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DEPARTMENT OF ENERGY,
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PAPER 68-42

STRATIGRAPHY OF THE LOWER
PROTEROZOIC (APHEBIAN), GREAT SLAVE
SUPERGROUP, EAST ARM OF GREAT SLAVE
LAKE, DISTRICT OF MACKENZIE

P. F. Hoffman

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ABSTRACT

The Aphebian-age Great Slave Supergroup (formerly the Great Slave Group) is divided into four groups. The Sosan Group (formerly the Sosan Formation), composed predominantly of non-marine sandstones, is divided into four formations that are defined in this report. The Kahochella Group (formerly the Kahochella Formation), composed predominantly of marine shales, is divided into four formations that are also defined in this report. The Pethei Group (formerly the Pethei Formation) is composed of two lithologically distinct sequences. On the north side of the East Arm synclinerium, where littoral marine limestones and dolomites predominate, the group is divided into five formations defined in this report, whereas on the south side of the synclinerium, where deep water marine shales, greywackes and limestones predominate, the group is divided into four formations, only the oldest of which occurs to the north. The Christie Bay Group, composed predominantly of non-marine and marine red beds, is divided into the Stark Formation, Tochatwi Formation and Pearson Formation of earlier reports, and one additional formation defined in this report. The thickness, distribution, lithology, contact relations and origin of each formation is discussed briefly and a type section established.

The Union Island Group, also of Aphebian age, underlies the Great Slave Supergroup unconformably. Quartz diorite laccoliths, the age relations of which were formerly in dispute, intrude the lower Stark Formation and all older rocks.

STRATIGRAPHY OF THE LOWER PROTEROZOIC (APHEBIAN)
GREAT SLAVE SUPERGROUP, EAST ARM OF GREAT SLAVE LAKE,
DISTRICT OF MACKENZIE

INTRODUCTION

More than 50,000 feet of unmetamorphosed Precambrian sedimentary and volcanic rocks are exposed in the region of the East Arm of Great Slave Lake, District of Mackenzie. They occur in a fold belt 180 mile long and 60 miles wide which consists of an asymmetric, canoe-shaped synclinorium over which has been superimposed a Precambrian graben. Gently dipping Aphebian strata on the north side of the synclinorium overlie Archean rocks of the Slave Province. On the south side, tightly folded and faulted Archean, Aphebian and perhaps Paleohelikian sedimentary strata abut against gneissic rocks of the Churchill Province along the McDonald Fault system.

This report results from field work carried out during 1966 and 1967 and introduces a revised and expanded stratigraphic nomenclature for the Aphebian rocks of the East Arm. This nomenclature will be used in reports being prepared on the paleocurrents, paleoecology, and depositional history of the sedimentary rocks. In addition, the more detailed stratigraphic descriptions will aid interbasin correlation with other Aphebian fold belts in the northwestern Precambrian Shield.

The figures that illustrate this report are reproduced unchanged from copy submitted by the author.

ACKNOWLEDGMENTS

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Ms. received 21 May, 1968

HISTORY OF INVESTIGATIONS

In 1900, Robert Bell of the Geological Survey made the trip to Fort Reliance (see Fig. 1) by way of the north shore of McLeod Bay, and he gives the first description of the geology of the area (Bell, 1902).

In 1929, Rutherford reported the occurrence of algal stromatolites in samples collected by a mineral exploration party in the area.

The same year, Lausen (1929) published a report on the geology of the south shore of the East Arm between Fort Resolution and Fort Reliance. Lausen described most of the sedimentary formations in the East Arm, but his attempt to correlate formations in different parts of the area, and to correlate these with the then well established Precambrian successions in southern Canada was not confirmed by later, more detailed work.

The first systematic mapping of the East Arm was accomplished by Stockwell (1932) between 1928 and 1930. His Table of Formations (1936) was the basis for all subsequent geologic work in the area (see Fig. 2). He divided the Precambrian rocks into three major groups, named in ascending order the Wilson Island, Great Slave and Et-then Groups, each separated by angular unconformities. A fourth, relatively minor division, named the Union Island Group, was deposited during the same interval as the Great Slave Group, but its stratigraphic relations to the Great Slave were unknown.

The geology of certain small areas not visited by Stockwell were subsequently mapped by Henderson (1939), Brown (1950a, 1950b, 1950c) and Wright (1951, 1952). The maps of Brown and Wright also served to place Stockwell's geology on an adequate topographic base.

Barnes (1951, 1952, 1953) mapped two 1 mile to 1 inch mapsheets in the structurally complex southern limb of the synclinorium.

Radiometric dating of igneous rocks in the area has established that the Wilson Island Group is Archean, the Great Slave Group Aphebian, and the Et-then Group late Aphebian or Paleohelian.

formations on the north limb of the synclinorium		formations on the south limb of the synclinorium	
Stockwell (1936)	this report	groups	this report
(eroded)	(eroded)	CHRISTIE BAY	Pearson
	Tochatwi		Portage Inlet
			Tochatwi
Stark	Stark		Stark
Pethei	Hearne	PETHEI	Pekanutui Point
	Wildbread		Blanchet ¹
	Utsingi		McLean
	Taltheillei ¹		Douglas Peninsula
	Douglas Peninsula		Charlton Bay
Kahochella	Charlton Bay	KAHOCHELLA	McLeod Bay
	McLeod Bay		Gibraltar
	Gibraltar		Seton ¹
	Seton ¹		
Sosan	Akaitcho River	SOSAN	Akaitcho River ²
	Kluziai		Kluziai
			Duhamel ¹
			Hornby Channel

¹absent in east half of synclinorium

²absent in west half of synclinorium

Figure 2. Comparison between the stratigraphic nomenclature for the 'Great Slave Group' used by Stockwell (1936) and that proposed in this report.

REVISED STRATIGRAPHIC NOMENCLATURE

The revised Table of Formations for the East Arm fold belt is shown in the Table of Formations. A comparison of the revised stratigraphic nomenclature with that of Stockwell (1936) is shown in Figure 2. Stockwell's nomenclature is essentially correct and entirely adequate for reconnaissance mapping, but does not provide sufficient formal subdivisions for detailed stratigraphic analysis.

In erecting the proposed nomenclature, conformity with Phanerozoic usage and with the recommendations of the Code of Stratigraphic Nomenclature of the American Commission on Stratigraphic Nomenclature has been attempted. Specifically, formations have been erected which are "characterized by internal lithologic homogeneity" (Article 6) and which are capable of being mapped "at scales on the order of 1:25,000" (Article 6d). Many of the new formations contain stratigraphic units which may later be formally erected as members. Four new groups are proposed which conform to the recommendation that they be "recognized for the purpose of expressing the natural relations of associated formations having significant lithologic features in common" (Article 9a, italics added). The useful reconnaissance term 'Great Slave' which encompasses the four newly defined groups is retained at the rank of a supergroup, a "formal assemblage of related groups" (Article 9e).

GREAT SLAVE SUPERGROUP

SOSAN GROUP

Stockwell (1936) gave the name 'Sosan Formation' to "perhaps 3,000 feet" of "beds of sandstone and quartzite with partings of shale" found at the base of the 'Great Slave Group'. Stockwell did not designate a specific type section but presumably considered the region near Sosan Island in McLeod Bay to be the type area. Unfortunately, the formation is only partly exposed in that area, and several stratigraphic units mapped as Sosan Formation by Stockwell in other parts of the East Arm are absent there.

Nevertheless, it is clear from his maps precisely which strata he considered to belong to the formation. These strata are divisible into four easily mappable stratigraphic units. It is proposed that these four units, defined in succeeding paragraphs, be established as formations, and the Sosan Formation of Stockwell be elevated to the rank of a group.

Stratigraphic correlations are difficult in the Sosan Group because of the paucity of completely exposed sections and the presence of thick uniform lithologic units, recurrent lithologies, rapid lateral variation in lithology particularly in the uppermost formation, abundant faults, and a suspected internal unconformity. Only north of Lac Duhamel is the entire group exposed without serious structural complications, and consequently this area was selected as the type location for three of the four formations.

Figure 3 shows the locations of measured sections in the Sosan Group and Figure 4 gives a correlation chart of formations.

TABLE OF FORMATIONS

EON	ERA	SUPER-GROUP	GROUP	FORMATION	LITHOLOGY	
PROTEROZOIC	PALEO-HELIXIAN	1295 m. y. Mackenzie Swarm			Diabase, northwest trending dykes	
		Intrusive contact				
	APHEBIAN or PALEOHELIXIAN	Intrusive contact				Diabase, sills and shallow dipping dykes
		Intrusive contact				
		Et-then Group	Preble Formation	10,000 +	Sandstone, buff to red, feldspathic, weakly indurated, cross-bedded; minor conglomerate, shale	
			Murky Formation	0 - 3,000	Conglomerate, buff to red, very thick bedded, weakly indurated; minor lithic sandstone lenses, shale, mudcracks, caliche horizons	
	Unconformity					
	APHEBIAN	1845 m. y.			Quartz-diorite, laccoliths and minor dykes (may be older than the upper Stark Formation)	
		Intrusive contact				
		Christie Bay Group	Pearson Formation	550 +	Basalt, columnar; minor argillite, argillite-pebble conglomerate	
			Portage Inlet Formation	705	Shale, red to brown, mudcracked, halite and gypsum casts; minor thin beds of siltstone and sandstone	
			Tochatwi Formation	1,870 - 2,600	Sandstone, red to buff, fine-grained, lithic and feldspathic, crossbedded, ripple-marked, mudcracked; minor conglomerate and shale	
			Stark Formation	2,000 ?	Mudstone, red, brecciated, hematitic, halite casts; beds of inter-laminated dolomite and limestone, stromatolitic, ripple-marked, crossbedded, convolute bedded; extensive non-tectonic breccias	
		Disconformity ?				
		GREAT SLAVE SUPERGROUP	Pethei Group	Hearne Formation	0 - 300	Limestone, grey to white, thick bedded, medium- to coarse-grained, crystalline, massive to mottled; minor stromatolitic limestone and dolomite
				Wildbread Formation	0 - 600 ?	Limestone, grey to white, thin- to medium-bedded, oolitic, stromatolitic, laminated, mottled, or crystalline; minor dolomite, stromatolitic; some sections extensively dolomitized
				Pekanatui Point Formation	0 - 340	Limestone, white, very thin bedded, aphanitic; very thinly inter-bedded limestone and argillite; argillite with limestone nodules; interbedded greywacke and argillite; nodular argillaceous dolomite and limestone; limestone 'debris flow' breccia beds; some sections extensively dolomitized
				Blanchet Formation	0 - 995	Greywacke, dark red-brown to dark green, thin-bedded, graded bedding, interbedded argillite and interlaminated argillite and limestone; argillite with limestone nodules
				McLean Formation	0 - 395	Argillite, red-brown, very thin bedded, calcareous, interbedded limestone or limestone nodules; some sections extensively dolomitized
				Utsingi Formation	0 - 900	Limestone, grey, medium- to thick-bedded, medium-grained, crystalline, mottled to laminated; minor stromatolitic limestone
				Taltheilei Formation	0 - 390	Dolomite, brown, medium- to thin-bedded, fine-grained, crystalline, stromatolitic, laminated, or massive; stromatolitic limestone with dolomite laminations; calcite cemented dolarenite, dolorudite
				Douglas Peninsula Formation	55 - 110	Marlstone, red-brown, laminated, gypsum casts; argillite, hematitic, limestone and jasper nodules

TABLE OF FORMATIONS (cont'd.)

