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PAPER 74-40

GEOLOGY OF THE LOWER PALEOZOIC FORMATIONS IN THE SUBSURFACE OF THE FORT SIMPSON AREA, DISTRICT OF MACKENZIE, N.W.T.

N.C. MEIJER-DREES

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ABSTRACT

The subdivision proposed by M. Y. Williams in 1923 for the Cambrian to Lower Silurian rocks in the Franklin Mountains is extended to the subsurface of the Great Slave and Great Bear Plains, District of Mackenzie, as far as the eastern outcrop margin.

Three rock successions, separated by unconformities, are recognized. The lower succession, including the Mount Clark and Mount Cap Formations, consists of a normal marine sequence of sandstone, shale and carbonate strata of Early and Middle Cambrian age. The middle succession, composed of the Saline River and Franklin Mountain Formations, comprises evaporitic and clastic sediments of Late Cambrian age and a thick dolomite unit of Late Cambrian to Early or Middle Ordovician age. The uppermost succession, comprising the Mount Kindle Formation, consists mainly of dolomite, is of Late Ordovician to Early Silurian age, and is widely distributed.

A north-trending high area, consisting of Proterozoic rocks, in part similar to the Proterozoic succession at Mount Cap in the Franklin Mountains, existed during deposition of the lower two successions. This high area separated two shallow basins that probably were joined farther north. Also, there existed between deposition of the middle and upper successions a period of uplift, tilting and erosion that resulted in removal of large amounts of the middle succession.

Pre-Devonian erosion, in turn, has removed the upper part of the upper succession (the Mount Kindle Formation) throughout most of the Great Slave Plain area.

The Mount Kindle Formation includes, at the base, a dark grey shale unit, which could have generated hydrocarbons in late Paleozoic time. Porosity, in part related to biostromal units, commonly is present in the overlying dolomite. The Mount Kindle Formation, therefore, appears to be a fair prospect for the accumulation of hydrocarbons although, to date, none of the exploratory wells drilled in the area has indicated the presence of oil or gas in the formation.

RÉSUMÉ

La subdivision proposée par M.Y. Williams en 1923 quant aux roches du Cambrien au Silurien inférieur qui se trouvent dans les monts Franklin s'étend au sous-sol des plaines du Grand lac des Esclaves et du Grand lac de l'Ours, district de Mackenzie, jusqu'à l'affleurement de la bordure orientale.

On y reconnaît trois successions de roches séparées par des discordances. La succession inférieure, qui englobe les formations de Mount Clark et de Mount Cap, consiste en une séquence marine normale de calcaire, d'argile et de couches de carbonate datant du début et du milieu du Cambrien. La succession moyenne, qui se compose des formations de Saline River et de Franklin Mountain, comprend des sédiments évaporitiques et clastiques de la fin du Cambrien ainsi qu'une unité profonde de dolomite datant de la fin du Cambrien jusqu'au début ou au milieu de l'Ordovicien. Quant à la succession supérieure, elle englobe la formation de Mount Kindle, se compose essentiellement de dolomite, date de la fin de l'Ordovicien au début du Silurien et se trouve largement répartie.

Au cours du dépôt des deux successions inférieures, il a existé une région élevée a orientation nord qui se composait de roches protérozoïques et qui ressemblait en partie à la succession protérozoïque que l'on trouve au mont Cap et dans les monts Franklin. Cette région élevée séparait deux bassins peu profonds qui se rejoignaient probablement plus au nord. De plus, entre le dépôt de la succession moyenne et celui de la succession supérieure, il y a eu une période de soulèvement, de basculement et d'érosion qui a eu pour effet de faire disparaître une grande partie de la succession moyenne.

L'érosion qui s'est produite à l'époque antérieure au Dévonien a enlevé, à son tour, la partie supérieure de la dernière succession (la formation de Mount Kindle) dans la majeure partie de la région de la plaine du Grand lac des Esclaves.

La formation de Mount Kindle comprend, à sa base, une unité d'argile grise et sombre qui pourrait bien avoir produit des hydrocarbures à la fin de l'époque paléozoïque. La porosité, que l'on associe en partie aux unités de biostrome, se retrouve généralement dans la dolomite de couverture. Il semble donc que la formation de Mount Kindle se prête bien à l'accumulation d'hydrocarbures même si, jusqu'à présent, aucun des puits d'exploration qui ont été forés dans cette région n'a révélé la présence de pétrole ou de gaz à l'intérieur de la formation.

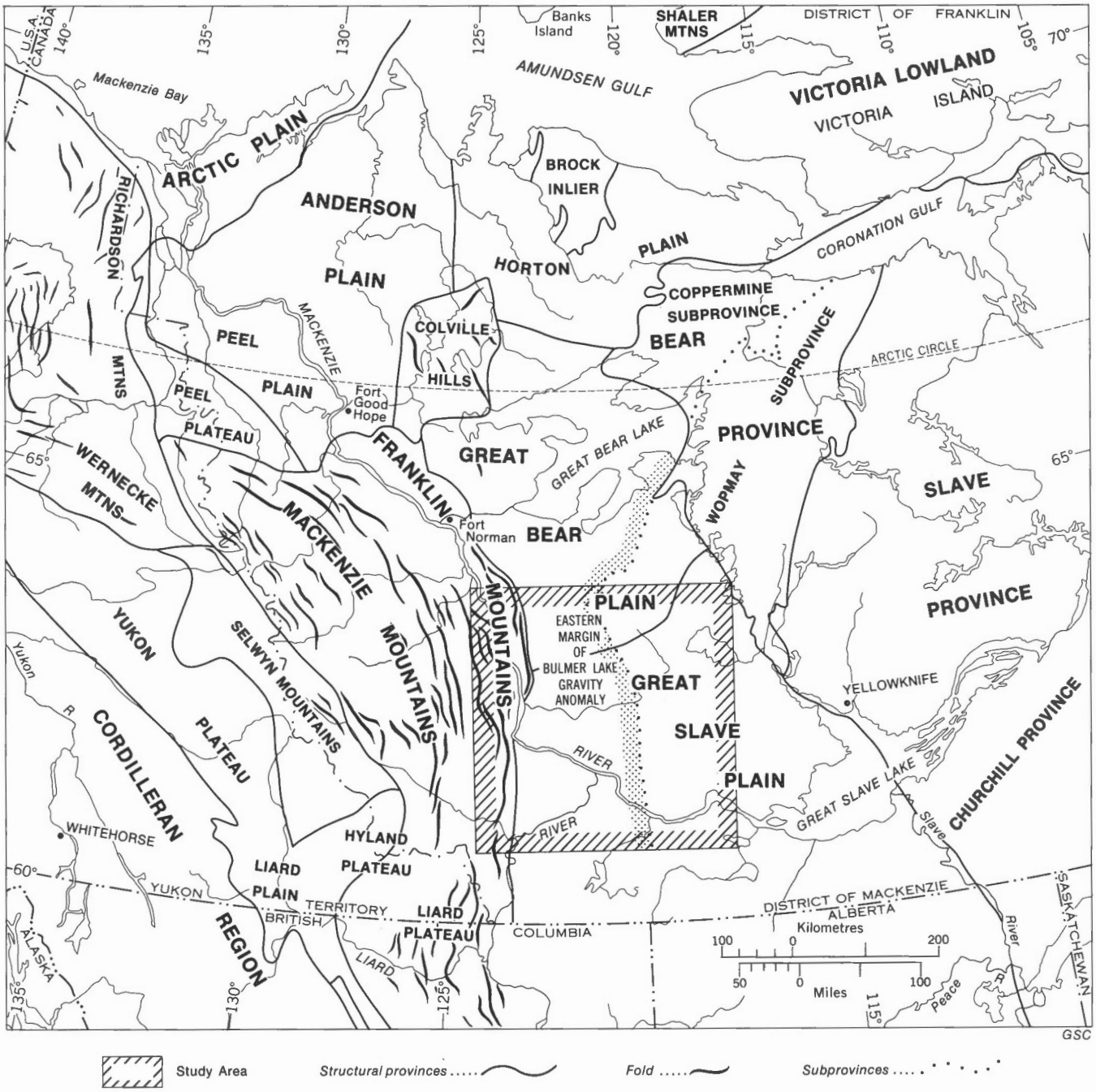

FIGURE 1. Structural provinces, northern Interior Plains and environs (modified from Douglas *et al.*, 1970).

GEOLOGY OF THE LOWER PALEOZOIC FORMATIONS IN THE SUBSURFACE OF THE FORT SIMPSON AREA, DISTRICT OF MACKENZIE, N.W.T.

INTRODUCTION

The distribution of lower Paleozoic rocks in the upper Mackenzie River area is widespread. They outcrop in the Franklin Mountains and eastern Mackenzie Mountains (*see* Fig. 1). In the lowlands of the Interior Plains (Great Bear and Great Slave Plains), they are present in the subsurface at depths ranging from less than 800 to more than 5,000 feet (244-1524 m), and are buried by rocks of younger age (Devonian and Cretaceous). To the east, toward the margin of the Great Slave and Great Bear Plains, lower Paleozoic rock units reappear at the surface between Great Slave Lake and Great Bear Lake.

PREVIOUS WORK

The lower Paleozoic succession has been studied from outcrop sections in the McConnell Range (Franklin Mountains) by M. Y. Williams (1922, 1923) and W. A. Bell (1959), as well as during Operation Mackenzie of the Geological Survey of Canada from 1960 to 1962 (*see* Douglas and Norris, 1961, 1963). A. W. Norris (1965) and H. R. Balkwill (1971) have reported on the succession in the outcrop area along the eastern margin of the Interior Plains (*see* Fig. 1). In the subsurface of the Interior Plains, the succession is known to be present from wells drilled in search of petroleum (*see* Tassonyi, 1969; Law, 1971), but some confusion exists regarding boundaries, nomenclature and correlation with outcrop sections.

Recent work, as part of Operation Norman of the Geological Survey of Canada, by Macqueen (1970), Aitken, Macqueen and Usher (1974), and Norford and Macqueen (in press) in the northern Franklin Mountains and eastern Mackenzie Mountains has provided detailed descriptions of outcrop sections dated by fossils. This has increased greatly the knowledge of the lower Paleozoic succession. In addition, three non-confidential oil company reports describe the lower Paleozoic succession in the southern Franklin Mountains (Brady and Wissner, 1961; Capstick, 1968; Hughes, 1959).

PRESENT WORK

Correlation is based on the study of cores, samples and borehole logs of non-confidential exploratory wells drilled in the northwestern part of the Great Slave Plain and available at the Institute of Sedimentary and Petroleum Geology, Calgary (*see* Fig. 4). North of the study area, in the Great Bear Plain, well control is very sparse and, in the southern parts of the Great Slave Plain, the entire lower Paleozoic succession is missing. Because of these two limitations, the present study is concerned mainly with the correlation of the lower Paleozoic succession in an east-west direction, and extends the subdivisions proposed by Williams (1923) for the Franklin Mountains and by Balkwill (1971) for the outcrop area on the eastern margin of the Great Slave Lake Plain into the subsurface.

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STRATIGRAPHY

The sedimentary rocks present in the subsurface of the Interior Plains range in age from ?Helikian to Cretaceous. They form a wedge of ancient shelf deposits which thins toward the east and lies on an irregular, west-dipping surface of igneous and metamorphic rocks of Precambrian age. Within the wedge, five major unconformity-bounded stratigraphic successions can be recognized. These are the Proterozoic, Lower and Middle Cambrian, Upper Cambrian to ?Middle Ordovician, Upper Ordovician to Lower Silurian, and Devonian to Carboniferous successions. Due to the unconformities above and below, and because of the paleotopographic irregularities of the granitic basement complex, each succession has a different geographic distribution.

In the Interior Plains of the upper Mackenzie River area, the sedimentary succession is relatively undisturbed and dips very gently toward the west. In the Franklin and Mackenzie Mountains, the sediments are folded and thrust faulted in north-south trending anticlinal-synclinal structures (*see* Douglas and Norris, 1961, 1963).

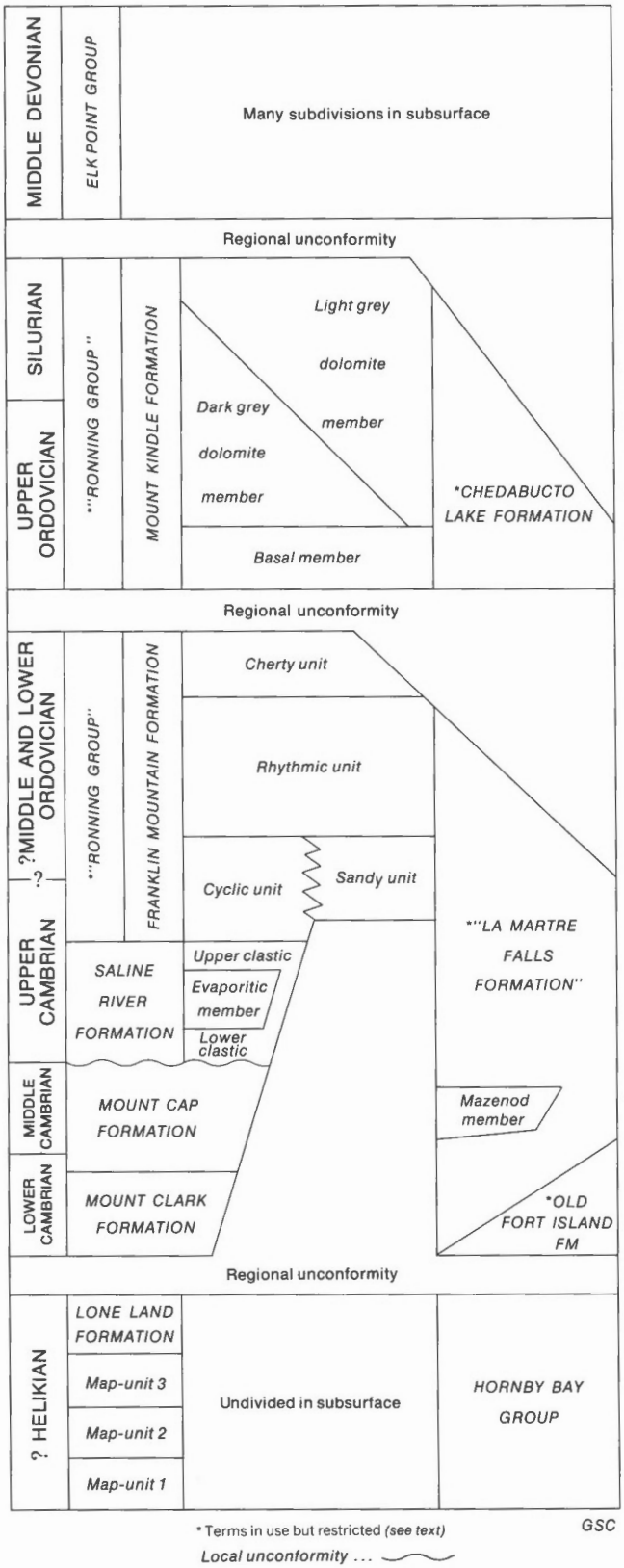


FIGURE 2. Table of formations

PROTEROZOIC SUCCESSION

The Proterozoic succession has a widespread distribution in the Mackenzie Mountains, the Bear Province and in the subsurface of the Great Bear Plain (*see* Fig. 1).

In the Mackenzie Mountains, the succession consists of 5,000 to 18,000 feet (1524-5486 m) of sedimentary rocks of probable Helikian age, which are overlain unconformably by more than 10,000 feet (3048 m) of sedimentary rocks of probable Hadrynian age (Aitken *et al.*, 1974; Gabrielse *et al.*, 1973).

The Proterozoic succession also outcrops in the area northeast and east of Great Bear Lake, known as Bear Province (Stockwell *et al.*, 1970). In the Wopmay subprovince of the Bear Province, metasediments and metavolcanic rocks of the Aphebian Epworth Group are severely folded and intruded by granites and related plutonic rocks. This presumably occurred during the Hudsonian orogeny (Stockwell *et al.*, 1970; Hoffman and Cecile, 1973). In the Coppermine subprovince of the Bear Province, gently folded Helikian sandstone, quartzite and dolomite of the Hornby Bay Group (Baragar and Donaldson, 1974) unconformably overlie the Aphebian volcanic and plutonic rocks. According to Baragar and Donaldson (ibid.), the Hornby Bay Group is probably about 6,500 feet (1981 m) thick and in turn is overlain unconformably by about 3,500 feet (1067 m) of dolomite, sandstone and mudstone of the Dismal Group and the conformably succeeding basalt and red sandstone of the Coppermine River Group (about 14,000 ft, 4267 m thick). Sedimentary rocks of the Rae Group succeed the Coppermine River Group unconformably, and are assumed to be of Hadrynian age. The Rae Group is at least 4,000 feet (1219 m) thick and is overlain unconformably by essentially flat-lying Paleozoic sediments.

Southeast of Great Bear Lake (*see* Fig. 1) at Leith Peninsula, rocks of the Hornby Bay Group overlie granitic rocks of the Wopmay subprovince. Balkwill (1971) estimated the Hornby Bay Group to be about 1,000 feet thick (305 m) at Leith Peninsula and made a twofold division. The lower 600 feet (182 m) consist of white to pinkish buff and locally maroon, fine- to coarse-grained, thin- to thick-bedded quartzite. This is overlain by 400 feet (120 m) of thin-bedded, medium brown, very finely to finely crystalline dolomite, with grey and buff chert laminae. At Leith Peninsula, the Hornby Bay strata dip gently to the northwest and it is likely that the Hornby Bay Group extends into the subsurface of the Great Bear Plain.

At Cap Mountain in the McConnell Range, a thick succession of ?Helikian rocks is described in some detail by Aitken *et al.* (1974). Three map-units and one formation are recognized, having a combined thickness of 5,948 feet (1813 m). The lower contact of the succession is not exposed and the top of the succession is overlain unconformably by the Lower Cambrian Mount Clark Formation.

In the subsurface of the southern Great Bear Plain and northern part of the Great Slave Plain, quartzite and argillite, in part very similar to the ?Helikian succession at Cap Mountain, are penetrated by many boreholes. However, none of the sections

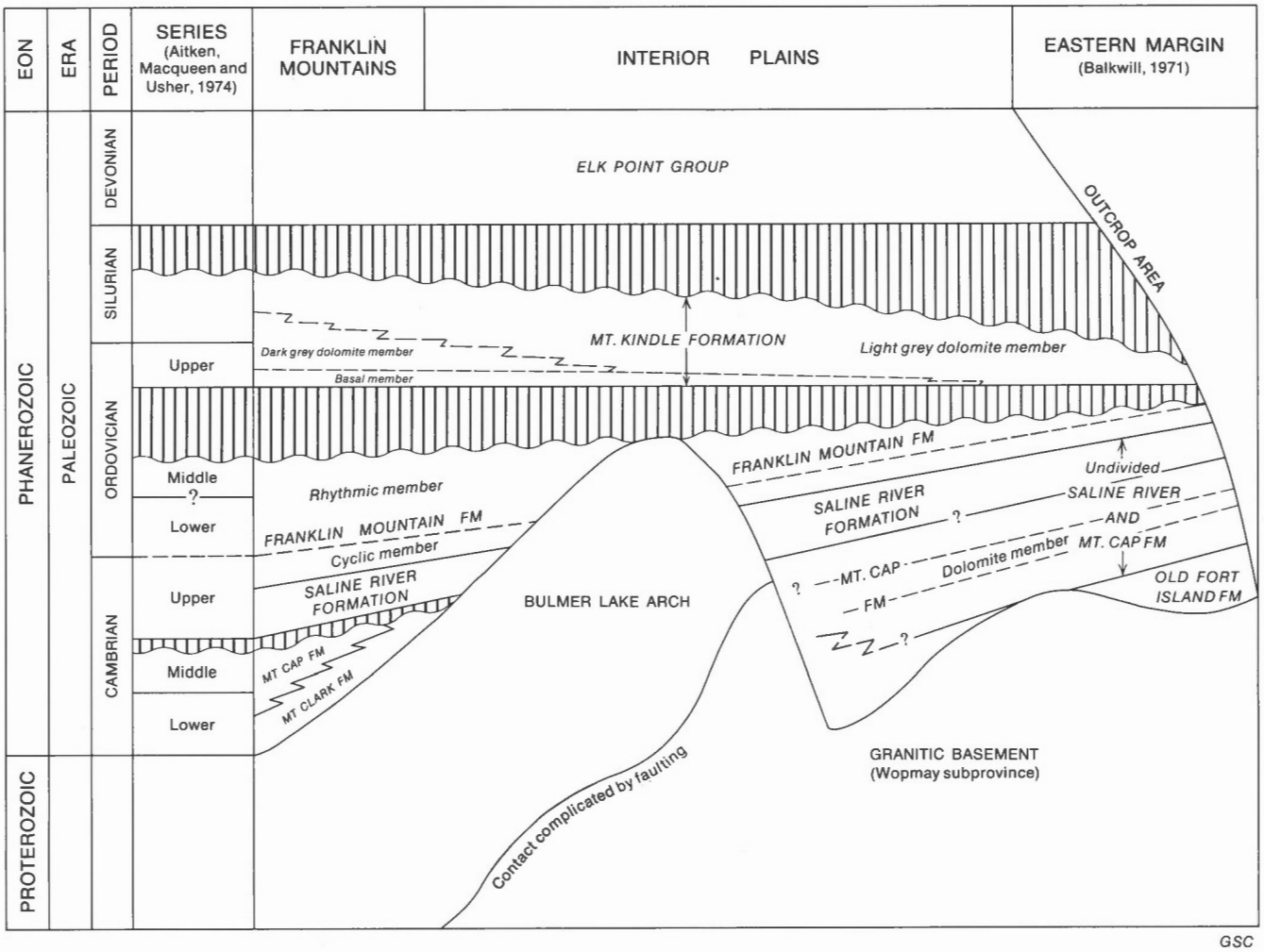


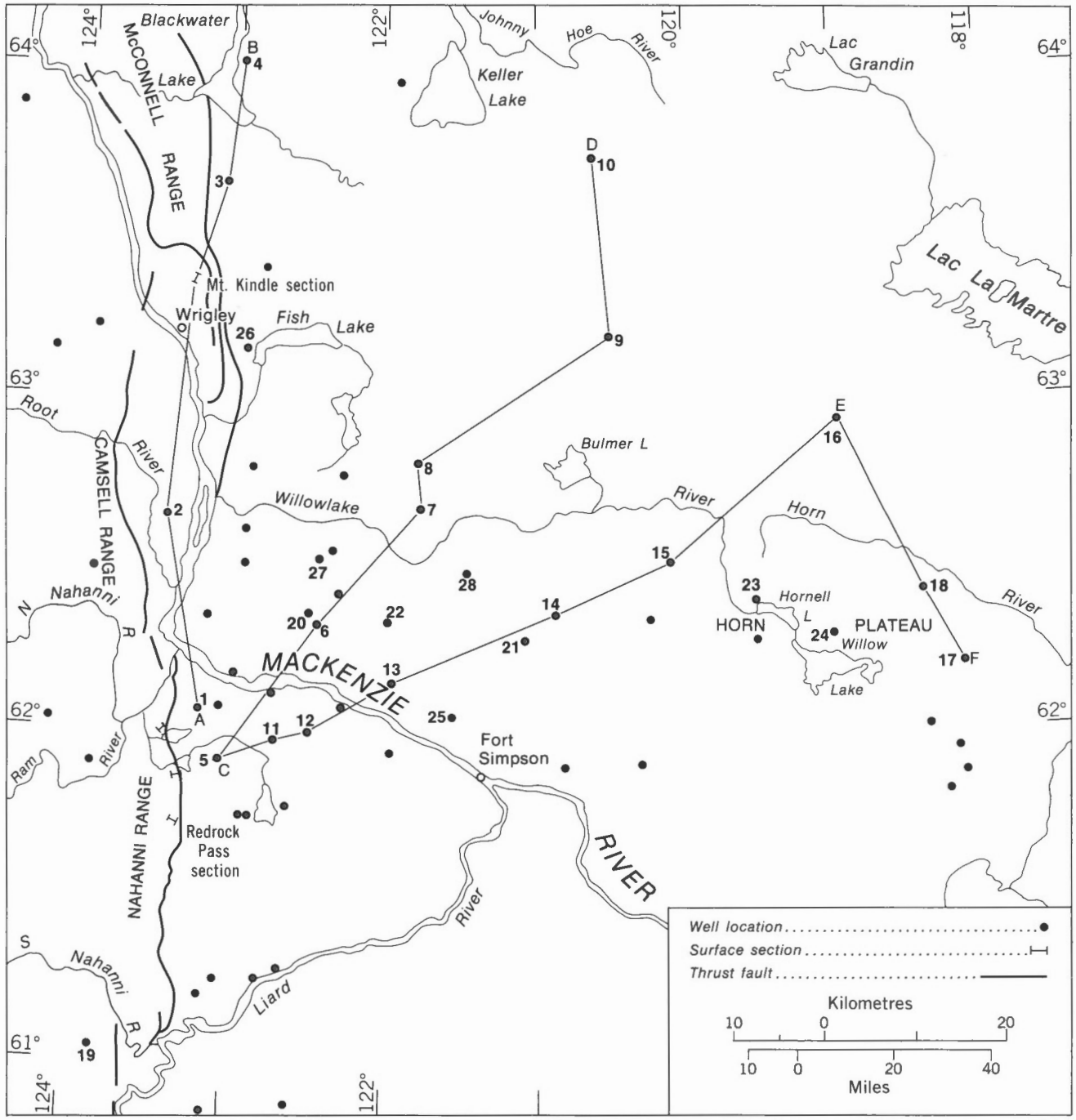
FIGURE 3. Schematic east-west structural and stratigraphic cross-section

penetrated is thick enough to demonstrate the presence of mappable units. The few cores recovered from Proterozoic strata in the subsurface are relatively undisturbed and show subhorizontal bedding. The succession, which is commonly thin bedded and laminated, consists of pale, well-sorted, very fine and fine[1] quartzitic sandstone, interbedded with red-brown, light green, light grey or very dark grey, often somewhat micaceous argillite. In the area just northwest of Horn Plateau (*see* Fig. 4), the Proterozoic succession is cut by granitic sills in several wells.

The distribution of Proterozoic strata is restricted to the western and central parts of the study area (Fig. 3). "Basement" strata in wells in the Lac La Martre area consist of granitic rocks. This area may be the subsurface extension of the Wopmay structural subprovince (*see* Fig. 1). The Precambrian geology of the western part of the study area appears to be similar to that of the Coppermine structural subprovince, and it is possible that the Proterozoic rocks in the subsurface of the southern Great Bear Plain form a gently dipping homocline or gently folded wedge, which overlies a granitic and metamorphic basement. The unconformity at the base of the Paleozoic succession has influenced greatly the areal distribution of the Proterozoic rocks and it is likely that faulting has complicated the geology of the Proterozoic succession. Therefore, no attempt has been made to reconstruct the geological history of the Proterozoic rock units and no definite correlation could be established between the ?Helikian succession at Cap Mountain in the McConnell Range and the Proterozoic rocks in the subsurface north of Fort Simpson. Summarized descriptions of the Proterozoic rocks are given in Appendix II for individual boreholes, and a discussion is given in the following paragraphs.

The Imperial Cartridge B-72 well (Lat. 63°11' 19"N, Long. 120°29'04"W; Fig. 4, well no. 9) was drilled on a north-south trending gravity anomaly, the "Bulmer Lake High" (Hornal *et al.*, 1970) north

[1] Note: Wentworth (1922) grade scale is used for both clastic and carbonate rocks.



SECTION A-B

1 *B.A.O.H. Cli Lake K-54*
2 *F.P.C. Tenneco Root River I-60*
3 *Union Japex Blackwater E-11*
4 *Shell Blackwater Lake G-52*

SECTION C-D

5 *Horn R AmHess Gulf Cli Lake M-05*
6 *IOE Triad Ebbutt D-50*
7 *Horn R CDR IOE Willow Lake R I-71*
8 *Husky HB* et al. *Willow Lake H-10*
9 *Imp Cartridge B-72*
10 *Imp Lac Taché C-35*

SECTION C-E

5 *Horn R Am. Hess Gulf Cli Lake M-05*
11 *Husky* et al. *Sibbeston G-59*
12 *Mobil Ft. Simpson M-70*
13 *Fina* et al. *Willow Lake L-59*
14 *Husky* et al. *Willow Lake G-32*
15 *Chevron Harris River A-31*
16 *Imp Windflower G-77*

SECTION F-E

17 *Imp Triad Davidson Creek P-2*
18 *Horn R Shell Levis D-76*
16 *Imp Windflower G-77*

Not shown on section

19 *Pan Am A-1 Mattson Creek No. 1*
20 *Chevron C.S. Ebbutt G-72*
21 *Husky* et al. *Willow Lake O-27A*
22 *IOE Triad Ebbutt J-70*
23 *Chevron Hornell Lake G-24*
24 *Imp Triad Willow Lake B-28*
25 *IOE Trail River P-13*
26 *H-B- Gulf Fish Lake G-60*
27 *Aquit Highland Lake K-42*
28 *C.S. IOE Jackfish N-69*

FIGURE 4. Map showing locations of wells, sections and cross-sections

of Bulmer Lake. The Proterozoic succession consists of thin-bedded, light green, green and light grey, very fine and fine-grained, well-sorted quartzitic sandstone interbedded with minor light green, dark grey and locally red-brown argillite and overlies pink granite (*see* Appendix II). This succession is in a stratigraphic position similar to the Hornby Bay Group.

In the general area between Ebbutt Hills and Horn Plateau (*see* Fig. 4), a number of wells have penetrated a Proterozoic section consisting of pale, often red-brown speckled, hematitic, quartzitic sandstone, and pale green, locally glauconitic sandstone. These are interbedded with light red-brown or pale yellowish, in part micaceous argillite, green or olive-grey argillite or siltstone, and minor purplish to purple-red argillite or siltstone. This succession is cut by granitic sills in four wells (*see* Appendix II). The occurrence of red-brown speckled, hematitic and quartzitic sandstone in the subsurface is interesting, because these are present also in Map-unit 3 of the Proterozoic succession at Cap Mountain (Aitken, Macqueen and Usher, 1974) in the McConnell Range.

In the Husky H.B. *et al.* Willow Lake H-10 well (Lat. 62°49'16"N, Long. 121°45'01"W; Fig. 4, well no. 8), drilled north of the Ebbutt Hills, the Proterozoic section between depths of 2,760 and 3,270 feet (total depth) consists of very dark grey siltstone laminated with black shale and interbedded with light-coloured quartzitic sandstone (*see* Appendix II). This section resembles the uppermost Proterozoic unit exposed on Cap Mountain, the Lone Land Formation.

In the east, the FPC Tenneco Root River I-60 well (Lat. 62°39'32.21"N, Long. 123°24'28.96"W; Fig. 4, well no. 2) drilled and cored a succession between a depth of 7,676 and 8,571 feet, which consists of a very light coloured, very fine to medium-grained quartzitic sandstone at the base, overlain by approximately 880 feet (268 m) of brick red and minor light green argillite interbedded with grey and dark grey argillite with black laminae. This succession is somewhat similar to Proterozoic Map-unit 2 at Mount Cap. In BAOH Cli Lake K-54 well (Lat. 62°03'41.79"N, Long. 123°10'24.18"W; Fig. 4, well no. 1), the interval between the depths of 8,560 and 8,714 feet consists of interbedded brick red argillite, very light grey siltstone and red-brown mottled, hematitic sandstone (*see* Appendix II). This unit also has some resemblance to Proterozoic Map-unit 2 at Mount Cap.

Special note is made of a sandstone unit present in the Imperial Lac Tache C-35 well (Lat. 63°44'15"N, Long. 120°36'45"W; Fig. 4, well no. 10), which is located on the east flank of a north-south trending gravity high, the "Bulmer Lake High" (Hornal *et al.*, 1970). The sandstone is present between the depths of 1,412 and 1,719 feet. It is in places somewhat quartzitic and consists of medium to coarse quartz grains with locally prominent, red-brown, hematitic cement or red-brown shale partings (*see* Appendix II). The subangularity and coarseness of the sandstone and the absence of interbedded shale contrast sharply with the well-sorted, dominantly fine-grained quartzitic sandstone and interbedded shale succession of Proterozoic age exposed near the Great Bear Lake and in the McConnell Range (*see* Balkwill, 1971; Aitken *et al.*, 1974). The sandstone is considered to belong to the Proterozoic succession but it also may represent a Cambrian fluviatile facies of abnormal thickness (a minimum of 307 ft, or 93.5 m) deposited locally in a Precambrian paleotopographic depression. In that case, the sandstone would be the lateral equivalent of the combined Old Fort Island, Mount Cap and Saline River Formations (*see* Fig. 3). One would have to explain the sandstone as being related to events of uplift and erosion in the Cambrian, which is represented elsewhere by sediments of a stable environment.

