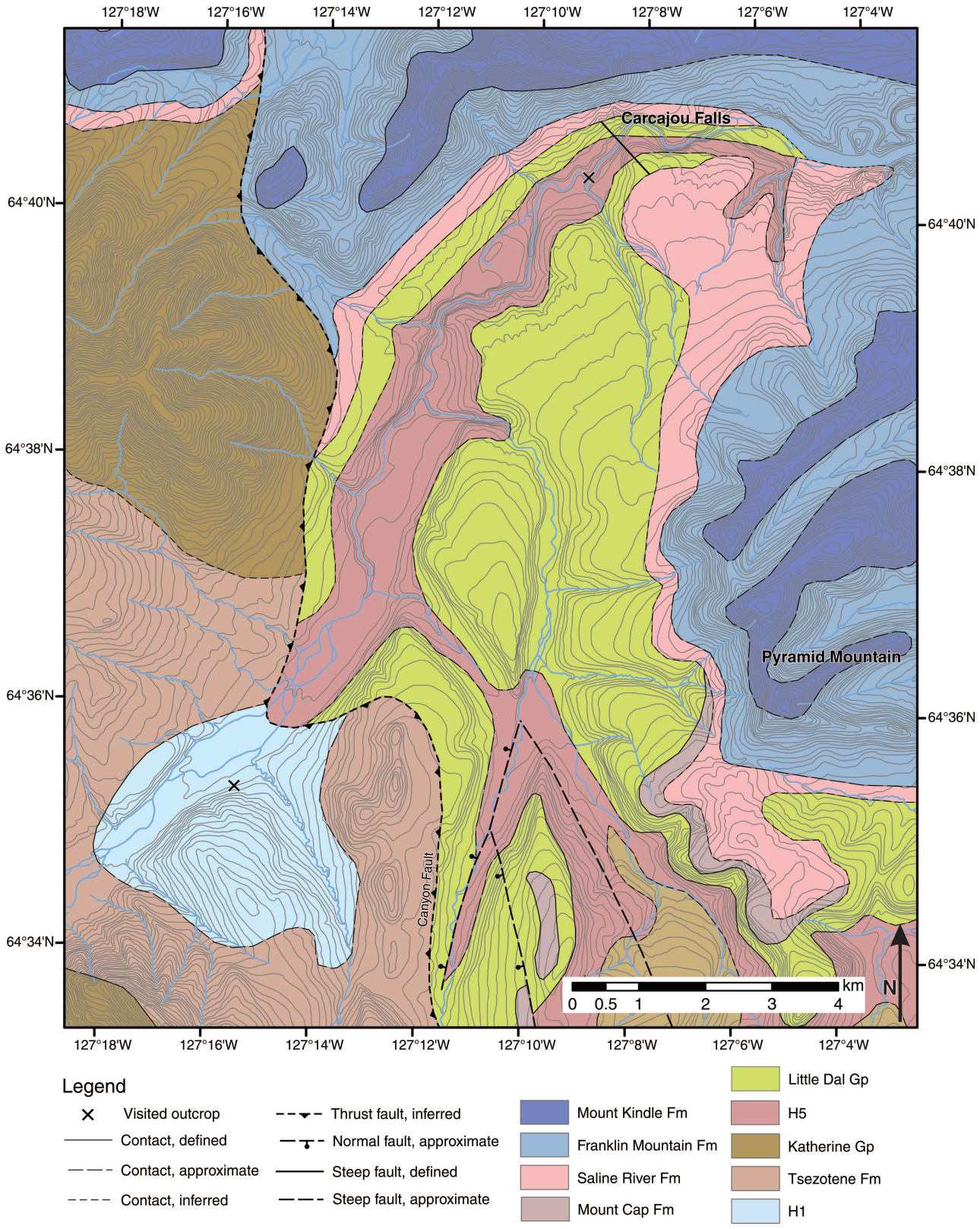

Figure 8. **a)** Map of part of eastern Mackenzie Mountains around Carcajou Falls and Pyramid Mountain. Geology is *after* Aitken et al. (1974).