EON	ERA	SUPER-GROUP	GROUP	FORMATION	LITHOLOGY
PROTEROZOIC	APHEBIAN	GREAT SLAVE SUPERGROUP	Kahochella Group	Charlton Bay Formation 30 - 500	Argillite, dark green, calcareous concretions; minor graded siltstone beds, bentonite beds
				McLeod Bay Formation 450 - 1,050	Shale, red, calcareous concretions, intraformational concretion conglomerate; minor dark green argillite
				Gibraltar Formation 600 - 3,450	Shale, red; minor oolitic hematite, intraformational conglomerate, stromatolites, marlstone beds, gypsum casts
				Seton Formation 0 - 4,300	Andesite, massive, columnar, or brecciated; basic ash-fall tuff, agglomerate; reworked basic lithic and vitric tuff, volcanic conglomerate; minor columnar rhyolite flows; minor sandstone, hematitic siltstone, oolitic hematite, gypsum casts
			Sosan Group	Akaitcho River Formation 0 - 1,000	Siltstone, red, micaceous, massive to ripple-marked, mud-cracked, thin-bedded; white, crossbedded, glauconitic sandstone with Scolithus-like tubes; red, micaceous shale; minor oolitic hematite, conglomerate
				Kluziai Formation 1,450	Sandstone, pink, medium-grained, crossbedded, shale-pebble conglomerate, heavy mineral bands
				Unconformity ?	
				Duhamel Formation 0 - 915	Dolomite, stromatolitic, oolitic, intraformational conglomerate, chert nodules; crossbedded calcarenite and orthoquartzite; ripple-marked, mudcracked siltstone
				Hornby Channel Formation 0 - 5,000 +	Sandstone, coarse-grained, grey, crossbedded, feldspathic; minor conglomerate, stromatolitic dolomite, siltstone
			Unconformity ?		
			Union Island Group	unnamed	Dolomite, brown, massive, quartz veins
				unnamed	Volcanic rocks, basic, pillowed or brecciated flows; minor slate
				unnamed	Slate, grey; minor greywacke
				unnamed	Slate, black, carbonaceous; dark grey dolomite
				unnamed	Dolomite, massive to laminated; minor red argillite, arkose and conglomerate at base
Unconformity					
ARCHEAN	2460 m. y.			Granodiorite; migmatite; granite pegmatite	
	Intrusive contact				
	Wilson Island Group	unnamed	Slate, dark grey; minor siltstone		
		unnamed	Siltstone, light grey, thin-bedded, interbedded with dark grey argillite		
		unnamed	Quartzite, grey to red to white, crossbedded; minor hematitic quartzite, argillite		
		unnamed	Dolomite, grey to brown, massive to laminated; minor argillite, micaceous dolomite		
		unnamed	Quartzite, grey to white, crossbedded; minor conglomerate, feldspathic quartzite		
unnamed	Volcanic rocks, dark grey to dark brown, porphyritic, sheared, ignimbritic?				

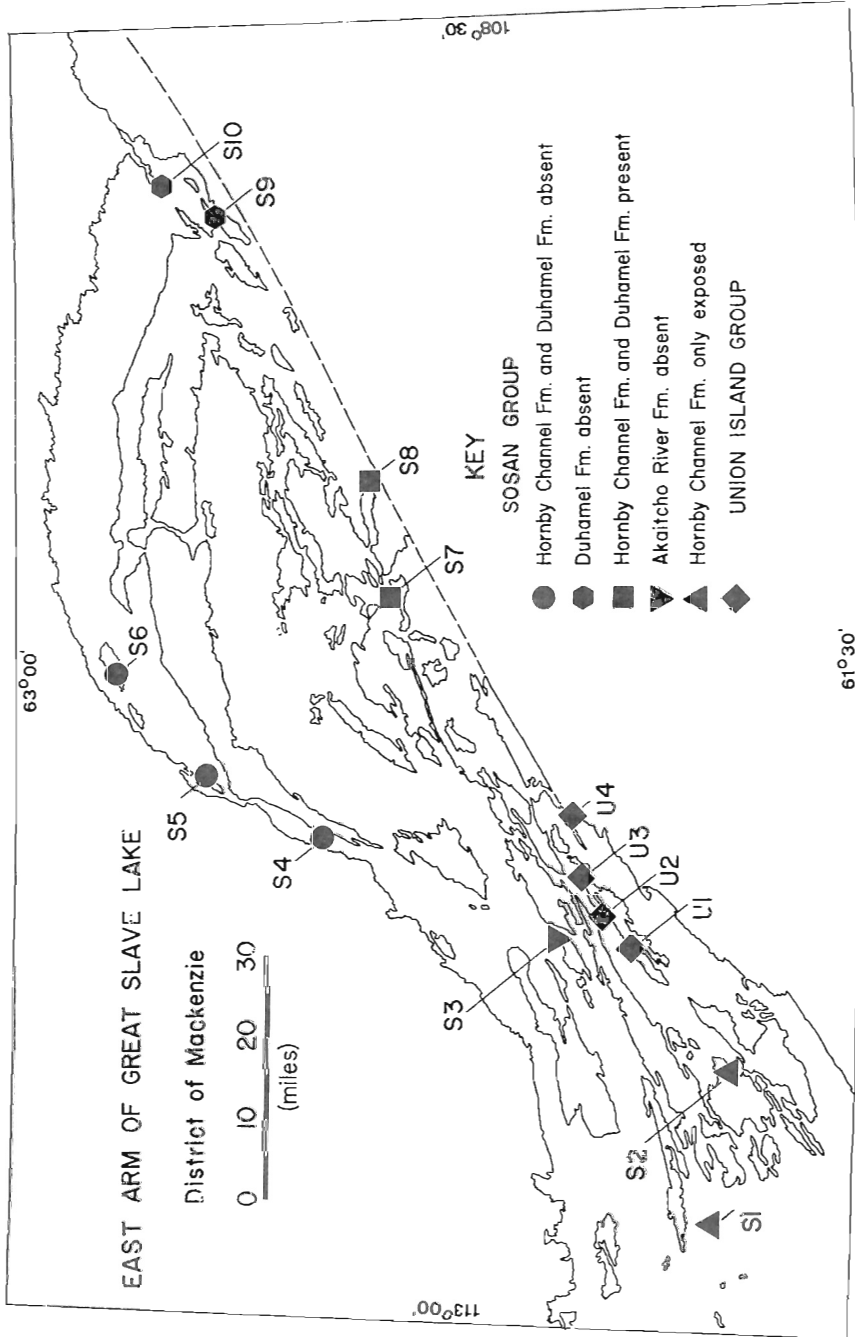


Figure 3. Location map showing measured sections in Union Island and Sosan Groups.

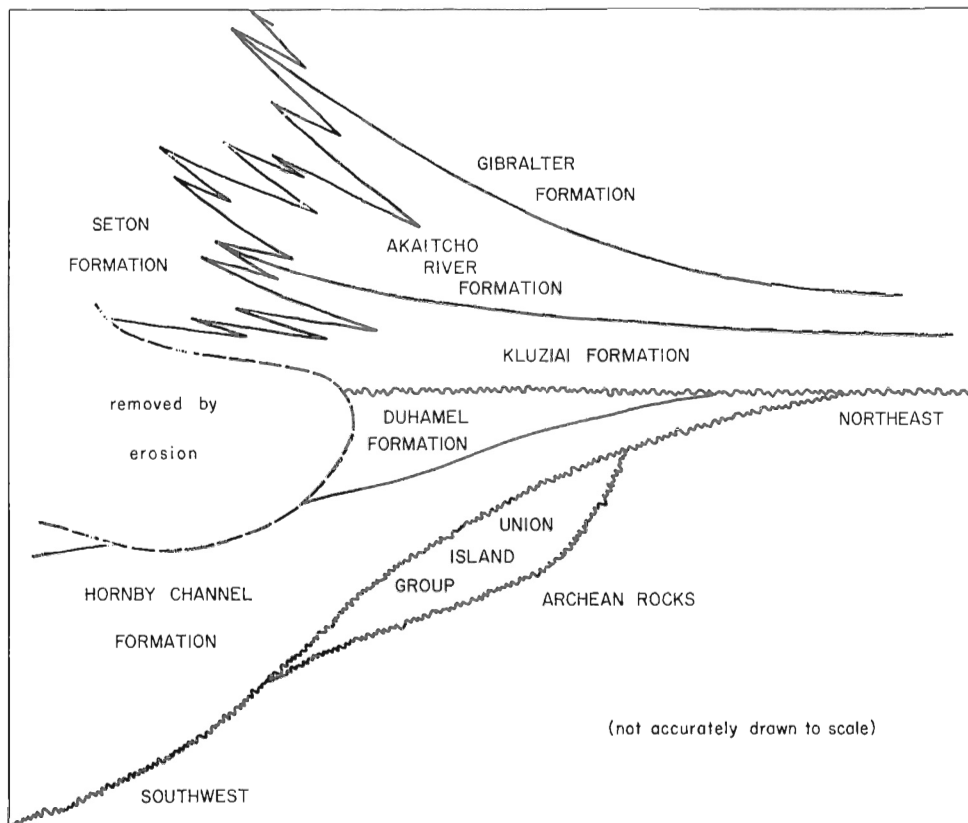


Figure 4. Diagrammatic cross-section showing the stratigraphic relations of formations in the Union Island and Sosa Groups.

Hornby Channel Formation

The name of the formation is derived from Hornby Channel, located between Simpson and Union Islands, East Arm of Great Slave Lake. Excellent exposures occur on the north side of Union Island and near the southwest end of Simpson Island, but this area was not selected as the type section because the top of the formation is not exposed.

The type section is 1 mile north of Lac Duhamel at latitude $62^{\circ}20'N$, longitude $110^{\circ}44'W$ where the formation is completely exposed on the south side of a burned-over ridge easily reached from the shore of the lake (see Appendix 1).

The Hornby Channel Formation is recognized only on the south limb of the East Arm synclinorium. It is most extensively exposed on and near Simpson Island (S2)¹ at the southwest end of the area, but it is also found in Charlton Bay (S10) at the northwest end of the East Arm,

The type section is 742 feet thick. The formation thickens to the southwest and is more than 5,000 feet thick on Simpson Island. It probably thins to the northeast of the type section and only about 150 feet are exposed on Fairchild Point in Charlton Bay. This section is complicated by faults, however, and is unreliable.

The formation consists dominantly of thin, lenticular beds of grey, pebbly, coarse-grained quartzite separated by thin shale partings. Most beds contain festoon crossbedding, and some have rippled tops. The quartzite is a texturally mature subarkose, consisting of 60 to 65 per cent clastic quartz, 10 to 15 per cent feldspar and granite rock fragments, and about 25 per cent quartz cement.

Conglomerate beds occur near the base of the formation, and south of Wilson Island (S1) and on Simpson Island (S2), medium- to fine-grained, even textured, brown sandstone interbedded with stromatolitic dolomite overlies the Archean granitic rocks. In the type section (S7), ripple-laminated siltstone and shale occur near the top of the formation, as does a thin tuffaceous bed.

The Hornby Channel Formation overlies Archean granitic rocks unconformably. The contact is well exposed on a small island south of Wilson Island (S1) and in the type section (S7). On the north side of the Incomu Channel, the formation overlies the Wilson Island Group unconformably. The formation also overlies the Union Island Group on the north side of Union Island (U1). This contact is not well exposed, but is also thought to be an unconformity (see p. 42). Quartz-pebble conglomerate overlying the Union Island Group paraconformably on the south side of Great Slave Lake (U4) may belong to this formation.

In the type section (S7), the Hornby Channel Formation is overlain conformably by dolomite of the Duhamel Formation. The upper contact is not exposed at the southwest end of the East Arm (S1, S2). At the northeast end in Charlton Bay (S9, S10), the Duhamel Formation is apparently missing and the formation is overlain by the Kluziai Formation which it resembles. The contact relations here are obscured by faults.

The substantial thickness, uniform lithology, ubiquitous festoon crossbedding, presence of mudcracks, and the texturally mature but mineralogically submature nature of the formation indicate a non-marine origin. The absence of fining-upward alluvial cycles, the abundance of conglomeratic sandstones, the thin lenticular bedding, the absence of channel-fill deposits, and the uniformity of crossed orientation suggest deposition from braided rather than meandering rivers.

¹Numbers in brackets refer to the locations of measured sections shown in the figures.

Duhamel Formation

The name of the formation is derived from Lac Duhamel, south of the village of Snowdrift on the east side of Christie Bay, Great Slave Lake.

The type section (S7) is 1 mile north of Lac Duhamel at latitude 62°20'N, longitude 110°44'W (see Appendix 1) where the formation is well exposed on a burned-over ridge. This is also the type section of the underlying and overlying formations.

The Duhamel Formation is of very restricted distribution. Aside from the type section (S7), it is known only from the south side of McLean Bay in Stark Lake (S8). It does not occur in the McLeod Bay area (S5, S6) to the north of the type section, nor in the Charlton Bay area (S9, S10) to the northeast. To the southwest of the type area (S1, S2), rocks of comparable stratigraphic position have been removed by erosion, but presumably the formation originally extended into that area. Interbedded dolomite and quartzite examined briefly on Jackson Island, north of the west end of Wilson Island at the extreme west end of the East Arm, may belong to the Duhamel Formation.

In contrast to other formations in the Sosan Group, the Duhamel Formation contains highly variable lithologies. The dominant lithology is dolomite, of which five facies are recognized; stromatolitic cryptalgal laminate (Aitken, 1967), intraformational flat-pebble conglomerate, oncolitic, and oolitic. These facies occur in beds mostly less than 6 feet thick, although stromatolite beds as much as 25 feet thick occur near the top of the formation. Interbedded with the dolomite are beds of crossbedded sandstone which vary in composition from pure orthoquartzite to pure dolomite. Beds of ripple-laminated brown or green terrigenous siltstone also occur, particularly near the base of the formation.