LOWER AND MIDDLE CAMBRIAN SUCCESSION

In the McConnell Range of the Franklin Mountains and in the subsurface of the Interior Plains, the Proterozoic succession is overlain disconformably by Lower Cambrian sediments (*see* Douglas and Norris, 1963). In two wells located just east of the McConnell Range (Union Japex *et al.* Blackwater E-11, Lat. 63°40'20"N, Long. 123°03'30"W; and Shell Blackwater Lake G-52, Lat. 64°01'20"N, Long. 122° 55'12"W; Fig. 4, well nos. 3 and 4), a lower Paleozoic section occurs which can be correlated with the succession in the McConnell Range at Mount Kindle described by Williams (1923), Bell (1959), and Norford and Macqueen (in press) (*see* Sec. A-B, Fig. 12). In wells farther east and south, the Lower and Middle Cambrian formations are missing and Upper Cambrian strata overlie Proterozoic rocks (*see* Fig. 3). Wells in the Lac la Martre area have a complete Cambrian section similar to the one described by Balkwill (1971) for the outcrop area north of Lac la Martre.

Present data suggest that the Lower and Middle Cambrian succession in the subsurface was deposited in western and eastern basins which were separated by an area of non-deposition (*see* Fig. 6).

In the McConnell Range, the sequence consists of two formations: a lower sandstone, the Mount Clark Formation; and an upper carbonate and shale succession with minor sandstone, the Mount Cap Formation.

In the eastern parts of the Great Bear and Great Slave Plains, the succession consists of a lower discontinuous sandstone unit known as the Old Fort Island Formation and an upper unit, the Mount Cap Formation.

Mount Clark Formation
(Williams, 1923)

The Mount Clark Formation, first described by Williams (1923) from the McConnell Range, consists of a very pale, orthoquartzitic sandstone, weathering red-brown and purple. It is very fine and fine grained, with subrounded and subangular clear and pink quartz grains, and in general has poor to fair intergranular porosity. The Mount Clark Formation is widespread in the northern Franklin Mountains and is thought to be of Early Cambrian age (Aitken *et al.*, 1974). At the type section on Cap Mountain (McConnell Range), it is 735 feet (224 m) thick

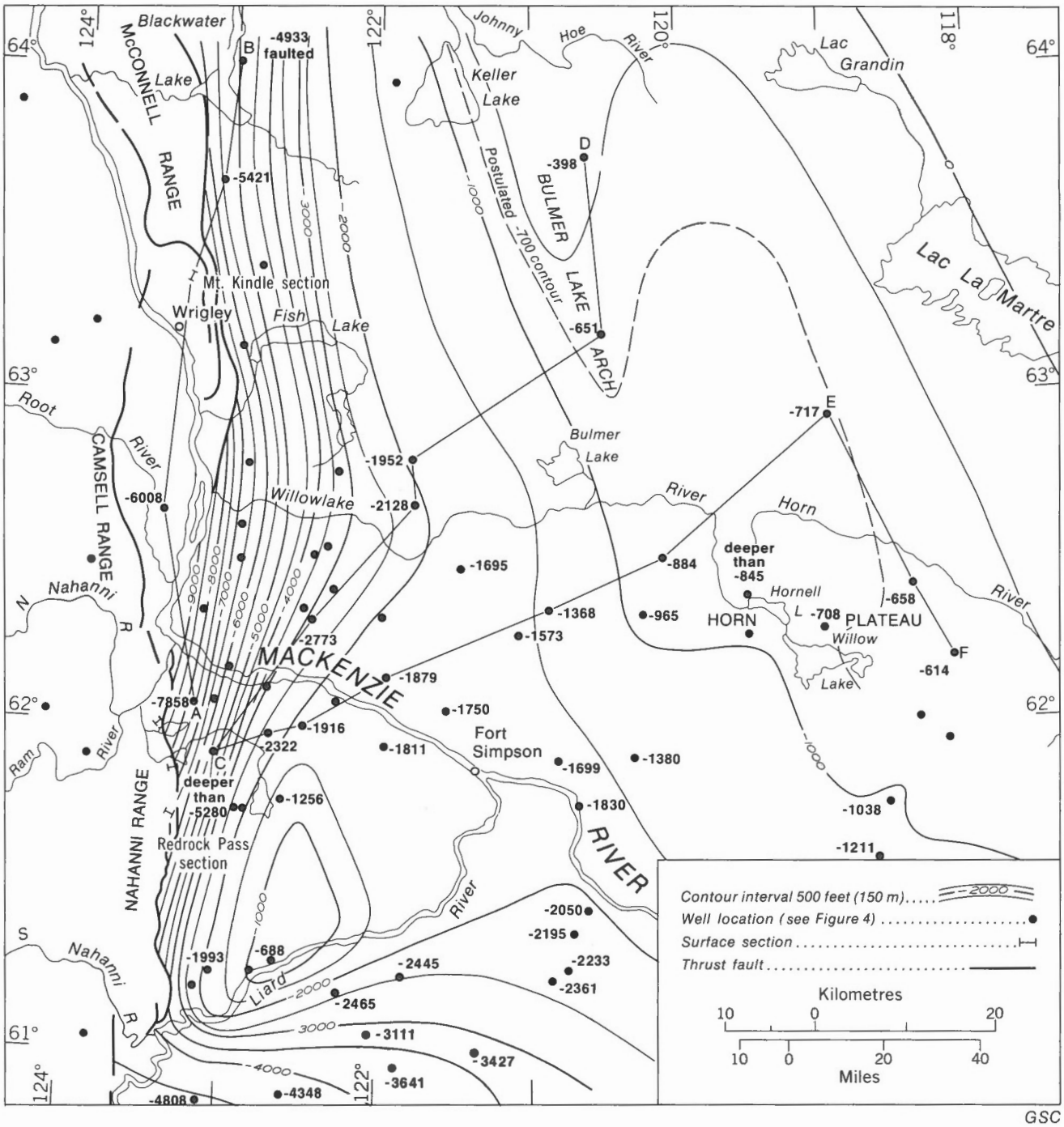


FIGURE 5. Structural map of top of Precambrian

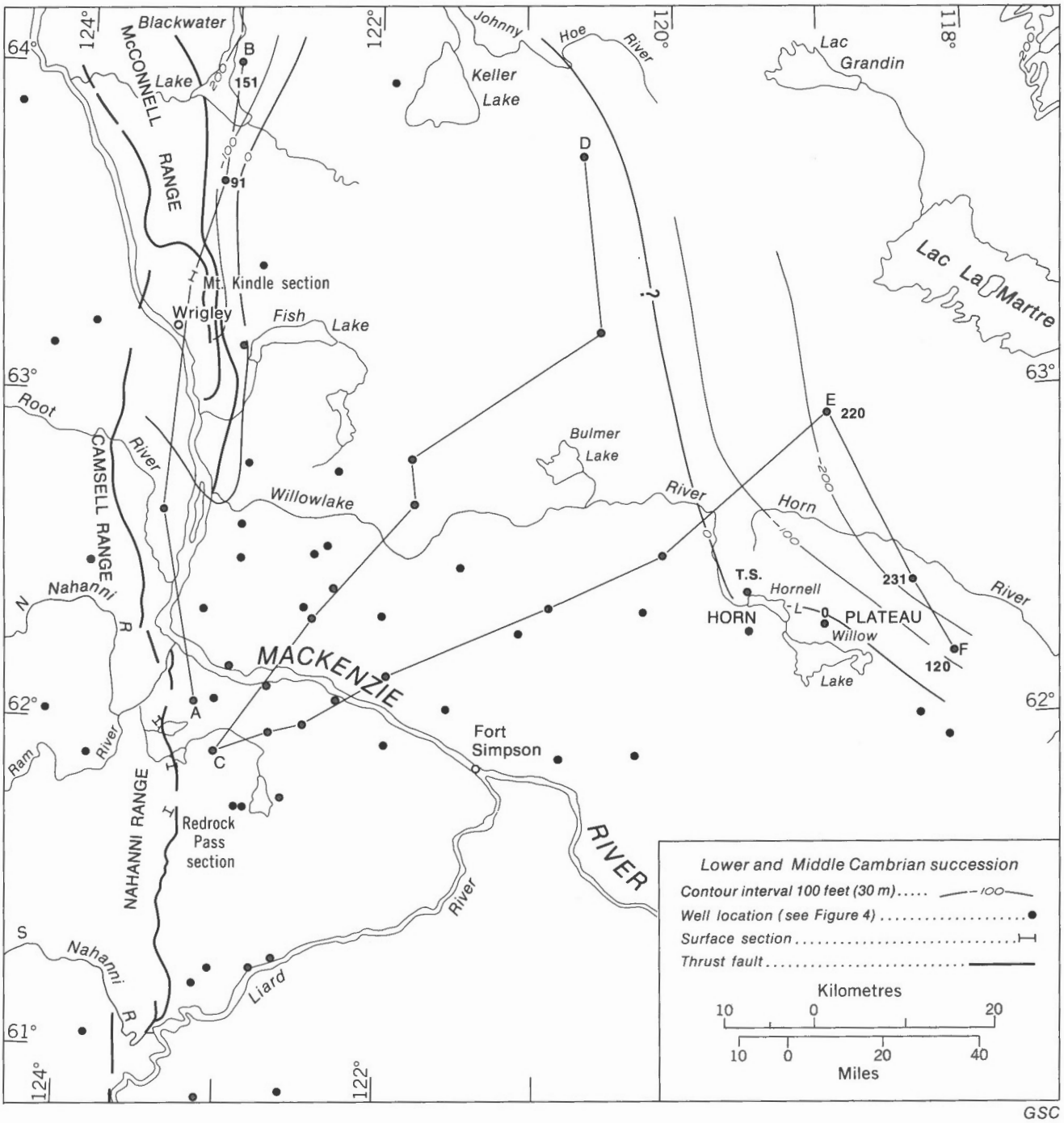


FIGURE 6. Isopach map of interval including Mount Clark and Mount Cap Formations

(Bell, 1959). In the subsurface of the study area, its distribution is limited to the extreme northwest corner (*see* Fig. 6) and is present in two wells.

In the Union Japex *et al.* Blackwater E-11 borehole (Lat. 63°40'20"N, Long. 123°03'30"W; Fig. 4, well no. 3), the Mount Clark Formation is only 70 feet (21 m) thick, occurring between the depths of 7,006 and 7,076 feet. In Shell Blackwater Lake G-52 well (Lat. 64°01'20"N, Long. 122°55'12"W; Fig. 4, well no. 4), the formation occurs between the depths of 6,011 and 6,146 feet and is 135 feet (41 m) thick (*see* Sec. A-B, Fig. 12). In the subsurface, the sandstone of the formation is very light grey with only a trace of red or rusty colours, and is fine or fine to medium grained with sporadic medium- to coarse-grained intervals. Porosity in the sandstone is poorly developed or absent.

Old Fort Island Formation
(Norris, 1965)

The sandstone unit which unconformably overlies the Precambrian rocks in the surface exposures along the eastern margin of the Interior Plains is known as the Old Fort Island Formation (A.W. Norris, 1965; Balkwill, 1971; Cook and Aitken, 1971). The formation varies in thickness from 0 to 135 feet (0-41 m) and occurs discontinuously in paleo-depressions between knobs and ridges in the Precambrian erosional surface. It consists of light grey to white, thin- to thick-bedded and locally crossbedded, fine- to coarse-grained, friable, quartzose sandstone, with thin interbeds of greenish grey and dusky red siltstone and occasional laminae and partings of green shale. Near Hottah Lake (Great Bear Plain), it is overlain conformably by strata of Middle Cambrian age (Balkwill, 1971). Thus the age of the Old Fort Island Formation may range from Early to Middle Cambrian.

In the subsurface of the Great Slave Plain, the existence of the Old Fort Island Formation has yet to be demonstrated. An interbedded sandstone and shale unit, overlying Precambrian granite, occurs in the Horn River Shell Levis D-76 well (Lat. 62° 25'06"N, Long. 118°29'34"W; Fig. 4, well no. 18) between the depths of 1,405 and 1,456 feet and in the Imperial Davidson Creek P-2 well (Lat. 62°11' 45"N, Long. 118°15'05"W; Fig. 4, well no. 17) between 2,690 and 2,705 feet and is considered to belong to the Mount Cap Formation because of its glauconite content (*see* Sec. F-E, Fig. 7; and Appendix II). The sandstone, however, is poorly represented in the samples. In the Imperial Windflower Lake G-77 well (Lat. 62°56'26"N, Long. 118°59'02"W), logs indicate the presence of a similar interval above granitic basement, but samples are missing (interval 1,575 to 1,620 ft). The three wells probably are drilled on paleotopographic high areas where the Old Fort Island Formation is not developed.

The Old Fort Island and the Mount Clark Formations are lithologically similar and probably represent the same basal transgressive deposit. The age of such a deposit may change from place to place.

Mount Cap Formation
(Williams, 1923)

The Mount Cap Formation was sketchily described by Williams (1923). At the type section at Cap Mountain, the formation, at least 100 feet (30 m) thick, is very poorly exposed. Aitken *et al.* (1974) described a 695-foot (212 m) thick, incomplete section at Mount Clark in the northern Franklin Mountains and Bell (1959) described an incomplete section, 650 feet (198 m) thick, located in the McConnell Range, just south of Blackwater Lake. Owing to the erosion associated with the sub-Upper Cambrian unconformity, the Mount Cap Formation in the Franklin Mountains varies greatly in thickness (*see* Fig. 3).

The Mount Cap Formation consists of thin-bedded and laminated, grey dolomite, limestone, shale and siltstone at the section south of Blackwater Lake described by Bell (1959). In the northern Franklin Mountains, it includes glauconitic sandstone, quartzose and glauconitic limestone, and non-calcareous sandy or silty, red, green, dark grey and black shale (Aitken *et al.*, 1974). The formation ranges in age from Early to Middle Cambrian (Aitken *et al.*, ibid.).

In the Great Bear Plain north of Great Bear Lake, the Mount Cap Formation has a wide distribution and varies in thickness from about 100 feet (30 m) to about 250 feet (76 m). Compared with the Mount Cap Formation of the Franklin Mountains in the west, the eastern facies is thinner, more shaly, more glauconitic and less fossiliferous (Aitken *et al.*, ibid.). The Mount Cap Formation is known from the subsurface of the Colville Hills area (Macqueen and MacKenzie, 1973) and from surface exposures along the eastern margin of the Great Bear Plain in the Colville Lake-Coppermine, Erly Lake and Brock River map-areas (*see* Cook and Aitken, 1969, 1971; Balkwill and Yorath, 1970). South of Great Bear Lake, Balkwill (1971) mapped the combined Mount Cap and Saline River Formations as one unit. He described the Mount Cap Formation equivalents as being 125 feet (41 m) thick near Hottah Lake, and consisting principally of red, green and dark grey, papery shale, platy siltstone, and fine-grained sandstone. The sandstone has very abundant tabular glauconite grains as large as 0.3 mm, and abundant ?burrow trails on bedding surfaces. The middle part of the sequence is distinguished by an interval, about 30 feet (9 m) thick, of thin to medium, grey-brown, finely to medium crystalline dolomite, and reddish brown, finely crystalline dolomite, which probably can be correlated with the Mazenod member of the La Martre Falls Formation of A. W. Norris (1965). A. W. Norris (ibid.) did not recognize the Mount Cap Formation in the area north of Great Slave Lake because of poor exposures.

The western facies of the Mount Cap Formation is represented in two wells just east of the McConnell Range (*see* Sec. A-B, Fig. 12). In the Shell Blackwater Lake G-52 well (Lat. 64°01'20"N, Long. 122°55'12"W; Fig. 4, well no. 4), it consists of 15 feet (4.5 m) of black shale (depth 5,995 to 6,010 ft). In the Union Japex *et al.* Blackwater

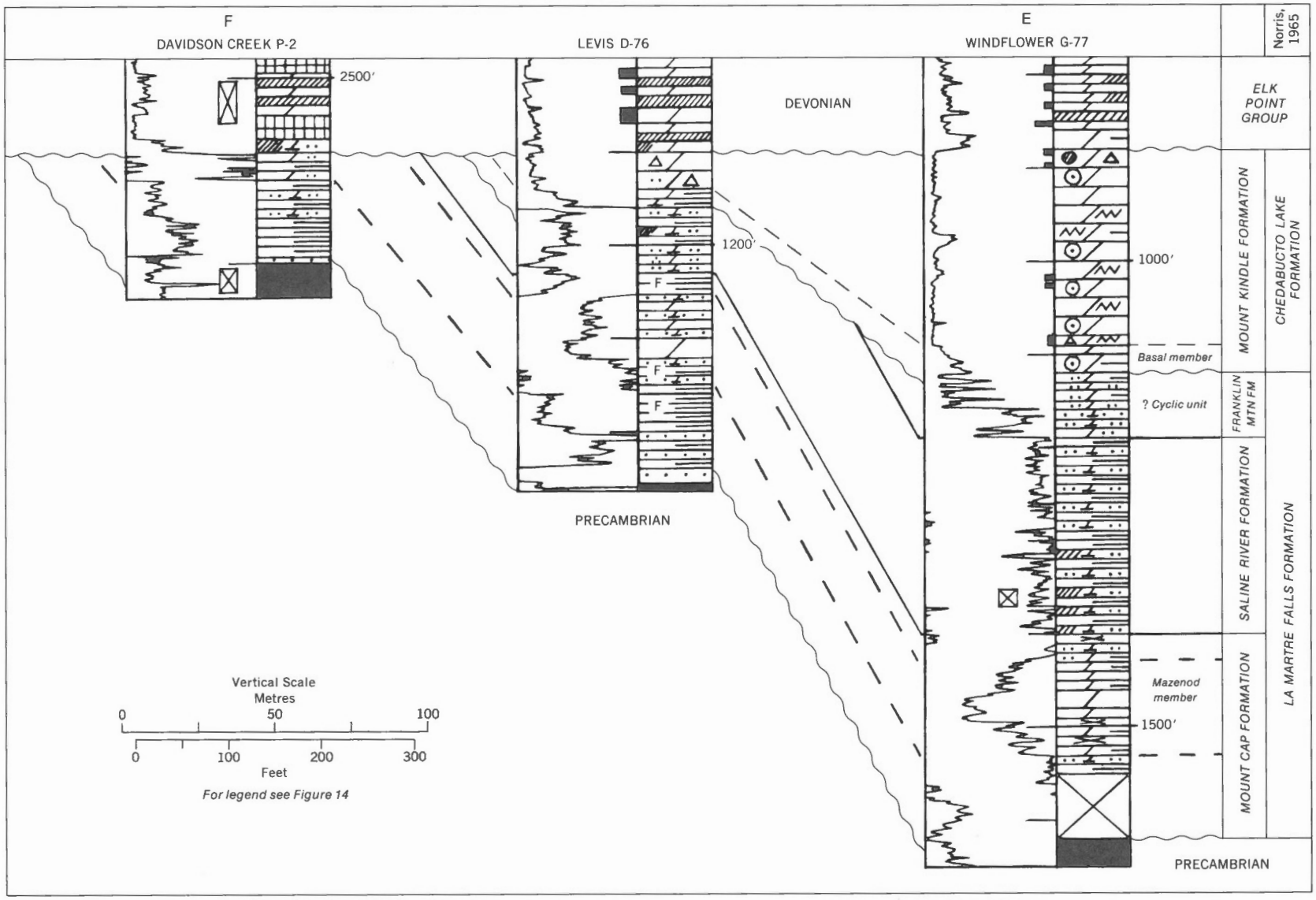


FIGURE 7. Section F-E (*see* Fig. 4) showing correlation of lower Paleozoic succession in selected exploration wells using combined radioactivity and lithology logs. Datum is top of Mount Kindle Formation

E-11 well (Lat. 63°40'20"N, Long. 123°03'30"W; Fig. 4, well no. 3), it consists of grey-green shale laminated with light grey, very fine sand and interbedded with a dark grey, in part very glauconitic sandy dolomite containing medium-grained black chert grains (depth 6,984 to 7,006 ft).

The eastern facies is present in three wells on Horn Plateau (*see* Fig. 6). These are the Imperial Windflower Lake G-77 (Lat. 62°56'26"N, Long. 118° 59'02"W), Horn River Shell Levis D-76 (Lat. 62°25' 06"N, Long. 118°29'34"W) and Imperial Davidson Creek P-2 (Lat. 62°11'45"N, Long. 118°15'05"W) wells (*see* Sec. F-E, Fig. 7). A basal unit consisting of interbedded green shale and light greenish grey, very fine grained, in part silty, glauconitic sandstone overlies granitic basement rocks. This unit passes upward to green shale, with rare fragments of inarticulate brachiopods which, in turn, is overlain by a variably argillaceous, finely to medium crystalline, very light brown to light greenish grey dolomite (possibly equivalent to the Mazenod member; Norris, 1965). The uppermost unit of the Mount Cap Formation, overlying the dolomite unit, consists of green and greyish green shale. The top of the formation is picked at the base of the lowest prominent anhydrite bed.

The Mount Cap Formation is not present in wells south of Imperial Davidson Creek P-2 because of pre-Devonian erosion.

La Martre Falls Formation
(Norris, 1965)

This formation was introduced by A. W. Norris (1965) for a recessive and highly variable succession of shale, mudstone, sandy and argillaceous dolomite, gypsum and salt, which overlies the Old Fort Island Formation or locally overlies Precambrian granitic rocks in the outcrop area north of Great Slave Lake. At the type section in the canyon of Rivière la Martre, the formation consists of "green and dusky red, fissile, soft, ferruginous shale, in places containing interbeds of fine-grained, ripple-marked, dolomitic sandstone; and a few harder fairly thick units of pale greenish grey and light grey, resistant, cliff-forming sandy and silty dolomite" at the top (A. W. Norris, 1965). The type section is incomplete, but it is possible to divide the La Martre Falls Formation into four units which include, in ascending order (A. W. Norris, 1965, Fig. 5, Sec. 4):

I. A basal recessive unit not exposed, which overlies a granitic basement.

II. A dolomite unit, the Mazenod member.

III. A recessive unit of which only the upper part is exposed, consisting at the type section of interbedded and in part laminated, variably dolomitic, pale brown, pale or medium green sandstone, olive-green mudstone and dusky red to dark olive-green shale.

IV. An upper unit consisting of interbedded very dark grey shale; greenish grey shale and mudstone; and grey and pale greenish grey, sandy or silty dolomite which underlies the Upper Ordovician Chedabucto Lake Formation.

Units III and IV include, farther north, in the area west of the south end of Hislop Lake, "thinly bedded, laminated red dolomite weathering reddish brown; mottled greyish red and pink shale; green shale; red, platy, fissile shale; red, sandy and silty; ripple-marked dolomite containing salt crystal moulds; and grey, finely crystalline, flaggy weathering, limonitic dolomite and edgewise conglomerate towards the top" (A. W. Norris, 1965, p. 18, Sec. 11 in Appendix, and Fig. 9). Unit IV was dated by fossils as Ordovician, younger than the Chazyan, and was considered to be of Middle Ordovician age by Norris (1965, p. 20). According to Williams (1974), unit IV actually may belong with the Mount Kindle Formation and, in fact, may correlate with the basal member of the Mount Kindle Formation. Unit III is considered to be equivalent approximately to the Mount Cap Formation. Balkwill (1971, p. 14) mapped the Mount Cap and Saline River Formations as a single map-unit, and recognized possible equivalents of the Mazenod member as far north as Hottah Lake.

In the subsurface, the La Martre Falls Formation is recognizable (*see* Williams, 1974) in the Imperial Windflower Lake G-77 well (Lat. 62°56'26"N, Long. 118°59'02"W; Fig. 4, well no. 16) between the depths of 1,118 and 1,620 feet, in the Horn River Shell Levis D-76 well (Lat. 62°25'06"N, Long. 118° 29'34"W; Fig. 4, well no. 18) between 1,160 and 1,456 feet and in the Imperial Davidson Creek P-2 well (Lat. 62°11'45"N, Long. 118°15'05"W; Fig. 4, well no. 17) between 2,585 and 2,705 feet. The three wells are shown on section F-E on Figure 7.

Six lithologic units are present in the Imperial Windflower Lake G-77 well between the 1,118-foot depth (the base of the Mount Kindle or Chedabucto Lake Formation) and the granitic basement rocks at 1,620 feet (*see* Appendix II). These include, in ascending order: 1) a basal interbedded sandstone and shale unit; 2) a green shale unit (with inarticulate brachiopods in the Levis well); 3) a dolomite unit (Mazenod member); 4) a green shale unit (with inarticulate brachiopods in the Levis well; 5) an interbedded red-brown and grey-green shale unit, with light grey siltstone and thin anhydrite beds; and 6) an interbedded unit consisting of green-grey silty dolomite, very light brown dolomitic siltstone, and minor sandstone. The top unit (unit 6) is missing in the Levis D-76 and Imperial Davidson Creek P-2 wells presumably because of erosion associated with the unconformity at the base of Mount Kindle-Chedabucto Lake Formation. The top unit could correspond to the cyclic unit in the Franklin Mountain Formation as is indicated on Figure 7, or could correlate with the uppermost unit of the La Martre Falls Formation which yielded a Middle Ordovician fauna. The underlying, interbedded, red-brown dolomitic shale and siltstone unit corresponds to the Saline River Formation. The two green shale units, with the dolomite unit (Mazenod member) in the middle, and the basal unit correlate with the Mount Cap Formation.

Because the siltstone beds in the Saline River equivalents of both wells are glauconitic and in part micaceous, and the anhydrite beds are very thin, it may be difficult to separate the Mount Cap and Saline River Formation equivalents, especially in places where the Saline River equivalents are thin. For this reason, the term La Martre Falls Formation

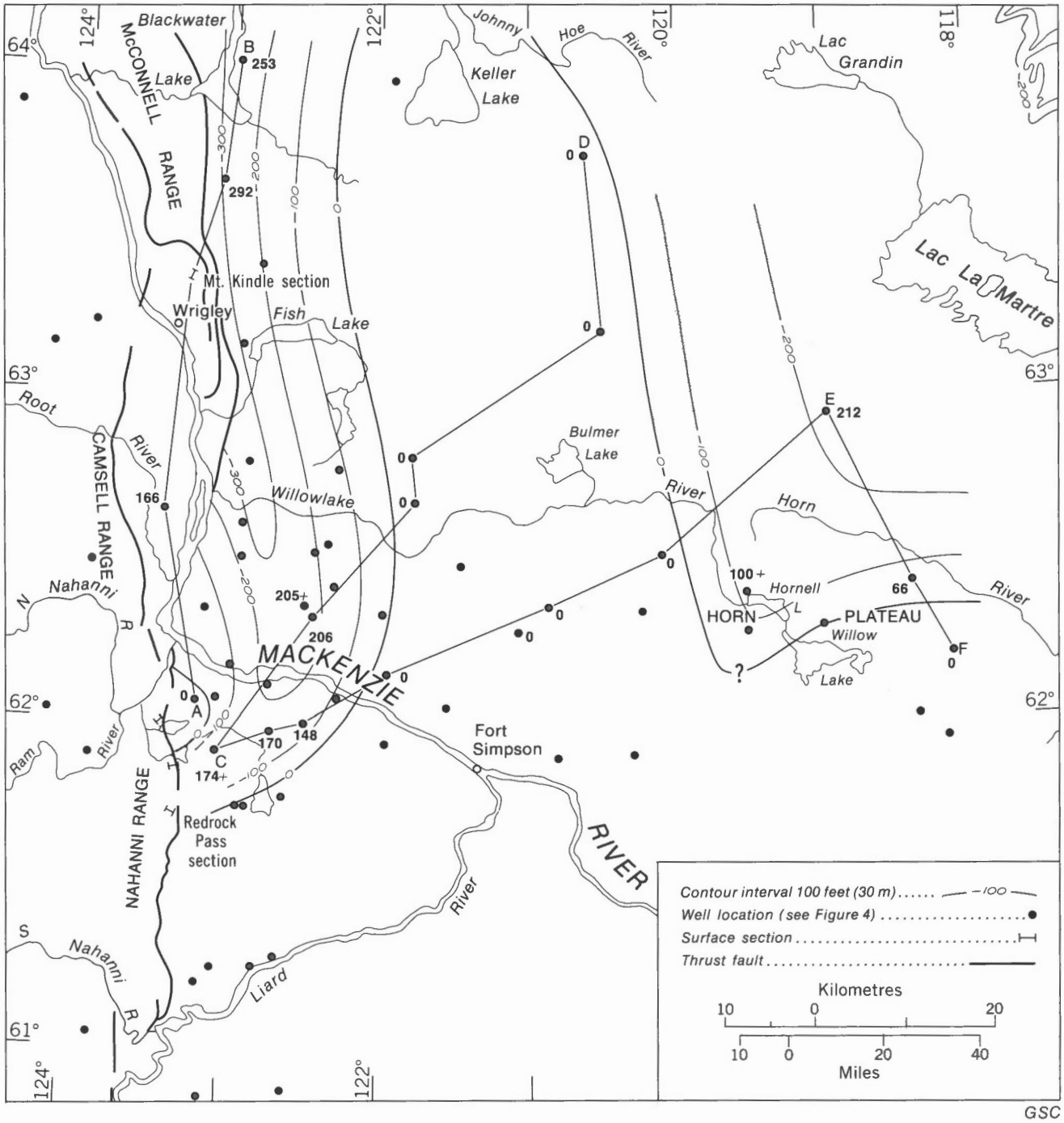


FIGURE 8. Isopach map of Saline River Formation or equivalents

could be retained for the erosional remnants of the Mount Cap Formation, Saline River Formation and Franklin Mountain Formation equivalents in the southeastern part of the Great Slave Plain, but its use should be restricted to the type area.

UPPER CAMBRIAN TO ?MIDDLE ORDOVICIAN SUCCESSION

This succession overlies Lower to Middle Cambrian strata in the McConnell Range and Proterozoic rocks in the subsurface of the Interior Plains (*see* Figs. 13 and 14). It can be demonstrated that the sequence onlaps a Precambrian high area, with the lower part, consisting of fine clastics and evaporites (Saline River Formation), missing and the upper part, a thick succession of carbonates (Franklin Mountain Formation) directly overlying Proterozoic rocks. Pre-Late Ordovician erosion greatly modified the distribution and thickness of the sequence.

As seen on the isopach maps, the Saline River Formation (Fig. 8) is absent in an area between Bulmer Lake and Keller Lake and there seems to be a thinning and absence of the Franklin Mountain Formation (Figs. 13 and 14) in the same area. The Saline River Formation is absent because of non-deposition; the Franklin Mountain Formation probably covered the area completely but later was removed by pre-Mount Kindle erosion.

Saline River Formation
(Williams, 1923)

The Saline River Formation consists of red-brown and green mottled shale interbedded with light grey siltstone with "salt-hoppers", in part dolomitic, and pink gypsiferous shale. In the McConnell Range, it is poorly exposed and has been mapped, together with the Mount Cap Formation, as a single map-unit (Douglas and Norris, 1963). The type section at Saline River, measured in detail by Usher (Aitken *et al.*, 1974), shows the formation in conformable contact with the overlying Franklin Mountain Formation. The upper contact is placed at the top of the last prominent red-brown shale or mudstone bed.

In the subsurface of the study area, the Saline River Formation overlies either Proterozoic rocks or the Mount Cap Formation (*see* Sec. A-B, Fig. 12). The formation consists of red-brown dolomitic shale laminated and interbedded with light grey, anhydritic and dolomitic, in places glauconitic, siltstone, which has scattered medium and coarse pink anhydrite crystals. The Saline River Formation is 292 feet (89 m) thick in the Union Japex *et al.* Blackwater E-11 well (Lat. 63°40'20"N, Long. 123°03'30"W; Fig. 4, well no. 3) where it occurs between the depths of 6,692 and 6,984 feet (Fig. 12). In this well, the section can be divided into: a lower clastic member consisting of shale and anhydritic siltstone (between 6,935 and 6,984 feet); a middle evaporitic member comprising salt and anhydrite (between 6,785 and 6,935 feet); and an upper clastic member consisting of shale and anhydritic siltstone (between 6,692 and 6,785 feet). In other wells, the salt in the evaporitic member is replaced by interbedded dark grey argillaceous anhydrite and black argillaceous dolomite.