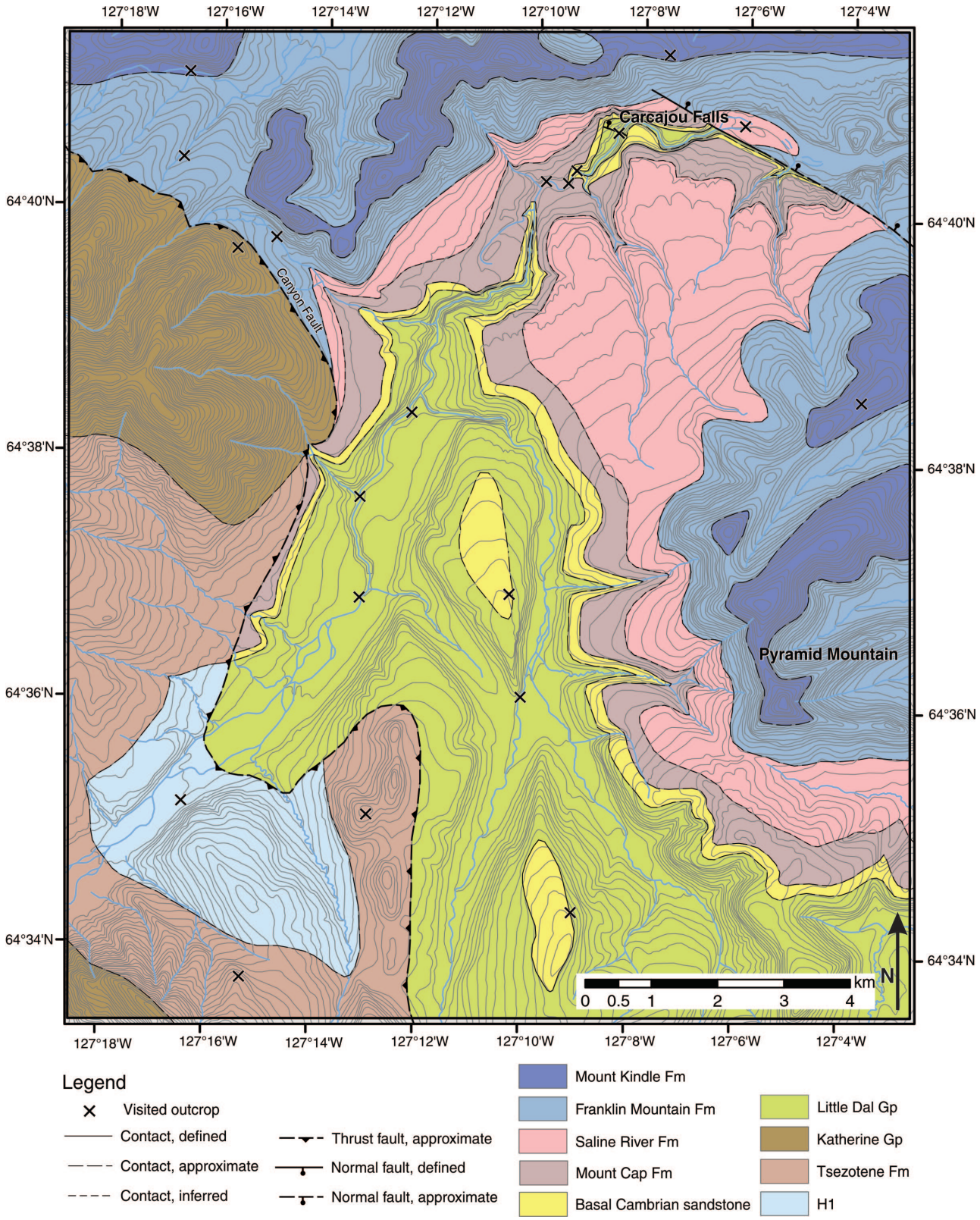

Figure 8. **b)** Map of region shown in Figure 8a, with geology updated following 2009 and 2010 field-work. Note continuous, mappable belt of basal Cambrian sandstone (Mount Clark Formation), and greater extent of Mount Cap Formation compared to earlier mapping.

Figure 9. Contact between Mount Clark Formation and underlying upper Katherine Group. Arrow points to sharp, disconformable contact. Person in lower left corner is 185 cm tall. Location 65.064841N, 127.794309W (NAD83). 2011-180.

CONCLUDING DISCUSSION

Bedrock mapping has demonstrated that a quartz sandstone-dominated basal Cambrian succession is mappable over significant areas in the eastern Mackenzie Mountains. The authors have assigned these strata provisionally to the Mount Clark Formation, a unit not previously mapped in the Mackenzie Mountains. Present work, together with regional subsurface seismic studies (MacLean, 2011), is contributing to a more detailed understanding of the distribution of Cambrian formations in this part of the Mackenzie Corridor. This will lead to a clearer understanding of the burial and uplift history across the region. For example, the present work suggests that current understandings of the influence of the Mackenzie arch on the Cambrian succession may require revision. Recognition that Mount Clark Formation is more widely preserved than previously recognized is significant in view of the unit's role as a reservoir for gas plays in the Colville Hills. Detailed controls on the distribution of Cambrian formations remain to be determined. Subsurface studies based on public-domain reflection-seismic data, currently being done as part of the Mackenzie Delta and Corridor Project (MacLean, 2011) may clarify these issues, as will further bedrock mapping and allied studies planned for 2011.

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