The Duhamel Formation conformably overlies the Hornby Channel Formation. The contact is placed at the base of the lowest dolomite bed.

In the type section the Duhamel Formation is overlain by the Kluziai Formation. The Duhamel Formation thins rapidly and ultimately disappears to the north and northeast. In the Charlton Bay area (S10), the Kluziai Formation rests directly on the Hornby Channel Formation. In McLeod Bay area (S9), the Kluziai Formation rests directly on Archean granitic rocks and both the Duhamel and Hornby Channel Formations are missing. The uppermost dolomite bed of the Duhamel Formation is extensively fractured and silicified in the type section, and the contact with the Kluziai Formation is not well exposed. Although no structural discordance is apparent, the contact is tentatively considered to be an unconformity, over which the Kluziai Formation overlaps the Duhamel and Hornby Channel Formations, truncating progressively older strata from south to north.

The presence of stromatolites, oncolites, oolites, edgewise conglomerate, and mudcracks indicates that the dolomite beds were deposited on a shallow marine platform frequently subjected to subaerial exposure. The beds of terrigenous sedimentary rocks are perhaps also of marine origin.

Kluziai Formation

The name of the formation is derived from Kluziai Island in McLeod Bay in the East Arm of Great Slave Lake. The upper part of the formation is well exposed on the north side of the island (S6), but because the base is not exposed here, this location was not selected as the type section. The type section is 2 miles north of Lac Duhamel at latitude $62^{\circ}21'N$, longitude $110^{\circ}44'W$ (see Appendix 1). It is 1,450 feet thick and is the only completely exposed, unfaulted section measured. Thickness estimates of partially exposed sections indicate that the formation becomes thinner north of the type section.

The Kluziai Formation is found throughout the East Arm area except near the extreme southwest end where it has presumably been removed by erosion. It consists of a uniform sequence of crossbedded, fine-grained, even textured, pink to grey sandstone. The beds are lenticular, generally less than 2 feet thick, and are separated by shale partings. The tops of many beds are ripple-marked and mudcracked. Petrographically, the sandstone is a texturally mature subarkose. Heavy mineral bands and scattered granule-sized quartz grains are typical.

The Kluziai Formation overlies the Duhamel Formation in the type section (S7), the Hornby Channel Formation in Charlton Bay (S10), and Archean basement rocks in the McLeod Bay area (S5, S6). The disappearance of the Duhamel Formation, nearly 1,000 feet of shallow marine dolomite, in less than 30 miles suggests a sub-Kluziai Formation unconformity. No angular discordance is visible at the contact which is not well exposed, but extensive fracturing and silicification of the underlying dolomite are compatible with such an interpretation.

The formation is overlain conformably by the Akaitcho River Formation in the eastern part of the East Arm. On Seton Island, it is overlain by the Seton Formation of the Kahochella Group. This contact is placed at the base of the lowest volcanic flow, but sandstones similar to those in the Kluziai Formation in the lower part of the Seton Formation indicate that volcanism began contemporaneously with the deposition of the upper Kluziai Formation.

Like the Hornby Channel Formation, which it resembles, and from which it is best distinguished by its finer grain size, more even texture and pink colour, the Kluziai Formation is interpreted as being of fluvial origin.

Akaitcho River Formation

The name of the formation is derived from Akaitcho River which flows into McLeod Bay in the East Arm of Great Slave Lake about 5 miles west of the type section.

The type section is on the north side of Kluziai Island in McLeod Bay at latitude $62^{\circ}50'N$, longitude $111^{\circ}01'W$ (see Appendix 2) where the formation is exposed on a cliff face capped by a diabase sill. The top of the formation is not exposed here but occurs at the base of the type section of the

Gibraltar Formation on Kahochella Peninsula between Gibraltar Point and Shelter Bay about 8 miles east of the type section.

The formation is found in the eastern half of the East Arm region but is nowhere completely exposed because of its recessive weathering character.

The precise thickness of the formation is unknown. Although the type section (S6) is 260 feet thick many hundreds of feet of the upper part of the formation are not exposed there. Airphoto interpretation suggests that the formation is about 1,000 feet thick north of Lac Duhamel (S7). More than 400 feet of the formation are exposed on the north side of Fairchild Point (S10) but neither the top nor bottom of the formation is exposed.

The formation is composed of three major lithologies. White, crossbedded sandstone with intraformational conglomerate forms a distinctive marker bed at the base of the formation in the McLeod Bay area (S5, S6) and similar beds occur at several levels within the formation around Charlton Bay (S9, S10). There the sandstone contains abundant pellets of glauconite (identified by X-ray diffraction) and vertical, brown-weathering, sand-filled, 5 to 7-mm wide tubes identical in form to the ichnofossil 'Skolithos', common in lower Paleozoic sandstones. These observations are important inasmuch as glauconite has never previously been reported from any but the latest of Precambrian rocks, and, because of its high ferric to ferrous ratio, its absence from the Precambrian has been used as an argument for a 'reducing' Precambrian atmosphere. The biological affinities of 'Skolithos' are not known with certainty, for it does not occur in rocks younger than Lower Silurian, but this fact is itself a powerful argument for an organic origin. 'Skolithos' tubes are considered to have been formed by a burrowing metazoan (Seilacher, personal communication), perhaps a worm. 'Skolithos' has not previously been reported from rocks older than Cambrian, and the oldest accepted metazoan fossils occur in the latest Precambrian.

Fine-grained, massive, dark red sandstone and siltstone beds, mostly less than 1-foot thick, are the major component of the formation on the south limb of the synclinorium. On the north limb, thinly interbedded red micaceous siltstone and shale predominate. These beds have abundant mud-cracks, ripple-marks, low angle crossbedding, convolute bedding, current lamination, flute casts and a variety of other sole markings, some of which are possibly organic in origin. Lenses of quartz-pebble conglomerate are rarely found.

The Akaitcho River Formation overlies the Kluziai Formation conformably. In the type section (S6), the contact is placed at the base of the distinctive white sandstone bed. North of Lac Duhamel (S7), and in McLean Bay (S8), pink sandstone of the Kluziai Formation is sharply overlain by thin bedded, crumbly, dark red siltstone of the Akaitcho River Formation.

The formation is overlain by the Gibraltar Formation of the Kahochella Group, and the contact is placed at the uppermost siltstone bed. The contact is best seen in the type section of the Gibraltar Formation near the west end of Kahochella Peninsula (K8).

The widespread mudcracks attest to periodic subaerial desiccation, and hence to a shallow water origin. The presence of glauconite indicates that the formation is at least partly marine (Cloud, 1955). The low angle crossbedding in some of the siltstone beds is characteristic of beaches and the large scatter in paleocurrent directions also suggests a near-shore marine environment. The formation is characterized by rapid lateral changes in the stratigraphic position of the sandstone bodies. These bodies generally do not have as sharp bases as do fluvial sandstones, but grade upwards from shale and siltstone. These observations are typical of deltaic sands. Environmental interpretation of the individual sandstone bodies would require more detailed information on the shape and internal structure of the bodies, but poor exposures make such information difficult to obtain. Tentatively, the sandstones are considered to be deltaic, the shales shallow neritic and the siltstones delta-front and delta-top environments, the latter distinguished by the presence of mudcracks.

KAHOHELLA GROUP

Stockwell (1936) gave the name 'Kahochella Formation' to "about 1,000 feet of shaly sediments with laminated, argillaceous limestone, jasper and oolitic iron formation" and "lava flows, tuff, volcanic breccia and agglomerate" associated with the iron-formation. Stockwell did not designate a specific type section, but presumably considered the north shore of Kahochella Peninsula to be the type area.

Stockwell's 'Kahochella Formation' is divisible into four distinctive, mappable stratigraphic units. It is proposed that each of these be erected as a formation, and the 'Kahochella Formation' be elevated to the rank of a group. Certain rocks mapped as 'Kahochella Formation' by Stockwell (1936), Henderson (1939) and later workers are now known to belong to other formations and are not included in the proposed Kahochella Group. Such rocks include basic pillow lavas on the small islands near Union Island, and a succession of dolomite, shale, greywacke and lava on the south shore of Great Slave Lake 4 miles southwest of McDonald Lake (U4), which belongs to the Union Island Group. In addition, many rocks on the south side of the synclorium mapped by Stockwell (1936) as 'Kahochella Formation' are now known to be stratigraphically equivalent to his 'Pethei Formation' and are here included in the Pethei Group.

Figure 5 shows the locations of measured sections of the Kahochella Group and Figure 6 gives a correlation chart of formations.

Seton Formation

The Seton Formation derives its name from Seton Island, between Blanchet Island and Keith Island in the East Arm of Great Slave Lake. The type section (K3) is on the north shore of Seton Island at latitude 62°02'N, longitude 112°06'W (see Appendix 3).

The Seton Formation is found only in the southwestern half of the East Arm. It is best exposed on Seton Island (K3) and on the west side of Pethei Peninsula between Utsingi Point and Taltheilei Narrows (K5). On the

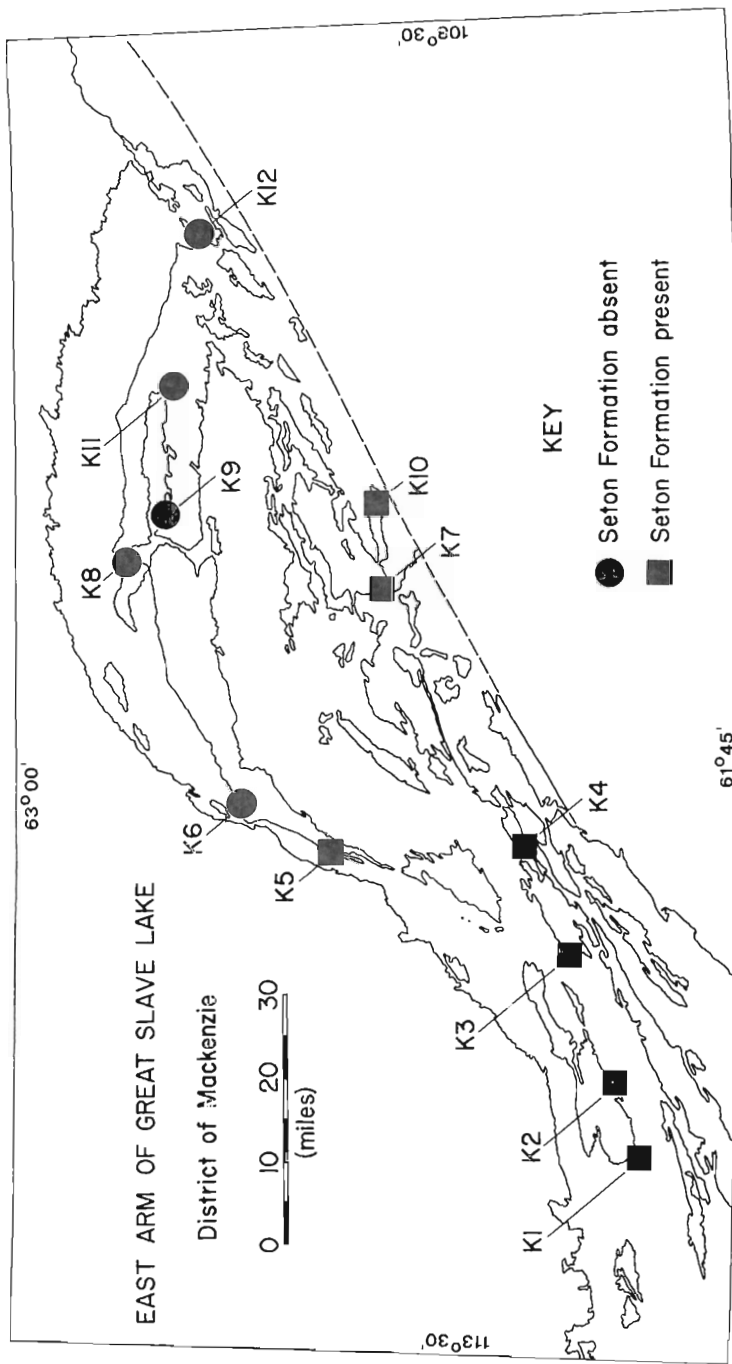


Figure 5. Location map showing measured sections in the Kahochehlla Group.