Tassonyi (1969, p. 17) reported a twofold division of the Saline River Formation in the Imperial Vermilion Ridge No. 1 well (Lat. 65°07'N, Long. 126°05'W). The lower member consists of a 2,200-foot (670 m) thick succession of salt and anhydrite with minor shale and rests abruptly on dark green to greyish green flaky shales interbedded with light grey dolomitic siltstone characteristic of the Mount Cap Formation. The upper member consists of red, pink, and green, in part dolomitic shale interbedded with light-coloured anhydrite and, in places, very silty dolomite.

Equivalents of the Saline River Formation are present in the upper part of the La Martre Falls Formation (above the Mazenod member) in the Imperial Windflower Lake G-77 well (between 1,188 and 1,400 feet). The evaporitic aspect of the Saline River Formation suggests deposition in a very shallow basin. Figure 8 shows the formation to be absent in an area between Bulmer and Keller Lakes and suggests the presence of two sedimentary basins. In both basins, the contact with the overlying cyclic member of the Franklin Mountain Formation is gradational. Near the southeastern edge of the western basin (in the Ebbutt Hills area), the Saline River Formation is overlain sharply by a very sandy dolomite facies of the Franklin Mountain Formation, and the cyclic member is absent (*see* Sec. A-B, Fig. 12). In the BAOH Cli Lake K-54 well (Lat. 62°02'41.7"N, Long. 123°10'24"W), the Saline River Formation is absent.

Franklin Mountain Formation
(Williams, 1923)

The Franklin Mountain Formation (Williams, 1923) overlies "talus covered beds" of the Saline River Formation at its type section near Mount Kindle in the McConnell Range, and underlies grey, coral-bearing dolomite of the Mount Kindle Formation. Williams measured nearly 500 feet (152 m) of grey, buff-weathering, calcareous shale, with red interbeds, grading upward into buff limestone. Douglas and Norris (1963) estimated a minimum thickness of 1,265 feet (384 m) at Mount Kindle.

Equivalents of the Franklin Mountain Formation are present in the lower part of the Ronning Formation, as used by Tassonyi (1969) in the subsurface of the lower Mackenzie River north of Latitude 64 degrees (*see* Fig. 2). Macqueen (1970) subsequently recognized an unconformity present within the 'Ronning Group', and described four distinct stratigraphic units. In ascending order these include the 'cyclic', 'rhythmic' and 'cherty' units, which are unconformably overlain by the uppermost unit, the Mount Kindle Formation.

Re-examination of the type section of the Franklin Mountain Formation by Macqueen and Aitken in 1972 showed that only the upper 917 feet (296 m) of the Franklin Mountain Formation are exposed, belonging to the cherty unit (45 ft, 14 m thick) and the rhythmic unit (minimum thickness 872 ft, 266 m). The lowermost unit or cyclic unit is not exposed at the type section (Norford and Macqueen, in press).

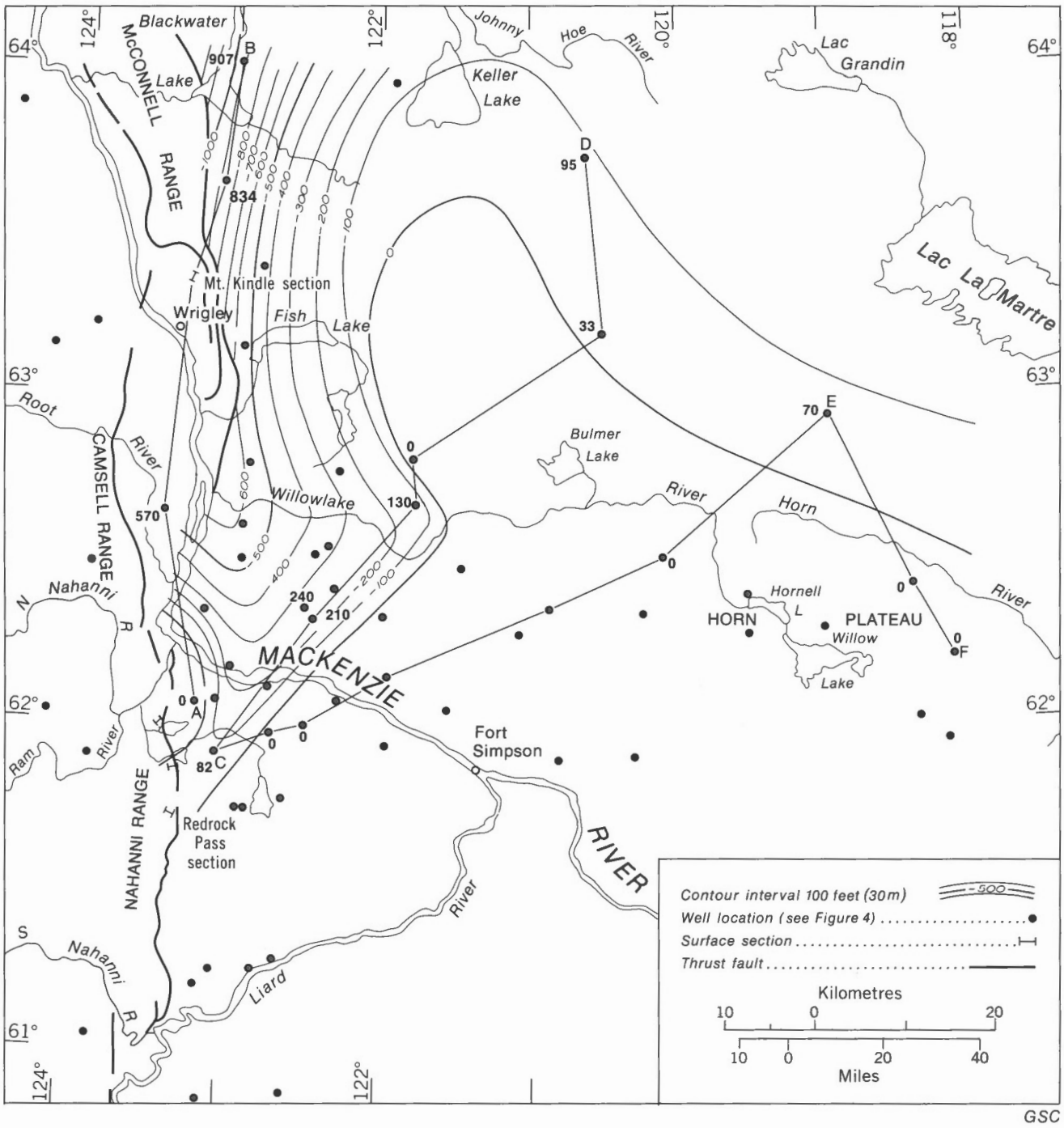


FIGURE 9. Isopach map of Franklin Mountain Formation

The Franklin Mountain Formation is widespread in the Franklin and eastern Mackenzie Mountains and consists of banded brownish grey, grey and light brownish grey dolomite with orange-weathering colours (Brady and Wissner, 1961; Macqueen, 1970).

In the subsurface of the Interior Plains in the lower Mackenzie River area, the presence and thickness of the Franklin Mountain Formation (*see* Fig. 9) depend on the amount of erosion associated with the overlying unconformity (Macqueen and MacKenzie, 1973). The cherty unit is absent in the subsurface south of Latitude 64 degrees; the rhythmic and/or cyclic units are present in the western parts of the Interior Plains, and both members are present in the outcrop area between Great Slave Lake and Great Bear Lake (Balkwill, 1971). The upper part of the La Martre Falls Formation (Norris, 1965) probably includes equivalents of the cyclic unit.

The cyclic unit overlies the Saline River Formation gradationally in the lower Mackenzie River area. The base of the cyclic unit is drawn arbitrarily at the top of the stratigraphically highest red shale or mudstone unit that is at least five feet (1.5 m) thick (Aitken *et al.*, 1973, p. 30).

In the Shell Blackwater Lake G-52 (Lat. 64°11' 05"N, Long. 122°15'12"W) and Union Japex *et al.* Blackwater E-11 (Lat. 63°40'20"N, Long. 123°03'30"W) wells (*see* Fig. 12), the cyclic unit comprises interbedded grey to dark and very dark grey, argillaceous, silty, in places pelletoidal dolomite, and light grey to light greyish brown, very silty (clear quartz silt) dolomite; toward the base, the amount of dark grey shale partings increases. Greenish grey and maroon dolomitic shale interbedded with very light grey or pale red-brown, very dolomitic siltstone is present in the basal part (*see* Appendix II).

In the Imperial Windflower G-77 well (Lat. 62° 56'26"N, Long. 118°59'02"W; Fig. 4, well no. 16), an interval present between the depths of 1,118 and 1,188 feet is thought to be equivalent to the cyclic unit (*see* Sec. C-E, Fig. 12).

In the subsurface of the Ebbutt Hills and Bulmer Lake areas, a sandy unit overlies Proterozoic rocks. In the Ebbutt Hills area and in the FPC Tenneco Root River I-60 well (Lat. 62°39'32.2"N, Long. 123°24'28.9"W), the Saline River Formation is overlain abruptly by light grey dolomite, rich in quartz sand. A similar light-coloured, sandy dolomite facies overlies Proterozoic rocks in the Bulmer Lake area in the Imperial Lac Taché C-35 well (Lat. 63°44'15"N, Long. 120°36'45"W) between depths of 1,319 and 1,415 feet and in the IOE Cartridge B-72 well (Lat. 63°11'19"N, Long. 120°29'04"W) between 2,042 and 2,080 feet (*see* cored interval between 2,041 and 2,045 ft). The basal sandy dolomite facies (this is the sandy unit on Fig. 2) and the absence of the Saline River Formation suggest the existence of a positive Precambrian area in the Bulmer Lake to Keller Lake area, which probably extends farther north and northeast in the Great Bear Plain (Fig. 5).

In the Mackenzie Mountains north of Latitude 64 degrees, a stratigraphically similar, basal sandy unit is present in areas where the Franklin Mountain Formation overlies Proterozoic rocks (Aitken *et al.*, 1973). The Franklin Mountain Formation may begin with a basal red-bed unit which grades up to rhythmic unit equivalents, or it may begin directly with rhythmic unit rocks or their equivalents, both rich in quartz sand (Aitken *et al.*, ibid., p. 40).

The rhythmic unit is moderately well exposed in the type section of the Franklin Mountain Formation at Mount Kindle. Both there and in the subsurface it consists of interbedded grey and dark grey, slightly silty, and in places sandy (silt or fine-grained sand-size quartz) micro- to very finely crystalline dolomite, locally pelletoidal. This sequence is followed by interbedded very light grey, grey, dark grey, and in places light red-brown, variably silty, micro- to very finely and finely crystalline dolomite which is, in places, finely to medium pelletoidal, with occasional dark and light grey, in part oolitic, chert inclusions. In the two Blackwater Lake wells, the upper part consists of a very light grey and light greyish brown, crypto- and very finely to coarsely crystalline dolomite with poor intercrystalline porosity.

Compared with the two Blackwater Lake wells (Fig. 4, wells 3 and 4), the section in FPC Tenneco Root River I-60 well (Fig. 4, well no. 2) is thinner and very silty and sandy (30% clear quartz silt or sand) and the cyclic unit is thin or absent (*see* Fig. 12). In the BAOH Cli Lake K-54 well, the entire Franklin Mountain and Saline River Formations are missing. This latter well may be located on the extension of the Mackenzie Arch, a Precambrian high area (*see* Aitken *et al.*, 1973, Fig. 3).

The unconformable contact between the Franklin Mountain Formation rhythmic unit and the basal unit of the overlying Mount Kindle Formation is visible in the cored interval of Shell Blackwater Lake G-52 well at a depth of 4,836 feet (*see* Appendix II).

UPPER ORDOVICIAN TO SILURIAN SUCCESSION

Carbonates of Late Ordovician and Silurian age are widespread in the Mackenzie and Franklin Mountains and in the subsurface of the Interior Plains. The Upper Ordovician part of the succession is very fossiliferous and is recognized easily over much of the North American continent (*see* Porter and Fuller, 1964). The sequence overlies the Cambrian to Middle Ordovician succession unconformably and laps on or overlies Precambrian granitic basement and Proterozoic high areas. Its present distribution has been greatly affected by pre-Early Devonian erosion, and only the lower part of the carbonate succession occurs in the subsurface of the Great Slave Plain. The sequence is represented by only one formation.

Mount Kindle Formation
(Williams, 1922)

The Mount Kindle Formation was described by Williams (1922) from Mount Kindle in the McConnell Range as a "grey magnesian limestone composed in large measure of the fossilized remains of Silurian (Niagaran) coral reefs". In the study area, the formation disconformably overlies the Franklin Mountain Formation and, in turn, is overlain disconformably by gypsiferous and brecciated limestone or by dolomite and anhydrite of Devonian age.

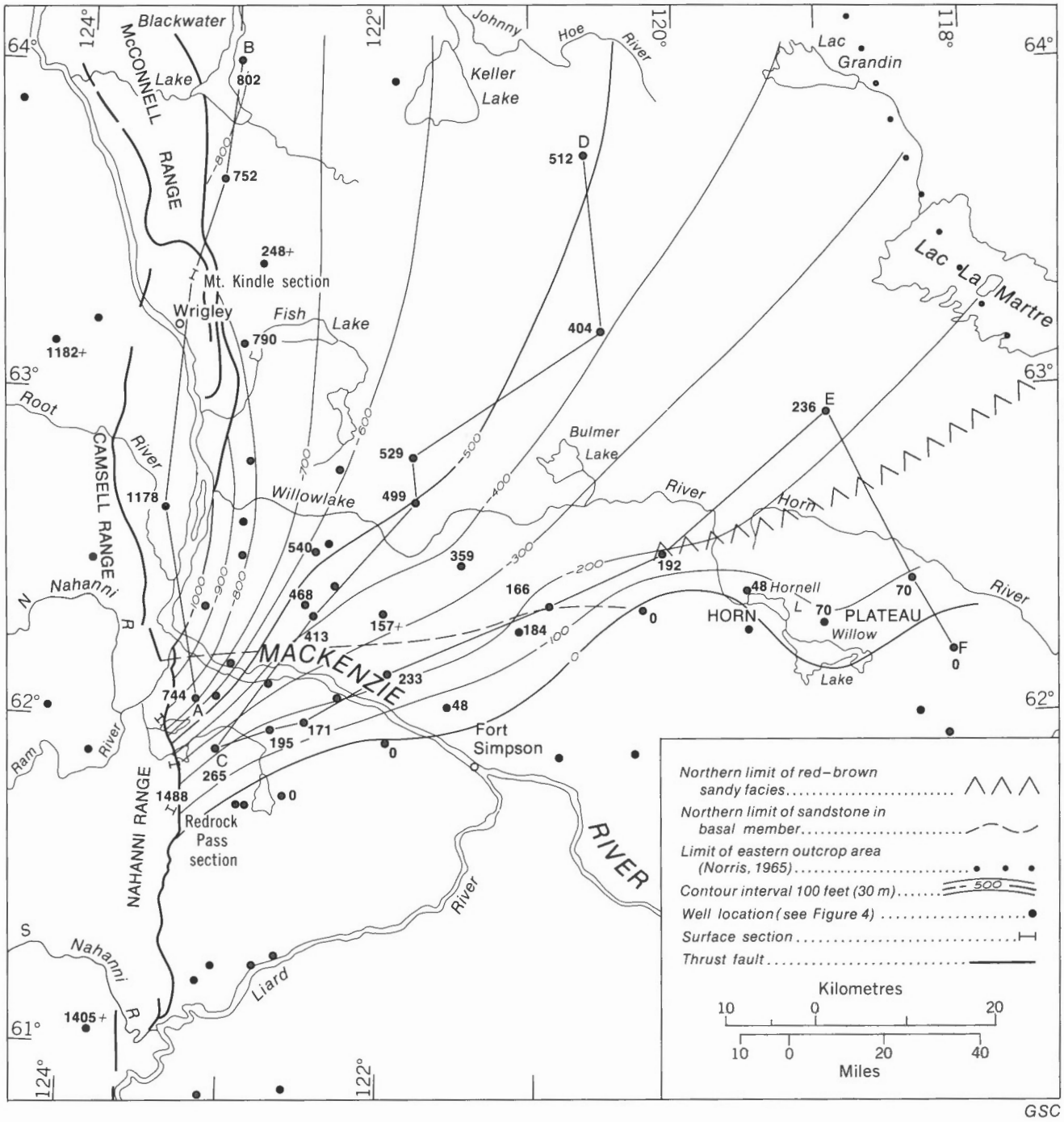


FIGURE 10. Isopach map of Mount Kindle Formation

The type section was measured in detail by Norford in 1965 (*in* Norford and Macqueen, in press), and is used to correlate the formation with strata in the subsurface (*see* Sec. A-B, Fig. 12). A completely exposed section is present in the Nahanni Range of the Mackenzie Mountains (Lat. 61°43'N, Long. 123°18'W), 11 miles (17.7 km) south of Little Doctor Lake (Brady and Wissner, 1961). At this location, the Mount Kindle Formation consists of 1,369 feet (410.7 m) of dolomite and overlies a 79-foot (24 m) recessive interval of dark, argillaceous dolomite underlain by dark grey, quartzitic sandstone. A similar argillaceous dolomite and sandstone unit is recognizable in the subsurface (*see* Sec. C-E, Fig. 14) where it unconformably overlies rocks of the Franklin Mountain Formation, the Saline River Formation, or Proterozoic quartzites.

The Mount Kindle Formation is distributed widely in the subsurface of the Great Bear Plain and along the entire outcrop area at the eastern margin of the Great Slave and Great Bear Plains (Balkwill and Yorath, 1970; Balkwill, 1971; Cook and Aitken, 1969, 1971; Macqueen and MacKenzie, 1973). The Chedabucto Lake Formation of the Great Slave Lake area (Norris, 1965) is lithologically similar to, in mappable continuity with and, in part, of the same age as the Mount Kindle Formation (Balkwill, 1971).

Norford (*in* Macqueen and Norford, in press) reports a threefold subdivision in the Mount Kindle Formation at the type section. These include: a basal member, 68 feet (20.7 m) thick, comprising argillaceous dolomite and dark shale; a middle resistant member consisting of dark grey dolomite with many colonial and solitary corals and rare stromatoporoids, 212 feet (64.6 m) thick; and an upper member which has a gradational lower boundary, and of which 579 feet (176.4 m) are exposed, consisting of grey and light grey dolomite with pentamerid brachiopods and rare solitary and colonial corals. The middle member contains a Late Ordovician fauna and the upper member has Early Silurian brachiopods.

Brady (*in* Brady and Wissner, 1961) described the Mount Kindle Formation in the Nahanni Range as being "composed of medium to dark grey, fine crystalline dolomite. The beds range from medium bedded to massive with some thin interlayers containing vugular porosity. Locally two- to five-foot beds occur which are so abundant in corals, stromatoporoids and brachiopods that they may be referred as 'biostromal'."

In the subsurface, the Mount Kindle Formation consists of a basal member of dark grey argillaceous dolomite and silty shale in places underlain or interbedded with sandstone; a lower dark grey fossiliferous dolomite member (or facies); and an upper light grey dolomite member (or facies).

The basal member varies in thickness from 68 feet (20 m) at Mount Kindle to about 30 feet (9 m) in the Imperial Windflower Lake G-77 well (Lat. 62° 56'26"N, Long. 118°59'02"W); Fig. 4, well no. 15). In the southwestern part of the study area, near the limit of the present distribution of the Mount Kindle Formation (*see* Fig. 10), the basal member consists of a clean, orthoquartzitic sandstone, interbedded with dark grey to black, argillaceous dolomite. In the BAOH Cli Lake K-54 well (Lat. 62°03'41.79"N, Long. 123°10'24.185"W; Fig. 4, well no. 1), the basal member is 98 feet (29.8 m) thick, and occurs between the depths of 8,462 and 8,560 feet. There, the sandstone is interbedded with dolomite, contains black chert grains, and is fine to coarse grained, orthoquartzitic, in places with a dark grey dolomitic matrix (*see* Appendix II). The basal member has been cored in two wells. The Shell Blackwater Lake G-52 well (Lat. 64°01'20"N, Long. 122°55'12"W; Fig. 4, well no. 4) cored an interval (between depths of 4,801 and 4,835 ft) of very dark grey, very argillaceous and silty dolomite, silty dolomite and dolomitic shale, containing small fragments of crinoids and brachiopods. The lower contact, with the Franklin Mountain Formation, at a depth of 4,832 feet, is unconformable. West of Horn Plateau in the Husky HB *et al.* Willow Lake G-32 well (Lat. 62°21'22"N, Long. 121°51'13"W; Fig. 4, well no. 14), a core was taken from an interval between the depths of 2,505 feet and 2,538 feet in the Mount Kindle Formation (*see* Sec. C-E on Fig. 14). In the core, the gradational upper contact of the basal member is visible at a depth of 2,528 feet. Dark grey, fossiliferous and argillaceous dolomite with irregular wavy shale partings overlies the dark grey, very silty, dolomitic shale of the basal member. No fossils were obtained from the shale but, in the argillaceous dolomite, corals were found that belong to the same Late Ordovician fauna in the dark grey dolomite facies (*see* Appendix I).

The dark grey dolomite member of the Mount Kindle Formation consists of dark greyish brown and greyish brown dolomite, very finely to finely crystalline, with medium to very coarse fragments of brachiopods and crinoids. Semi-quantitative X-ray diffraction analysis of the dark grey dolomite shows the presence of siliceous material and a trace of illite (*see* Fig. 11). Very dark grey to black chert inclusions and nodules are present in the basal part of the member. In the upper part, light grey chert inclusions are present, some of which contain abundant small fragments of brachiopods, crinoids, trilobites and corals floating in a microcrystalline matrix. Silicification has preserved the original texture of the sediment, which must have been a calcilutite with 10 to 20 per cent of fine to very coarse skeleton fragments. In the calcilutite, different species of tabulate corals and septate corals are found as dolomitized and partly leached out fossils, in most cases poorly preserved. No stromatoporoids were noted.

Corals were identified by B. S. Norford from cores in the dark grey member of the following wells (*see* Appendix I): Husky HB *et al.* Willow Lake O-27A (Lat. 62°16'48"N, Long. 121°04'21"W) between 2,524 and 2,554 feet; Husky HB *et al.* Willow Lake G-32 (Lat. 61°21'22"N, Long. 120°51'13"W) between 2,505 and 2,538 feet; Fina *et al.* Willow Lake L-59 (Lat. 62°08'40"N, Long. 131°56'00"W) between 2,340 and 2,387 feet; IOE - Triad Ebbutt J-70 (Lat. 62°19'31"N, Long. 121°57'03"W) between 2,606 and 2,625 feet; FPC Tenneco Root River I-60 (Lat. 62°39'32.21"N, Long. 123°24'28.96"W) between 6,620 and 6,645 feet; and Pan Am A-1 Mattson Creek No. 1 (Lat. 61°02'42"N, Long. 123°48'30"W) between 10,320 and 10,330 feet.

The genera *Bighornia, Favistina, Lobocorallium, Palaeophyllum, Calapoecia, Catenipora, Manipora,*

Location	Unit	Lithology	Sample Depth in Feet	Percentage of Minerals Present											
				Quartz	Feldspar	Calcite	Dolomite	Siderite	Anhydrite	Halite	Chlorite	Illite	Pyrophillite	Pyrite	Hematite
Blackwater E-11	Elk Point Group	Dolomite, light brown, argillaceous	5000-5050	15			85								
		Dolomite, light grey, anhydritic	5030-5040	11			72		17						
		Dolomite, light brown, mottled reddish brown	5080-5090	18	1	3	76					2			
Willow Lake L-59		Dolomite, light brown, mottled reddish brown	2245		1		98								1
Blackwater E-11	Mount Kindle Fm	Dolomite, light brown, slightly argillaceous	5130-5140	2	2		96								
		Dolomite, dark grey, argillaceous	5440-5460	7	3		90					Tr			
Willow Lake L-59		Dolomite, light greyish brown	2375	2			98								
Blackwater Lake G-52		Dolomite, very dark grey, argillaceous	4808.5	11	1		88								
Root River I-60	Saline River Fm	Sandstone, grey	7681	70		5	25								
Cli Lake K-54	Proterozoic (undivided)	Siltstone, mottled grey and reddish brown	8710	51	3	7						37*			2
Root River I-60		Argillite	7682	64	3	6						15		12	
		Argillite, olive-grey, sideritic	8010-8110	44	2	1		34			8	6			
		Sandstone, light greenish grey	8449	93	1	1	1	1				3	5		
Fort Simpson M-70		Argillite, silty, green and reddish brown, hematitic	3250	53	3	7					2	32*			3
Cartridge B-72		Sandstone, light greenish grey	2086	63	23	2	5	1			2	2		1	1
Harris River A-31		Sandstone, light greenish grey, ? glauconitic, pyritic	2408	87	8	Tr					3	2			
		Sandstone, light grey, feldspathic	2402	85	11	1	1	1			1	1			
Lac Taché C-35		Sandstone, light grey, mottled reddish brown, hematitic	1650	92	4	Tr	Tr				1				3
Davidson Creek P-2	Precambrian	Granite, pink	2706	47	13		2			11		24		3	

* 2M Illite Polynomorph

GSC

FIGURE 11. Results of semi-quantitative mineralogical X-ray diffraction analyses of selected samples.
Note: Discrepancies between lithologic descriptions and X-ray diffraction analyses are related to the use of minute samples in the analyses

Palaeofavosites and *Sarcinula* are represented. These indicate a Late Ordovician age. In the Pan Am A-1 Mattson Creek well, a core near the top of the dark grey member yielded *Cystihalysites*, which indicates a Silurian age.

Porosity in the dark grey dolomite member is of a vuggy nature. Most fossils have intrafossil porosity and in some parts solution and dolomitization have produced large, irregularly rounded vugs lined with clear dolomite and quartz crystals. In places, the matrix has poor intercrystalline porosity, which connects the vugs. Occasionally the vugs are filled with secondary anhydrite.

Above the dark grey dolomite member the colour changes. In the upper, light grey dolomite member, the dolomite is light greyish brown and greyish brown, with poorly defined dark grey intervals that have irregular, dark grey, in part stylolitic, shale laminae and partings. The change is gradational and is not detectable on borehole logs. The dolomite of the light grey member is micro- to very finely crystalline, in places slightly silty (clear quartz silt) and has rare scattered light grey chert inclusions. Semi-quantitative X-ray diffraction analysis of light grey dolomite shows the presence of up to 2 per cent siliceous material and the absence of clay minerals (*see* Fig. 11). Bedding is very poorly developed. Some beds are pelletal and contain abundant rounded vugs (0.5-1.0 cm in diameter) and grade upward to faintly laminated, non-porous dolomite. This "laminoid-fenestral" or "birdseye" fabric (Tebbutt *et al.*, 1965; Shinn, 1968) is generally found in sediments of shallow, subtidal or supratidal environments (Shinn, ibid.). The vugs usually are not connected by intercrystalline porosity. In some cases the vugs are related to intrafossil porosity; elsewhere they are related to differences in the original texture of the carbonate mud. In areas where the Mount Kindle is buried below Devonian anhydrite, some vugs are filled with clear secondary anhydrite, and small anhydrite crystals (0.1-0.3 cm) occur scattered in the matrix, replacing the dolomite. In the Imperial Lac Taché G-35 well (Lat. 63°44'15"N, Long. 120°36'45"W; Fig. 4, well no. 10), the light grey dolomite member has a brecciated appearance with silt- and anhydrite-infilled vugs. In this case, the vuggy porosity is the result of a solution process that began in the fossiliferous parts of the dolomite. Partial brecciation, dolomitization, infill with dolomitic silt and, finally, replacement of dolomite by anhydrite along fractures and in the vugs suggest that the light grey dolomite member of the Mount Kindle Formation has been above sea level for a long period of time.

A few wells have cored the light grey member: Imperial Lac Taché C-35 (Lat. 63°44'15"N, Long. 120°36'45"W) between 853 and 872 feet; Husky HB *et al.* Willow Lake H-10 (Lat. 62°49'16"N, Long. 121°34'01"W) between 2,267 and 2,317 feet; Horn River CDR Willow Lake I-71 (Lat. 62°40'44"N, Long. 121°43'18"W) between 2,454 and 2,504 feet; and Chevron CS Ebbutt G-72 (Lat. 62°21'25"N, Long. 122°28'38"W) between 3,340 and 3,400 feet. Some gastropods, brachiopods

and poorly preserved corals are present in the Willow Lake I-70 well. The corals found at a depth of 2,463 feet (750 m) include *Catenipora* sp., *Cystihalysites* sp., *Favosites?* sp. and suggest a Silurian age (*see* Appendix I).

In the central and eastern parts of the study area, the subdivision into dark and light grey dolomite members is not useful. The upper part of the dolomite is missing because of pre-Devonian erosion leaving a thin, dark grey basal shale member and the lower dolomite member which, in these regions, has changed in colour to light brown. This dolomite is crinoidal in approximately the lower 100 feet (30 m).

In the Horn Plateau area (*see* Fig. 10), the stratigraphic equivalents of the dark grey dolomite member and the basal member are light reddish brown or reddish brown mottled. The basal member in the Chevron Hornell Lake G-24 well (Lat. 62°23'21"N, Long. 119°34'40"W; Fig. 4, well no. 23) consists of interbedded light brown, in part red-brown mottled, very sandy dolomite and light grey, in part green mottled dolomitic siltstone. In the Imperial Triad Willow Lake B-28 well (Lat. 62°17'05"N, Long. 119°04'25"W; Fig. 4, well no. 24), the basal member consists of a light grey, light reddish brown mottled, sandy dolomite, which overlies a light grey, reddish brown mottled, dolomitic sandstone. This facies is common in the outcrop area north of Great Slave Lake near Chedabucto Lake, in the Upper Ordovician dolomite of the Chedabucto Lake Formation (Norris, 1965). The Chedabucto Lake Formation in the type area near Chedabucto Lake can be correlated with the lower part of the dolomite member of the Mount Kindle Formation. The use of the term Chedabucto Lake Formation should be restricted to the reddish brown, silty and sandy facies of the Upper Ordovician dolomite present near Chedabucto Lake and in the subsurface of the Great Slave Plain. The disappearance of the Chedabucto Lake Formation south of Alexander Point on Great Slave Lake (Norris, 1965, p. 22) can be attributed to pre-Devonian erosion.

Environment of deposition

One would expect that the large number of cores taken from the Mount Kindle Formation would make it possible to study the sedimentological aspects of the carbonate rock. Unfortunately there are very few sedimentary features present in the dolomite. It is probable that the original sediment was a calcareous mud (calcilutite) with subtle sedimentary structures which have been obliterated by bioturbation and the process of dolomitization. The fossiliferous parts of the dolomite are affected by the process of solution and secondary dolomitization and the results are large vugs partly filled with dolomite crystals. Consequently, little can be said of the faunal community in relation to the environment of deposition. The following discussion, therefore, is based as much on negative as on positive information and is, by necessity, highly speculative.

The sediments of the basal member of the Mount Kindle Formation comprise dark grey, very silty shale and argillaceous and fossiliferous dolomite of a normal marine environment. The sandstone unit developed along the southwestern margin of the present day distribution of the Mount Kindle Formation may reflect a basal transgressive or near-shore environment.

In the eastern parts of the study area the deposition of dark grey calcareous muds was dominant, and an abundance of corals in growth position is found together with scattered fragments of crinoids and brachiopods. The lack of well-developed bedding and the non-existence of sediment deposited under the influence of currents (laminated and well-sorted sediments) suggest a semi-restricted, shallow-water environment. The presence of patches rich in crinoid and brachiopod debris suggests bioturbation. Some of the light grey chert inclusions show up to 10 per cent of unsorted small fossil fragments in a cryptocrystalline matrix, indicating that some of the original sediment was a mud rich in skeletal debris. It is speculated that the corals, brachiopods and crinoids formed organic banks near tidal inlet channels and that the remains of brachiopods and crinoids were scattered in the bioturbated lime mud which accumulated in the areas behind the organic banks, much in the same way as calcareous sands accumulate at present in Florida Bay (Ginsburg, 1956).