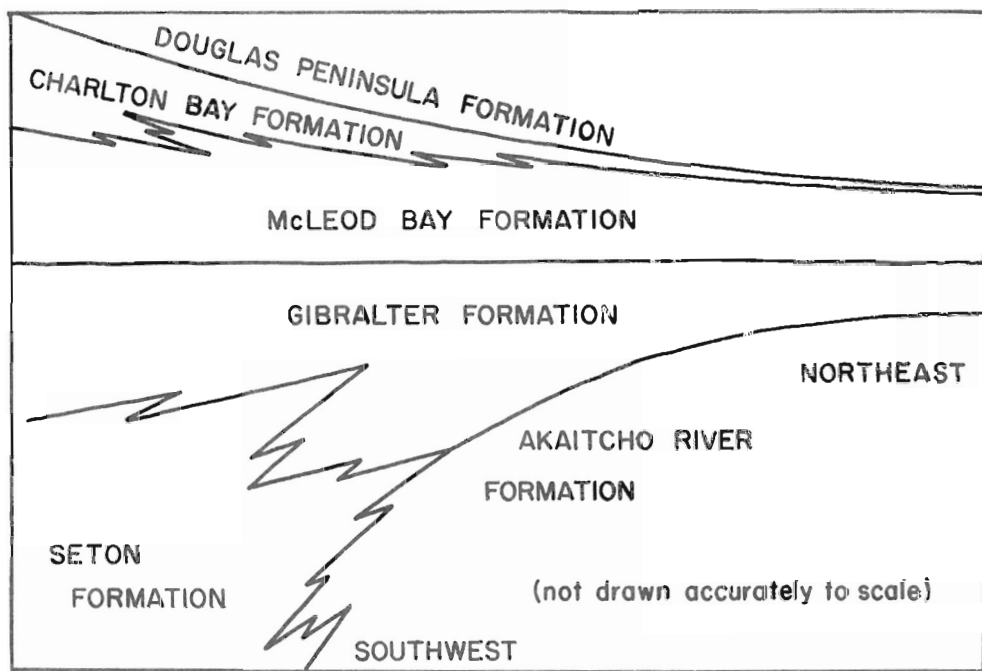


Figure 6. Diagrammatic cross-section showing the stratigraphic relations of formations in the Kahochella Group.

north limb of the East Arm synclinorium it does not occur east of Taltheilei Narrows, and is absent in Charlton Bay on the south limb (K12).

The type section of the Seton Formation is estimated to be 4,300 feet thick. The formation thins to the north and east of the type section, but accurate estimates of thickness are difficult to obtain because of the presence of igneous intrusive bodies, basic sills and acid plugs being the most common, and of diatreme breccias.

The formation consists primarily of volcanogenic rocks with interbedded sandstone, ferruginous sandstone, granular hematite and tuffaceous shale. The volcanogenic strata include massive to columnar andesite flows, andesite flow breccias, minor columnar rhyolite flows, and a wide variety of pyroclastic rocks. Ash-fall tuffs and agglomerates are well-bedded rocks containing silt-sized to cobble-sized angular fragments in a matrix of very fine grained ash. Reworked tuffs are common and contain calcite-cemented, well-sorted and moderately well rounded volcanic fragments. The silt-sized and sand-sized reworked tuffs have very well preserved sedimentary structures including crossbedding, ripple lamination and convolute lamination. In most tuffs, the volcanic fragments are mostly of andesitic lithic types, but chloritized vitric fragments and altered plagioclase and pyroxene crystal fragments also are present.

Volcanic vents, as much as one half mile across, transect the bedded rocks of the formation and are filled with coarse-grained, poorly sorted, basic agglomerate and breccia. Exhumed remnants of cinder cones with inclined bedding which dips away from the volcanic vents, occur between Utsingi Point and Taltheilei Narrows (K5), where the vents form prominent subcircular hills which interrupt the otherwise linear topographic pattern controlled by the gently dipping diabase sills.

The base of the Seton Formation is placed at the base of the lowest volcanogenic bed. In the type section (K3), the formation overlies the Kluziai Formation conformably, beds of sandstone similar to those in the Kluziai Formation occurring within the Seton Formation. In other sections (K5, K7, K10), the lowest beds of the Seton Formation overlie rocks of the Akaitcho River Formation. The absence of the Akaitcho River Formation in the type section (K3) suggests that volcanism began contemporaneously with the deposition of the upper members of the Sosan Group.

The Seton Formation is overlain conformably by the Gibraltar Formation. The contact is placed at the transition from predominantly volcanogenic rocks to red shales with little or no tuffaceous admixture. The tuffaceous shales of the Seton Formation may be distinguished from the overlying Gibraltar Formation by their predominantly green colour, which is a result of chloritization of basic vitric shards.

The Seton Formation is a stratigraphically complex unit. After more detailed study of these interesting rocks, it may well be advisable to elevate its rank to that of an independent group. Present knowledge, however, does not permit its subdivision into constituent formations, a prerequisite of a group.

Most of the rocks in the Seton Formation are totally or partially volcanogenic. Volcanic flow rocks are massive, brecciated or columnar. Pillow lavas described by Stockwell (1932) are now known to belong to the Union Island Group. In the absence of evidence for submarine extrusion, the flows are tentatively considered to be subaerial. Among the pyroclastic beds, the ash-fall tuffs were deposited subaerially or in very quiet water, but such rocks are less common than tuffs which have clearly been subjected to subaqueous reworking. Tuffs in the exhumed cinder cones are reworked only on the lower and distal flanks suggesting that while the centres of volcanism were elevated above water level, their flanks were subjected to subaqueous current action. The presence of gypsum casts in the fine-grained ash beds associated with reworked tuffs between Taltheilei Narrows and Utsingi Point (K5) indicates the water was saline, and therefore shallow. Abundant mud-cracks in tuffaceous shales in the same section point to frequent emergence and desiccation.

Gibraltar Formation

The name of this unit is derived from Gibraltar Point at the west end of Kahochella Peninsula in McLeod Bay, East Arm of Great Slave Lake and the type section is on the north side of Kahochella Peninsula between Gibraltar Point and Shelter Bay at latitude 62°49'N, longitude 110°44'W (see Appendix 4). The formation is found throughout the East Arm area but

is seldom completely exposed because of its recessive character. The thickness of the formation is difficult to measure because of incomplete exposure. In the type section (K8), and in the northeastern part of the East Arm area in general, it is 400 to 600 feet thick. The formation thickens to the southwest and an estimated 3,450 feet of strata occur on the northwest side of Keith Island (K3).

The dominant lithology of the Gibraltar Formation is red shale. The shale contains thin lenses of pale yellow or greenish calcareous shale. Minor thin beds of red siltstone occur near the base of the formation as does a bed of quartz-pebble conglomerate in the Charlton Bay section (K12). The upper parts of the formation are characterized by beds of granular hematite, intraformational conglomerate, hematite-calcite stromatolites and crystal casts after gypsum. In the southwestern part of the East Arm area, dark green shales with red and white chert nodules also occur near the top of the formation.

The upper and lower contacts of the formation are conformable and transitional, but are sufficiently abrupt to be easily mapped. The base rests either on sandstones and siltstones of the Akaitcho River Formation, or volcanic rocks of the Seton Formation. The formation is everywhere overlain by the McLeod Bay Formation which is easily distinguished by its abundant calcareous concretions.

The origin of shales is difficult to interpret because of the destruction of sedimentary structures, where present, by compaction. In the Gibraltar Formation, the occurrence of stromatolites and gypsum crystal casts indicates shallow, and at least locally saline conditions. The flat-pebble edgewise conglomerates of intraformational derivation in this formation are characteristic of the littoral environment. Such an environment would at first thought seem inconsistent with the fine grain size of the sediment, but the beds of crossbedded granular hematite show that the currents were sufficiently strong to transport sand-sized sediment where such sediment was available. Indeed, muds have been accumulating in the vast intertidal flats of the northwest coast of the Gulf of California since the Pliocene. Furthermore, these muds become red during diagenesis (Walker, 1967) and contain evaporite minerals, two features they have in common with the Gibraltar Formation and which are not characteristic of deeper water shales. The great thickness and lateral extent of the formation may be cautiously used to reject a lacustrine origin for the formation. Tentatively, a shallow water, perhaps littoral, marine origin is advocated.

McLeod Bay Formation

The formation derives its name from McLeod Bay in the East Arm of Great Slave Lake. The type section is on the north side of Pethei Peninsula near the west end of McLeod Bay, 4 miles northeast of Taltheilei Narrows at latitude 62°37'N, longitude 111°23'W (see Appendix 5). Here the lower part of the formation is well exposed, and the upper part, although largely covered by talus in this section, is exposed along the shoreline to the east.

The McLeod Bay Formation, like the underlying Gibraltar Formation, is found throughout the East Arm region and is seldom completely exposed because of its recessive character. Accurate thickness measurements are difficult to obtain because of incomplete exposure. In the type section (K6) the formation is about 550 feet thick. At the northeast end of the East Arm in Charlton Bay (K12), the formation is 110 feet thick; on Keith Island (K3), near the southwest end of the East Arm, it is 1,050 feet thick.

The McLeod Bay Formation is composed of red shale with closely-spaced calcareous concretions, mostly less than 10 centimetres across. The concretions are arranged in rows parallel to bedding and many have nearly flat bottoms and convex-upward tops, allowing them to be used for 'stratigraphic top' determination. Bowing of the shale laminations, or planes of fissility, around the concretions is ubiquitous. The laminations pass through the concretions and in a few cases ripple-laminations and low angle cross-laminations were observed within the concretions. In Charlton Bay (K12), small crystal casts after gypsum occur in the concretionary shales. At several horizons, single beds are found in which the concretions are randomly oriented, or are standing on end with their internal laminations perpendicular to bedding. Lenses of 'out of place' concretions also occur, and examination of the 'micro-stratigraphy' of the laminations within the individual concretions shows that they were derived from a single concretion bed.

The McLeod Bay Formation overlies the Gibraltar Formation and underlies the Charlton Bay Formation, both conformably. It is distinguished from the former by its abundant concretions, and from the latter by its red colour and close spacing of the concretions.

As in the case of the Gibraltar Formation, the origin of the McLeod Bay Formation is not easily determined. Concretions form in both freshwater sediments and shallow to deep water marine sediments and are therefore not environmentally diagnostic. The bowing of shale laminations around the concretions indicates that the concretions were formed prior to compaction of the surrounding muds. Measurements of the amount of curvature of the laminations consistently indicates a 60 per cent loss in original sediment thickness during compaction. The conglomerate beds of reworked concretions shows first of all that the concretions were formed penecontemporaneously with sedimentation, and secondly that the depositional environment was periodically subjected to currents of sufficient intensity to winnow the mud surrounding the concretions and to transport the concretions. The beds containing 'out of place' concretions are a type of lag conglomerate. Evidence of current action is also manifested as ripple-laminations and cross-laminations within the concretions. Such sedimentary structures were destroyed by compaction in the adjacent shales. The lack of structures in the shales should not therefore be used as an argument for a quiescent environment, and by extension, for deep water. The presence of gypsum crystal casts indicates saline, and therefore shallow water; and the thickness and lateral extent of the formation favours a marine rather than lacustrine origin. A littoral or neritic origin is therefore favoured.

Charlton Bay Formation

The name of the formation is derived from Charlton Bay at the east end of McLeod Bay in the East Arm of Great Slave Lake. The type

section is on the northwest shore of Charlton Bay southeast of Meridian Lake at latitude 62°37'N, longitude 109°19'W (see Appendix 6).

The formation is found throughout the East Arm area and is well exposed at many locations, being less recessive than the underlying red shale formations but not as resistant as the overlying Pethei Group. At the type section (K12) the formation is 120 feet thick. It thins to only 30 feet on the north side of Douglas Peninsula (K11), but is more than 500 feet thick in the southwestern end of the East Arm on Keith Island (K3) and Blanchet Island (K1).

The formation consists of very finely laminated, dark green shale or argillite with large, widely spaced, oblate spheroidal, brown-weathering, calcareous concretions as much as 50 centimetres across. Smaller pyrite or marcasite nodules are also found and irregular patches of jasper occur within some of the concretions. In most sections, the uppermost bed, 2 to 5 feet thick, consists of coalesced calcareous concretions which are so closely spaced that they make up 90 per cent of the rock.

In the southwestern part of the East Arm area, where the formation is thickest, parallel-sided beds of graded siltstone, mostly less than 1-foot thick, contain sedimentary structures characteristic of turbidites. These beds are well exposed on the south side of Blanchet Island (K2) and on the east side of Keith Island south of Pekanatui Point (K4).

On Douglas Peninsula (K11), very recessive, thin beds of bright apple-green micaceous bentonite occur.

The Charlton Bay Formation conformably overlies the McLeod Bay Formation from which it is distinguished by its green colour, greater resistance to weathering, lesser fissility, and much more widely spaced and larger concretions. The formation is conformably overlain by the Douglas Peninsula Formation of the Pethei Group. The latter is easily distinguished by its red colour, higher carbonate content, and distinctive laminations. The resistant, light grey weathering, concretion-rich bed serves as a good marker horizon of the top of the Charlton Bay Formation and of the Kahochella Group.

Like the other sedimentary formations in the Kahochella Group, the origin of the Charlton Bay Formation is not easily determined. Its uniformly fine grained lithology, substantial thickness and lateral extent favour a marine origin. Its dark green colour and the presence of turbidite beds suggests deposition in deeper water than the underlying red shales.

PETHEI GROUP

Stockwell (1936) gave the name 'Pethei Formation' to "1,500 feet of limestone and dolomite characterized by algal structures at some horizons". He described the type section, "on the north slope of Pethei Peninsula south of Mountain River", as follows (Stockwell, 1932):

5. "wavy and massive white limestone about 100 feet thick" occurring "to the east of the type section" (Hearne Formation of this report)

4. "about 200 feet of white and grey limestone with wavy structure" overlain by a bed of "algal limestone about 20 feet thick" (Wildbread Formation of this report)
3. "about 500 feet of mottled limestone . . . overlain by a 50-foot bed of massive, cliff-forming limestone" (Utsingi Formation of this report)
2. "about 700 feet of dolomite with wavy, algal-like structures" overlain by "a bed of limestone about 20 feet thick . . . with excellent algal structure" (Taltheilei Formation of this report)
1. "a thin bed of laminated limestone" (Douglas Peninsula Formation of this report).

Stockwell (1932) reported that the limestone and dolomite of the type section were missing on the south limb of the East Arm synclinorium.

Barnes (1952) reported that rocks stratigraphically equivalent to Stockwell's 'Pethei Formation' occur around Stark Lake on the south limb of the East Arm synclinorium, but are of different lithology than those in the type section on Pethei Peninsula. This interpretation is confirmed, and the nature and distribution of the facies changes were established.

Stockwell's 'Pethei Formation' is readily divisible into several distinctive, mappable units. The lowermost of these, the thin Douglas Peninsula Formation, is found throughout the East Arm area. On the north side of the synclinorium this formation is overlain by four formations referred to collectively in this report as the "carbonate platform sequence" of the Pethei Group. On the south side, the Douglas Peninsula Formation is overlain by three different formations referred to collectively as the "terigenous basinal sequence" of the Pethei Group. A location map of measured sections is shown in Figure 7, and a correlation chart of formations is given in Figure 8.

Douglas Peninsula Formation

The formation is named for Douglas Peninsula, which separates Wildbread Bay and Tochatwi Bay in the East Arm of Great Slave Lake. The type section is on the north shore of Douglas Peninsula at latitude 62°45'N, longitude 110°20'W (see Appendix 7). The entire formation including its contacts with the underlying and overlying formations is well exposed along the lake shore at this location.

The Douglas Peninsula Formation is the only formation in the Pethei Group found throughout the East Arm area, and is therefore a good marker of the base of the group. In the type section (P29) the formation is 83 feet thick and in none of the sections measured on both the north and south limbs of the East Arm synclinorium was it less than 55 feet nor more than 110 feet thick. The formation is thinnest at the northeast end of the East Arm.

The formation is lithologically homogeneous, consisting of thin bedded, fissile, red marlstone. The marlstone consists of ragged lenticles

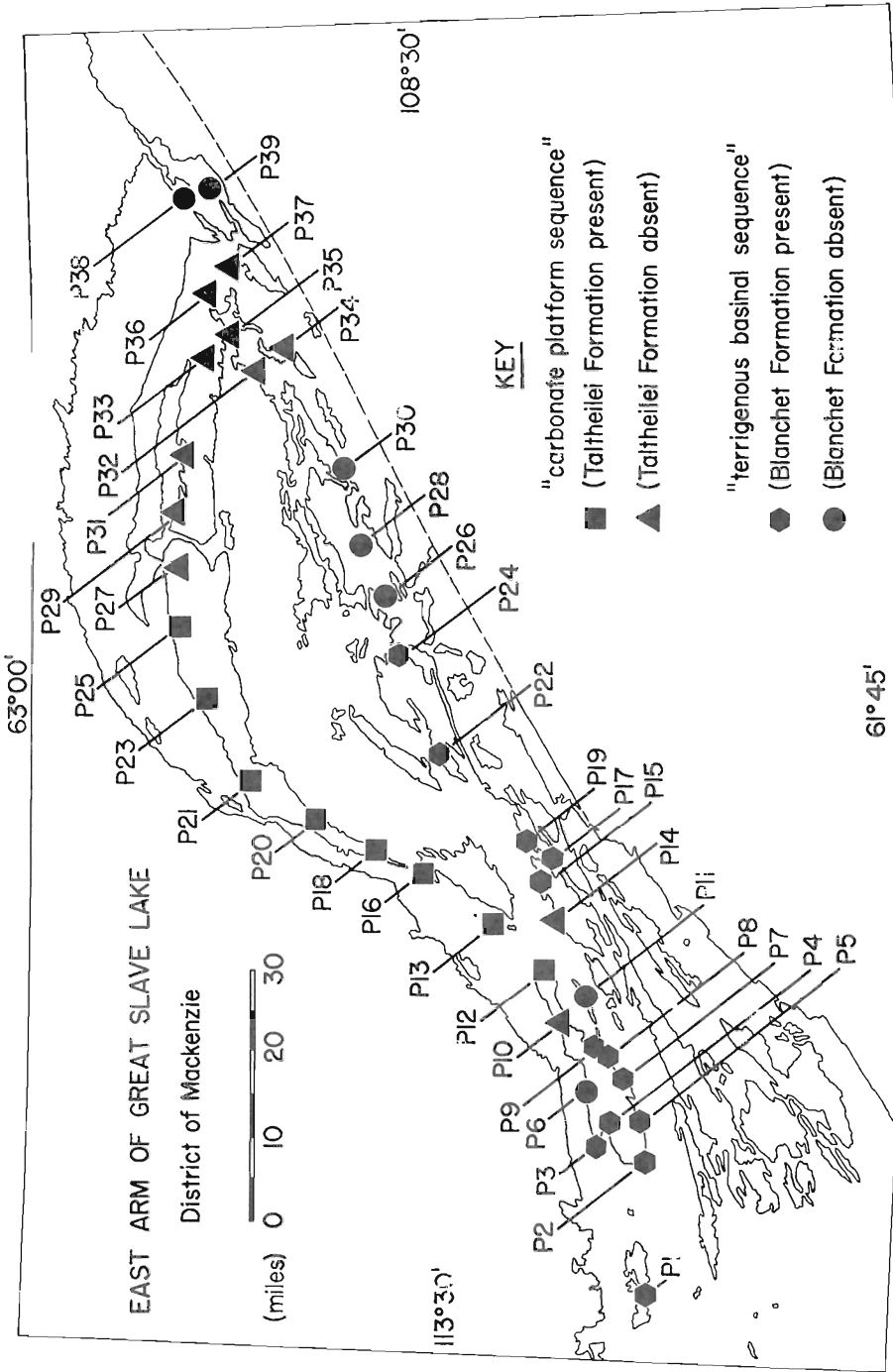


Figure 7. Location map showing measured sections in the Pethei Group.

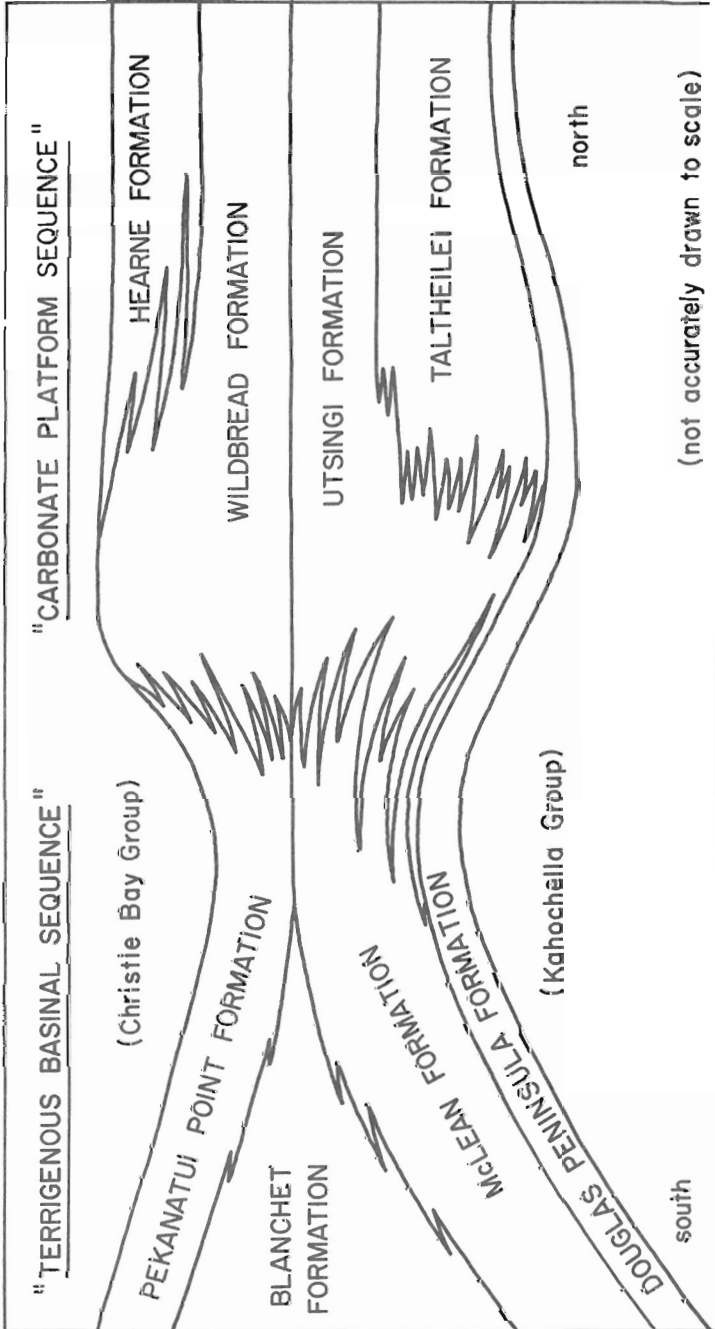


Figure 8. Diagrammatic cross-section showing the stratigraphic relation of formations in the Pethei Group.

of pink to light brown argillaceous limestone, 1 to 10 centimetres long and about 5 millimetres thick, embedded in dark red-brown mudstone. The mudstone weathers in relief and gives the rock a distinctive bifurcated lamination. In the type section (P29) the mudstone contains rare crystal casts after gypsum less than 2 millimetres long.

On the south limb of the synclinorium the carbonate content of the formation is generally less than on the north limb and, very thinly bedded, fissile, red, hematitic siltstone and mudstone contain scattered lenses of limestone and jasper. A bed of light grey weathering laminated limestone, about 5 feet thick, occurs near the base of the formation on the south limb.

The Douglas Peninsula Formation overlies the Charlton Bay Formation of the Kahochella Group conformably. The change in colour from dark green to red-brown, the increase in carbonate content, and the distinctive lamination of the Douglas Peninsula Formation make this contact easy to recognize.

The formation is overlain by the Taltheilei Formation on the north limb of the synclinorium, or, where this formation is absent, by the Utsingi Formation. The contact with the Taltheilei Formation is recognized by abrupt change from red-brown, laminated marlstone to yellow-brown weathering, stromatolitic dolomite. The contact with the Utsingi Formation is also most readily recognized by the colour change from red-brown to blue-grey limestone with yellow-brown dolomite laminations and mottling. Both the Taltheilei Formation and the Utsingi Formation are thicker bedded and more resistant than the underlying Douglas Peninsula Formation. Both contacts are conformable.

On the south limb of the synclinorium, the formation is less easily distinguished from the overlying McLean Formation. The latter is thicker bedded, has a higher carbonate content, a more nodular distribution of limestone, and more irregular laminations. In addition, the McLean Formation is more commonly dolomitized.

The origin of the formation is uncertain. Marlstones with the 'microbreccia' laminated fabric of the Douglas Peninsula Formation are known to be formed in two types of environments. In freshwater lakes, calcareous crusts are precipitated as the result of the extraction from dissolved calcium bicarbonate by photosynthetic organisms such as algae. The crusts are periodically inundated by influxes of terrigenous mud. Calcareous crusts of 'caliche' are formed in the soils of semiarid regions (Pettijohn, 1957). The crusts are precipitated from lime-bearing waters drawn to the surface by capillary action induced by evaporation. In this environment, some other agent would be required to introduce terrigenous sediment. Although lithologically similar to many non-marine calcareous rocks, the presence of gypsum casts in this formation indicates at least local high salinity.