In the central and western parts of the study area, the Mount Kindle Formation is represented by a pale dolomite facies. The lower part of this facies is crinoidal and coraliferous and the upper part is dominated by a lagoonal, carbonate mud facies with rare fossil remains. The nature of the lagoonal facies is well displayed in the core of the Willow Lake River I-71 well (Lat. 62°40'44"N, Long. 121°43'18"W) and consists of poorly defined beds with sharply defined, clear dolomite infilled voids having a laminar arrangement. Some beds contain abundant pellets, mud lumps and intraclasts with clear cement filling interparticle openings; these show various degrees of "soft sediment deformation". The deformed beds commonly have undisturbed upper contacts with desiccation cracks, in places partly filled with laminated intraclasts.

The infilled voids are reminiscent of the "laminoid-fenestral" fabric (Tebbutt *et al.*, 1965) and "birdseye" structure (Shinn, 1968) commonly found in carbonate sediments of supratidal and intertidal origin (Shinn, ibid.). Some of the pellets and lumps are thought to be the remains of fecal pellets of invertebrates (brachiopods and gastropods are found in the core) or of microorganic slimes that accumulate on any surface. Some of the laminated intraclasts may have been derived by erosion of compacted mud (Ginsburg, 1964, p. 20). The rounded vugs commonly seen in other cores of the light grey member have arisen from leaching of the original laminar-fenestral fabric.

DEVONIAN TO CARBONIFEROUS SUCCESSION

This sequence overlies the Upper Ordovician-Silurian succession unconformably and onlaps the granitic basement of the Tathlina Lake Uplift (*see* Belyea, 1971). In the subsurface of the Great Slave Plain, the lower part of the sequence comprises carbonates and evaporites of Middle Devonian age. In the Franklin and eastern Mackenzie Mountains, the unconformity at the base of the sequence is not

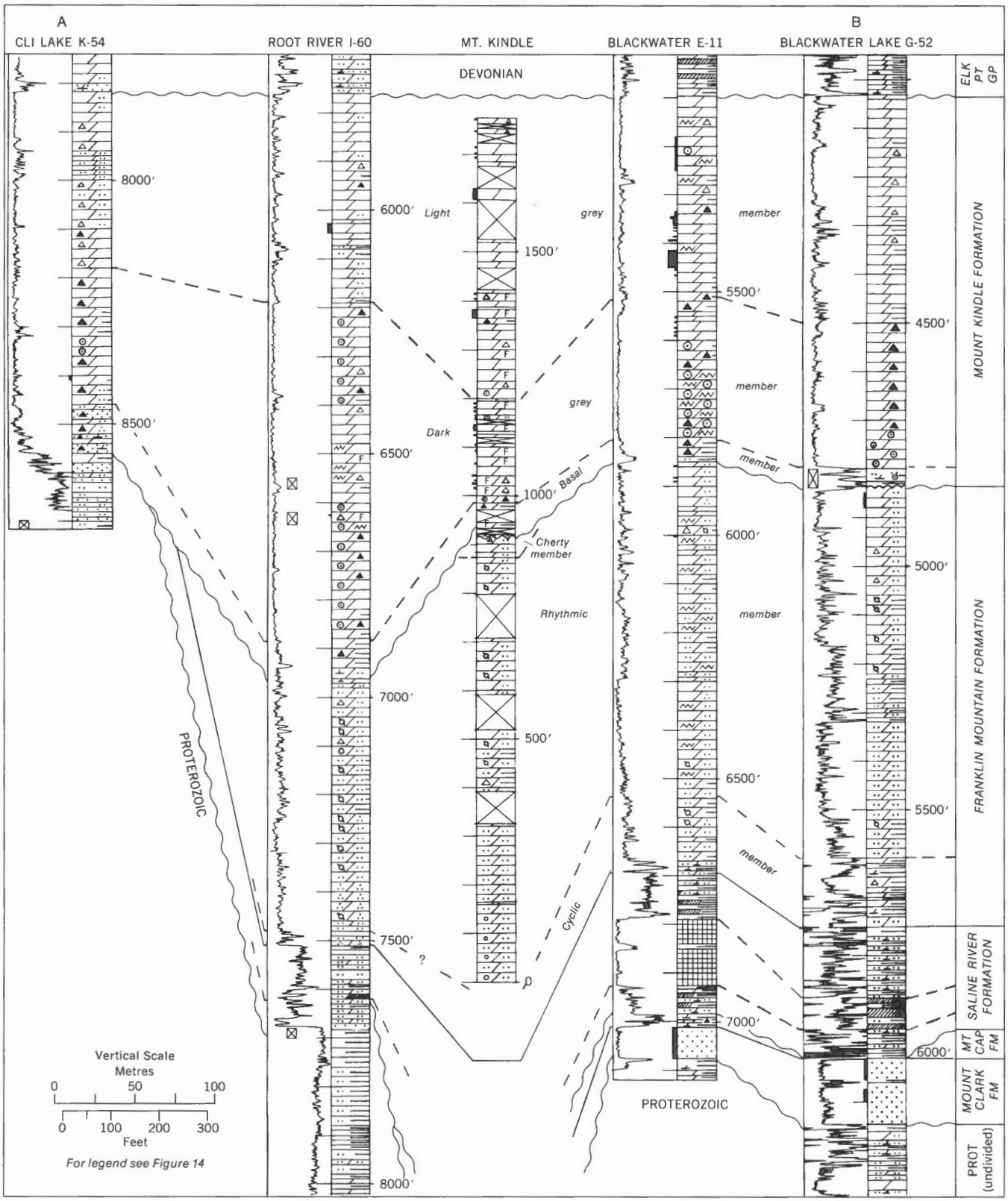


FIGURE 12. Stratigraphic sections between A and B (*see* Fig. 4) showing the correlation of the lower Paleozoic formations between the stratigraphic section at Mount Kindle and those in nearby exploration wells using combined radioactivity and lithology logs

pronounced, and Lower Devonian and ?Upper Silurian carbonates form the base of the sequence. In the study area, the Mount Kindle Formation is overlain by variably sandy, crypto- to microcrystalline dolomite, mostly light grey or greyish brown, with traces of pale red-brown. Semi-quantitative X-ray diffraction analysis of the pale red-brown dolomite shows the existence of 15 to 20 per cent quartz and 1 to 2 per cent each of illite and feldspar (*see* Fig. 11). These basal beds grade upward into the interbedded dolomite and anhydrite of the lower Elk Point Group. In the subsurface, immediately northeast of the Nahanni Range, light and dark grey banded, very finely crystalline, in places fine pelletoidal dolomite of the Elk Point Group (Arnica Formation) overlies the Mount Kindle Formation. Here the change in lithology is not well marked. In the Nahanni Range, the Mount Kindle underlies "260 feet of dolomite interbedded with sandstone" of map-unit 10 of the Sibbeston Lake map-area (Douglas and Norris, 1960), which were included in the basal part of map-unit 9 of the Camsell Bend map-area (Douglas and Norris, 1961). The age of this "sandy unit" (Brady and Wissner, 1961) is unknown.

STRUCTURAL GEOLOGY

Three structural regions are present in the general study area. The Canadian Shield to the east is the exposed part of a vast cratonic region which dips westward to form the basement of the Interior Plains region and the Mackenzie fold-belt region. In the Interior Plains, flat-lying and gently dipping sedimentary rocks of ?Helikian and early Paleozoic age overlie the rocks of the Canadian Shield and, in the Mackenzie fold belt of the Franklin and Mackenzie Mountains to the west, the same Helikian and early Paleozoic cover is folded and thrust-faulted (Douglas *et al.*, 1970).

The Canadian Shield east of the study area consists of two structural provinces: the Slave and the Bear Provinces of Figure 1 (Stockwell *et al.*, 1970). In the Slave Province, Archean volcanic and sedimentary rocks of the Yellowknife Group were metamorphosed and intruded by quartzdiorite, granodiorite and quartzmonzonite plutons during the Kenoran Orogeny. In the Bear Province, sedimentary and volcanic rocks of Aphebian age unconformably overlie the Archean rocks of the Slave Province and were folded, metamorphosed and intruded by granodiorites and granites during the Hudsonian Orogeny (in the Wopmay subprovince). The Aphebian complex, in turn, is overlain unconformably by unmetamorphosed sedimentary and volcanic rocks of Helikian age (in the Coppermine subprovince on Fig. 1).

In the Interior Plains, between Great Slave Lake and Great Bear Lake, rocks of the Canadian Shield are overlain unconformably by gently westward-dipping sedimentary rocks of Helikian and early Paleozoic age (*see* Fig. 3). The sedimentary cover is not, or only slightly, affected by the Laramide Orogeny, and relatively minor epeirogenic events are mappable. The sedimentary cover thickens gradually, and in places rapidly, toward the west (Law, 1971). The boundary with the Mackenzie fold belt to the west is not sharp; folds and thrust faults are present in the subsurface northwest of Ebbutt Hills and east of Blackwater Lake (Law, 1971; Douglas and Norris, 1961).

The Mackenzie fold belt lies west of the Interior Plains and is composed of a layered crust of Phanerozoic and Helikian sedimentary rocks which was folded and transported differentially to the northeast over a relatively passive basement during the Laramide Orogeny (Norris, 1972). The Mackenzie fold belt forms a great arc which protrudes northeastward toward the continental interior (*see* Fig. 1). It consists of a southern flank made up of right-hand *en echelon* anticlines, in which the individual folds trend north, and of a northern flank made up of left-hand *en echelon* anticlines, in which the individual folds trend northwest (Norris, ibid.).

The eastern ranges of the Mackenzie fold belt are west-dipping homoclinal structures in Middle Devonian carbonates which are underlain by thrust faults (Nahanni and Camsell Ranges), or are anticlinal folds. The McConnell Range is an asymmetrical, north-trending anticline in Helikian and Paleozoic sedimentary rocks underlain by thrust faults, complicated by faults in the crestal region and broken along the strike by transverse faults.

EPEIROGENETIC EVENTS AND PRECAMBRIAN PALEOTOPOGRAPHY

Important Paleozoic epeirogenetic events in the Interior Plains mark their presence as unconformities at the base of the Cambrian, Upper Ordovician and Devonian successions. Minor epeirogenetic events are present within these successions and are recorded as local unconformities or pronounced facies changes. Some of the minor events can be attributed to paleotopographic features of the sub-Cambrian unconformity.

Proterozoic quartzite and argillite are present in the western and central parts of the study area. They are overlain unconformably by Cambrian strata. In the eastern parts of the Great Slave Plain, Cambrian strata directly overlie Precambrain granitic and metamorphic rocks.

On the two sections C-D and C-E (Figs. 13 and 14), Cambrian strata of the Saline River Formation unconformably overlie Proterozoic rocks in the west, and are overlain by the Franklin Mountain Formation toward the east. Both formations are truncated by the Mount Kindle Formation which directly overlies the Proterozoic rocks in the area between Bulmer Lake and Keller Lake. In the Lac La Martre area and along the eastern (outcrop) margin of the Interior Plains, a relatively thin but complete Cambrian section is present. The disappearance of the Franklin Mountain Formation in the Bulmer and Keller Lakes area can be explained by erosion that pre-dates the deposition of the Mount Kindle Formation. The disappearance of the Saline River Formation may be attributed in part to the same phenomenon (*see* Sec. C-E, Fig. 14) but the presence of a sandy dolomite facies of the Franklin Mountain Formation directly overlying Proterozoic rocks on Section C-D (Fig. 13) suggests either an unconformity at the base of the sandy Franklin Mountain facies or the existence of a pre-Saline River basement high.

North-south Section A-B (Fig. 12) shows a complete and thick Cambrian succession in the subsurface just east of the McConnell Range, which thins in a southward direction. In the FPC Tenneco Root River

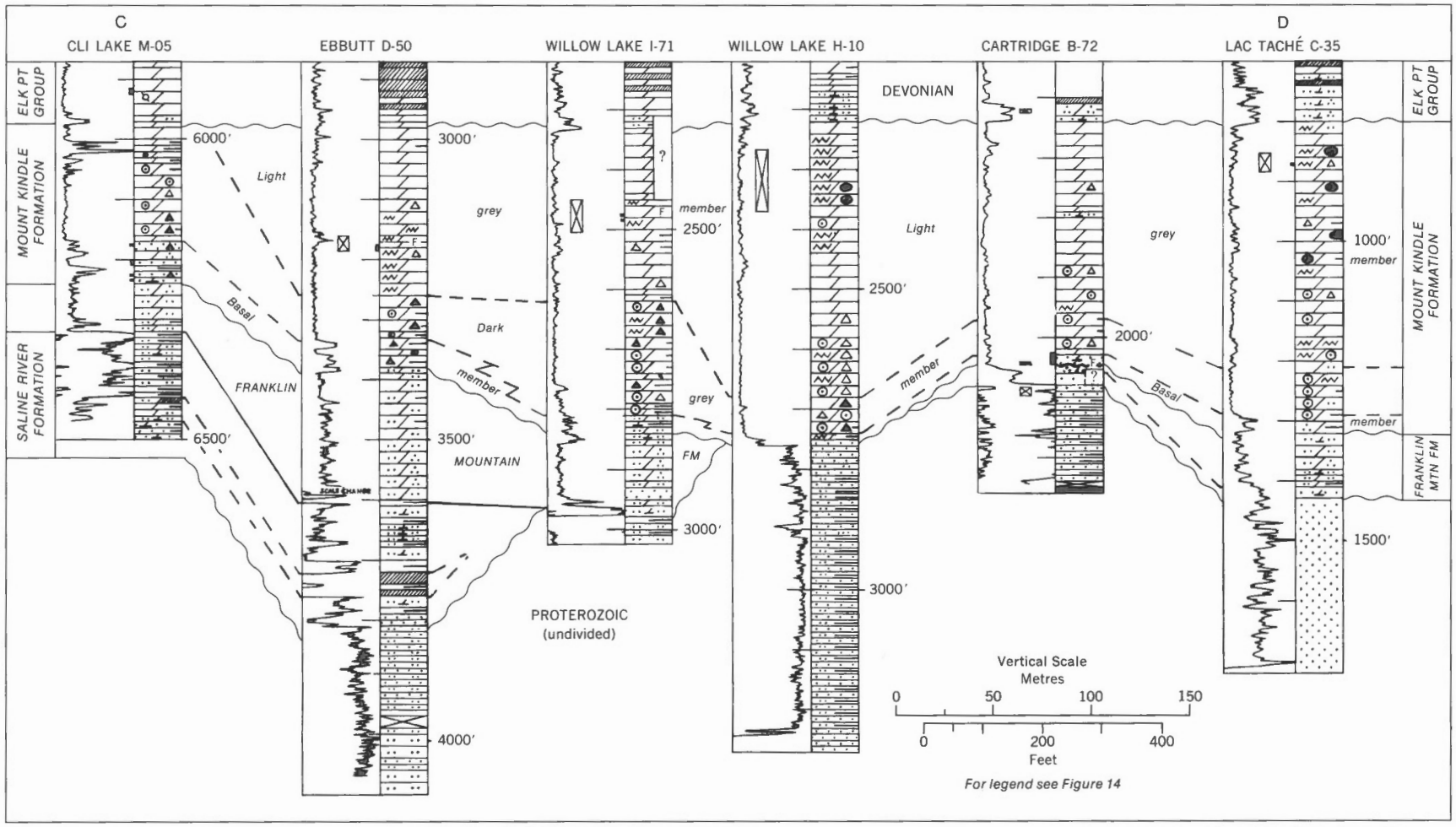


FIGURE 13. Stratigraphic sections between C and D (*see* Fig. 4) showing the correlation of the lower Paleozoic formations between selected exploration wells using combined radioactivity and lithology logs

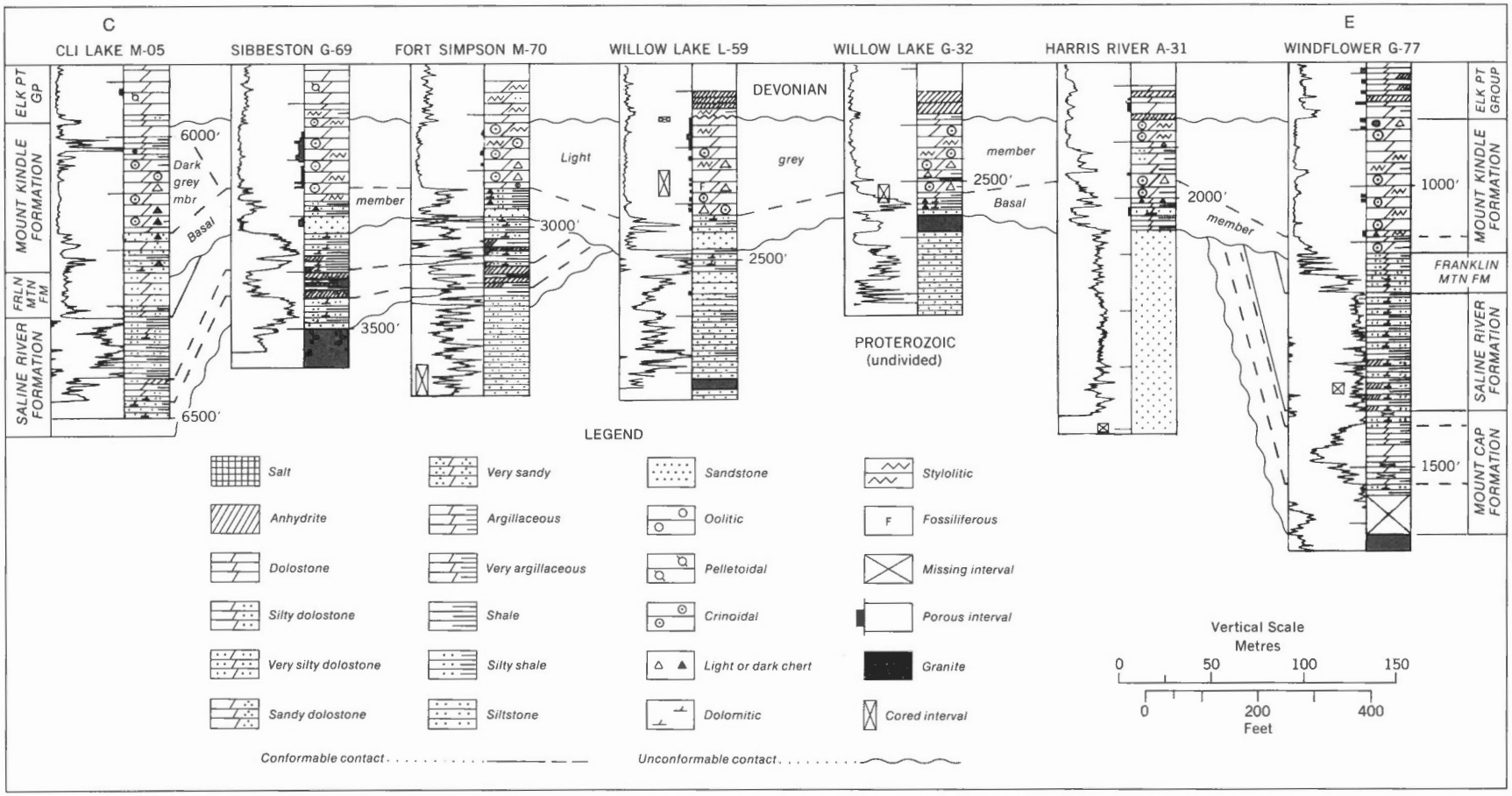


FIGURE 14. Stratigraphic sections between C and E (*see* Fig. 4) showing the correlation of the lower Paleozoic formations between selected exploration wells using combined radioactivity and lithology logs

I-60 well (Fig. 4, well no. 2), the Saline River Formation directly overlies Proterozoic rocks and in the BAOH Cli Lake K-54 well (Fig. 4, well no. 1) the complete Cambrian succession is missing. The absence of the Mount Clark and Mount Cap Formations can be explained by an unconformity at the base of the Saline River Formation or by the presence of a pre-Saline River basement high.

Aitken *et al.* (1973) mapped similar stratigraphic relationships in Cambrian rocks in the northeastern part of the Mackenzie Mountains and attributed these relationships to the presence of a positive tectonic element, or series of elements, of Proterozoic and early and middle Paleozoic ages which they identified as the Mackenzie Arch. Aitken *et al.* (ibid., p. 9, Fig. 3) show that the Cambrian formations onlap the Mackenzie Arch and unconformities at the base of the Cambrian and at the base of the Saline River Formation are postulated.

In the subsurface of the southern Great Bear Plain, the presence of a similar positive tectonic element is assumed in the area between Bulmer Lake and Keller Lake (*see* Fig. 5). This Precambrian high is flanked on its eastern and western sides by basal Cambrian sandstones and the Mount Cap and Saline River Formations and is overlain at the crest by a sandy facies of the Franklin Mountain Formation (*see* Fig. 3). This Precambrian paleotopographic high has been named the Bulmer Lake Arch (Meijer-Drees, 1974). It is suggested that the Bulmer Lake Arch consists of gently westward-dipping, Proterozoic argillite and quartzite which overlie a granitic and metamorphic basement.

The Bulmer Lake Arch cannot be defined precisely at present because of a scarcity of well control, but it coincides with a relatively positive gravity anomaly in the Bulmer Lake area, the "Bulmer Lake High" of Hornal *et al.* (1970). This anomaly extends from the Trout River northward through Bulmer Lake and Keller Lake to McVicar Arm on Great Bear Lake. There it merges, on Leith Peninsula, with a relatively positive gravity anomaly which coincides with a Precambrian granite ridge mapped by Balkwill (1971). This ridge stands 1,100 feet (335 m) above the base of nearby Cambrian sandstone. Near Hottah Lake, the ridge is flanked on its southeastern side by approximately 325 feet (99 m) of Cambrian sediments. On the northwestern flank, it is capped by Proterozoic rocks of the Hornby Bay Group which dip gently to the northwest and are estimated to be about 1,000 feet (304 m) thick. The Hornby Bay Group is flanked in turn on the northwest side by Cambrian sediments of the combined Mount Cap and Saline River Formations, by the cyclic unit of the Franklin Mountain Formation and by the Mount Kindle Formation.

The geology in the subsurface north of Fort Simpson appears to be strikingly analogous to the geology of Leith Peninsula as described by Balkwill. The similarity of the geology in the two areas permits the suggestion that the eastern boundary of the "Bulmer Lake High" gravity anomaly (Hornal *et al.*, 1970) may be the southward extension of the boundary between the Wopmay subprovince and the Coppermine homocline of the Bear Province (*see* Fig. 1).

The total absence of Cambrian formations in the BAOH Cli Lake K-54 well (Fig. 4, well no. 1) and the partial absence of Cambrian strata in the FPC Tenneco Root River I-60 well (Fig. 4, well no. 2) west of Fort Simpson could be explained in part by pre-Mount Kindle erosion and by the presence of another positive tectonic Precambrian element, located west of the Root River I-60 well. Very little is known about this structure, except that it is on trend with the Mackenzie Arch.

In summary, the stratigraphic relationships of the Cambrian formations in the subsurface of the Great Slave Lake and southern Great Bear Plain can be attributed to paleotopographic features of the Precambrian basement. The Precambrian paleotopographic high areas may have acted as barriers and were a local source of clastic sediment. Effects of differential compaction and depositional draping can be expected over these basement ridges.

The Mount Kindle Formation of Late Ordovician age truncates Cambrian geology and forms a blanket of carbonate rocks which thickens toward the northwest (*see* Fig. 10). To the southwest, clean quartzose sandstone in the basal member of the Mount Kindle Formation suggests the presence of positive tectonic elements farther south. Uplift of the southern Interior Plains at the end of the Silurian period was followed by erosion which, in some areas, may have removed the entire lower Paleozoic succession.

The Devonian succession overlies the Mount Kindle Formation unconformably and directly overlies Precambrian rocks in the area south of the zero isopach line of the Mount Kindle Formation of Figure 10. Rocks of early Middle Devonian age onlap the Tathlina Uplift, a Precambrian paleotopographic high south of the study area (Belyea, 1971). The evaporitic succession of carbonates, anhydrite and salt that overlies the Mount Kindle Formation is marked at the base by a sandy dolomite facies which thickens in western and northwestern directions.

ECONOMIC GEOLOGY

A proper assessment of the hydrocarbon potential of the lower Paleozoic succession (Cambrian and Ordovician Periods) in the study area requires more than the knowledge obtained from the study of drill cuttings and cores. Some work has been directed toward the gathering of more data in order to evaluate some of the parameters important for this assessment. Discussed here are the following parameters: (1) success ratio and well density; (2) existence of source rocks; (3) depth of burial related to the maximum paleotemperature and hydrocarbon generation; (4) evaluation of the porous intervals; and (5) configuration of expected hydrocarbon reservoirs.

1. Success ratio and well density.

None of the exploratory wells drilled in the southern Great Bear Plain has indicated the presence of oil or gas in rocks older than Devonian. The success ratio is 0 to 24. Well density in the area, however, is very low, roughly one well per 1,000 square miles (2589 km^2).

2. Existence of source rocks.

The basal and the dark grey dolomite members of the Mount Kindle Formation are the only potential source rocks present in the lower Paleozoic successions. Norford and Macqueen (in press) report organic carbon weight per cents between 0.32 to 0.77 for the dolomite of the Mount Kindle Formation at Mount Kindle. An argillaceous dolomite in the basal member has 0.64 weight per cent organic carbon. A sample of the shale was taken from core no. 2, Husky HB *et al.* Willow Lake G-32 well (Lat. 62°21'22"N, Long. 120°51'13"W), and was analyzed by L. R. Snowdon (Institute of Sedimentary and Petroleum Geology, Calgary). The results of the analysis are presented in Figure 15. The percentage of the organic carbon present in the shale is about average for shale and the ratio of total benzene methanol extract over total organic carbon is low. If the thickness of the shale, which varies from 10 to 20 feet (3-6 m), is taken into account, it is evident that the basal member of the Mount Kindle Formation, if it is considered at all as a source rock, cannot have generated large amounts of hydrocarbons.

Depth	2530-2538 feet
Weight of samples	144 grams
Organic carbon (acid insoluble)	0.868%
Mineral carbon (acid soluble)	3.220%
Total benzene methanol extract	9.1 mg
Ratio extract/total sediment	63.15×10^{-6}
Ratio extract/organic carbon	7.28×10^{-3}

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FIGURE 15. Chemical analysis of the organic material present in basal shale member of the Mount Kindle Formation, Husky H.B. *et al.* Willow Lake G-32, core no. 2

3. Depth of burial and geothermal gradient.

The depth at which the rocks of the Cambrian and Ordovician successions are present in the southern parts of the Great Bear Plain varies greatly. In the east, the rocks crop out along the Precambrian Shield. In the central parts of the Plain, the top of the lower Paleozoic succession is 800 to 3,000 feet (243-914 m) deep and, in the western part, the depth increases to 5,000 to 7,800 feet (1524-2377 m). Temperatures in the various exploratory wells (measured in connection with the logging and testing operations during the drilling of the well) vary from 60°F at a depth of 1,700 feet (518 m)(Imperial Lac Taché well, Lat. 63°44'15"N, Long. 120°36'45"W) to 162°F at a depth of 6,800 feet (2072 m)(FPC Tenneco Root River I-60 well, Lat. 62°39'32.2"N, Long. 123°24'28.9"W). This gives a geothermal gradient of 2°F per 100 feet of depth. According to Tissot *et al.* (1971), the depth of burial (increases in pressure and especially temperature) "constitutes the determining factor in the evolution of organic matter. The temperature rise promotes the formation of petroleum compounds particularly hydrocarbons, at the expense of kerogen. The transformation is initially very slight and becomes appreciable only after a certain threshold [corresponding to about 60°C (146°F) in the Paris Basin of France] is passed; then the rate of transformation increases rapidly."

It is now generally accepted that, in the evaluation of the hydrocarbon potential of a sedimentary succession, some knowledge is required of the history of possible source rocks. An interpretation of the burial history of the basal part of the Mount Kindle Formation, based on sediment thicknesses of the overlying, younger rock successions, is shown on Figure 16. The graph indicates a maximum burial depth of about 7,000 feet (2133 m) during Pennsylvanian time in the Bulmer Lake area, assuming a minimum thickness of about 1,000 feet (305 m) of Carboniferous sediments, which were removed during the early Mesozoic uplift (*see* de Wit *et al.*, 1973, Fig. 7). Assuming a paleogeothermal gradient of about 2°F per 100 feet, the organic material present in the dark grey shale of the Willow Lake well would have been subjected to temperatures between 150°F and 200°F. The expected thermal alteration of the organic material within this temperature range would be relatively low, but high enough for the generation of petroleum during the Carboniferous period (Tissot *et al.*, 1971). Landes (1967) and Pusey (1973) supply evidence for the concept that generation and accumulation of oil in buried sediments is restricted to a temperature interval lying between 150°F and 300°F (65.6°C and 148.9°C).

In the area of the Ebbutt Hills, Fish Lake and Blackwater Lake, the greatest depth of burial of the basal part of the Mount Kindle Formation is estimated to be at least 11,000 feet (3352 m), assuming a minimum thickness of about 2,000 feet (609 m) of Carboniferous sediments (*see* de Wit *et al.*, 1973, Fig. 7). The temperature range would have been between 250°F and 270°F, high enough for the generation of oil and gas.

Because Triassic and Jurassic sediments are thin or absent in the Mackenzie Mountains, it is assumed that, during those epochs, the depth of burial decreased because of a general uplift. During this period, hydrocarbons could have migrated into stratigraphic and combined stratigraphic and structural traps. Erosion removed all rocks of Permian and Carboniferous age. Only the hydrocarbons trapped in Devonian and older rocks could have been preserved.