Carbonate Platform Sequence

Overlying the thin Douglas Peninsula Formation on the north side of the East Arm synclinorium are four formations which comprise the bulk of Stockwell's type 'Pethei Formation'. These four formations are composed of nearly pure carbonate, predominantly limestone, and the abundance of

stromatolites, oolites, edgewise conglomerate, and 'birds-eye' structures indicates that they were deposited on a very shallow water marine platform. The four formations are therefore collectively referred to in this report informally as the 'carbonate platform sequence' of the Pethei Group.

This sequence has clearly defined geographic limits, limits which mark the edge of the shallow platform. To the south and southwest, stratigraphically correlative rocks are composed of both carbonate and terrigenous sediments. These beds are interpreted as being of deeper water origin than the carbonate platform sequence and are therefore referred to informally as the 'terrigenous basinal sequence' of the Pethei Group, the term 'basinal' being used in the bathymetric sense.

Taltheilei Formation

The name of the formation is derived from Taltheilei Narrows which joins the west ends of McLeod Bay and Christie Bay in the East Arm of Great Slave Lake. At the type section, on the north side of Pethei Peninsula 4 1/2 miles northeast of Taltheilei Narrows at latitude 62°38'N, longitude 111°25'W (see Appendix 8), the formation is typically developed and completely exposed on an easily climbed scarp which rises over 400 feet from lake level in a series of steps.

The formation is exposed along a 70-mile long outcrop belt in the central part of the north limb of the East Arm synclinorium. It is found along the north and west sides of Pethei Peninsula west of longitude 110°40'W, on the more southerly of the small islands west of Et-then Island, and on the northeast end of Blanchet Island east of longitude 112°10'W. The type section (P21) of the formation is 390 feet thick. The formation thickens to the east of the type section, and perhaps also to the southwest. None of the sections measured are more than 600 feet thick.

The formation consists predominantly of light brown weathering, thin- to thick-bedded, fine- to medium-grained crystalline dolomite with minor limestone. Two major facies associations occur. The first, which characterizes most of the type section (P21), consists of interbedded stromatolitic, laminated and massive dolomite. The stromatolitic beds are laterally continuous and are from 2 to 50 feet thick. The thinner beds contain scattered, well-laminated to poorly laminated, columnar or turbinate stromatolites of the non-linked 'SH' type (Logan et al., 1964). The thicker beds have closely spaced, well-laminated, branching columnar stromatolites, the diameter of which reaches a maximum of 3 feet about 10 to 15 feet from the base of the beds, and a minimum near the top of the beds. Adjacent columns are alternately linked and non-linked, except near the base where they are commonly non-linked. One bed of this type, 50 feet thick, occurs at the top of the formation and is a prominent ridge-forming unit. Magnificent bedding plane exposures of the stromatolites in this bed, revealing both circular and elliptical cross-sections, may be seen on the small islands east of Pethei Peninsula about 1 mile north of Utsing Point (P18). The laminated dolomite of the first facies association contains oncolites (detached, disc-shaped stromatolites with discontinuous concentric layering), edgewise conglomerate or 'micro-breccia', desiccation cracks, and stromatolites of the laterally

linked 'LLH' type (Logan et al., 1964). The laminations, which are of millimetre scale, contain many 'micro-disconformities' and in many beds grade upward into massive dolomite.

In the second major facies association the stromatolites occur in mounds or bioherm-like assemblages rather than in continuous beds. Stromatolite mounds about 20 feet across occur near the base of the type section (P21), but far more impressive mounds 50 to 150 feet across and 60 feet thick occur at the northeast corner of Blanchet Island (P12). The mounds are made up internally of branching columnar stromatolites and are mostly elliptical in plan view. Stromatolite mounds also occur east of the type section, but here secondary dolomitization obscures their intricate internal structure. Where unaffected by secondary dolomitization, the stromatolites within the mounds are commonly composed of limestone with dolomitic laminations. The mounds are surrounded by coarse-grained, clastic carbonate sediment, made up mostly of fragments derived from the stromatolites in the mounds. Thin beds of stromatolites pass continuously from the mounds into the intervening clastic beds and provide a measure of the amount of relief attained by the mounds. Even in the largest mounds, the relief apparently was not more than about 6 feet, and commonly less than 3 feet. The clastic beds are commonly ripple-marked and crossbedded, and, where undolomitized, are cemented by sparry calcite. Laminated dolomites are rare in this facies association.

The Taltheilei Formation overlies the Douglas Peninsula Formation conformably. The contact is marked by an abrupt change from thin bedded, fissile, red, laminated marlstone to thick bedded, resistant, brown weathering, stromatolitic dolomite.

The formation is overlain by the thick bedded, largely non-stromatolitic, blue-grey limestone of the Utsingi Formation conformably. A few thin stromatolite beds occur near the base of the Utsingi Formation but the contact is placed at the top of the uppermost, ridge-forming, 50-foot thick stromatolite bed of the Taltheilei Formation.

Laterally, the Taltheilei Formation passes with abrupt facies change into beds typical of the Utsingi Formation. This contact is exposed on the cliff face on the northeast side of Blanchet Island (P12) at longitude $112^{\circ}10'W$. At the east end of the Taltheilei Formation outcrop belt the same facies change occurs but is obscured by secondary dolomitization. The Utsingi Formation in part overlies, and is in part laterally equivalent to the Taltheilei Formation.

The Taltheilei Formation is of shallow water marine origin. Many of the facies are similar to those occurring in carbonate platform reef complexes of younger rocks. The first facies assemblage is characteristic of back-reef lagoonal deposition with accumulation occurring predominantly in the intertidal zone. The beds of non-linked stromatolites are interpreted as low intertidal, whereas the laminated dolomite beds, analogous to 'cryptalgal laminites' (Aitken, 1967), accumulated in the high intertidal zone. The massive dolomite beds are more difficult to interpret, but their intimate association with laminated and stromatolitic beds indicates that they too were formed within, or close to the littoral zone, perhaps under supratidal conditions.

The stromatolite mounds of the second facies assemblage are analogous to the organic reefs of younger rocks. That the mounds formed an effective barrier in front of the lagoonal facies is evidenced by the much coarser clastic sediments surrounding the mounds deposited under higher mechanical energy conditions. The tops of the mounds probably protruded into the littoral zone, but the clastic beds accumulating at the base of the mounds may have been permanently submerged and subject to nearly continuous sediment movement, conditions which did not allow the sediment surface to be stabilized by algal mats.

Utsingi Formation

The name of the formation is derived from Utsingi Point at the southwesternmost end of Pethei Peninsula. The type section is on the east side, near the north end, of the largest and most northerly of the islands east of Pethei Peninsula about 4 1/2 miles north of Utsingi Point at latitude 62°25'N, longitude 111°36'W (see Appendix 9).

The formation is exposed along a linear outcrop belt which extends from the northeast side of Blanchet Island, past the northwest corner of Et-then Island, and along the entire length of Pethei Peninsula and Douglas Peninsula to the area around Meridian Lake, a distance of about 120 miles.

The type section (P18) is 210 feet thick, a minimum for the formation. Between longitudes 110°40'W and 112°10'W, where it overlies the Taltheilei Formation, the Utsingi Formation is less than 500 feet thick. To the east and west of this area, where the Taltheilei Formation is absent and the Utsingi Formation rests directly on the Douglas Peninsula Formation, it reaches a thickness of 1,000 feet or more.

The formation is informally considered to comprise two members. The lower, and thicker member consists of a monotonous succession of thick bedded, blue-grey weathering, crystalline limestone with distinctive discontinuous laminations and mottling of brown weathering dolomite. At the base of the member, these laminations have the form of concave-upward discs 2 to 3 centimetres across. The discs are commonly vertically-superimposed to form vertical or steeply inclined rods several feet long. In the upper parts of the member the dolomitic mottling is more irregular and the intervening limestone takes the form of poorly defined columns, about 5 centimetres across, with faint, convex-upward laminations. At several horizons in this member, the bedding surfaces have the configuration of preferentially oriented, elliptical domes or linear ridges, with gently convex-upward tops and sharp, angular troughs. The domes are from 2 to 50 feet across, and from 5 to 250 feet long, and have long axes which consistently strike perpendicular to the outcrop belt.

The upper member forms a prominent low ridge along the entire length of Pethei and Douglas Peninsulas. It consists of massively bedded white limestone which produces very large and angular talus blocks. The limestone contains closely spaced and highly crenulated siliceous or dolomitic laminations. The limestone of this member is in many sections coarsely crystalline.

The Utsingi Formation conformably overlies both the Taltheilei Formation and the Douglas Peninsula Formation. The former contact is placed at the top of the prominent ridge-forming 50-foot thick stromatolite bed. The contacts are easily mapped on the basis of contrasting colours, from brown to blue-grey in the former case, and from red to blue-grey in the latter.

The formation is overlain by the Wildbread Formation. This contact is placed at the top of the prominent ridge formed by the upper member of the Utsingi Formation, and is marked in most sections by a thin, but easily recognized, stromatolitic limestone bed.

On the north limb of the synclinorium, much of the lower part of the Utsingi Formation passes laterally with abrupt transition into stromatolitic dolomite of the Taltheilei Formation. To the south, the formation passes laterally into the McLean Formation. This latter facies change is gradational and separation of the two formations in the area around New Lake (P36) is arbitrary. The McLean Formation contains more argillite and less dolomite, except where it has undergone complete secondary dolomitization, which has obliterated structures and produced a highly cavernous fabric. The McLean Formation is more prominently laminated and is red-brown rather than blue-grey.

The origin of the Utsingi Formation is not easily established. It is megascopically similar to the Devonian Palliser Formation and to the 'parted limestone' facies described by Aitken (1967) from the Cambrian, both occurring in the Canadian Rocky Mountains. Beales (1956) interprets the former as being of shallow marine origin on the basis of petrography, and Aitken reaches a similar conclusion for the latter on the basis of stratigraphic position. On the other hand, Fischer (1964) described rocks in the Triassic of the Swiss Alps which petrographically closely resemble the Utsingi facies. Fischer interprets these rocks, which he named 'loferites', to have been deposited on high intertidal or supratidal salt flats or 'sabkhas' similar to those found today along the Trucial Coast of the Persian Gulf (Illing, et al., 1965).

The wrinkled laminations and concave-upward, disc-shaped mottling of the Utsingi Formation superficially resemble desiccated algal mats, and the elliptical domes, although without known modern analogues, are presumably a type of algal stromatolite. Under the microscope, much of the rock is seen to consist of partly recrystallized pelleted calcilutite, but scattered throughout are patches of clear, sparry calcite or 'birds-eyes' interpreted by Fischer as the fillings of shrinkage pores produced during desiccation. The presence of scattered grains of quartz silt of detrital origin is also a feature which these rocks have in common with the sediments of modern supratidal mud flats, the quartz having been transported by winds. The mottled pattern of dolomitization, varying in percentage of dolomite from bed to bed, is also comparable to penecontemporaneous dolomitization observed in many supratidal lime mud flats in the Recent. Although a supratidal origin is favoured, a major difficulty with any interpretation of the Utsingi Formation is to explain its remarkable thickness and uniformity.

Wildbread Formation

The name of the formation is derived from Wildbread Bay, between Douglas Peninsula and Kahochella Peninsula in the East Arm of Great Slave Lake. The type section is south of the west end of Wildbread Bay, 1 mile west of the Gap, near the east end of Pethei Peninsula at latitude $62^{\circ}44'N$, longitude $110^{\circ}30'W$ (see Appendix 10). Here, the formation is typically exposed on the north side of the highest ridge of the peninsula. A much more accessible and better exposed, but unfortunately incomplete section occurs about half-way down the east side of the largest and most northerly of the islands east of Pethei Peninsula (P18), about 4 miles north of Utsingi Point. This section is continuous with the type section of the underlying Utsingi Formation, but the uppermost 50-foot thick stromatolite bed of the Wildbread Formation is not exposed. This remarkable bed, however, is well-exposed in a series of accessible lakeshore outcrops at the east end of Tochatwi Bay (P35) at latitude $62^{\circ}40'N$, longitude $109^{\circ}43'W$, and latitude $62^{\circ}39'N$, longitude $109^{\circ}41'W$. Two photographs of this bed at the Tochatwi Bay location are presented by Lausen (1929, pp. 384-385).

The formation is exposed on the north limb of the East Arm synclinorium from longitude $112^{\circ}17'W$ near the northeast end of Blanchet Island, across the northwest corner of Et-then Island, and along the entire length of Pethei Peninsula and Douglas Peninsula to the east end of Tochatwi Lake at longitude $109^{\circ}25'W$, a distance of about 140 miles. On the south limb, the formation is absent in all but two sections, the northwest side of Keith Island (P14) and 1 mile northeast of Compton Lake (P34).