Renewed sedimentation started during Early Cretaceous time (*see* Fig. 16) and a second phase of oil generation in the Paleozoic succession was possible in the deeper parts of the Cretaceous basin. The Laramide Orogeny and the subsequent uplift, however, greatly affected the Paleozoic rocks in the deeper parts of the Cretaceous basin and all oil of Paleozoic age in or near the disturbed belt probably was altered to supermature gas. This is suggested by the vitrinite reflectance measurements done by P. R. Gunther (Institute of Sedimentary and Petroleum Geology, Calgary) on two Upper Devonian coal samples from the IOE Triad Ebbutt D-50 well (Fig. 4, well no. 6) and one "coaly dolomite" from the basal member of the Mount Kindle Formation in the Shell Blackwater Lake G-52 (Fig. 4, well no. 4). The three measurements (*see* Appendix III) indicate a high degree of thermal alteration corresponding to the rank of anthracite (*see* Table 1 *in* Hacquebard and Donaldson, 1970). Hacquebard and Donaldson (ibid.) and Bostick (1973) use the "Karweil" diagram to show the relationship between coal rank, rock temperature and duration of heating. Studies by Hacquebard and Donaldson

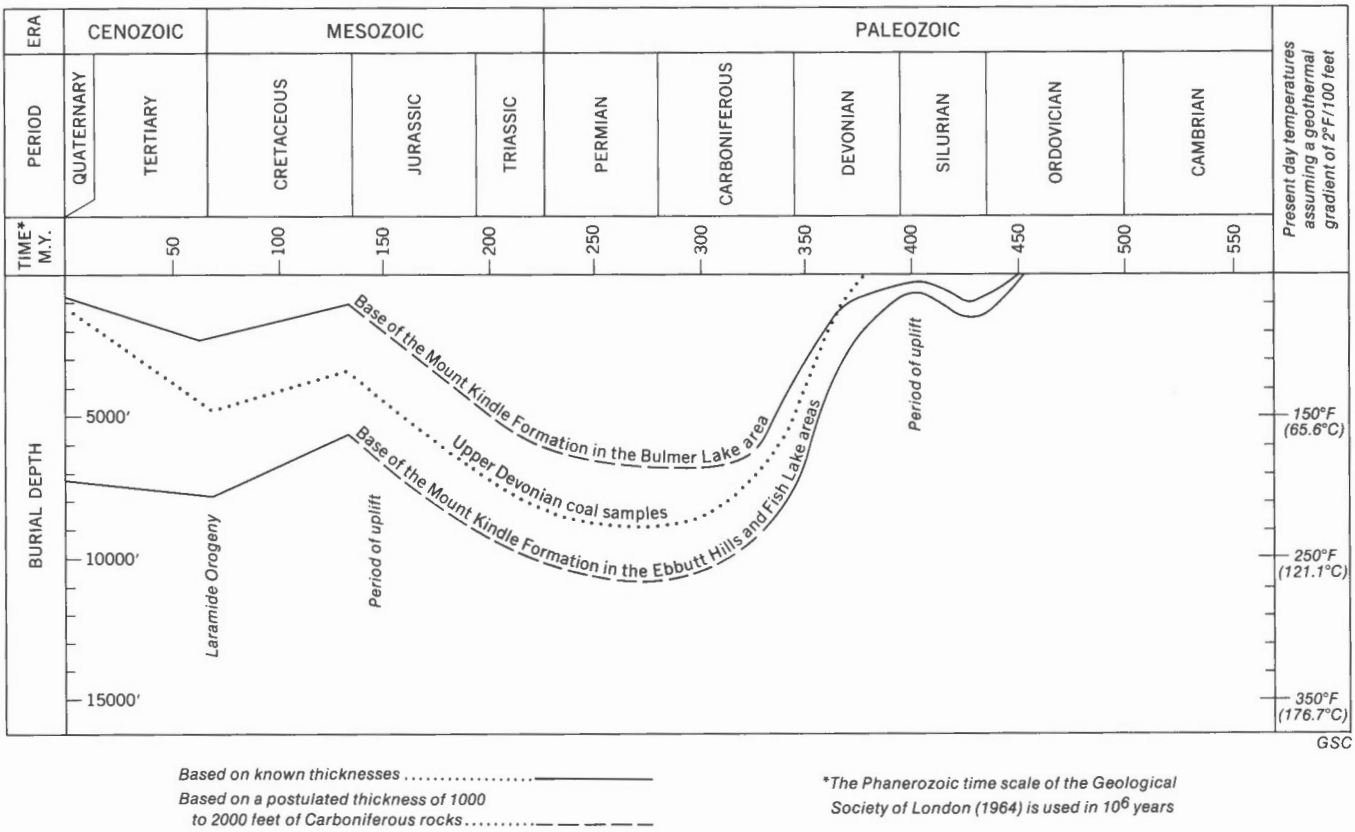

FIGURE 16. Interpretation of the burial history of the Mount Kindle Formation

(ibid., Fig. 7) show that an Upper Devonian coal particle will change to anthracite rank at a temperature of 100-120°C (212-248°F) over a time span of 350 million years. This is a minimum temperature value since it is assumed that the temperature remained constant for the total 350 million years. The burial history of the Upper Devonian coal particles (*see* Fig. 16) shows that the depth of burial (and the temperature) were not constant during the 350 million years. Bostick (1973) has developed a method which makes use of the information from the history of the burial depth to calculate the maximum temperature to which the coal particles were subjected. By using the information from Figure 16 and transferring the burial history curve of the Upper Devonian coal particles to the diagram of Bostick (ibid., Fig. 8) and using a figure of 3/2 times[1] the reflectance value of the vitrinite measured by P. R. Gunther (3.09 and 2.83%Ro), a maximum temperature of about 150°C (302°F) is found. Empirical data on hydrocarbon potential (Landes, 1967) indicate that destruction of liquid hydrocarbons dominate at temperatures greater than 300°F (Pusey, 1973). The presence of the Upper Devonian anthracite, therefore, indicates that any hydrocarbons generated in the lower Paleozoic succession of the Ebbutt Hills area were altered to gas by the end of the Paleozoic era.

In the central and eastern parts of the Great Bear and Great Slave Plains, the lower Paleozoic rocks were not buried deeply (*see* Fig. 16). This is indicated also by the qualitative thin layer chromatography analysis of the organic material present in a sample from the basal member of the Mount Kindle Formation in the Husky HB *et al.* Willow Lake G-32 well (Fig. 4, well no. 14). According to L. R. Snowdon (Institute of Sedimentary and Petroleum Geology, Calgary), the analysis showed the presence of some saturated and aromatic hydrocarbons, but a predominance of nitrogen-, sulphur-, oxygen-, and asphaltene-type compounds, which are indicative of low levels of thermal alteration.

It is possible that hydrocarbons from the first phase of generation (during late Paleozoic and early Mesozoic time) are preserved in stratigraphic traps and "pre-Laramide" structural traps. It is possible also that some oil and gas generated in Cretaceous rocks may have been trapped in lower Paleozoic rocks below the sub-Cretaceous unconformity. However, only in the central and northern parts of the Great Bear Plain is the Cambrian to Silurian succession directly overlain by Cretaceous rocks. In the southern part of the Great Bear Plain, rocks of Middle Devonian age are present below the Cretaceous unconformity, and the chance that oil and gas generated

[1]Note: The ratio 3/2 equals the ratio "plotted actual depth of burial x 350 million years"/ "maximum depth of burial x 350 million years".

in Cretaceous rocks would have moved in Cambrian, Cambro-Ordovician or Siluro-Ordovician rocks is considered to be very small. Chances that hydrocarbons generated in lower Paleozoic or older rocks and trapped in the Paleozoic succession have survived the pre-Cretaceous epeirogenesis and the Laramide Orogeny appear to be good. A thick sequence of Middle Devonian dolomite and evaporites (lower Elk Point Group) overlies the lower Paleozoic succession continuously in the southern parts of the Great Bear Plain. These rocks are, in general, good "cap-rocks".

4. Evaluation of the porous intervals in the lower Paleozoic rocks.

Porous intervals are present in the Mount Clark and Old Fort Island sandstones and in the Mount Kindle Formation. No porosity was noted in the Franklin Mountain Formation.

The porosity present in the Mount Clark Formation is of the intergranular type. In Shell Blackwater Lake G-52 well (Fig. 4, well no. 5), the borehole logs show approximately 10 feet (3 m) of porosity with an average of 13.8 per cent and a maximum of 18 per cent porosity. In the Union Japex *et al.* Blackwater E-11 well (Fig. 4, well no. 3), borehole logs indicate porosities between 3 and 9 per cent over 69 feet (21 m).

Porosity is present also in the Old Fort Island Formation in the outcrop area according to Norris (1965) and Balkwill (1971). The Old Fort Island Formation, however, is a discontinuous unit and is not present in the three wells which penetrate the Cambrian section north and east of Horn Plateau (Imp. Windflower G-72; Imperial Davidson Creek P-2 and Shell Levis D-76; Fig. 4, well nos. 16, 17 and 18).

The sandstone in the basal member of the Mount Kindle Formation is porous in a number of wells. In the Husky *et al.* Sibbeston Lake G-69 well (Lat. 61° 58'28"N, Long. 122°41'45"W; Fig. 8, well no. 11), the sandstone is porous over an interval of ten feet (3 m) (3-6% porosity on logs) and yielded 2,050 feet (625 m) of salt water on a drill stem test. The sandstone was tested near its stratigraphic pinch-out in the Husky HB *et al.* Willow Lake O-27A well (Lat. 62°16'48"N, Long. 121°04'21"W; Fig. 8, well no. 21) but yielded only mud. The sandstone is porous also [9% porosity over a 12-ft (3.6 m) interval] in Chevron Harris River A-31 (*see* Fig. 8, well no. 15) but was not tested. In the Imperial Cartridge B-72 well (Lat. 63°11'19"N, Long. 120°29'04"W; Fig. 8, well no. 9), a sandstone unit in the basal member of the Mount Kindle Formation [14% porosity, over a 16-ft (4.8 m) interval] yielded 1,040 feet (317 m) of salt water on a drill stem test.

The recrystallized biostromal and laminoid-fenestral beds of the Mount Kindle dolomite contain large open vugs and in places intercrystalline porosity is developed. The porosity in the Mount Kindle varies from 4 to 8 per cent with maximum values of 18 per cent and is present in beds 1 to 10 feet (0.3-3 m) thick. Figure 17 lists the wells which penetrated the Mount Kindle Formation and gives the total amount of porosity in relation to the thickness of the dolomite section. In three wells, Imperial Windflower G-77 (Lat. 62°56'26"N, Long. 118°59'02"W),

WELL NAME AND LOCATION		Maximum porosity %	Average porosity%	Total thickness dolomite member in feet	Total porosity over 4% from sonic log in feet	Drillstem test results
Union Japex et al. *Blackwater E-11* *63°40'20"N, 123°03'30"W*		20	8	709	61	*3575' slightly salty water*
Shell Blackwater Lake G-52 *64°01'20"N, 122°55'12"W*	*U. sect.*	26	7	502*	21	
	L. sect.	17	5	761	12	
Buttes et al. *Blackwater Lake I-54A* *64°33'43.88"N, 122°39'40.18"W*		12	6	576	64	
I.O.E. Cartridge B-72 *63°11'19"N, 120°29'04"W*		25	10	388	49	
B.A.O.H. Cli Lake K-54 *62°54'41.79"N, 123°10'24.185"W*		9	5	650	6	
Horn R. et al. *Cli Lake M-05* *61°54'58"N, 123°01'47"W*		—	—	195	0	
I.O.E. Triad Ebbutt D-50 *62°19'01"N, 122°24'05"W*		7	4	363	28	*1920' salt water*
Chevron C.S. Ebbutt G-72 *62°21'25"N, 122°28'38"W*		6	5	412	20	
Horn R. et al. *Ebbutt J-05* *62°24'37"N, 122°15'56"W*		18	12	453	30	
I.O.E. Triad Ebbutt J-70 *62°19'31"N, 121°57'03"W*		33	8	221*	15	*540' mud cut salt wtr +1510' salt water*
H.B. Gulf Fish Lake G-60 *63°09'29.84"N, 122°54'59.80"W*		11	7	750	30	*360' salt water cut mud*
Mobil Ft. Simpson M-70 *61°59'57.5"N, 122°27'58.9"W*		4	4	120	7	
Chevron Harris River A-31 *62°30'02"N, 120°06'00"W*		8	6	153	9	
Aquit. Highland Lake K-42 *62°31'39.87"N, 122°23'36.18"W*		25	5	502	63	
Chevron Hornell Lake G-24 *62°23'21"N, 119°34'40"W*		—	—	37	0	
C.S. I.O.E. Jackfish N-69 *62°28'47"N, 121°27'32"W*		4	4	317	22	*1900' salt water*
Imp. Lac Taché C-35 *63°44'15"N, 120°36'45"W*		12	6	484	66	*720' mud cut water*
Horn R. Shell Levis D-76 *62°25'06"N, 118°29'34"W*		7	6	40	16	
Pan Am A-1 Mattson Creek No. 1 *61°02'N, 123°48'30"W*		17?	10?	835*	93**	*misrun*
Shell Ochre River I-15 *63°24'45"N, 122°46'57"W*		7	5	248*	12	*120' salt water cut mud*
F.P.C. Root River I-60 *62°39'32.21"N, 123°24'28.96"W*		6	4	1124	40	*4400' salt water*
Husky et al. *Sibbeston G-69* *61°58'28"N, 122°41'45"W*		6	4	139	7	
I.O.E. Trail River P-13 *62°02'59"N, 121°32'13"W*		—	—	50	0	
Imp. Triad Willow Lake B-28 *62°17'05"N, 119°04'25"W*		—	—	52	0	
Husky et al. *Willow Lake G-32* *62°21'22"N, 120°51'13"W*		4	4	139	1	*475' mud*
Horn R. et al. *Willow Lake G-47* *62°36'23"N, 122°53'12"W*		4	4	190	5	
Husky et al. *Willow Lake H-10* *62°49'16"N, 121°45'01"W*		15	5	530	42	
Fina et al. *Willow Lake L-59* *62°08'40"N, 121°56'00"W*		10	6	178	32	*990' salt water*
Husky et al. *Willow Lake O-27A* *62°16'48"N, 121°04'21"W*		10	6	117	3	*1569' salt water*
Horn R. et al. *Willow Lake R. I-71* *62°40'44"N, 121°43'18"W*		4	3	476	2	*200' mud cut salt water*
Imp. Windflower G-77 *62°56'26"N, 118°59'02"W*		20	12	207	38	

*Section incomplete **Porosity from neutron log GSC

FIGURE 17. Drillstem test results, porosity and thickness of the Mount Kindle dolomite

Imperial Cartridge B-72 (Lat. 63°11'19"N, Long. 120° 29'04"W), and Imperial Lac Taché C-35 (Lat. 63°44' 15"N, Long. 120°36'45"W) (Fig. 10, well nos. 16, 9 and 10), part of the porosity is present at the top of the formation and is associated with the sub-Devonian unconformity. In the Lac Taché C-35 well, secondary anhydrite partly fills the vugular porosity.

5. Configuration of expected hydrocarbon reservoirs

In the final analysis of a new explorative drilling venture, a petroleum geologist has to answer questions regarding the shape, size and location of the expected reservoir. An important factor in the economic evaluation of an exploration venture is the upper limit of the expected pool size and the thickness of the reservoir. With some knowledge of the rock succession, the porosity distribution and the general structural geology, an upper limit of the pool size may be postulated. Porosity is best developed in the Mount Kindle Formation and the best trapping conditions exist at the top of this formation in places where it is overlain by anhydrite, anhydritic dolomite or salt. The most prospective areas are located on structural highs. The largest traps are present in the anticlinal structures near the eastern edge of the Mackenzie Mountains. Vertical closure in the anticlines is measured in thousands of feet and the area of closure could be as large as 200 square miles (518 km^2). Most of these Laramide structures have been drilled and found barren. Smaller traps are postulated to be present above buried Precambrian paleotopographic highs. The size of these traps is difficult to estimate. Vertical closure probably does not exceed 400 feet (122 m) and areal closure is measured in tens of square miles.

In summary, the most attractive concept for a drilling venture in the central and eastern parts of the southern Great Bear Plain is the postulated existence of stratigraphic traps, related to the effects of draping over buried Precambrian hills, in the Mount Clark or Old Fort Island sandstone, and in the porous biostromal or laminoid-fenestral beds in the Mount Kindle dolomite. The largest pools are expected to have reserves in the order of 5 to 10 x 10^7 cubic feet of gas in place, and are relatively small. According to this concept, the hydrocarbons are of Paleozoic age and were generated in the lower part of the Mount Kindle Formation. It is unlikely that large amounts of hydrocarbons could have been generated because of the poor "source rock" quality of the Mount Kindle Formation.

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APPENDICES

I Reports on Ordovician-Silurian fossils

II Description of the lithology of the lower Paleozoic succession from borehole samples and cores

III Report on coal rank determination by vitrinite reflectance

APPENDIX I

Report on Silurian and Ordovician fossils from cores of the Mount Kindle Formation by B.S. Norford (*in* Norford *et al.*, 1970, 1971; and *in* Barnes *et al.*, 1974).

Well, depth	Fauna and Age	GSC Loc. No.
10E-Triad Ebbutt J-70 62°19'31"N, 121°57'03"W		
Depth 2,616-2,625 ft	*?Favistina* sp. *?Lobocorallium* sp. *Palaeofavosites* 2 spp. age: Late Ordovician	C-10016; C-10016a
FPC Tenneco Root River I-60 62°39'32.21"N, 123°24'28.96"W		
Depth 6,631 ft	*Bighornia* sp. age: Late Ordovician	C-2520
Pan Am A-1 Mattson Creek No. 1 61°02'42"N, 123°48'30"W		
Depth 10,329-10,330 ft	*Cystihalysites* sp. *?Palaeofavosites* sp. age: Silurian	C-24550
Husky H.B. *et al.* Willow Lake 0-27A 62°16'48"N, 121°04'21"W		
Depth 2,527-2,530 ft, core	*Favistina*? sp. age: probably Middle or Late Ordovician	C-26292
Depth 2,537-2,538 ft, core	indeterminate coral, not diagnostic	C-26293
Depth 2,543-2,548 ft, core	echinoderm and trilobite debris streptelasmid coral *Palaeophyllum* sp. *Palaeophyllum*? sp. *Catenipora* sp. age: probably Middle or Late Ordovician	C-26294
Depth 2,548-2,544 ft, core	*Lobocorallium* sp. *Palaeophyllum* sp. *Catenipora* sp. *Palaeofavosites* sp. *Palaeofavosites*? sp. age: Late Ordovician	C-26295
Husky H.B. *et al.* Willow Lake G-32 61°21'22"N, 120°51'13"W		
Depth 2,505-2,508 ft, core	echinoderm debris *Palaeophyllum* sp. streptelasmid coral *Calapoecia* sp. *Catenipora* sp. *Palaeofavosites* sp. indeterminate tabulate coral age: probably Late Ordovician	C-26286

Well, depth	Fauna and Age	GSC Loc. No.
Depth 2,510-2,515 ft, core	echinoderm debris streptelasmid coral *Catenipora* sp. *Palaeofavosites*? sp. *Sarcinula* sp. indeterminate tabulate coral age: Late Ordovician to Early Silurian	C-26287
Depth 2,515-2,520 ft, core	echinoderm and brachiopod debris *Favistina* sp. streptelasmid coral *Calapoecia* sp. *Catenipora* sp. *Palaeofavosites*? sp. age: Late Ordovician	C-26288
Depth 2,520-2,525 ft, core	*Bighornia* sp. *Palaeophyllum* sp. streptelasmid coral *Catenipora* sp. age: Late Ordovician	C-26289
Depth 2,525-2,530 ft, core	echinoderm debris *Bighornia* sp. *Palaeophyllum*? sp. undetermined rugose and tabulate corals *Catenipora* sp. *Palaeofavosites* sp. age: Late Ordovician	C-26290
Depth 2,531-2,532 ft, core	echinoderm debris *Palaeophyllum* sp. streptelasmid coral age: probably Late Ordovician	C-26291
Fina *et al* Willow Late L-59 62°08'40"N, 121°56'00"W, 1971		
Depth 2,357 ft, core	?*Palaeofavosites* sp. ?trilobite fragment age: Late Ordovician to Silurian	C-28092
Depth 2,367 ft, core	indeterminate brachiopod not diagnostic	C-28093
Depth 2,369 ft, core	?*Catenipora* sp. ?streptelasmid coral age: Late Middle Ordovician to Silurian	C-28094
Depth 2,379 ft, core	echinoderm fragments rhynchonellid brachiopod ?streptelasmid coral not diagnostic	C-28095
Depth 2,381-2,384 ft, core	*Bighornia* sp. ?*Favistina* sp. *Manipora* sp. *Palaeofavosites* sp. age: Late Ordovician	C-28096

Well, Depth, Formation	Fauna and Age	GSC Loc. No.
Horn River-C.D.R.-I.O.E. Willowlake R. I-71 62°40'44"N, 121°43'18"W, 1971		
Depth 2,463 ft, core	stromatoporoid undetermined tabulate coral *Catenipora* sp. *Cystihalysites* sp. *Favosites*? sp. indeterminate brachiopods age: Silurian	C-34854

All samples, except two, appear to represent the same Late Ordovician fauna that is commonly developed in the lower part of the Mount Kindle Formation. The samples from the Mattson Creek No. 1 and the Willow Lake River I-71 wells are from the upper part of the Mount Kindle Formation which is Silurian in age.

APPENDIX II

This appendix contains lithological descriptions of the Proterozoic and Paleozoic successions in twenty-eight exploratory wells. These lithological descriptions are interpretations by the writer resulting from a detailed study of well cuttings and cores stored at the Geological Survey of Canada, Calgary, Alberta.

Semi-quantitative X-ray analyses of dolomite samples from the Union Japex *et al.* Blackwater E-11 well were made by A. G. Heinrich of the Institute of Sedimentary and Petroleum Geology. These analyses showed that the light grey dolomite of the Mount Kindle Formation and Elk Point Group contains varying amounts of siliceous clay and silt but no clay minerals, whereas the dark-coloured dolomite of the Mount Kindle Formation contains a small amount of illite (*see* Fig. 11).

Grain or crystal sizes in both clastic and carbonate rocks are according to the grade scale of Wentworth (1922). The amount of the clay-size acid-residues of the dolomites is entered in the description as slightly argillaceous, argillaceous and very argillaceous.

Union Japex *et al.* Blackwater E-11
Location: Lat. 63°40'20"N; Long. 123°03'30"W
Measured from 1,655' above sea level
Total depth: 7,122'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 5,000'-5,096':

Interbedded dolomite, light grey to grey, microcrystalline, very argillaceous, in part dark grey and pelletoidal; dolomite, light grey-brown, crypto- to microcrystalline, anhydritic; and anhydrite, light grey to light grey-brown. Lower part of interval consists of dolomite, very light to light brown, with red-brown blotches, crypto- to microcrystalline, argillaceous; interbedded with dolomite, light grey to grey, slightly greenish, microcrystalline, argillaceous (*see* mineralogical analysis, Fig. 11).

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 5,095'-5,250':

Dolomite, very light to light brown, very finely crystalline, slightly sucrosic, very slightly silty, in places sparsely porous with pyrobitumen, trace of dark grey stylolitic partings, trace of light green shale and trace of very light grey chert fragments (*see* mineralogical analysis, Fig. 11).

Interval 5,250'-5,322':

Dolomite, very light to light brown, microcrystalline; interbedded with dolomite, grey-brown to dark grey-brown, argillaceous to very argillaceous, in part silty; microcrystalline, with dark grey shale laminae. Upper part of interval has minor amounts of very dark grey shale and traces of light and dark grey chert fragments.

Interval 5,322'-5,460':

Dolomite, very light to light brown, mottled with dark grey, very finely to finely crystalline, with poor to fair intercrystalline, and fine vuggy porosity. Clear dolomite and quartz crystals line the vugs. Some dark grey stylolitic partings are present in dolomite.

Interval 5,460'-5,510':

Dolomite, light and dark grey mottled, microcrystalline, very silty with very dark grey, in part stylolitic shale partings (*see* mineralogical analysis, Fig. 11).

Dark grey member

Interval 5,510'-5,545':

Dolomite, dark grey, mottled with light grey, microcrystalline, argillaceous, with dark grey shale partings. Abundant very dark grey chert fragments in samples.

Interval 5,545'-5,595':

Dolomite, very light to light brown, very finely crystalline with patches of medium to coarsely crystalline; clear dolomite and quartz crystals indicate the existence of vuggy porosity; trace of light grey chert fragments.

Interval 5,595'-5,805':

Dolomite, dark grey and light brown mottled, micro- to very finely crystalline, with medium to coarse crinoid ossicles, dark grey stylolitic partings; in upper part of interval abundant very dark grey chert fragments.

Basal member

Interval 5,805'-5,850':

Dolomite, very argillaceous, dark grey to greyish brown, slightly silty, with some medium and coarse crinoid ossicles. Basal ten feet of interval are shale, very dark grey to black, very dolomitic, silty and fine sandy.

FRANKLIN MOUNTAIN FORMATION

Rhythmic member

Interval 5,850'-5,950':

Dolomite, very light grey, light green and red-brown, medium to coarsely or very finely to finely crystalline, somewhat sucrosic, in part slightly silty and very fine sandy, with traces of poor intercrystalline porosity; interbedded with dolomite, light grey to light green, micro- to very finely crystalline, silty.

Interval 5,950'-6,110':

Dolomite, very light to light grey, mottled with pale red-brown, micro- to very finely to finely crystalline, silty, with rare floating medium to coarse quartz grains; interbedded with dolomite, grey to dark grey, micro- to very finely, in part finely crystalline, silty and very fine sandy, with rare floating medium to coarse quartz grains and dark grey to black shale partings, rarely medium pelletoidal. Some very light grey chert fragments.

Interval 6,110'-6,295':

Dolomite, grey-brown mottled with dark grey, micro- to very finely crystalline, silty, with some very dark shale partings; and dolomite, dark to very dark grey, very silty in part grading to dolomitic siltstone, microcrystalline, with abundant very dark grey shale partings. Lower part of interval is interbedded with dolomite, light red-brown to light brown microcrystalline, silty to very silty; and dolomite, very light to light grey, microcrystalline.

Interval 6,295'-6,530':

Dolomite, very light to light grey, micro- to very finely crystalline, silty; and dolomite, grey to dark grey, micro- to very finely crystalline, slightly argillaceous, slightly silty. Interval 6,400'-6,500' is dark to very dark grey dolomite as above, but in part very fine sandy, with rare floating fine, clear quartz grains, and with very dark grey, in part stylolitic, shale partings. Interval 6,500'-6,530' is very dark and dark grey dolomite, as above, which is very silty and argillaceous.

Cyclic member

Interval 6,530'-6,692':

Dolomite, grey to dark grey, in part very dark grey, microcrystalline, slightly argillaceous to argillaceous, very silty; interbedded with dolomite, very light to light grey-brown, microcrystalline, silty to very silty, in places with floating, clear, fine to medium quartz grains. Interval 6,670'-6,692' contains shale, grey, slightly greenish, very dolomitic; interbedded with dolomite, light grey, very silty, grading to siltstone, very light grey to very light red-brown, very dolomitic, in part very fine sandy.

SALINE RIVER FORMATION

Upper shale member

Interval 6,692'-6,788':

Shale, red-brown, in part green, light green and grey-green; interbedded with siltstone, very light to light grey or light red-brown, dolomitic in part anhydritic, with clear pink crystals; and minor anhydrite, very light grey, dolomitic, mostly associated with green and red-brown shale. In lower part of interval some beds of dark grey, very argillaceous anhydrite.

Salt member

Interval 6,788'-6,936':

Borehole logs indicate the existence of salt in this interval. Samples contain small amounts of dolomite in irregular chips, with vuggy porosity; vugs lined with quartz and dolomite crystals.

Lower shale member

Interval 6,936'-6,984':

Shale, dark red-brown, mottled dark green and dark grey, in part associated with very light grey anhydrite; interbedded with shale, grey to dark grey, laminated with very light grey anhydritic dolomite; anhydrite, very light grey; and siltstone, very dolomitic, anhydritic, very light to light grey.

MOUNT CAP FORMATION

Interval 6,984'-7,006':

Shale, grey-green to green, dolomitic, with laminae of light grey, very finely grained sandstone; interbedded with minor dolomite, very dark grey to black, argillaceous, silty, with medium, black, oolitic chert grains, in part very glauconitic.

MOUNT CLARK FORMATION

Interval 7,006'-7,076':

Sandstone, very light grey to clear, fine to medium grained, well sorted, subrounded, clear and pink quartz grains; trace of glauconite; poor to fair intergranular porosity.

PRECAMBRIAN

(undivided)

Interval 7,076'-7,122':

Shale, dark red-brown to red-brown, in part silty and sandy; interbedded with shale, black, silty. Lower part of interval contains interbeds of argillaceous dolomite, light red-brown.

Shell Blackwater Lake G-52
Location: Lat. 64°11'05"N, Long. 122°15'12"W
Elevation: Measured from 1,213.5' above sea level
Total depth: 6,500'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 3,800'-4,034':

Dolomite, very light grey to grey-brown, cryptocrystalline; interbedded with dolomite, grey to dark grey-brown, crypto- to microcrystalline; and minor shale, very dark grey. In basal part of interval the light grey dolomite has red-brown mottles.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 4,034'-4,290':

Dolomite, very light grey to light grey-brown, very finely to finely crystalline, somewhat sucrosic; interbedded with minor amounts of dolomite, grey to dark grey, slightly argillaceous, cryptocrystalline. Traces of light grey chert fragments are present in lower half of interval and poor intercrystalline porosity and black bitumen infill in basal part of interval.

Interval 4,290'-4,320':

Dolomite, light grey to grey, slightly argillaceous, microcrystalline.

Interval 4,320'-4,500':

Dolomite, grey to dark grey, micro- to very finely crystalline, argillaceous, with traces of shale partings interbedded with dark grey dolomite, light grey-brown to grey-brown, micro- to very fine crystalline.

Dark grey dolomite member

Interval 4,500'-4,720':

Dolomite, grey to dark grey, microcrystalline, in part somewhat argillaceous; and dolomite, mottled light grey and grey-brown, micro- to very finely crystalline. Grey-brown and black chert fragments are common or abundant throughout interval.

Interval 4,720'-4,795':

Dolomite, mottled light and dark grey, micro- to very finely crystalline, with coarsely recrystallized crinoid ossicles.

Basal member

Interval 4,795'-4,836':

Cored interval of shale, very dolomitic and very silty, dark grey, bituminous, with small shale clasts and isolated, very coarse black chert grains; interbedded with very dolomitic siltstone, dark grey, argillaceous, bituminous, with abundant light grey patches consisting of coarse fragments of crinoids, corals and brachiopods (*see* mineralogical analysis, Fig. 11). Lower part of interval consists of shale, very dark grey, dolomitic, with a thin siltstone bed at 4,836', which unconformably overlies the light grey to grey, very silty dolomite of the Franklin Mountain Formation.

FRANKLIN MOUNTAIN FORMATION

Rhythmic member

Interval 4,836'-4,930':

Dolomite, very light grey, slightly silty; interbedded with dolomite, as above, finely to medium crystalline, sucrosic, with poor intercrystalline porosity.

Interval 4,930'-5,100'

Dolomite, very light grey, very finely crystalline, slightly silty, in places with red-brown or rusty spots and mottles; interbedded with dolomite green-grey, very finely crystalline, slightly silty; and minor shale, light green-grey, "waxy". Rare white chert fragments are present in some samples. Basal part of interval contains fine pelletoidal dolomite, grey, slightly argillaceous.

Interval 5,100'-5,320'

Dolomite, very light to light grey, microcrystalline, slightly silty; interbedded with dolomite, grey to dark grey, slightly argillaceous to argillaceous, in part slightly silty or silty and very fine sandy, micro- to very finely crystalline. Trace of fine pelletoidal dolomite, light grey-brown with red-brown mottles. Grey chert fragments are present in some samples.

Interval 5,320'-5,536'

Dolomite, very light to light grey, silty, micro- to very finely crystalline; and dolomite, grey to dark grey, silty, slightly argillaceous to argillaceous, micro- to very finely crystalline.

Interval 5,536'-5,600'

Dolomite, grey to dark grey, microcrystalline, silty and argillaceous; and minor dolomite, very light to light grey, microcrystalline, silty.

Cyclic member

Interval 5,600'-5,740'

Dolomite, grey to dark grey, microcrystalline, slightly silty, slightly argillaceous to argillaceous; interbedded with dolomite, dark to very dark grey, argillaceous to very argillaceous; minor shale, very dark grey, or maroon. Basal 20 feet of interval consist of dolomite, very light to light grey, in part green-grey, very silty and slightly pyritic.

SALINE RIVER FORMATION

Upper shale member

Interval 5,740'-5,885'

Interbedded unit: shale, red-brown and maroon; shale, grey-green, very dolomitic; siltstone, very light grey with red-brown, dolomitic, variably anhydritic; and anhydrite, very light grey, associated with red-brown and greyish green shale.

Anhydrite member

Interval 5,885'-5,950':

Anhydrite, very light grey, very finely to finely crystalline or cryptocrystalline; interbedded with shale, grey to dark grey, slightly dolomitic, with laminae of anhydrite, in part pelletoidal.

Lower shale member

Interval 5,950'-5,995':

Interbedded unit: shale, dark red-brown; siltstone, very light grey, very fine sandy; and minor anhydrite, very light grey, as laminae in shale.

MOUNT CAP FORMATION

Interval 5,995'-6,010':

Shale, very dark grey to black, slightly dolomitic. Trace of sandstone, light grey, fine grained, glauconitic.

MOUNT CLARK FORMATION

Interval 6,010'-6,146':

Sandstone, very light grey, fine grained, consisting of clear, subrounded quartz grains in a light grey matrix. Sandstone is sparsely porous. Lower part of sandstone has red-brown and rusty mottles. The basal 30 feet are very fine grained.

PRECAMBRIAN

(undivided)

Interval 6,146'-6,235':

Interbedded shale, siltstone and dolomite: shale, mottled red-brown and green-grey, dolomitic; siltstone, very light red-brown, very dolomitic, with minute red-brown specks in places; dolomite, red-brown, silty, slightly argillaceous; and dolomite, light grey, with yellowish and reddish colours, crypto- to microcrystalline.

Interval 6,235'-6,318':

Interbedded dolomite and siltstone: dolomite, light grey, light yellow or light red, very silty, crypto- to microcrystalline; siltstone, very light grey, light red-brown, in part very fine sandy, dolomitic; and dolomite, light grey and grey, with minor light red-brown, crypto- to microcrystalline.

Interval 6,318'-6,365':

Interbedded and laminated dolomite, grey-green, argillaceous to very argillaceous, in places pyritic; and shale, very dark grey to black, micro-laminated.

Interval 6,365'-6,424':

Interbedded sandstone, dark red-brown, very fine to fine grained, argillaceous; and shale, red-brown, in part dolomitic.

Interval 6,424'-6,500':

Interbedded dolomite, shale and sandstone: dolomite, very light grey, silty to very silty; dolomite, light red-brown, silty, crypto- to microcrystalline; shale, red-brown; sandstone, red-brown, very fine grained, in part dolomitic.

Imperial Cartridge B-72
Location: 63°11'19"N; 120°29'04"W
Measured from 1,428.9' above sea level
Total depth: 2,256'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 1,600'-1,610':

Anhydrite, very light grey, very dolomitic, grading to anhydritic dolomite.

Interval 1,610'-1,638':

Dolomite, very light grey, in part greenish, silty and very fine sandy, in places with floating fine and medium, subrounded, clear quartz grains, crypto- to microcrystalline. Basal part interbedded with sandstone, very light grey, very dolomitic, fine to medium grained.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 1,638'-1,830':

Dolomite, very light to light brown, crypto- to microcrystalline, in part very finely crystalline, in part somewhat sucrosic with poor to fair intercrystalline porosity and some vuggy porosity. Minor amounts of light blue-grey, silty dolomite and green-grey "waxy" dolomite are present at 1,660'; some porous, very light brown siltstone is present, and at 1,800' some light blue-grey, very dolomitic siltstone.

Interval 1,830'-1,970':

Dolomite, very light to light grey-brown, microcrystalline, in part fine fragmental and ?crinoidal. Lower part of interval with some medium to coarse crinoid fragments and some dark grey stylolitic partings.

Dark grey dolomite member

Interval 1,970'-2,026':

Dolomite, grey-brown to dark grey, mottled with very light brown, microcrystalline, with some medium to coarse crinoid ossicles, slightly argillaceous. At base of interval some crystals of anhydrite and dolomite, filling intrafossil vug porosity.

Basal member

Interval 2,026'-2,043':

No samples are present for this interval because mud circulation was lost at 2,026', but core 19 shows a sandstone, light grey, mottled with dark grey, medium to very coarse grained, with clear, dark grey and pink, subrounded quartz grains in a light grey dolomite matrix, with, in upper part, fair intergranular porosity. Sandstone has a burrowed, mottled appearance.

FRANKLIN MOUNTAIN FORMATION

(undivided)

Interval 2,043'-2,080':

At base of core 19 is a dolomite, light grey-brown, micro- to cryptocrystalline, silty and sandy, with scattered very fine to medium, subrounded, clear quartz grains, and some wavy, dark grey, argillaceous partings; with small rounded brachiopods. Contact with overlying sandstone not visible in core. Samples just below core 19 indicate the existence of sandstone, very light grey, fine to medium grained, with subangular quartz grains; interbedded with light green shale.

PRECAMBRIAN

(undivided)

Interval 2,080'-2,237':

Sandstone, grey to green-grey, in part light grey, laminated, very fine to fine grained, well sorted, quartzose, in part quartzitic; with minor light green shale, in part micaceous, in part very silty, and chloritic (*see* mineralogical analysis, Fig. 11).

PRECAMBRIAN

Interval 2,237'-2,256':

Weathered granite, consisting of weathered pink feldspars in part intergrown with quartz, biotite, quartz and hornblende.

BAOH Cli Lake K-54
Location: Lat. 62°03'41.7"N, Long. 123°10'24"W
Measured from 702' above sea level
Total Depth: 8,714'
Status: D & A

ELK POINT GROUP

(undivided)

Interval 7,600'-7,800':

Dolomite, interbedded very light grey and light grey-brown, crypto- to microcrystalline. In upper part traces of very fine to fine pelletoidal dolomite; in lower part minor amounts of silty dolomite with floating, clear, very fine quartz grains.

Interval 7,800'-7,816':

Sandstone, very light to light grey, very dolomitic, very fine to medium grained; with clear, subrounded quartz grains; interbedded with dolomite, light grey, cryptocrystalline, silty.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 7,816'-7,936':

Dolomite, mottled light grey and grey, micro- to very finely crystalline, silty, with dark grey, stylolitic partings. In lower part abundant light grey chert fragments.

Interval 7,936'-8,030':

Dolomite, very silty, grading in part to very dolomitic siltstone, very light to light grey, microcrystalline; interbedded with dolomite, mottled light grey and grey, slightly silty, very finely to finely crystalline. Abundant light grey chert fragments in lower 20 feet.

Interval 8,030'-8,180':

Dolomite, mottled light grey and grey, micro- to very finely crystalline and silty in upper part, microcrystalline and slightly silty in lower part. Abundant light grey chert fragments in upper part, rare light grey and black chert fragments in lower part. Some intercrystalline porosity containing black bitumen in finely crystalline dolomite, some clear secondary dolomite.

Dark grey dolomite member

Interval 8,180'-8,320':

Dolomite, mottled very dark grey-brown and light grey, slightly silty and argillaceous, microcrystalline. In the lower part of the interval abundant very dark grey chert fragments.

Interval 8,320'-8,370':

Dolomite, grey-brown to dark grey, in part light grey, micro- to very finely crystalline, with coarse recrystallized fragments of crinoids; in part finely to medium crystalline, with poor intercrystalline porosity.

Interval 8,370'-8,466':

Dolomite, dark to very dark grey, very finely to finely crystalline, slightly argillaceous, pyritic, in part silicified, with some clear secondary dolomite and quartz crystals indicative of vuggy porosity.

Basal member

Interval 8,466'-8,560':

Sandstone, clear, very finely to medium grained with subangular and subrounded quartz and some black chert grains, in part slightly porous; interbedded with dolomite, dark to very dark grey, silty and sandy with floating medium and coarse grains of clear quartz and black chert. From 8,520' to 8,560' the sandstone is medium to coarse grained with a black dolomite matrix.

PRECAMBRIAN

(undivided)

Interval 8,560'-8,714':

Interbedded: siltstone, red-brown, very fine sandy, quartzitic, hematitic; and sandstone, very light grey, quartzitic; and sandstone, red-brown, very fine to fine grained, quartzitic. Core shows thin-bedded succession of red-brown sandstone,quartzitic, siltstone and light grey shale with small-scale sedimentary structures (laminae, crossbedding, intraclasts and ?burrows) cut by small faults (*see* mineralogical analysis, Fig. 11).

Horn R. AmHess Gulf Cli Lake M-05
Location: Lat. 61°54'58"N, Long. 123°01'47"W
Measured from: 1,220.5' above sea level
Total depth: 6,500'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 5,800'-5,920':

Dolomite, very light to light grey, micro- to very finely crystalline, in part finely crystalline, very poor intercrystalline porosity. Minor amounts of dolomite, light greenish grey, slightly argillaceous.

Interval 5,920'-5,975':

Dolomite, mottled very light and dark grey, very finely crystalline, indistinctly pelletoidal, fair intercrystalline porosity and small vugs. Some black bitumen in vugs. Basal part of interval is interbedded with dolomite, very light grey, microcrystalline, silty.

MOUNT KINDLE FORMATION

Dark grey dolomite member

Interval 5,975'-6,005':

Dolomite, very light grey to light grey-brown, micro- to finely, in part medium crystalline, with very poor intercrystalline porosity.

Interval 6,005'-6,020':

Dolomite, very dark grey, microcrystalline, slightly argillaceous, silty, in part pyritic; interbedded with dolomite as in interval 5,975'-6,005'.

Interval 6,020'-6,055':

Dolomite, very light grey-brown, microcrystalline, silty; interbedded with dolomite, very dark grey-brown, slightly argillaceous, microcrystalline; and dolomite, very light to light grey-brown, microcrystalline, with some medium-size fragments of crinoids.

Interval 6,055'-6,110':

Dolomite, very light to light grey-brown, microcrystalline, in part finely crystalline, with some fine and medium fragments of crinoids, in places with very poor intercrystalline porosity and black bitumen infill. Trace of white chert fragments.

Interval 6,110'-6,170':

Dolomite, grey-brown to dark grey-brown, mottled with light grey, micro- to very finely crystalline, slightly silty, slightly argillaceous, with some small- and medium-size fragments of crinoids; interbedded with dolomite, very light to light grey-brown, silty, micro- to very finely crystalline. Basal part of interval contains white and dark grey chert fragments.

Basal member

Interval 6,170'-6,240':

Sandstone, light to dark grey, very fine to medium grained, subangular to subrounded, clear quartz grains in light or dark grey dolomite matrix or black cherty matrix, in places sparsely porous, with black bitumen; interbedded with shale, grey to dark grey.

FRANKLIN MOUNTAIN FORMATION

(undivided)

Interval 6,240'-6,322':

Dolomite, very light to light grey, crypto- to microcrystalline, silty, in places with floating, fine to medium, subrounded quartz grains.

SALINE RIVER FORMATION

(undivided)

Interval 6,322'-6,430':

Shale, red-brown to orange-brown, in part silty; interbedded with siltstone, in part very fine sandy, very light grey, with some greenish and reddish colour, laminated, in part slightly dolomitic, in part very dolomitic, with clear pink anhydrite crystals; siltstone, red-brown mottled with green, argillaceous; and shale,light green, "waxy".

Interval 6,430'-6,465':

Dolomite, very light to light grey, in part greenish, microcrystalline, silty, with clear pink anhydrite crystals, in places anhydritic; interbedded with dolomite, greenish grey to green, mottled with red-brown, argillaceous; and siltstone, red-brown, slightly dolomitic.

Interval 6,465'-6,500':

Sandstone, greenish grey to green, interbedded with sandstone, red-brown, very fine to fine, in part medium grained, dolomitic, argillaceous; and shale, light green, "waxy", in part sandy.

Imperial Triad Davidson Creek F-2
Location: Lat. 62°11'45"N, Long. 118°15'05"W
Measured from: 2,085.9' above sea level
Total depth: 2,737'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 2,500'-2,540':

Dolomite, light brown, micro- to very finely, in places medium crystalline, somewhat sucrosic, in part with intercrystalline and vugular porosity, vugs filled with salt, oil stained; interbedded with anhydrite, very light grey, in part mottled with light brown dolomite, in places with vugular porosity. Interval 2,505'-2,540', core 11, shows laminated and thin-bedded succession of dolomite and anhydrite, the anhydrite often as inclusions in the dolomite. Clear rock-salt is present in thin beds at 2,525' and 2,529' or fills the vugs present in the dolomite.

Interval 2,540'-2,566':

Borehole logs indicate the presence of salt. Interval 2,540'-2,550', core 11, was not recovered.

Interval 2,566'-2,582':

Siltstone, dolomitic, very fine sandy, argillaceous to very argillaceous, with scattered medium to coarse quartz grains.

MOUNT CAP FORMATION

Dolomite member

Interval 2,582'-2,610':

Interbedded dolomite and shale: dolomite, dark red-brown in upper part of interval, light grey, finely to medium crystalline, somewhat sucrosic, argillaceous and silty, in part very fine sandy (clear quartz) with poor intercrystalline porosity; shale, mottled red-brown and greenish grey, dolomitic, in part very dolomitic, and grading to dolomite, with fine, red-brown dolomite crystals; and dolomite, very sandy, grading to sandstone, mottled light greenish grey and red-brown, very finely to finely crystalline.

Interval 2,610'-2,690':

Shale, light green, in places mottled with red-brown, with rare light brown imprints of inarticulate brachiopods; minor sandstone, light greenish grey, dolomitic, very fine grained, silty.

Interval 2,690'-2,700':

Shale, light green and greyish green; minor sandstone, very light brown, very fine grained, silty, slightly dolomitic, with a trace of glauconite and scattered very coarse quartz grains.

PRECAMBRIAN

Interval 2,700'-2,737':

Weathered granite. Interval 2,705'-2,730', core 12, consists of pink granite, in part weathering light green, very coarsely crystalline, banded. Granite consists of quartz, pink k-feldspars, in part intergrown with quartz, and chloritic biotite (*see* mineralogical analysis, Fig. 11).

IOE Triad Ebbutt D-50
Location: Lat. 62°19'01"N, Long. 122°24'05"W
Measured from: 1,039' above sea level
Total depth: 4,094'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 2,800'-2,950':

Anhydrite, very light grey, cryptocrystalline; interbedded with dolomite, very light grey to light grey-brown, crypto- to microcrystalline, with floating, medium to coarse crystals of anhydrite.

Interval 2,950'-2,975':

Dolomite, very light grey to light grey-brown, crypto- to microcrystalline, with floating medium and coarse anhydrite crystals.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 2,975'-3,160':

Dolomite, very light grey to very light brown, micro- to very finely, in places finely crystalline, slightly sucrosic, rarely with poor or fair intercrystalline porosity; lower part of interval with trace of very light grey chert fragments; fine to medium dolomite crystals indicative of vuggy porosity; and dark grey stylolitic partings.

Interval 3,160'-3,175':

Interval studied in core 31. Dolomite, grey to dark grey, slightly argillaceous, microcrystalline, with dark grey, stylolitic shale laminae. Lower part of interval consists of dolomite, grey to dark grey, mottled light grey, micro- to very finely, in places finely crystalline, with irregular white, very coarsely crystalline dolomite inclusions, and dark grey stylolitic laminae.

Interval 3,175'-3,260':

Dolomite, grey and light grey mottled, micro- to very finely crystalline, in upper part of interval with very finely to finely crystalline parts, which have abundant pin-point and scattered large, irregular vugs (*see* core 31). Lower part of interval contains dark grey, stylolitic laminae.

Dark grey dolomite member

Interval 3,260'-3,338':

Dolomite, grey to light grey, in places dark grey and slightly argillaceous, micro- to very finely crystalline; with scattered fine fragments of crinoid ossicles, dark grey, stylolitic laminae, and some grey-brown and dark grey chert fragments.

Basal member

Interval 3,338'-3,388':

Dolomite, grey to dark grey, slightly argillaceous to argillaceous, micro- to very finely crystalline; interbedded with dolomite, dark to very dark grey, argillaceous to very argillaceous, silty, with medium size fragments of crinoid ossicles; and dolomite, very dark grey, very silty and very argillaceous, grading to silty shale, very fine sandy, slightly pyritic. Samples contain some fragments of very dark grey chert.

FRANKLIN MOUNTAIN FORMATION

Interval 3,388'-3,435':

Dolomite, very light grey, micro- to very finely crystalline, silty, in part with dark grey stylolitic partings.

Interval 3,435'-3,576':

Dolomite, light grey to grey, crypto- to microcrystalline, silty to very silty, with floating fine to coarse, subrounded, clear quartz grains; interbedded with dolomite, grey to dark grey, slightly argillaceous, crypto- to microcrystalline, silty, with floating quartz grains.

Interval 3,576'-3,605':

Dolomite, very light to light grey and grey to dark grey, in places very fine sandy, with floating fine to medium, clear quartz grains, grading to siltstone; interbedded with siltstone, very dark grey, dolomitic.

SALINE RIVER FORMATION

Upper shale member

Interval 3,605'-3,721':

Shale, red-brown to greenish grey, in part mottled, in part dolomitic, in part anhydritic; interbedded with siltstone, very light grey with light red-brown colour, dolomitic to very dolomitic, in part anhydritic, with trace of translucent pink crystals.

Anhydrite member

Interval 3,721'-3,762':

Anhydrite, grey to light grey, mottled very light grey, dolomitic, micro- to very finely crystalline, silty; interbedded with shale, grey to dark grey, in places laminated with red-brown, interlaminated with very light grey silt.

Lower shale and sandstone member

Interval 3,762'-3,812':

Interbedded and interlaminated: shale, grey to dark grey; siltstone, very light grey, dolomitic, grading to silty dolomite; sandstone, very light grey, in part greenish, very fine grained and silty, dolomitic; and shale, greenish grey, silty, very dolomitic, grading to very argillaceous dolomite. Lower part of interval consists of interbedded sandstone, red-brown, mottled very light grey, very fine to fine grained, in part medium grained; sandstone quartzitic, very light grey, very fine grained; and sandstone, light brown and grey-brown, very fine to medium grained, in places with pin-point intergranular porosity.

PRECAMBRIAN

(undivided)

Interval 3,812'-3,850':

Siltstone, very light grey with red-brown mottles, in part very fine sandy, in part hematitic; interbedded with sandstone, quartzitic, very light grey, in part red-brown mottled, very fine grained.

Interval 3,850'-4,094':

Sandstone, mainly light grey, but with light purple, green, red-brown and brown colours, very fine to fine grained, well sorted, subrounded quartz grains, in places micaceous, in places glauconitic; interbedded with siltstone, quartzitic, light grey with light purple, green, brown, and red-brown colours, in part micaceous.

NOTE: During the time the well was drilled, mud circulation was lost at a depth of 3,981'. Borehole logs and a drillstem test show the existence of porosity in the interval 3,965'-3,994'. In the samples, no indication of porosity was noted.

Chevron C.S. Ebbutt G-72
Location: Lat. 62°21'25"N, Long. 122°28'38"W
Measured from: 1,215.1' above sea level
Total depth: 4,235'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 3,200'-3,270':

Dolomite, light brown to grey-brown, in part mottled with dark grey, microcrystalline, with dark grey, in part stylolitic partings and pin-point vugs lined with very fine, clear dolomite crystals; in places micro-veins of white dolomite are present.

Interval 3,270'-3,320':

Siltstone, grey and greenish grey, very dolomitic, with in places fine to medium, clear, well-rounded quartz grains, in part pyritic; interbedded with dolomite, light grey to light grey-brown, very silty, crypto- to microcrystalline, with in places fine to medium rounded quartz grains.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 3,320'-3,530':

Dolomite, very light to light brown (in cores 4 and 5, the dolomite is grey to grey-brown), micro- to very finely, in places finely crystalline, in part slightly sucrosic, with dark grey, in part stylolitic laminae and small rounded vugs, in part related to leaching of clear dolomite, infilled interparticle voids ("birdseye structure). Dolomite is in places silty, and has thin beds of light greenish grey, somewhat "waxy", very dolomitic silty shale (*see* core 5).

Interval 3,530'-3,590':

Dolomite, grey-brown to dark grey, mottled very light brown, microcrystalline, with dark grey, in part stylolitic, argillaceous laminae; interbedded with dolomite, very light to light brown, micro- to very finely crystalline, slightly sucrosic.

Interval 3,590'-3,700':

Dolomite, light brown to grey-brown, mottled very light brown, micro- to very finely crystalline, with traces of medium and coarse fragments of crinoid ossicles, in places abundant white "spongy" chert, in places slightly pyritic, with dark grey, in part stylolitic laminae; upper part of interval with vuggy porosity and porous silicified dolomite.

Dark grey dolomite member

Interval 3,700'-3,732':

Dolomite, mottled light and dark grey-brown, micro- to very finely, in part finely crystalline, with medium to coarse crinoid fragments, and dark grey, argillaceous, in part stylolitic laminae. In lower part of interval abundant very dark grey chert fragments.

Basal member

Interval 3,732'-3,788':

Siltstone, very dolomitic, very argillaceous, grading to shale, very dark grey, in places with crinoid fragments; interbedded with dolomite, mottled light brown and very dark grey, very finely crystalline, slightly silty, with medium fragments of crinoids, in places argillaceous to very argillaceous. In places abundant very dark grey fragments of chert nodules.

FRANKLIN MOUNTAIN FORMATION

(undivided)

Interval 3,788'-3,860':

Dolomite, very light to light grey, slightly silty to silty, crypto- to microcrystalline, in part with floating, clear, medium size, rounded quartz grains.

Interval 3,860'-3,910':

Dolomite, grey-brown to dark brown, very argillaceous, very silty, micro- to cryptocrystalline, in places with dark grey argillaceous laminae; interbedded with dolomite, very light to light brown, crypto- to microcrystalline, silty to very silty, in part with floating, clear, medium quartz grains.

Interval 3,910'-3,995':

Dolomite, very light grey to light brown, crypto- to microcrystalline, slightly silty in upper part of interval, very silty and sandy in lower part. Some dark grey stylolitic partings, and traces of light greenish grey siltstone, dark grey to black, dolomitic, very fine to fine grained, pyritic sandstone.

Interval 3,995'-4,030':

Dolomite, very silty, very light grey to light brown, crypto- to microcrystalline, in places very fine sandy; interbedded with siltstone, light greenish grey, argillaceous to very argillaceous, dolomitic.

SALINE RIVER FORMATION

Upper shale member

Interval 4,030'-4,142':

Interbedded and interlaminated siltstone and shale: siltstone, very light brown to very light grey, with some light green and pink colours, dolomitic to very dolomitic, anhydritic, with clear pink anhydrite crystals; siltstone, red-brown, argillaceous; shale, greyish green, or reddish brown, in part mottled.

Anhydrite member

Interval 4,142'-4,185':

Interbedded succession: siltstone, very light brown, dolomitic, in places greenish; anhydritic dolomite, dark grey, mottled with light grey, in places medium pelletoidal, grading to dolomitic anhydrite; shale, grey to dark grey, slightly dolomitic; and shale, greyish green, very silty, slightly dolomitic, in places with clear pink anhydrite crystals.

Lower shale member

Interval 4,185'-4,235':

Interbedded shale, siltstone and sandstone: shale, grey-green and dark grey, in part silty, slightly pyritic; shale, light green to greenish grey, mottled red-brown; sandstone, light greenish grey, very silty, very fine grained, with rare fine clear quartz grains; and siltstone, red-brown, very fine sandy.

IOE Triad Ebbutt J-70
Location: Lat. 62°19'31"N, Long. 121°57'03"W
Measured from: 868.5' above sea level
Total depth: 2,711'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 2,400'-2,442':

Anhydrite, very light grey to light greyish brown, cryptocrystalline; interbedded with minor dolomite, light greyish brown to greyish brown, micro- and finely crystalline, with scattered fine to medium, light brown anhydrite crystals.

Interval 2,442'-2,490':

Dolomite, very light brown, crypto- to microcrystalline, dense, very argillaceous, with light grey clay residue, slightly anhydritic, slightly pyritic. Cored interval 2,464'-2,474' consists of dolomite, grey to light greyish brown, crypto- to microcrystalline, dense, with scattered fine to very fine anhydrite crystals, some clear anhydrite veinlets, and from 2,469'-2,470' thin beds of brecciated, laminated dolomite.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 2,490'-2,616':

Dolomite, light brown to light greyish brown, micro- to very finely crystalline, slightly argillaceous, with dark grey, in part stylolitic laminae and traces of pyrite. Some samples contain very light grey to white chert fragments. Interval 2,606'-2,616', core 6, consists of dolomite, grey to greyish brown, marbled with white, micro- to very finely crystalline anhydrite, with dark grey stylolitic partings, and scattered coarse to very coarse anhydrite crystals. Dolomite has large irregular vugs, partly filled with white anhydrite and clear dolomite crystals. Light brown, rounded chert inclusions are present.

Dark grey dolomite member

Interval 2,616'-2,670':

Dolomite, mottled light brown and dark grey, micro- to very finely crystalline, slightly argillaceous, with dark grey, in part stylolitic shale laminae and traces of pyrite. Interval 2,616'-2,625', core 6, consists of dolomite, grey to dark grey, microcrystalline, slightly argillaceous, with dark grey, wavy shale laminae, in part stylolitic. Irregular light brown chert inclusions and some corals are present (*see* Appendix I).

Interval 2,670'-2,711':

Dolomite, mottled light brown and dark grey, micro- to very finely crystalline, slightly argillaceous, with scattered fine to coarse, light brown crinoid fragments and dark grey stylolitic shale partings. Samples contain traces of grey chert fragments.

H.B. Gulf Fish Lake G-60
Location: Lat. 63°09'29.84"N, Long. 122°54'59.80"W
Measured from: 1,277' above sea level
Total depth: 5,495'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 4,140'-4,210':

Interbedded dolomite, very argillaceous and grading to claystone, light greyish brown to greyish brown, silty; dolomite, argillaceous, very light to light greyish brown, microcrystalline, silty; minor claystone, light greenish grey mottled with reddish brown, dolomitic; and locally sandstone, quartzose, light grey, very dolomitic, finely to medium grained.

MOUNT KINDLE FORMATION

Light grey member

Interval 4,210'-4,305':

Dolomite, silty, very light grey to light greyish brown, mottled with greyish brown, micro- to very finely crystalline, in part very finely to finely crystalline, slightly sucrosic, with poor intercrystalline porosity. Dark grey stylolitic partings are present in the dolomite and some light greyish brown chert fragments are found in the samples.

Interval 4,305'-4,365':

Dolomite, very silty and argillaceous, grey to greyish brown, microcrystalline, pyritic.

Interval 4,365'-4,420':

Dolomite, light greyish brown, very finely to finely crystalline with medium to coarsely crystalline patches and veinlets, slightly pyritic, in places with pin-point vugs.

Interval 4,420'-4,480':

Dolomite, light greyish brown, very finely to finely crystalline, with scattered crinoid ossicles and an abundance of partly silicified dolomite and white chert.

Interval 4,480'-4,550':

Dolomite, slightly silty, light greyish brown to greyish brown, micro- to very finely crystalline, in places slightly pyritic.

Interval 4,550'-4,700':

Dolomite silty, greyish brown to dark greyish brown, micro- to very finely crystalline, with dark grey, in part stylolitic, shale partings.

Dark grey dolomite member

Interval 4,700'-4,880':

Dolomite, slightly argillaceous, greyish brown to dark greyish brown, micro- to very finely and finely crystalline, with scattered fragments of crinoids. Samples contain small amounts of pale and dark chert fragments. The dolomite in interval 4,700'-4,730' has pin-point vugs associated with pale patches of medium to coarsely crystalline dolomite.

Interval 4,880'-4,960':

Dolomite, slightly argillaceous, dark greyish brown mottled with light brown, micro- to very finely crystalline, crinoidal. In the upper part of this interval, 10 to 30 per cent of the lithology consists of pale chert (silicified siltstone and dolomite).

Basal member

Interval 4,960'-5,000':

Interbedded dolomite, very argillaceous, very dark greyish brown; and shale, very dolomitic, very silty and grading to siltstone, very dark grey to black, slightly pyritic.

FRANKLIN MOUNTAIN FORMATION

Rhythmic member

Interval 5,000'-5,020':

Dolomite, silty and very fine arenaceous, very light to light grey, somewhat sucrosic, with scattered fine to medium rounded quartz grains.

Interval 5,020'-5,160':

Dolomite, silty and very fine arenaceous, very light grey to very light brown, speckled with pale reddish brown and in part laminated with grey, micro- to finely crystalline, in places slightly pyritic. Some samples contain fragments of very light grey chert fragments.

Interval 5,160'-5,320':

Interbedded dolomite, slightly argillaceous, grey to dark grey, micro- and micro- to very finely crystalline, commonly with dark grey shale partings; and dolomite, silty, light grey to grey, micro- to very finely crystalline. Some samples contain minor amounts of dolomite rich in medium- to coarse-grained quartz sand; other samples contain pelletoidal or oölitic dolomite and oölitic chert fragments.

Interval 5,320'-5,390':

Interbedded dolomite, silty to very silty, in places with fine- to medium-grained quartz sand, light grey with pale reddish brown, micro- to very finely crystalline; and dolomite, slightly argillaceous, dark grey, micro- to very finely crystalline, somewhat pyritic, with dark grey shale partings.

Interval 5,390'-5,495':

Interbedded dolomite, slightly silty, light grey, micro- to very finely crystalline, in places with fine-grained quartz sand; and dolomite, slightly argillaceous, dark grey, micro- to very finely crystalline, in part pelletoidal.

Mobil Fort Simpson M-70
Location: Lat. 61°59'57.5"N, Long. 122°27'58.9"W
Measured from: an estimated 1,214' above sea level
Total depth: 3,300'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 2,740'-2,813':

Dolomite, very light grey to very light brown, microcrystalline, in places with dark grey stylolitic laminae; interbedded with dolomite, light grey to light greyish brown, in places slightly greenish grey, microcrystalline, slightly silty, in part with black bituminous laminae and patches.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 2,813'-2,933':

Dolomite, very light to light brown, micro- to very finely, in part very finely to finely crystalline, with scattered medium, or medium to coarse crinoidal fragments, in places with dark grey, stylolitic shale laminae, in places with traces of small vugs lined with very fine quartz needles. Some samples have fragments of coarse dolomite crystals indicative of vuggy porosity, other samples contain very light grey fragments of chert. Minor amounts of greenish grey, pyritic shale are present in some samples.

Basal member

Interval 2,933'-2,984':

Upper part of interval consists of siltstone, very dark grey to black, very argillaceous, grading to shale, dolomitic, in places with scattered, fine to medium, clear, subrounded quartz grains and with very dark greyish brown chert fragments. Lower part of interval consists of a sandstone, somewhat quartzitic, very light grey, fine to coarse grained, with subangular to subrounded, clear quartz grains, with traces of pyrite and black bitumen, in places poorly porous.

SALINE RIVER FORMATION

Upper shale member

Interval 2,984'-3,065':

Interbedded and interlaminated siltstone, shale, dolomite and anhydrite: siltstone, very light grey, in part greenish, very dolomitic, very fine sandy;

shale, greyish green, in part very light greenish grey, dolomitic, slightly "waxy", pyritic in part, anhydritic, with rare pink anhydrite crystals; shale, red-brown, mottled with green; dolomite, very argillaceous, dark greyish brown, in part pyritic; and in lower part of interval anhydrite, very light grey to grey, in part greyish brown to dark grey, very dolomitic, in part very argillaceous, with rare, clear, pink, medium to coarse crystals of anhydrite.

Anhydrite member

Interval 3,065'-3,108':

Anhydrite, very light grey to light greyish brown, mottled with greyish brown, very finely crystalline, in places fine pelletoidal, variably argillaceous, slightly dolomitic; interbedded with shale, very dark grey to black, very dolomitic, grading to dolomite, in part anhydritic; and shale, greenish grey, light greenish grey, red-brown or dark grey, variably anhydritic, in part dolomitic.

Lower shale and sandstone member

Interval 3,108'-3,130':

Interbedded shale, siltstone and sandstone: shale, red-brown, slightly dolomitic, silty; siltstone, very light to light greenish grey, in places mottled red-brown, very argillaceous, grading to "waxy" shale; sandstone, very light grey to light greenish grey, fine to medium grained, somewhat quartzitic, with subrounded clear quartz grains; sandstone red-brown, very argillaceous, in part grading to sandy shale, fine grained; and sandstone, very light grey to light green, in part red-brown mottled, very dolomitic, very fine to fine grained, in part very glauconitic.

PRECAMBRIAN

(undivided)

Interval 3,130'-3,300':

Interbedded sandstone, siltstone and shale: sandstone, quartzitic, very light grey in places, with abundant red-brown hematitic spots, very fine to fine grained, in places micaceous; siltstone, very light grey, in part very fine sandy, argillaceous, micaceous; and siltstone, red-brown to light red-brown, in part laminated with very light grey, micaceous, argillaceous. Interval 3,245'-3,300', core 7, consists of interbedded and interlaminated sandstone and minor shale. Sandstone is light green and light purplish with red-brown stain, very fine grained, silty, somewhat quartzitic, in part micaceous (*see* mineralogical analysis, Fig. 11); thin bedded and laminated, interbedded and interlaminated with very micaceous siltstone and shale, both light purple or light green. Sandstone beds vary in thickness from 1/4 inch to 3 feet, but are usually 2 to 6 inches thick. The thin beds are laminated, in places with low angle, planar crossbedding. At 3,253' and at 3,262', 1/2-inch thick, flat-pebble conglomerate beds are present. Core is somewhat fractured and has some quartz veinlets. Some metallic mineralization is present at 3,250'.

Chevron Harris River A-31
Location: Lat. 62°30'02"N, Long. 120°06'00"W
Measured from: 1,169.6' above sea level
Total depth: 2,413'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 1,800'-1,862':

Interbedded succession: dolomite, light brown, microcrystalline, very porous, "spongy"; dolomite, dark grey-brown, microcrystalline, vuggy; dolomite, very light to light brown, microcrystalline, with rare floating, medium anhydrite crystals; and anhydrite, very light grey, dolomitic, very finely crystalline.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 1,862'-1,916':

Dolomite, very light to light brown, microcrystalline, with trace of fine to medium fragments of crinoids, and dark grey, in part stylolitic partings, slightly pyritic. In lower part slightly silty, with trace of light grey chert fragments.