The type section of the formation is 198 feet thick. All of the sections on the north side of the synclinorium are between about 200 and 250 feet thick. The formation thickens to the south, and although difficult to measure accurately because of dolomitization, it is perhaps 600 feet thick northeast of Compton Lake (P34), north of Meridian Lake (P37), and on Keith Island (P14).

Like the Taltheilei Formation, two major facies associations occur in the Wildbread Formation. The first is on the north limb of the synclinorium between Et-then Island (P16) and the base of Douglas Peninsula (P32). In this area, the top of the formation is marked by a 50-foot thick branching columnar stromatolite bed very similar to the topmost bed of the Taltheilei Formation. Below this bed, three facies are interbedded. These are (1) white, commonly recrystallized, ripple-marked, thin-bedded, oolitic limestone; (2) well-laminated, grey limestone and brown weathering dolomite with stromatolites of the laterally linked ('LLH') type (Logan et al., 1964), oncolites and edgewise conglomerate; and (3) thick-bedded white to grey limestone with a mottled crystalline texture, crenulate siliceous or dolomitic laminations, 'cone-in-cone' structure, and elliptical dome-like bedding configuration similar to that found in some horizons of the Utsingi Formation.

The scattered exposures on the south limb of the synclinorium belong to the second facies association. Secondary dolomitization obscures the primary structures in many of these sections. Where undolomitized, the rocks are composed of stromatolite mounds, bioherm-like structures generally less than 15 feet across. The mounds are surrounded by crudely bedded calcirudite, in which most of the limestone fragments were derived from the

stromatolite mounds. Oolitic limestone, so common on the north limb of the synclinorium, is rare in these rocks, and the 50-foot thick branching columnar stromatolite bed is not recognizable. This association is best exposed about 1 mile northeast of Compton Lake (P34) and sections transitional between the two associations, which contain stromatolite mounds and oolitic beds, occur near the northeast end of Blanchet Island (P12), on the small island north of Keith Island (P14), and on the south side of Tochatwi Bay near the east end (P32).

The Wildbread Formation overlies the Utsingi Formation conformably, the contact being placed at the top of the prominent low ridge formed by the upper massively bedded white limestone member of the Utsingi Formation. In most sections, a thin but distinctive, well-laminated stromatolite bed marks the base of the Wildbread Formation.

The formation is conformably overlain by the Hearne Formation, the contact being placed at the top of the prominent, ridge-forming, 50-foot thick branching columnar stromatolite bed. As in the case of the Utsingi Formation which it closely resembles, a few thin stromatolite beds occur near the base of the Hearne Formation in some sections, but its predominantly non-stromatolitic, thick-bedded character make it easily distinguishable from the Wildbread Formation. The upper part of the Wildbread Formation in the more southerly exposures is laterally correlative with the Hearne Formation. In this area the Wildbread Formation is thicker, the Hearne Formation thinner or absent, and typical Wildbread and Hearne lithologies are in part inter-tongued.

Farther south, the Wildbread Formation passes abruptly into the Pekanatui Point Formation. This lateral facies change is usually obscured by dolomitization, but minor intertonguing of lithologies occurs in the Compton Lake section (P34). The contact is easily mapped because the Pekanatui Point Formation is very thinly bedded, fine-grained (except for a few coarse debris-flow beds), and entirely non-stromatolitic.

As in the case of the Talthalei Formation, the varied and well-preserved primary sedimentary facies in the Wildbread Formation facilitate detailed interpretation. The first facies association is a typical back-reef lagoonal succession. The oolitic limestone beds were deposited under shallow marine, subtidal conditions, the stromatolite beds on intertidal flats, and the thick-bedded limestones are perhaps supratidal. Poorly developed stromatolites in some of the oolitic beds may have formed in the subtidal environment.

The stromatolitic mounds of the second facies association are analogous to the reefs of younger carbonate complexes. The coarse clastic carbonate sediments which surround the mounds were deposited in the high energy inter-reef environment.

The depositional strike, parallel to the contemporary coastline, is approximately parallel to the outcrop belt on the northern limb of the synclinorium. Many beds can be traced for over 100 miles along this belt, whereas very rapid facies changes take place perpendicular to the belt. The sedimentary structures record tidal currents and wave surge perpendicular to the belt.

Hearne Formation

The name of the formation is derived from Hearne Channel which separates Blanchet Island from the north shore of Great Slave Lake. The type section is on the south side of the peninsula which protrudes from the northeast side of Blanchet Island south of Hearne Channel at latitude 62°05'N, longitude 112°14'W (see Appendix 11).

The Hearne Formation is exposed along the north limb of the East Arm synclinorium from longitude 112°17'W near the northeast end of Blanchet Island to the east end of Tochatwi Bay. Only at the ends of this belt is the formation completely exposed. On Pethei Peninsula and Douglas Peninsula a thick diabase sill intrudes the formation and only the lower part, beneath the sill, is exposed.

The type section (P10) of the formation is 300 feet thick, and there is little apparent change in thickness along the outcrop belt. The formation thins to the south.

The predominant lithology is thick bedded, white to light grey limestone with laminations and mottling of reddish limestone or dolomite similar, but less distinct, than in the Utsingi Formation. Elliptical domal bedding configurations similar to the Utsingi Formation also occurs, as do a few thin stromatolite beds near the base of the formation. A single, thin, well-laminated stromatolitic limestone and dolomite bed occurs at the top of the formation and is well exposed in the type section. The stromatolites in this bed have a distinctive triangular outline in plan view. 'Cone-in-cone' structure is well developed in the limestone beneath this stromatolite bed.

The Hearne Formation conformably overlies the Wildbread Formation, the contact being placed at the top of the 50-foot thick branching columnar stromatolite bed of the Wildbread Formation. The thick-bedded, and predominantly non-stromatolitic Hearne Formation is easily distinguished from the thin-bedded, stromatolitic Wildbread Formation.

The formation is overlain by the Stark Formation of the Christie Bay Group without structural discordance. At several locations on the east side of Blanchet Island, red, brecciated mudstones of the Stark Formation are conformable with the uppermost laminations in the thin stromatolitic bed at the top of the Wildbread Formation.

Toward the south limb of the East Arm synclinorium, the Hearne Formation passes laterally into the thickened, 'reefal' facies of the Wildbread Formation. There is considerable intertonguing of typical Wildbread and Hearne lithologies, but the contact between the two may be arbitrarily placed where stromatolitic beds make up more than one-quarter of the total thickness.

The same interpretive problems arise in the Hearne Formation as were outlined in the discussion of the Utsingi Formation which it closely resembles. The stratigraphic position of the formation sheds some light on its origin. The Hearne overlies the back-reef lagoonal facies of the Wildbread Formation, and passes laterally into the reefal facies of that formation. A back-reef lagoonal origin for the Hearne Formation is therefore probable, with the original sediment perhaps being lime mud rather than oolitic lime

sand as in the Wildbread Formation. The lack of stromatolites suggests a permanently submerged rather than intertidal site of deposition.

Terrigenous Basinal Sequence

The strata on the south limb of the East Arm synclinorium which are stratigraphically correlative to the rocks in the type section of Stockwell's (1932, 1936) Pethei Formation are markedly different in lithology and origin. Most of these beds contain terrigenous sediment, argillite or greywacke, in contrast to the pure carbonate rocks of the north limb. None of the formations of the southerly sequence contain stromatolites, although some have structures which may be organic in origin. These formations are interpreted as being of deeper water origin than the rocks of the north limb. Because they are more terrigenous, and were deposited in a bathymetric basin, they are here referred to informally as constituting the 'terrigenous basinal sequence' of the Pethei Group, in contrast to the 'carbonate platform sequence' to the north.

McLean Formation

The name of the formation is derived from McLean Bay in Stark Lake, south of Tochatwi Bay in the East Arm of Great Slave Lake. The type section is exposed near the west end of the long island west of Krys Point in Stark Lake at latitude 62°25'N, longitude 110°31'W (see Appendix 12), but a better exposed section which was not measured occurs on the north side of McLean Bay on a cliff 4 miles southeast of the type section.

The McLean Formation is found in scattered exposures along the entire length of the southern limb of the East Arm synclinorium from Fairchild Point (P38) on the east, to the Caribou Islands (P1) on the west, a distance of more than 150 miles. The type section of the formation is 395 feet thick, and other measured sections are of comparable thickness.

The lower part of the formation consists of medium to thin bedded, grey limestone with closely spaced, 1 centimetre thick, ragged and crenulated, discontinuous laminations of red-brown mudstone. The mudstone imparts an irregular fissility to the rock. The upper part of the formation consists of brown to green mudstone with flat-bottomed, convex-upward nodules of argillaceous limestone 3 to 5 centimetres across. In many of the beds the nodules have been rotated and dislocated from their original positions.

The McLean Formation overlies the Douglas Peninsula Formation conformably. This contact is not always easy to select in the field because the dominant lithology of both formations is laminated, red-brown, argillaceous limestone. The McLean Formation is more calcareous, and the lamination is less well developed than in the Douglas Peninsula Formation.

The formation is overlain by the Blanchet Formation, or the Pekanatui Point Formation where the Blanchet Formation is absent. The lower contact of the Blanchet Formation is placed at the base of the lowest greywacke sandstone bed, and is conformable. The contact with the Pekanatui Point Formation, also conformable, is marked by an abrupt change from

nodular bedded calcareous mudstone to thin, evenly bedded limestone with partings of argillite or argillaceous dolomite. The Pekatanui Point Formation is grey or white whereas the McLean Formation is red-brown.

Laterally, the McLean Formation passes through a broad transition zone into the Utsingi Formation of the Carbonate Platform Sequence. The transition zone is dolomitized in many sections, but where undolomitized, the contact is arbitrarily placed according to both the argillite content and the disappearance of the concave-upward disc-shaped laminations characteristic of the Utsingi Formation.

The McLean Formation is considered to be largely of marine origin, and its upper part is thought to have been deposited in deeper water than the correlative Utsingi Formation of the Carbonate Platform Sequence. Deeper water origin cannot be proved directly from sedimentary structures in the McLean Formation, but rather by the fact that identical lithologies are interbedded with turbidite greywacke beds in the lower part of the Blanchet Formation, inasmuch as turbidite sequences are believed to be deep water deposits. Nodular-bedded calcareous argillites typical of the McLean Formation are characteristic of the 'open marine off-reef' environment in the Lower, Middle and Upper Devonian sections in Western Canada (Dooce, 1966) but the genetic significance of the nodular structure is not well established.

Blanchet Formation

The name is derived from Blanchet Island in the East Arm of Great Slave Lake and the type section is near the southwest end of the island at latitude 61°56'N, longitude 112°40'W (see Appendix 13). Other impressive exposures of this formation occur on the south side of Blanchet Island and on the small islands between that island and the Caribou Islands.

The formation occurs only in the southwestern part of the East Arm. It is exposed on the south side of the Caribou Islands (P1) and Blanchet Island (P2, P4, P5, P7, P8, P9), around Pekatanui Point (P15, P17, P19), on the south shore of Christie Bay south of Redcliff Island (P22), and north of Murky Lake (P24) (Barnes, 1953). It is absent east of Snowdrift.

The type section is 995 feet thick, but thicknesses diminish to the northeast.

The most conspicuous lithology of the Blanchet Formation is greywacke sandstone in closely spaced, parallel-sided, graded beds less than 1.5 feet thick. The greywacke beds are separated by thin beds of argillite or interlaminated argillite-limestone. At some horizons, several greywacke beds are superimposed with no intervening argillite and form single greywacke units up to 8 feet thick. Aside from grain size gradation, the greywackes have little visible internal structure. Ripple-drift-laminations are seen at the top of some beds, but the bottoms of the beds, although very sharply defined, rarely have sole markings or cut-and-fill structures.

The greywackes consist of 35 per cent very angular quartz grains, 15 per cent rock fragments, 20 per cent feldspar and 30 per cent fine-grained chloritic matrix. The rock fragments are mainly sedimentary, volcanic and low grade metamorphic types.

Interbedded with the greywacke are units of argillite up to 75 feet thick with nodules of argillaceous limestone and very thin, evenly bedded limestone with argillite partings. The former are lithologically similar to rocks of the underlying McLean Formation and occur in the lower part of the Blanchet Formation. The latter occur in the upper part and are lithologically like beds in the overlying Pekanatui Point Formation.

The Blanchet Formation overlies the McLean Formation and underlies the Pekanatui Point Formation both conformably. The formation wedges out to the northeast and in the area of Stark Lake the Pekanatui Formation directly overlies the McLean Formation. Several of the upper units of the McLean Formation and lower units of the Pekanatui Point Formation can be traced from northeast to southwest between the greywacke beds within the Blanchet Formation. The lower contact of the Blanchet Formation is placed at the base of the lowest greywacke bed, and the upper at the top of the uppermost greywacke bed below the major, thin-bedded limestone member of the Pekanatui Point Formation. A thin greywacke and shale unit occurs near the top of the Pekanatui Point Formation in some sections, but this unit is not included in the Blanchet Formation.