Interval 1,916'-1,955':

Dolomite, grey-brown, mottled grey, microcrystalline, silty to very silty, argillaceous; interbedded with dolomite, light grey-brown, microcrystalline, argillaceous to very argillaceous, with dark grey laminae; in places with rounded, fine to medium white chert inclusions (crinoid ossicles?).

Interval 1,955'-1,970':

Dolomite, light grey-brown, with red-brown mottles and specks, very finely to finely crystalline, with medium to coarse fragments of ?crinoids, and medium to coarse rounded white chert inclusions, slightly argillaceous.

Basal member

Interval 1,970'-2,015':

Dolomite, light greenish grey to grey, very finely crystalline, with abundant medium to coarse fragments of ?crinoids, argillaceous, with dark grey shale laminae; interbedded with dolomite, grey to dark grey, very argillaceous and grading to shale, with abundant clear, fine to medium or coarse to very coarse, rounded quartz grains. Abundant light grey to grey chert fragments in samples.

Interval 2,015'-2,030':

Sandstone, very light brown to light grey, very dolomitic, fine to coarse grained, with subrounded to subangular, clear and rarely pink quartz grains, in places with fair intergranular porosity.

Interval 2,030'-2,054':

Dolomite, dark grey-brown to very dark grey, very argillaceous, grading to shale, microcrystalline; interbedded with dolomite, light grey-brown, micro- to very finely crystalline, slightly argillaceous.

PRECAMBRIAN

(undivided)

Interval 2,054'-2,413':

Sandstone, very light grey and very light greenish grey, fine, in part fine to medium grained, well sorted in part, quartzitic, with traces of poor intergranular porosity; interbedded with sandstone, feldspathic, light grey-brown to light olive-grey, fine and fine to medium grained, with a trace of ?glauconite. Cored interval, 2,400'-2,413', shows well-bedded and laminated, in places crossbedded sandstone as above (*see* mineralogical analysis, Fig. 11).

Aquit. Highland Lake K-42
Location: Lat. 62°31'39.87"N, Long. 122°23'36.18"W
Measured from: 1,186' above sea level
Total depth: 3,849.5'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 3,150'-3,205':

Dolomite, very light grey to grey, crypto- to micro-, and micro- to very finely crystalline, slightly argillaceous and silty, in part micropyritic, in places with scattered coarse anhydrite crystals.

Interval 3,205'-3,225':

Cored interval 3,210'-3,225' consists of siltstone, dolomitic to very dolomitic, light greenish grey and light greyish brown, argillaceous, very pyritic, with abundant irregular laminae and lenses of quartz silt and sand. Interval 3,222'-3,225' contains very sandy dolomitic siltstone with abundant pyrite lenses and laminae. The contact at 3,225' is not present in the core.

MOUNT KINDLE FORMATION

Light grey member

Interval 3,225'-3,450':

Dolomite, very light grey to light greyish brown, finely crystalline, sucrosic, with medium to coarsely crystalline patches associated with vugs, in places slightly pyritic. Cored interval 3,256'-3,265' consists of dolomite, light greyish brown, laminated with dark grey, with abundant horizontally arranged small vugs lined or filled with coarse dolomite and quartz crystals ("laminar birdseye" or "laminoid-fenestral" fabric). Larger vugs are filled with light brown and dark grey, laminated, very fine pyritic quartz and sand ("internal, vadose silt deposit").

Interval 3,450'-3,510':

Dolomite, slightly silty, very light to light greyish brown, microcrystalline, in places slightly pyritic, with minor dark grey, stylolitic shale laminae.

Interval 3,510'-3,670':

Dolomite, very light to light greyish brown, micro- to very finely and very finely to finely crystalline, in places with scattered coarse crinoidal fragments, with dark grey stylolitic partings, and with poor intercrystalline and vugular porosity. Some samples are very rich in fragments of white fossiliferous chert and partly silicified dolomite.

Dark grey dolomite member

Interval 3,670'-3,700':

Dolomite, mottled light and dark greyish brown, slightly argillaceous, very finely crystalline and medium to coarsely crinoidal. Samples contain traces of very dark grey chert fragments.

Interval 3,700'-3,727':

Interbedded dolomite, very argillaceous, very dark grey, microcrystalline, with black shale partings; and dolomite, mottled light and dark greyish brown, very finely crystalline, argillaceous, and medium to coarsely crinoidal. Samples contain a minor amount of black chert fragments.

Basal member

Interval 3,727'-3,765':

Interbedded dolomite, argillaceous, very dark grey, micro- to very finely crystalline, crinoidal; and shale, variably dolomitic, very dark grey to black, in places with medium to coarse quartz grains or crinoid ossicles.

FRANKLIN MOUNTAIN FORMATION

Rhythmic member

Interval 3,765'-3,780':

Dolomite, slightly silty, very light to light grey, somewhat sucrosic, microcrystalline, slightly pyritic.

Interval 3,780'-3,849.5':

Dolomite, very light grey to very light brown, variably silty and very fine sandy, interlaminated with greenish grey, dolomitic and silty sandstone.

Chevron Hornell Lake G-24
Location: Lat. 62°23'21"N, Long. 119°34'04"W
Measured from: 2,341' above sea level
Total depth: 3,186'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 2,917'-2,979':

According to borehole logs, this interval consists of salt.

Interval 2,979'-3,038':

Dolomite, light brown to brown, ?oil stained, micro-, in part very finely crystalline, in part porous, with ?salt infill; interbedded with anhydrite, very light grey, cryptocrystalline, in part with vugular porosity (leached salt inclusions?).

MOUNT KINDLE FORMATION (CHEDABUCTO LAKE FM.)

Dolomite member

Interval 3,038'-3,075':

Dolomite, very light brown, mottled with light reddish brown and light green, slightly argillaceous to argillaceous (light grey siliceous residue), with scattered medium, in part siliceous, ?crinoid fragments and some small vugs lined with dolomite crystals.

Basal member

Interval 3,075'-3,130':

Interbedded dolomite and siltstone: dolomite, very light brown, in part mottled light green, very finely crystalline, very sandy with abundant fine to coarse, clear and pink quartz grains, slightly argillaceous, slightly pyritic; siltstone, very light grey with green mottles, very dolomitic, grading to dolomite, with a trace of glauconite grains; siltstone, green, argillaceous, dolomitic, with minor green shale partings; and dolomite, very light brown, mottled very light reddish brown, cryptocrystalline.

SALINE RIVER FORMATION

(undivided)

Interval 3,130'-3,170':

Interbedded and interlaminated siltstone, and shale: siltstone, very light greyish brown, with light reddish brown mottles, dolomitic, glauconitic; siltstone, light reddish brown, dolomitic, slightly glauconitic; shale, green and reddish brown dolomitic; and dolomite, greyish green, argillaceous. In basal part of interval siltstone, light reddish brown, dolomitic, sandy, with scattered coarse clear quartz grains.

Interval 3,170'-3,186':

Interbedded shale, sandstone and dolomite: shale, red-brown, dolomitic; sandstone, very light grey, dolomitic, very fine grained, slightly glauconitic; and dolomite, red-brown, very argillaceous.

Imperial Lac Tache C-35
Location: Lat. 63°44'15"N, Long. 120°36'45"W
Measured from: 1,013.8' above sea level
Total depth: 1,719'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 690'-745':

Interbedded anhydrite, siltstone and dolomite: anhydrite, very light grey, very coarse, in part cryptocrystalline; siltstone, light greenish grey, dolomitic to very dolomitic, argillaceous, in part anhydritic; and dolomite, very light grey to light grey-brown, crypto- to microcrystalline, in part anhydritic, in part pyritic.

Interval 745'-806':

Siltstone, light grey to grey and greenish grey, dolomitic to very dolomitic, very fine sandy, argillaceous, with scattered medium to coarse, subrounded quartz grains, in places anhydritic. Basal part of interval contains interbeds of light grey-brown, silty shale, and greenish grey with red-brown mottles, very dolomitic, argillaceous siltstone.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 806'-970':

Dolomite, light brown to grey-brown, micro- to very finely crystalline, with dark grey, in part stylolitic argillaceous laminae. Upper part of interval contains vugs and veins infilled with anhydrite and light grey silt; some grey-brown chert nodules and some vuggy porosity (*see* cored interval 853'-872').

Interval 970'-1,210':

Dolomite, dark to very dark grey, microcrystalline, argillaceous, with dark grey shale partings; interbedded with dolomite, light brown to greyish brown in places, mottled with dark grey, microcrystalline, with traces of medium to coarse fragments of crinoids and light grey chert. From 990' to 1,010', abundant very dark grey argillaceous anhydrite.

Dark grey dolomite member

Interval 1,210'-1,290':

Dolomite, mottled light brown and dark grey, micro- to finely crystalline, with abundant medium to coarse crinoid fragments, slightly silty.

Basal member

Interval 1,290'-1,318':

Dolomite, dark to very dark greyish brown, argillaceous to very argillaceous, slightly silty, in places grading to silty, dolomitic shale, with rare floating, clear, fine to medium rounded quartz grains.

FRANKLIN MOUNTAIN FORMATION

(undivided)

Interval 1,318'-1,340':

Siltstone, very dolomitic, grading to dolomite, greenish grey, very sandy, with clear, rounded, fine to coarse quartz grains.

Interval 1,340'-1,412':

Dolomite, very light to light grey, micro- to cryptocrystalline, slightly silty to silty, in places slightly pyritic; interbedded with siltstone, very dolomitic, grading to dolomite, very light to light greenish grey, very fine sandy, slightly argillaceous, in places very argillaceous, with scattered fine to medium rounded quartz grains. At base of interval, shale light greenish grey to greenish grey, very dolomitic, micropyritic.

?PRECAMBRIAN

(undivided)

Interval 1,412'-1,719':

Sandstone, quartzitic, light grey and reddish brown, fine to very coarse grained, poorly sorted, subangular with clear, light grey and pink quartz grains. Upper part of interval cemented with light grey silty dolomite. Lower part of sandstone interval is red-brown, hematitic, with red-brown coating and brown shale partings (*see* mineralogical analysis, Fig. 11).

C.S. I.O.E. Jackfish N-69
Location: Lat. 62°28'47"N, Long. 121°27'32"W
Measured from: 825.5' above sea level
Total depth: 2,622'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 2,110'-2,135':

Anhydrite, very light grey to white, cryptocrystalline.

Interval 2,135'-2,148':

Interbedded dolomite, greenish grey, argillaceous; and anhydrite, dolomitic, greyish brown with pale green and reddish brown, crypto- to microcrystalline, silty.

MOUNT KINDLE FORMATION

Light grey member

Interval 2,148'-2,430':

Dolomite, very light to light greyish brown mottled with grey, micro- to very finely crystalline, in places very finely to finely crystalline, somewhat sucrosic, with scattered poor, vugular porosity and traces of bituminous infill, in places with dark grey stylolitic shale partings. Samples between 2,350' and 2,400' contain minor amounts of brown chert fragments.

Interval 2,430'-2,465':

Dolomite, light greyish brown and greyish brown mottled with dark grey, slightly argillaceous, very finely to finely crystalline with scattered medium and coarse crinoidal debris, with dark grey stylolitic shale partings, and in places with intercrystalline and vugular porosity with traces of bitumen. Some samples contain a small amount of light brown and black chert fragments.

Basal member

Interval 2,465'-2,507':

Interbedded siltstone, very argillaceous, dolomitic, dark grey, pyritic, very fine sandy; and dolomite, very argillaceous, mottled greyish brown and dark grey, very finely crystalline, in part crinoidal, with dark grey shale partings. Some samples contain an abundance of dark grey, fossiliferous chert fragments.

PRECAMBRIAN

(undivided)

Interval 2,507'-2,540':

Succession of interbedded and interlaminated sandstone, quartzitic, very light grey, pale reddish brown or pale green, silty, very fine grained; shale, very pale greenish grey, pyritic; and siltstone, reddish brown, argillaceous.

Interval 2,540'-2,600':

Interbedded and interlaminated succession of siltstone, dark to very dark grey, argillaceous, very fine sandy; shale very dark grey; and sandstone, quartzitic, very light reddish brown, very finely grained.

Interval 2,600'-2,622':

Interbedded sandstone, quartzitic, light grey to grey, very finely grained; siltstone dark to very dark grey, argillaceous, in places very fine sandy, in places quartzitic; and minor shale, very dark grey.

Horn R. Shell Levis D-76
Location: Lat. 62°25'06"N, Long. 118°29'34"W
Measured from: 798' above sea level
Total depth: 1,463'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 990'-1,085':

Interbedded and interlaminated anhydrite and dolomite: anhydrite, very light grey, in part light brown speckled, with scattered dolomite crystals in anhydrite matrix; interbedded with dolomite, light brown to brown, micro- to very finely or finely crystalline, sucrosic, with good intercrystalline porosity, in places slightly vugular, all stained, in part mottled with very light grey anhydrite inclusions.

Interval 1,085'-1,100':

Dolomite, light greyish brown to light brown, cryptocrystalline, very anhydritic, with scattered medium to coarse anhydrtie crystals.

MOUNT KINDLE FORMATION (CHEDABUCTO LAKE FM.)

Light grey dolomite member

Interval 1,100'-1,140':

Upper part of interval is dolomite, light grey to light greenish grey, micro- to very finely crystalline, slightly sucrosic, slightly silty, dense, with fragments of very light grey fossiliferous chert fragments. Lower part of interval consists of dolomite, light grey, with abundant red-brown and purple mottles, very finely to finely crystalline, slightly silty, very argillaceous, with a trace of scattered crinoid ossicles; interbedded with siltstone, very fine sandy, light greenish grey, very dolomitic, with red-brown mottles and very fine glauconite grains. Abundant very light grey, red-brown mottled chert fragments, in places fossiliferous.

Basal member

Interval 1,140'-1,159':

Dolomite, light greenish grey, mottled with red-brown, very argillaceous, grading to dolomitic shale, micro- to very finely crystalline, slightly pyritic, with dark grey shale laminae.

SALINE RIVER FORMATION

(undivided)

Interval 1,159'-1,220':

Siltstone, very light greyish brown or light greenish grey, dolomitic, in part very fine sandy, glauconitic, in part anhydritic, in part micaceous, with scattered clear pink crystals of anhydrite; interbedded and interlaminated with shale, green, in part mottled with red-brown. At base of interval sandstone, grading to siltstone, light greyish brown to greyish brown, very fine grained, very dolomitic, with quartz and dark grey chert grains.

MOUNT CAP FORMATION

Upper shale member

Interval 1,220'-1,253':

Shale, green, in part dark grey, soft, with rare brown brachiopod shell imprints.

Dolomite member

Interval 1,253'-1,355':

Dolomite, light greyish brown, mottled with dark grey, very finely to finely to medium crystalline, sucrosic, variably silty and variably argillaceous, with very poor intercrystalline porosity; interbedded with sandstone, light greenish grey and light green, very dolomitic, silty, very fine sandy, in places very argillaceous. Lower part of interval consists of interbedded sandstone (as above) and shale, green, silty slightly dolomitic, with brown shell imprints of inarticulate brachiopods.

Lower shale member

Interval 1,355'-1,404':

Shale, green and greyish green, mottled with light brown and red-brown, soft, fissile.

Interval 1,404'-1,440':

Sandstone, very light brown, dolomitic, very fine grained, in places glauconitic, micaceous, in places with coarse and very coarse, clear and pink quartz grains; laminated with green shale, in part silty and very fine sandy, micaceous, in lower part of interval brown and red-brown mottled.

Interval 1,440'-1,456':

Weathered granite or sandstone, light grey and pink, coarse to very coarse grained, dolomitic, consisting of feldspar, quartz and green-weathered minerals in matrix of dolomitic silt.

PRECAMBRIAN

Interval 1,456'-1,463':

Granite, consisting of weathered K-feldspars in part intergrown with quartz, quartz, and biotite.

Pan. Am. A-1 Mattson Creek No. 1
Location: Lat. 61°02'00"N, Long. 123°48'30"W
Measured from: an estimated 2,075' above sea level
Total depth: 10,890'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 9,380'-9,445':

Interbedded dolomite: dolomite, light grey to grey, micro- to cryptocrystalline, silty; dolomite, very

light to light grey, micro- to very finely crystalline, slightly silty; and dolomite, dark to very dark grey, slightly argillaceous, crypto- to micro-, in part very finely crystalline.

Interval 9,445'-9,485':

Siltstone, very dolomitic, very light to light greenish grey, in part pyritic; interbedded with dolomite, very silty grading to siltstone, light grey to grey, crypto- to microcrystalline, in part with floating fine and medium clear quartz grains.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 9,485'-9,710':

Interbedded dolomite: dolomite, light grey to grey, very finely to finely crystalline, slightly sucrosic; and dolomite, grey to dark grey, micro- to very finely crystalline, slightly argillaceous, in part slightly pyritic, in upper part of interval slightly silty. Microscopic white veins of dolomite, and dark grey stylolitic partings are present in some parts of interval. Traces of light grey chert fragments are present in basal part of the interval.

Interval 9,710'-9,935':

Interbedded dolomite as in interval 9,485'-9,710', with minor amounts of very dark grey dolomitic shale, and traces of very dark grey chert fragments from 9,710'-9,748'. From 9,748' to 9,935', the light grey to grey dolomite is slightly silty to silty, and traces of medium and coarse crinoid fragments, fine pelletoids and very light grey chert fragments are present. Dolomite is in places brecciated, and has white, recrystallized patches and veinlets of finely to medium crystalline dolomite and traces of quartz crystals.

Interval 9,935'-10,000':

Dolomite, grey, slightly greenish, silty, in part argillaceous to very argillaceous, micro-, in part very finely crystalline.

Dark grey dolomite member

Interval 10,000'-10,192':

Dolomite, grey to dark grey, mottled with very light grey, micro- to very finely, in places finely crystalline, in part silty to slightly silty, in part slightly argillaceous, with scattered coarse fragments of crinoids, and white dolomite veinlets. Lower part of interval includes some very light to light grey, very finely to finely crystalline dolomite containing abundant very light grey chert fragments.

Interval 10,192'-10,225':

Dolomite, grey to dark grey, slightly argillaceous, very finely to finely crystalline, interbedded with dolomite, light grey to grey, very finely to finely crystalline, slightly silty.

Interval 10,225'-10,295':

Dolomite, very dark to dark grey, microcrystalline, very argillaceous, silty, grading to dolomitic shale in places, interbedded with dolomite, grey to dark grey, microcrystalline, silty.

Interval 10,295'-10,400':

Dolomite, grey to dark grey, mottled with very light grey, very fine, and very finely to finely crystalline, slightly argillaceous, slightly silty, in part with white patches and veinlets of very fine to fine dolomite. Traces of light brown chert fragments. Cored interval 10,320'-10,330' is fossiliferous (*see* Appendix I).

Interval 10,400'-10,505':

Dolomite, grey to dark grey, very much mottled with light grey, very finely to finely crystalline, with white patches of very fine to fine dolomite (brecciated?) and a trace of crinoid ossicles. Some very light grey chert fragments, and some coarse, white dolomite crystals.

Interval 10,505'-10,590':

Dolomite, grey mottled with light grey, very finely to finely crystalline, in part slightly pyritic, in places with very light grey silicified patches; interbedded with dolomite, grey to dark grey, mottled with light grey, very finely crystalline, slightly argillaceous, slightly silty, slightly pyritic, in part with vuggy porosity lined with quartz crystals. Some samples with a trace of clear anhydrite crystals.

Interval 10,590'-10,645':

Dolomite, light grey to greyish brown, microcrystalline, silty, in places with faint, fine pelletoids.

Interval 10,645'-10,705':

Dolomite, light greyish brown to grey, mottled with white, crypto- to microcrystalline, silty, with white silicified patches and coarse quartz crystals (vuggy porosity?). Some white chert fragments.

Interval 10,705'-10,835':

Dolomite, grey to dark grey, mottled with light grey, very finely to finely crystalline, slightly argillaceous, in places slightly silty, with rare ?crinoid fragments and very fine pelletoids. Basal part of interval with up to 50% anhydrite, white, light grey and clear, very dolomitic, micro- to very finely crystalline, associated with dolomite as veinlets or as matrix for fine dolomite pelletoids.

Interval 10,835'-10,865':

Dolomite, light grey, mottled with very light grey, crypto- to microcrystalline, slightly silty, with abundant white patches and veinlets of very fine to coarse dolomite and anhydrite.

Interval 10,865'-10,890':

Dolomite, dark grey, microcrystalline, argillaceous, slightly pyritic, with white veinlets of dolomite.

F.P.C. Tenneco Root River K-60
Location: Lat. 62°39'32.2"N, Long. 123°24'28.9"W
Measured from: 1,668' above sea level
Total depth: 8,571'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 5,600'-5,670':

Interbedded dolomite, very light to light grey, crypto- to microcrystalline, silty, with scattered very fine quartz grains; and dolomite, grey to greyish brown, micro- to cryptocrystalline.

Interval 5,670'-5,760':

Interbedded dolomite, light grey to greyish brown and greenish grey, microcrystalline, silty to very silty; and siltstone, dark grey to greenish grey, very dolomitic, argillaceous, in part very argillaceous, very fine sandy in places.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 5,760'-6,025':

Dolomite, very light grey to grey, micro- to very finely, in part very finely to finely crystalline, slightly sucrosic, slightly silty to silty, very poor intercrystalline porosity in places; interbedded with dolomite, grey to dark grey, mottled with light grey, slightly argillaceous, slightly silty.

Interval 6,025'-6,045':

Dolomite, very light grey to white, finely to medium crystalline, with poor to fair intercrystalline porosity and some vugs.

Interval 6,045'-6,190':

Dolomite, grey to dark grey, mottled with very light grey, micro-, in places micro- to very finely crystalline, slightly argillaceous, in places argillaceous; interbedded with dolomite, very light grey to grey, microcrystalline, very silty.

Dark grey dolomite member

Interval 6,190'-6,375':

Dolomite, greyish brown to dark grey, mottled with very light grey, micro- to very finely crystalline, slightly argillaceous, with scattered fragments of crinoids and white secondary dolomite; interbedded with dolomite, light greyish brown, micro- to very finely, and very finely crystalline, with scattered fragments of crinoids. Samples have small amount of light brown and very dark grey chert fragments.

Interval 6,375'-6,565':

Dolomite, grey to dark grey, mottled with very light grey, micro-, in part very finely crystalline, in part argillaceous, in places with scattered medium fragments of crinoids; interbedded with minor dolomite, light grey, microcrystalline, in part very finely crystalline, in places slightly silty. Lower part of interval with very dark grey shale partings, in part stylolitic, and some fragments of very dark grey chert. Cored interval 6,551'-6,565' consists of dark grey, microcrystalline dolomite, with widely scattered very dark grey chert nodules which contain light grey fossil fragments, and light grey lenses of secondary dolomite with poor intercrystalline and vuggy porosity. Dark grey wavy shale laminae, often stylolitic, are common.

Interval 6,565'-6,580':

This interval was cored and consists of dolomite, dark grey, microcrystalline, argillaceous, with a few scattered small very dark grey chert nodules and corals (*see* Appendix I).

Interval 6,580'-6,884':

Dolomite, dark grey, mottled with light grey, slightly argillaceous, micro- to very finely crystalline, with scattered, medium, crinoidal fragments; interbedded with dolomite, light grey to grey, micro- to very finely, in places very finely to finely crystalline, with scattered medium fragments of crinoids. Middle part of interval in places contains abundant very dark grey chert fragments. Lower part of interval consists of dark to very dark grey, argillaceous dolomite, micro- to very finely crystalline, with abundant fine- to medium-size fragments of crinoids. Cored interval 6,620'-6,645' consists of dolomite, dark grey with fine light grey specks, slightly argillaceous, slightly silty, very finely crystalline with abundant coarse to very coarse fossil debris, mostly crinoid ossicles. Dolomite has scattered dark grey, wavy, in part stylolitic shale laminae; scattered small vugs, partly lined with white dolomite and anhydrite crystals; light brown chert nodules, irregularly rounded, with microscopic fossil fragments; and a few corals and brachiopods (*see* Appendix I).

Basal member

Interval 6,884'-6,938':

Dolomite, dark to very dark grey, mottled with light grey, very argillaceous, microcrystalline, slightly pyritic, with a trace of crinoid ossicles; interbedded with very dark grey shale, in part as partings in dolomite. Some very dark grey chert fragments in samples.

FRANKLIN MOUNTAIN FORMATION

Rhythmic member

Interval 6,938'-6,970':

Dolomite, calcareous, light grey, micro- to very finely crystalline, very silty to silty, in part very fine sandy (clear quartz), with a trace of crinoid ossicles.

Interval 6,970'-7,090':

Dolomite, very light to light grey, micro- to very finely and finely crystalline, silty to very silty and sandy, with scattered clear, subangular and subrounded quartz grains, traces of dark grey pelletoids. Very light grey to white chert fragments and black chert fragments with pellets or clear quartz grains are present in some samples.

Interval 7,090'-7,380':

Dolomite, grey to dark grey, in part light grey mottled, micro- to very finely crystalline, slightly argillaceous, in part argillaceous, silty to very silty, in places coarsely pelletoidal; interbedded with dolomite, very light to light grey, micro- to very finely crystalline, very silty and sandy, in places with scattered, fine to medium, clear, subrounded quartz grains in places laminated with dark grey dolomite. In some samples traces of dark grey chert fragments are present. Lower part of interval has minor amounts of light grey, dolomitic sandstone, fine to medium grained; and the very light to light grey dolomite is very silty and grades to siltstone in places. Fine and medium, subrounded, clear quartz grains in the dolomite are present in abundance.

Interval 7,380'-7,510':

Dolomite, very light to light grey, in part greenish grey, cryptocrystalline, silty, with abundant, clear and pinkish, subrounded, very fine to coarse quartz grains, in places somewhat pyritic; in basal part of interval interbedded with siltstone, very light to light grey, very dolomitic, in part pyritic.

SALINE RIVER FORMATION

(undivided)

Interval 7,510'-7,606':

Interbedded and interlaminated siltstone, shale and dolomite: siltstone, light reddish brown to brick-red, dolomitic, in part argillaceous; siltstone, very light grey, with light reddish brown, dolomitic to very dolomitic; shale, brick-red, silty in part; and dolomite, light greenish grey, very silty, slightly argillaceous to argillaceous, in part pyritic, micro-laminated with very light grey siltstone and red shale.

Interval 7,606'-7,658':

Interbedded dolomite, siltstone and shale: dolomite, greenish grey, micro- to cryptocrystalline, very argillaceous, grading to shale, silty, in part pyritic; dolomite, very light grey to light greenish and light reddish grey, microcrystalline, very silty, in part anhydritic; minor siltstone, red-brown and light purple, argillaceous; and minor shale, brick-red, dolomitic.

Interval 7,658'-7,676':

Interbedded sandstone, dolomite and shale: sandstone, light greenish grey, very light brown, and light reddish brown to reddish brown, argillaceous, very dolomitic, fine to coarse, subrounded, poorly sorted, clear quartz; dolomite, greenish grey, argillaceous, as in interval 7,606'-7,658'; dolomite, light green, "waxy", very argillaceous; dolomite, grey to dark grey, very silty, slightly pyritic; and shale, brick-red, very dolomitic, in part silty, with scattered, fine to medium, clear quartz grains. Contact with underlying Proterozoic argillite is probably present in core 6. Interbedded sandstone, greenish grey to dark grey; and light grey to grey, dolomitic. Both sandstone types are very fine to coarse grained, poorly sorted, with subrounded clear and pinkish quartz grains, in places with metallic mineralization. Beds are separated by thin, dark grey, argillaceous intervals. Contact at 7,681' in core (probably corresponds with 7,676' on gamma-ray log) is irregular. Basal part of sandstone is grey to dark grey and greenish. The sandstone is present as flattened horizontal burrow-like structures in the light green to olive-grey argillite just below the contact at 7,681', and fills very thin vertical fractures in the argillite, just below the contact (*see* mineralogical analysis, Fig. 11).

PRECAMBRIAN

(undivided)

Interval 7,676'-7,980':

Argillite, reddish brown, in places mottled with very light greenish grey and light green, silty; interbedded with siltstone, reddish brown and light greenish grey, very argillaceous. Upper part of interval mainly argillite, red-brown, very regularly laminated, flaggy. In core 6, the uppermost two feet are light green to olive-grey, regularly laminated with dark grey, with abundant very fine pyrite crystals. Lower part of interval contains minor amounts of very light to light grey dolomite, micro- to very finely crystalline; and grey to dark grey dolomite, very argillaceous, microcrystalline.

Interval 7,980'-8,200':

Argillite, grey to dark grey and locally green, in part laminated with black, silty to very silty,

grading to siltstone, grey to dark grey, or olive-grey, laminated with black shale partings which have fine, rounded impressions on the bedding surface ("pitted"); interbedded with argillite, light green to olive-grey, very silty, in places with abundant scattered red-brown and rusty, fine, subrounded grains of siderite (*see* mineralogical analysis, Fig. 11). Minor amount of dolomite as in interval 7,676'-7,980' in upper part of interval.

Interval 8,200'-8,490':

Interbedded succession of argillite, brick-red, very silty; argillite, olive-grey to light green, in part very silty, in places with fine, rusty, siderite grains; argillite, grey to dark grey, very silty, as in interval 7,980'-8,200'; minor sandstone, very light grey and dark grey mottled, poorly sorted, very fine to medium grained, with clear, subrounded quartz grains; and in lower part minor sandstone, very light grey, very fine to fine grained, somewhat quartzitic, green and red-brown. Core 7 consists of red-brown argillite, mottled with light greenish grey, irregularly wavy laminations with silty argillite and minor, thin beds of sandstone, light greenish grey, mottled with light green and red-brown, argillaceous to very argillaceous (*see* mineralogical analysis, Fig. 11), medium and coarse, subrounded, clear and pinkish quartz grains, often floating in matrix, in places with metallic mineral deposits. The core shows an abundance of sedimentary structures, such as burrow-like infills, convoluted laminae, shale clasts and small-scale erosional features. No cross-bedding or regular laminations characteristic of well-sorted sediment were noted.

Interval 8,490'-8,571':

Argillite, brick-red, very silty and grading to siltstone, in places very fine sandy; interbedded with minor sandstone, very light grey, quartzitic, very fine to fine grained, or brick-red, very fine to fine grained, very silty.

Husky *et al.* Sibbeston G-69
Location: Lat. 61°58'28"N, Long. 122°41'45"W
Measured from: 1,178' above sea level
Total depth: 3,570'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 3,050'-3,135':

Dolomite, light brown to brown, with abundant white mottles, crypto- to microcrystalline, with patches of white, very finely to finely crystalline dolomite in veinlets and vugs, in places vaguely pelletoidal or brecciated, with poor pin-point vuggy porosity; interbedded with dolomite, light brown to dark brown, with fine pelletoids, pyritic; dolomite, dark grey, sucrosic, very finely crystalline, in places with poor pin-point vuggy porosity and fair intercrystalline porosity, in part filled with black bitumen. In lower part of interval dolomite, very light to light brown, microcrystalline, with dark grey stylolitic argillaceous partings, interbedded with dolomite, greenish grey, slightly argillaceous, microcrystalline.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 3,135'-3,274':

Dolomite, very light brown to brown, very finely to finely crystalline, in places with abundant fine to coarse, very light grey dolomite, and scattered medium to coarse crinoidal fragments, some poor intercrystalline and pin-point vuggy porosity is present, in part with black bitumen. Very dark grey stylolitic partings are present.

Basal member

Interval 3,274'-3,330':

Upper part of interval consists of shale, very dark grey to black, in part very silty, with abundant fine to coarse, subrounded, frosted clear quartz grains; interbedded with sandstone, very light grey, in places with black cherty matrix, fine to coarse grained, in places quartzitic, with subrounded, clear quartz and traces of black chert grains. Lower part of interval consists of sandstone only.

SALINE RIVER FORMATION

Upper shale member

Interval 3,330'-3,393':

Upper part of interval comprises siltstone, very light grey to very light green, very dolomitic, very fine sandy, with scattered fine to medium quartz grains, micropyritic and with traces of glauconite, interbedded with shale, greyish green, micropyritic. Lower part of interval consists of interbedded red-brown and grey-green mottled shale, slightly dolomitic, associated with anhydrite and minor anhydrite, very light grey.

Anhydrite member

Interval 3,393'-3,422':

Anhydrite, very light grey, mottled with light green, very finely to finely crystalline, with medium to coarse, clear, pink crystals of anhydrite, laminated with shale, light greenish grey; interbedded with shale, dolomitic to very dolomitic, very dark grey to black, in places anhydritic.

Lower shale member

Interval 3,442'-3,500':

Interbedded siltstone and shale: siltstone, very fine sandy, red-brown to dark red-brown, argillaceous to very argillaceous, dolomitic; shale, red-brown, in part silty and very fine sandy; siltstone, very light grey, light green and light red, argillaceous to very argillaceous, in part grading to green shale; and, in basal ten feet of interval, sandstone, very light greenish grey to very light green, very fine to fine grained, quartzose, with trace of glauconite.

PRECAMBRIAN

Interval 3,500'-3,570':

Upper 40 feet of interval consist of weathered granite, pink feldspar, light grey quartz and green mineral in red-brown shale or dolomite cement. Lower part of interval is a dark greenish grey granite, consisting of quartz, K-feldspars, hornblende and biotite. The quartz and K-feldspars are intergrown.

I.O.E. Trail River P-13
Location: Lat. 62°02'59"N, Long. 121°32'13"W
Measured from: 682.4' above sea level
Total depth: 2,700'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 2,300'-2,380':

Interbedded anhydrite, light greyish brown and light grey, crypto- to microcrystalline; anhydrite, variably dolomitic and argillaceous, light brown, microcrystalline; and minor dolomite, brown to greyish brown, microcrystalline, with scattered fine to coarse anhydrite crystals and dark grey stylolitic partings.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 2,380'-2,410':

Dolomite, very light to light brown, very finely and finely crystalline, somewhat sucrosic, with scattered coarse fragments of crinoids and abundant fragments of very pale chert.

Basal member

Interval 2,410'-2,428':

Interbedded dolomite, very light and light brown, very finely and finely crystalline, with scattered coarse fragments of crinoids; and siltstone, greenish grey, very dolomitic, very argillaceous, in places very finely sandy, and somewhat pyritic.

Interval 2,428'-2,445':

Interbedded shale, dark to very dark grey, somewhat dolomitic; and sandstone, quartzose, finely grained, slightly pyritic.

Interval 2,445'-2,502':

Sandstone, very light grey, quartzose. Between 2,445' and 2,465', the sandstone is very finely to finely grained, with clear, milky and rarely pink subangular quartz grains in a matrix of quartz silt. Between 2,465' and 2,502', the sandstone is finely to very coarsely grained and has abundant pink quartz grains. The sandstone is in places porous and according to the sonic log the porosity ranges between 7 and 10 per cent.

PRECAMBRIAN

(undivided)

Interval 2,502'-2,700':

Interbedded and interlaminated shale, very dark grey, silty; siltstone, very dark grey, argillaceous, very finely and finely micaceous; siltstone very light and light grey, in places sandy, in places micaceous; shale, very light greenish grey, somewhat "waxy"; and sandstone, somewhat quartzitic, very light grey to light greenish grey, silty and very finely grained.

Imperial Triad Willow Lake B-28
Location: Lat. 62°17'05"N, Long. 119°04'25"W
Measured from: 2,438' above sea level
Total depth: 3,223'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 2,942'-2,990':

Borehole logs indicate the existence of salt in this interval.

Interval 2,990'-3,042':

Samples are very poor over this interval. Interval 3,000'-3,019', core 5, consists of dolomite, light brown to brown, oil stained, micro- to very finely crystalline, in places with poor intercrystalline porosity, irregularly interbedded with very anhydritic dolomite beds, in which the anhydrite is present as irregular flattened inclusions or as bedded nodular mosaics. The lower two feet of the core consist of laminated anhydrite, light grey.

Interval 3,042'-3,050':

Sandstone, very light grey, dolomitic, slightly anhydritic, very fine to medium grained, poorly sorted clear and pink quartz grains.

MOUNT KINDLE FORMATION (CHEDABUCTO LAKE FM.)

Dolomite member

Interval 3,050'-3,102':

Dolomite, light pink, in places mottled red-brown, very finely to finely crystalline, argillaceous and slightly silty (light grey siliceous residue), in places with fair vugular and intercrystalline porosity.

Basal member

Interval 3,102'-3,146':

Upper part of interval consists of very sandy, very light grey, mottled with pink and light red-brown, argillaceous and silty dolomite, with abundant very fine quartz grains and some light grey chert inclusions. Lower part of interval is sandstone, very

dolomitic, very light grey, mottled with red-brown and purple, very fine to fine grained, silty and argillaceous, in places with poor intergranular porosity.

PRECAMBRIAN

Interval 3,146'-3,223':

Weathered crystalline rock fragments, dark greenish grey. Interval 3,219'-3,223', core 6, consists of a dark greenish grey weathered granite, containing biotite and intergrown quartz and K-feldspar.

Husky H.B. *et al.* Willow Lake G-32
Location: Lat. 62°21'22"N, Long. 120°51'13"W
Measured from: 1,192' above sea level
Total depth: 2,745'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 2,340'-2,375':

Anhydrite, light brown and grey to dark grey, slightly dolomitic, cryptocrystalline.

Interval 2,375'-2,388':

Dolomite, very light brown, in places grey, argillaceous, crypto- to microcrystalline.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 2,388'-2,460':

Dolomite, mottled very light grey and light brown, micro- to very finely crystalline, in part very finely crystalline, with medium to coarse fragments of ?crinoid ossicles and rare coarse to very coarse, rounded, very light grey chert inclusions, with very dark grey, in part stylolitic shale partings, in places pyritic.

Interval 2,460'-2,500':

Dolomite, mottled dark grey-brown and very light brown, micro- to very finely, and very finely crystalline, slightly argillaceous to argillaceous, with very dark grey shale partings, and scattered medium to coarse fragments of ?crinoid ossicles. Light brown dolomite is slightly silty. Lower five feet of interval contain very dolomitic shale, very dark grey, grading to very argillaceous dolomite, with light brown, medium to coarse fragments of crinoid ossicles. Samples with very light brown chert fragments.

Interval 2,500'-2,527':

Dolomite, mottled dark grey-brown and light brown, micro- to very finely crystalline, argillaceous, in part silty, with scattered light brown fragments of crinoid ossicles. Interval 2,505'-2,527', core 2, consists of dolomite, dark grey, micro- to very finely crystalline, argillaceous and silty to very fine sandy, with abundant light grey medium to coarse fossil fragments, including scattered, poorly preserved corals. From 2,510'-2,527', there are abundant irregular, wavy, dark grey shale laminae, and poorly defined, grey-brown chert nodules and nodular beds, which contain an abundance of light grey fossil fragments. Some corals were collected from this interval (*see* Appendix I).

Basal member

Interval 2,527'-2,560':

Interval 2,527'-2,538', core 2, consists of dark grey, dolomitic and silty shale, interbedded with dark grey, very argillaceous and variably dolomitic siltstone, with scattered very fine quartz grains. Pyrite is present in small clusters or scattered in matrix. Some beds are rich in light grey crinoid ossicles, and some corals are present at 2,528' (*see* Appendix I). Lower part of interval was not cored, and consists of sandstone, very light grey, very fine to coarse grained, in places slightly dolomitic and slightly pyritic, with clear and pinkish subrounded and subangular quartz grains and a trace of polished black chert grains, in part somewhat quartzitic; interbedded with shale, very dark grey to black, dolomitic with scattered medium to coarse quartz grains. Some very dark grey chert fragments and frosted medium to coarse quartz grains are present in the samples.

PRECAMBRIAN

(undivided)

Interval 2,560'-2,590':

Granite, greenish grey, mottled with red-brown, coarsely crystalline, weathered appearance, consisting of weathered K-feldspars, quartz and biotite.

Interval 2,590'-2,612':

Sandstone, quartzitic, very light grey, fine to coarse grained, with clear and pinkish, subangular quartz, in places with very light greenish grey clay cement, in places with red-brown clay cement.

Interval 2,612'-2,676':

Sandstone, light greenish grey to very light grey, very fine and fine to medium grained, well sorted, quartzose, in places laminated, in part micaceous.

Interval 2,676'-2,745':

Sandstone, quartzitic, very light grey, fine to coarse grained, with clear and pinkish quartz, in places traces of red-brown, hematitic cement. Lower part of interval contains minor amounts of light green to light greyish green shale and light green, in places micaceous siltstone.

Husky H.B. *et al.* Willow Lake H-10
Location: Lat. 62°49'16"N, Long. 121°45'01"W
Measured from: 798' above sea level
Total depth: 3,270'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 2,120'-2,175':

Upper part of interval consists of dolomite, greenish grey, crypto- to microcrystalline, argillaceous. Lower part of interval consists of dolomite, white to very light grey, slightly anhydritic, crypto- to microcrystalline.

Interval 2,175'-2,220':

Interbedded siltstone, dolomite and sandstone: siltstone, very dolomitic, light greenish grey to greenish grey, argillaceous, in part with scattered fine to medium, clear and pinkish, frosted, well-rounded quartz grains; dolomite, very light brown to white, very anhydritic, cryptocrystalline; and sandstone, greyish brown, dolomitic, very fine to medium grained, with subrounded to subangular, in part frosted clear quartz grains, in places with poor to fair intergranular porosity, and black bitumen infill.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 2,220'-2,230':

Dolomite, very light grey to light brown, very finely to finely crystalline, somewhat sucrosic, in places with light green "waxy" shale inclusions, slightly pyritic; and dolomite, light greenish grey, very argillaceous, slightly silty, crypto- to microcrystalline.

Interval 2,230'-2,335':

Dolomite, very light grey to light brown, crypto- to microcrystalline, somewhat argillaceous, with dark grey, in part stylolitic shale laminae; in places very finely crystalline with poor intercrystalline porosity. Interval 2,267'-2,335', cores 2 and 3, consists of interbedded dolomite, light grey to grey, crypto- to microcrystalline, slightly argillaceous, with abundant dark grey, wavy, stylolitic shale laminae; and dolomite, light grey to grey, mottled with dark grey, micro- to very finely, or finely crystalline, slightly argillaceous, with scattered small vugs and thin beds with intercrystalline porosity, in places filled with black bitumen. Cored interval is poorly bedded, the dark grey shale laminae sometimes outline brecciated beds, filling in vertical cracks. Sedimentary structures are present at 2,295' and include very thin, upward curved and broken beds and a vertical burrow-like disturbance. At 2,308' is an insignificant erosional contact below a dark grey argillaceous bed. Secondary anhydrite is present at 2,333' as vug filling and as crystals, replacing the dolomite matrix.

Interval 2,335'-2,450':

Dolomite, very light brown to light greyish brown, micro-, and micro- to very finely crystalline, with rare scattered crinoid ossicles, and very poor intercrystalline porosity with black bitumen infill; interbedded with dolomite, as above, but slightly argillaceous, and with dark grey, in part stylolitic shale laminae. Interval 2,335'-2,370', core 3, consists of dolomite, light grey to grey and light greyish brown, microcrystalline, with much secondary anhydrite, as irregular inclusions, star-like veinlets or as single crystals. Some beds have a brecciated appearance because of the anhydrite replacement. In samples the presence of fine clear quartz crystals indicates the existence of vuggy porosity.

Interval 2,450'-2,470':

Dolomite, greyish brown to dark grey, argillaceous to very argillaceous, microcrystalline, with dark grey shale laminae.

Interval 2,470'-2,580':

Dolomite, very light brown to light brown, micro- to very finely crystalline, with pin-point vugs, lined with very fine dolomite crystals and black bitumen, in places slightly argillaceous and slightly silty. Some samples contain medium to coarse quartz crystals in clusters, indicative of vuggy porosity, other samples contain some fragments of very light grey or light brown chert.

Interval 2,580'-2,680':

Dolomite, light greyish brown to greyish brown, in lower part of interval mottled with dark greyish brown, micro- to very finely crystalline, with scattered medium to coarse crinoid fragments, in places slightly argillaceous, with traces of dark grey stylolitic shale partings, in places with poor intercrystalline and vuggy porosity, and black bitumen infill. Samples contain abundant fragments of light brown chert and traces of very dark grey chert.

Dark grey dolomite member

Interval 2,680'-2,750':

Dolomite, dark greyish brown to very dark grey, argillaceous, slightly silty, micro- to very finely crystalline, with very dark grey stylolitic shale partings; interbedded with dolomite, light brown to greyish brown, mottled with dark greyish brown, in places slightly silty, with scattered medium to coarse fragments of crinoid ossicles, and rare very small vugs lined with black bitumen. Samples contain an abundance of very dark grey to black chert fragments and some brown chert.

PRECAMBRIAN

(undivided)

Interval 2,750'-2,790':

Sandstone, quartzitic, very light grey, in part light greenish grey, rarely red-brown, very fine to fine

grained, slightly pyritic, well sorted, subangular, clear quartz grains, and traces of glauconite. Minor amounts of light green argillite and light green argillaceous siltstone.

Interval 2,790'-2,890':

Interbedded and interlaminated siltstone, sandstone and argillite: siltstone, in places grading to very fine silty sandstone, very dark grey, laminated with black argillite; sandstone, very light grey, in part greenish, quartzitic, very fine to fine grained, in places micaceous; sandstone, light grey, light reddish brown and red-brown, quartzitic, very fine to fine grained, in places micaceous; argillite, light green, in places red-brown mottled, micromicaceous; and argillite, light red-brown to red-brown, very silty.

Interval 2,890'-2,900':

Sandstone, very light reddish brown, very fine to fine grained, with subangular clear quartz, and a trace of intergranular, vuggy porosity, coated with red-brown clay.

Interval 2,900'-3,230':

Siltstone, very sandy, grading to very fine sandstone, very dark grey, in part micaceous, laminated with black argillite and sandstone, very light greenish grey to light grey, quartzitic, very fine grained, from 3,100' to 3,200' in places bright green, very fine to fine grained, glauconitic and in places micaceous.

Interval 3,230'-3,270':

Sandstone, very light grey to white, in places with red-brown hematitic stain, quartzitic, very fine to fine grained, with clear subangular quartz.

Fina *et al.* Willow Lake L-59
Location: Lat 62°08'40"N, Long. 121°56'00"W
Measured from: 601' above sea level
Total depth: 2,750'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 2,200'-2,230':

Anhydrite, dolomitic, very light grey to light brown; interbedded with minor amounts of dolomite, very anhydritic, dark brown to very dark greyish brown, argillaceous, microcrystalline.

Interval 2,230'-2,247':

Dolomite, very light grey to grey, in places with light reddish brown or light green, slightly argillaceous to argillaceous, with dark grey, wavy laminae of pyritic shale, slightly silty and sandy, with clear, very fine quartz grains. Interval 2,245'-2,247', core 4, shows some dolomite beds with clear dolomite inclusions, somewhat similar to "birdseye structure", other beds are microbrecciated. Contact at 2,247' is unconformable (*see* mineralogical analsis, Fig. 11).

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 2,247'-2,425':

Dolomite, very light brown to light greyish brown, in part mottled with dark grey, micro- to very finely, and very finely crystalline, with dark grey, in part stylolitic shale laminae, in part very pyritic, with scattered, irregular shaped vugs lined with fine dolomite and quartz crystals, and with traces of black bitumen. Interval 2,247'-2,253', core 4, and core nos. 5 and 6, consist of dolomite (*see* mineralogical analysis, Fig. 11), as above, with wavy dark grey shale laminae, scattered and, in part, recrystallized fossils (*see* Appendix I), and scattered very light grey or light greyish brown, irregularly rounded chert inclusions which contain an abundance of coarse fragments of crinoids, brachiopods, trilobites and corals. The very light grey chert is porous and very permeable and is present from 2,360' to 2,375'. Vugular porosity is best developed in interval 2,340'-2,370', and is rated as poor. A large coral present in the core at 2,386' is preserved in growth position. The branches of the coral are abnormally wide. The dolomite is very poorly bedded. In the lower part of interval, the dolomite contains scattered medium to coarse fragments of crinoids. Samples have abundant very light grey, in part pyritic chert fragments.

Basal member

Interval 2,425'-2,480':

Upper part of interval consists of siltstone, very dolomitic, very argillaceous, grading to shale, very dark grey, very pyritic, with abundant very dark grey chert fragments. Lower part consists of sandstone, very light grey, fine to coarse grained, with clear and pinkish, subrounded and subangular quartz grains, slightly quartzitic, slightly pyritic.

PRECAMBRIAN

(undivided)

Interval 2,480'-2,524':

Interbedded shale and sandstone: shale, very light greenish grey; sandstone, very light greenish grey and light reddish brown, dolomitic, very fine to fine grained; sandstone, very light grey and light reddish brown, dolomitic, argillaceous, very fine to medium grained; sandstone, very light grey-brown laminated with light reddish brown; and sandstone, very light grey, non-dolomitic, fine to medium grained, with light green shale partings, clear and pinkish quartz grains, in places with red-brown, hematitic stain.

Interval 2,524'-2,710':

Sandstone, very light grey, non-dolomitic, fine to medium, in places coarse grained, with subrounded

to subangular clear and pinkish quartz grains, in places with light green shale partings, in places with red-brown hematitic specks; traces of shale, light green and reddish brown. Lower part of interval interbedded with sandstone, light green and light reddish brown, very fine grained, silty, laminated with very light green and very light reddish brown siltstone.

Interval 2,710'-2,730':

Fragments of weathered granite consisting of weathered K-feldspars, quartz and biotite, with some carbonate.

Interval 2,730'-2,750':

Sandstone, quartzitic, mottled light grey, light reddish brown and light green, fine grained; interbedded with sandstone, very light grey, with dark reddish brown hematitic specks, fine to medium grained.

Husky HB *et al.* Willow Lake O-27A
Location: Lat. 62°16'48"N, Long. 121°04'21"W
Measured from: 1,097' above sea level
Total depth: 2,920'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 2,400'-2,484':

Anhydrite, light brown mottled with grey, cryptocrystalline, veriably dolomitic, argillaceous in lower part of interval; interbedded with minor dolomite, very light brown, crypto- to microcrystalline, anhydritic.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 2,484'-2,550':

Dolomite, light grey to light brown, micro- to very finely crystalline, slightly argillaceous to argillaceous (light grey clay residue), in places slightly sucrosic, with brown and dark grey, in part stylolitic partings. Samples contain small amounts of light greyish brown fossiliferous chert fragments. Interval 2,524'-2,554', core 3, consists of dolomite, greyish brown, micro- to very finely crystalline, slightly argillaceous and silty, with abundant dark grey, wavy, in part stylolitic shale laminae and in places abundant small ?crinoidal fragments. Some irregularly shaped dark brown chert nodules, with light grey fossil remains (mainly brachiopods) are present in the lower half of the core. Some Late Ordovician corals were noted (*see* Appendix I).

Dark grey dolomite member

Interval 2,550'-2,601':

Dolomite, mottled greyish brown and dark grey, micro- to very finely crystalline, argillaceous, with scattered medium to coarse, in part silicified crinoid fragments and dark grey, stylolitic shale partings. Some samples contain abundant light brown chert fragments.

Basal member

Interval 2,601'-2,620':

Shale, dolomitic, very dark grey, with scattered light grey, medium to coarse fragments of crinoid ossicles.

Interval 2,620'-2,670':

Sandstone, very light grey, fine to very coarse grained, poorly sorted, clear, milky and pinkish, subangular and subrounded quartz grains, with very poor intergranular porosity. Lower part of interval is sandstone, very light greyish brown mottled with grey-brown, very fine grained, well-sorted, clear quartz, with dark grey shale partings, in places pyritic, with good intergranular porosity.

PRECAMBRIAN

(undivided)

Interval 2,670'-2,705':

Sandstone, quartzitic, light greenish grey to greyish green, in part red-brown mottled, or light reddish brown to red-brown, in part mottled with green, very fine grained, with rare, scattered, fine to medium quartz grains, in part micaceous, in places interlaminated with argillite, green or red-brown, micaceous. Lower ten feet of interval consist of sandstone, very quartzitic, clear to white, with red-brown specks, fine to coarse grained.

Interval 2,705'-2,795':

Granite, dark green to greyish green mottled with pink, medium to coarsely crystalline, consisting of weathered K-feldspars, often intergrown with quartz, quartz and biotite.

Interval 2,795'-2,875':

Interbedded and interlaminated sandstone and argillite: sandstone, quartzitic, very light to light greenish grey, very fine to fine grained; sandstone, quartzitic, very light to light reddish-brown, very fine to fine grained, in places argillaceous; and argillite, very light green, in places micaceous.

Interval 2,875'-2,920':

Sandstone, quartzitic to very quartzitic, very light to light greenish grey, very fine to fine grained; interlaminated with argillite, greenish grey to dark grey.

Horn R. CDR IOE Willow Lake R. I-70
Location: Lat. 62°40'44"N, Long. 121°43'18"W
Measured from: 834' above sea level
Total depth: 3,009'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 2,230'-2,255':

Anhydrite, very light grey, micro- to cryptocrystalline; interbedded with dolomite, light brown, cryptocrystalline.

Interval 2,255'-2,314':

Dolomite, very light to light brown, crypto- to microcrystalline.

Interval 2,314'-2,334':

Poor samples. Siltstone, very light greenish grey, very dolomitic, pyritic; interbedded with dolomite, very light brown to light brown, crypto- to microcrystalline.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 2,334'-2,454':

Poor samples. Dolomite, very light to light brown, microcrystalline, in places cryptocrystalline.

Interval 2,454'-2,504':

Interval 2,454'-2,504', core 1, consists of dolomite, light greyish brown, in places grey, micro- and in part very finely crystalline, slightly silty, some beds with many dark grey, wavy, in part stylolitic shale laminae, other beds have small rounded vugs, which are related to clear dolomite-infilled, often laminar arranged interparticle voids ("birdseye structure"). At 2,463' are scattered brachiopods and corals (*see* Appendix I). Interval 2,482'-2,483' contains a few well-preserved gastropods. Interval 2,486' to 2,488' consists of abundant pellets, mud lumps and intraclasts with clear dolomite-infilled "fenestral" voids. From 2,492' to 2,495', the laminated fabric is deformed by soft sediment loading.

Interval 2,504'-2,545':

Dolomite, brown to dark brown, microcrystalline, argillaceous to very argillaceous, with very dark grey shale laminae; interbedded with dolomite, very light to light brown, crypto- to microcrystalline, slightly pyritic, with dark grey, in part stylolitic shale partings.

Interval 2,545'-2,610':

Dolomite, very light grey to light greyish brown, microcrystalline, in part slightly sucrosic, in places very finely crystalline and with fine dolomite crystals indicative of vugular porosity. Lower part of interval contains some very light grey chert fragments.

Dark grey dolomite member

Interval 2,610'-2,730':

Dolomite, brown to dark brown, mottled with very light brown, in places brown to very dark brown, microcrystalline, slightly argillaceous to argillaceous, with dark grey, stylolitic shale laminae, slightly silty in places, with scattered medium to coarse fragments of crinoid ossicles. Some samples with light brown and very dark grey chert fragments, other samples with abundant very dark grey to black chert fragments.

Interval 2,730'-2,760':

Dolomite, very light brown to brown, micro- to very finely crystalline, with abundant scattered medium-size fragments of crinoid ossicles, in places very fine pelletoidal.

Interval 2,760'-2,768':

Dolomite, very dark grey to black, very argillaceous, grading to shale, microcrystalline, with scattered medium-size, light brown crinoid ossicle fragments. Abundant grey and black chert fragments.

Interval 2,768'-2,810':

Dolomite, light brown to brown, mottled with very light brown, micro- to very finely crystalline, with scattered medium ?crinoid ossicles; interbedded with dolomite, very dark greyish brown, argillaceous to very argillaceous, microcrystalline, slightly pyritic, with scattered medium crinoid fragments. Samples with some very light grey, light brown and black chert fragments.

Basal member

Interval 2,810'-2,833':

Interbedded shale and dolomite: shale, very dolomitic, very dark grey to black, very silty, with scattered medium to coarse, subrounded, clear quartz grains and rare, very fine, black chert grains; dolomite, greyish brown, very silty and grading to siltstone, microcrystalline; and dolomite, very light brown to brown, microcrystalline, with scattered, subrounded, medium, clear, quartz grains.

FRANKLIN MOUNTAIN FORMATION

(undivided)

Interval 2,833'-2,855':

Dolomite, very light grey to very light brown, in places greenish, crypto- to microcrystalline, very silty, in places slightly pyritic; interbedded with siltstone, very light grey to white, dolomitic, in places with scattered well-rounded, clear quartz grains; and dolomite, grading to siltstone, greenish grey, very silty, microcrystalline, in places pyritic, with scattered clear or pinkish, rounded, medium quartz grains.

Interval 2,855'-2,933':

Interbedded dolomite and siltstone: dolomite, very light to light greenish grey, very silty, crypto- to microcrystalline, with scattered fine to coarse, subrounded, clear quartz grains; dolomite, grey to light grey, very finely to finely crystalline, very silty, with very poor intercrystalline porosity; minor siltstone, light green, dolomitic, slightly argillaceous; and traces of very light reddish brown siltstone. Upper part of interval consists of dolomite, light green, very silty and grading to siltstone, slightly argillaceous, with scattered fine to coarse, clear quartz grains.

Interval 2,933'-2,962':

Upper part of interval consists of sandstone, white to very light grey, very dolomitic, fine to coarse grained, with milky, clear and pink, well-rounded quartz grains. Lower part of interval consists of dolomite, greenish grey to grey, silty, with scattered fine to medium quartz grains; interbedded with greyish green shale and argillaceous siltstone.

PRECAMBRIAN

(undivided)

Interval 2,962'-3,009':

Interbedded siltstone and shale: siltstone, brick-red, in part green mottled, slightly dolomitic, in places very fine to fine sandy, in places laminated with grey argillaceous siltstone; shale, red-brown, purple, mottled with greenish grey, in part silty, in part slightly dolomitic; and siltstone, greyish green and very dark grey to black, argillaceous, slightly dolomitic, in part sandy, in part pyritic.

Imperial Windflower G-77
Location: Lat. 62°56'26"N, Long. 118°59'02"W
Measured from: 902.7' above sea level
Total depth: 1,645'
Status: Abandoned

ELK POINT GROUP

(undivided)

Interval 790'-865':

Dolomite, light brown, slightly sucrosic, very finely crystalline, with poor to fair intercrystalline and vuggy porosity; and dolomite, light brown to light greyish brown, micro- to very finely crystalline, in places with pin-point vugs; interbedded with minor anhydrite, very light grey, coarsely crystalline.

Interval 865'-880':

Dolomite, very light grey in part greenish, microcrystalline, slightly argillaceous.

MOUNT KINDLE FORMATION

Light grey dolomite member

Interval 880'-970':

Dolomite, very light brown, micro- to very finely crystalline. Upper part of interval contains scattered medium to coarse fragments of crinoid ossicles, light brown cherty inclusions and some very light grey coarsely crystalline anhydrite; lower part of interval contains dolomite, slightly argillaceous, with scattered microcrystalline pyrite and dark grey, in part stylolitic partings.

Interval 970'-980':

Dolomite, grey to greyish brown, microcrystalline, argillaceous to very argillaceous, slightly pyritic.

Interval 980'-1,087':

Dolomite, greyish brown to light greyish brown, micro- to very finely crystalline, with scattered medium to coarse crinoid fragments, slightly argillaceous, with dark grey, in part stylolitic partings, in places with poor or good intercrystalline and vuggy porosity, in part slightly pyritic. Some samples with very light brown chert fragments.

Basal member

Interval 1,087'-1,118':

Dolomite, greyish brown to dark greyish brown, microcrystalline, argillaceous to very argillaceous, with a trace of medium to coarse fragments of crinoid ossicles, with dark grey stylolitic partings and in basal part of interval scattered fine to coarse polished, black chert grains.

FRANKLIN MOUNTAIN FORMATION

(undivided)

Interval 1,118'-1,156':

Dolomite, very light brown to very light grey, very silty and very fine sandy, microcrystalline in places, with clear and pinkish, fine to coarse quartz grains, and pebbles of dark grey dolomite; interbedded with dolomite, greenish grey, microcrystalline, silty, argillaceous, slightly pyritic; and dolomite, very silty, grading to siltstone, light brown to greyish brown, microcrystalline, very fine sandy; and trace of dolomite, fine to medium pelletoidal.

Interval 1,156'-1,188':

Interbedded sandstone, siltstone and shale: sandstone, very light grey, dolomitic, fine to medium grained, with subrounded, clear, pinkish and greenish quartz grains; siltstone, very light grey to grey-green, very fine sandy, dolomitic, in part grading to silty sandstone, in places argillaceous, with scattered fine to medium, clear and pinkish quartz grains, in places with glauconite grains and very fine mica flakes; minor shale, very dolomitic, grading to dolomite, dark to very dark grey-brown, silty.

SALINE RIVER FORMATION

(undivided)

Interval 1,188'-1,400':

Interbedded and interlaminated shale, siltstone and shale: shale, brick-red or green, often mottled and interlaminated red-brown and green, in part silty; siltstone, very light brown, variably dolomitic, glauconitic; siltstone, grey-green, argillaceous, dolomitic; and in lower part of interval, minor anhydrite, very light grey, and shale dark grey and, green. Interval 1,350'-1,370', core 3, consists of regularly and thin-bedded, green and greyish green, in part reddish brown shale; siltstone, very light grey to very light brown, dolomitic, with micrograins of glauconite, laminated with shale and argillaceous siltstone, in places with burrow-like structures; and minor (less than 5%) very light grey anhydrite beds, up to 1/4 inch or 1/2 cm thick.

MOUNT CAP FORMATION

Upper shale member

Interval 1,400'-1,425':

Shale, green and grey-green.

Dolomite member

Interval 1,425'-1,530':

Dolomite, very light brown, light grey, grey and greenish grey, variably argillaceous, with dark grey and greenish grey shale partings, finely, very finely to finely to medium crystalline, slightly silty, in places silty or very silty, slightly pyritic.

Lower shale member

Interval 1,530'-1,620':

Samples are missing in lower part of this interval. Upper part consists of green and greyish green shale interbedded with siltstone, greenish grey, dolomitic, argillaceous and siltstone, very light brown, dolomitic, in part very finely micaceous and glauconitic, in places laminated with green shale.

PRECAMBRIAN

Interval 1,620'-1,645':

Rock fragments consisting of clear quartz and pink feldspar, in part with a weathered appearance. Examination of a thin section of selected chips indicate that this interval is an arkose.

APPENDIX III

COAL RANK DETERMINATION BY VITRINITE REFLECTANCE

by P.R. Gunther

Samples submitted by: N.C. Meijer-Drees
Project no.: 710011
Date: May 6, 1974
Area: Northwest Territories (Fort Simpson area)
Type and number of samples, location and age:

Three samples from well cores were submitted for reflectance information. Two samples were coal seamlets (possibly bark vitrains) from core no. 4 at a depth of 1,480 and 1,505 feet in the I.O.E. Triad Ebbutt D-50 well (Lat. 62°19'01"N, Long. 122°24'05"W). These have a Late Devonian age. The third sample was a highly organic, argillaceous dolomite from core no. 1 at a depth of 4,808 feet in the Shell Blackwater Lake G-52 well (Lat. 64°11'05"N, Long. 122°15'12"W). It is Late Ordovician in age.

Results of reflectance measurements:

Well	Depth	% Ro	% V.M. of vitrinite (Kötter's)	Comparable ASTM Rank
D-50	1,480'	3.09	6	Anthracite
D-50	1,505'	2.83	7	Anthracite
G-52	4,808'	3.06	6	Anthracite

Remarks: The % Ro values given above are approximate because of the difficulty in standardizing the microscope for such high reflectance values. These are minimum values.

Discussion of results:

For the following categorization to be valid, it is necessary that the coal particles measured in a sample are truly vitrinite (a common constituent of coal). This was considered to be true for the samples used in this report. The categorization follows (Hacquebard, pers. com.).

0.0 - 0.5% Ro: Biogenic gas
0.5 - 0.8% Ro: Liquid hydrocarbons (oil)
0.8 - 1.2% Ro: Possibly oil, usually gas
1.2 - 1.8% Ro: Gas, but not common
> 1.8% Ro: Graphite, gas in rare cases

Because the reflectance values of the samples in question are greater than 1.8% Ro and are, in fact, minimum values, we may conclude that there is little possibility of finding gas of Paleozoic age.