The rhythmic alternation of parallel-sided greywacke and argillite, the graded bedding, and the lack of crossbedding, cut-and-fill, or mud-cracks indicate deposition from turbidity currents. Geologically instantaneous deposition of the greywacke beds is corroborated by the manner in which they wedge in between units of the McLean and Pekanatui Point Formation but do not replace them. It is generally agreed that turbidites are deposits of deep water, and the Blanchet Formation therefore provides the best evidence for bathymetric basinal conditions to the south and southwest of the carbonate platform sequence in the Pethei Group.

Pekanatui Point Formation

The type section of this formation is on the south shore of Christie Bay 2 miles east of Pekanatui Point (where the formational name is derived) at latitude 62°08'N, longitude 111°35'W (see Appendix 14). Here the lower members of the formation are well exposed on the west side of a small bay and the upper members on the east side of the same bay.

The Pekanatui Point Formation occurs along the entire length of the south limb of the East Arm synclinerium from Caribou Islands (P1) to Charlton Bay (P39), a distance of 160 miles and is well exposed on the south side of Blanchet Island (P7), Pekanatui Point (P19), Pointe-à-Tuer on Keith Island (P15), near Kryss Point in Stark Lake (P28), and on the south side of Belle Ile (P39) in Charlton Bay.

The type section of the formation is 340 feet thick but sections to the northeast decrease in thickness to less than 250 feet.

The Pekanatui Formation is composed of three major lithologies of which the most abundant and striking is very thin, evenly bedded, light grey aphanitic limestone. The limestone beds are mostly 1 to 5 centimetres thick and are separated by paper-thin siliceous seams or by argillite laminations less than 1 centimetre thick. Two outstanding features of these beds

are convolute bedding and breccia beds. The angular fragments in the breccia beds range in size from 2 centimetres to blocks up to 15 feet or more across. The size of fragments in any one bed is remarkably uniform and the smaller fragments are composed of lithologies similar to the surrounding beds. A spectacular exposure of this type of breccia occurs on the north side of Fairchild Point (P38). Breccias containing large blocks are rare but on the long island southeast of Blanchet Island, randomly oriented blocks of stromatolitic limestone and dolomite occur in beds associated with the normal thin-bedded aphanitic limestone typical of the formation. In most sections, however, the breccia beds are obscured by dolomitization which is a common feature of the formation near the contact with the Wildbread Formation. Where undolomitized, the thin-bedded limestones form prominent outcrops.

The two other common lithologies of the formation are dark grey argillites or argillaceous dolomite with nodules of limestone, and greywacke beds similar to those in the Blanchet Formation.

The Pekatui Point Formation conformably overlies the Blanchet Formation, or, where the latter is absent, the McLean Formation. The contact is at the transition from nodular calcareous mudstone of the McLean Formation, or greywacke and argillite of the Blanchet Formation to dominantly thin-bedded limestone.

The formation is overlain by the Stark Formation of the Christie Bay Group. The uppermost beds of the Pekatui Point Formation are commonly fractured and silicified beneath the Stark Formation, and in the area around Stark Lake comparison of different sections reveals that in some up to 50 feet of strata are missing from the top of the formation. This contact is therefore tentatively described as a disconformity.

The aphanitic limestones, their very thin and even bedding, and the lack of desiccation and stromatolitic structures suggest relatively deep water deposition. The presence of turbidite greywackes supports this interpretation. The breccia beds are therefore interpreted as submarine 'debris-flows' (Pray et al., 1967) generated on the sloping flanks of the carbonate platform to the north. Convolute bedding is interpreted to be the result of slumping of the limestone beds down the slope of the sea floor near the margin of the carbonate platform.

CHRISTIE BAY GROUP

Stockwell (1932) informally divided the 'Great Slave Group' into a 'Lower Part' and an 'Upper Part'. In the 'Upper Part' he named (Stockwell, 1936) and described three formations as follows:

3. Pearson Formation
"columnar-jointed lava flows with interbeds of argillite"
2. Tochatwi Formation
"a thick assemblage of shaly sediments and sandstone"

1. Stark Formation

"possibly 1,000 feet chiefly of interbedded vari-coloured dolomite, red shale and limestone, some layers being much brecciated".

He did not designate specific type sections for these formations other than the locations implicit in their names.

The name Christie Bay Group is proposed for the strata referred to informally by Stockwell as the Upper Part of the Great Slave Group. The name is derived from Christie Bay in the East Arm of Great Slave Lake. Excellent exposures of each of the formations in the group occur on the south shore of the bay, and on the islands within it. The vast majority of beds are composed of red terrigenous sediments and are therefore in accordance with the recommendation that a group be an assemblage of "associated formations having significant lithologic features in common" (Article 9a of the "Code of Stratigraphic Nomenclature").

A location map of measured sections is shown in Figure 9.

Stark Formation

The Stark Formation was named by Stockwell (1936) after Stark Lake, south of Tochatwi Bay in the East Arm of Great Slave Lake.

A complete section could not be found by the writer. The mudstones which make up the bulk of the formation are highly recessive, and the abundant disharmonic folds and faults make extrapolation of thickness from scattered outcrops unreliable. Well-exposed, but incomplete sections are found at the narrows in Stark Lake (C19) at latitude 62°27'N, longitude 110°13'W, and this area is therefore chosen as the type location.

The Stark Formation is found throughout the entire area, from Caribou Islands (C1) on the west to Charlton Bay (C28) in the east, a distance of 160 miles. It is most extensively exposed on the south limb of the East Arm synclinerium around Stark Lake, but it also occurs on the north limb near the northwest corner of Et-then Island (C6) and on the north shore of Christie Bay southeast of Taltheilei Narrows (C8).

The thickness of the formation is extremely difficult to determine because of the recessive nature of the mudstones, and because of widespread faults, breccias, and disharmonic folds. In most areas, two distinctive stromatolitic carbonate beds can be recognized. The older of the two is about 85 feet thick, the younger about 125 feet thick. On the south side of Belle Ile in Charlton Bay (C28) (see Appendix 15), the two units are separated by about 150 feet of red mudstone. On the northeast side of Stark Lake (C23) the interval between the top of the upper carbonate unit and the base of the Tochatwi Formation is 135 feet (see Appendix 16). On the south side of Tochatwi Bay (C22) this interval is 220 feet. The interval between the base of the Stark Formation and the lower carbonate unit is commonly brecciated and varies from one area to another. On the east side of Christie Bay, 2 miles northeast of Snowdrift (C13), a minimum of 1,500 feet of unbrecciated red mudstone of the Stark Formation is exposed. The base of this section is

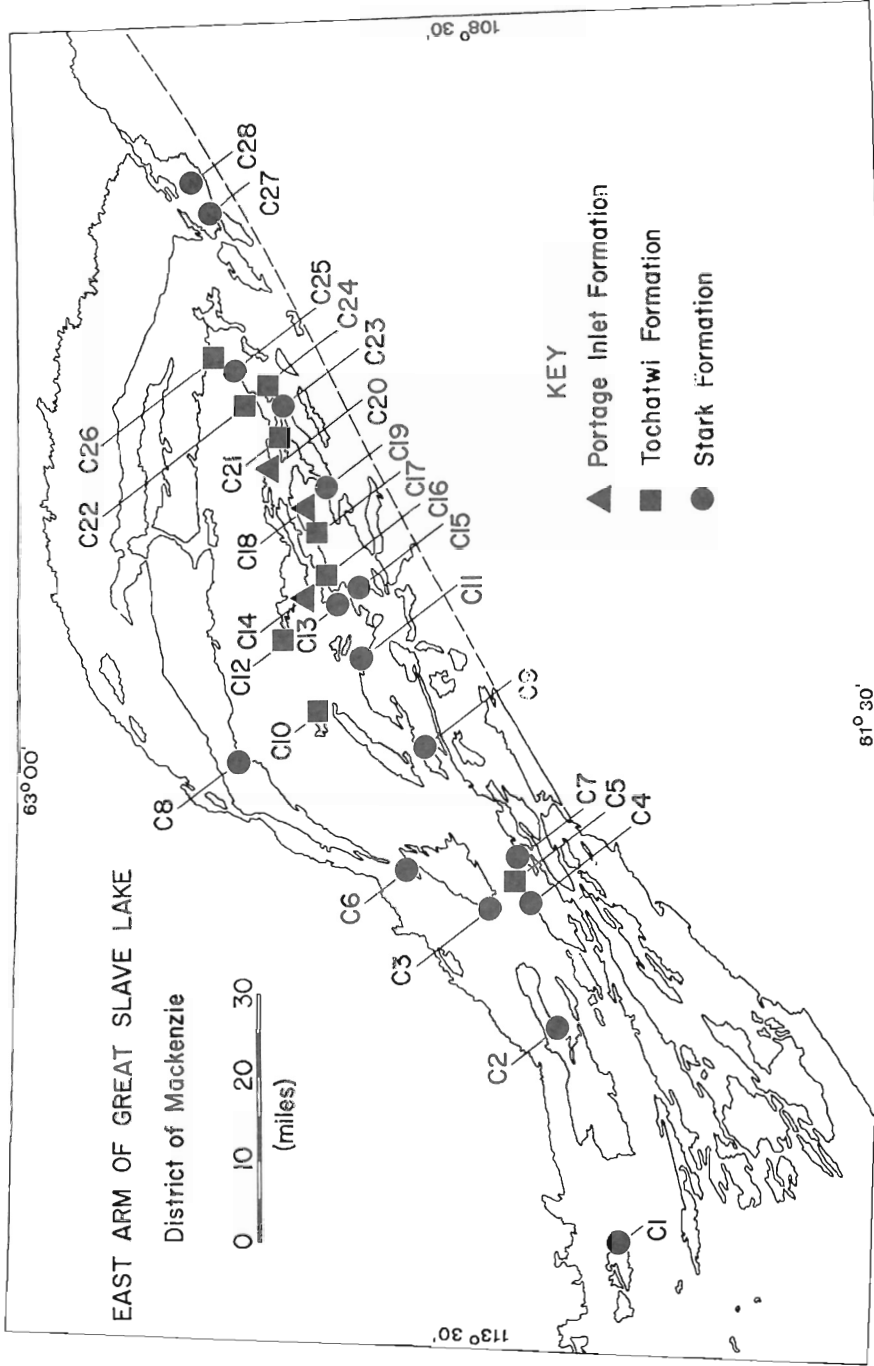


Figure 9. Location map showing measured sections in the Christie Bay Group.

not exposed, but because it is so much thicker than the mudstone intervals between and above the carbonate units, it is probable that these beds belong to the interval below them. If this is correct, a minimum thickness for the formation as a whole is about 2,000 feet.

The Stark Formation consists predominantly of red, silty, terrigenous mudstone. The mudstone is commonly fractured and the fracture planes are coated with specularite. Lenticular patches parallel to bedding are pale yellowish green. The more silty beds commonly contain calcite or hematite-filled hopper-shaped crystal casts after halite. Most of the mudstones are devoid of sedimentary structures but ripple-marked bedding planes may be found in most sections. Thin beds of lithic-carbonate-pebble conglomerate occur in the mudstone interval beneath the Tochatwi Formation.

Beds of yellow-brown weathering dolomite, mostly massive and less than 10 feet thick, commonly occur in the mudstone intervals. Two thicker carbonate units are prominently exposed throughout the East Arm area. These carbonate units consist of interlaminated yellow-brown-weathering dolomite and blue-weathering limestone, and unlike the terrigenous mudstones, commonly have exquisitely preserved sedimentary structures. Ripple-laminations, low angle crossbedding, edgewise conglomerate, convolute laminations, 'ball-and-pillow' structure, channels, and biohermal stromatolite mounds are all abundant features of these beds. In some outcrops, the carbonate beds are coloured green, mauve, purple, or pink as a result of small amounts of impurities. These bright colours are in striking contrast to the drab browns and greys of the underlying Pethei Group.

Three main types of breccias form an important component of the Stark Formation. The first type consists of scattered angular to subrounded fragments, mostly less than 3 centimetres across, of various dolomite and limestone lithologies widely scattered in a matrix of red mudstone. These breccias are thick and show little stratification. A second type consists of angular blocks of carbonate of uniform lithology in a matrix of mudstone and sparry white calcite. In some instances these breccias can be traced laterally into unbrecciated carbonate beds. In other instances they fill 'pipes' which stand perpendicular to bedding. The third, and most spectacular type of breccia consists of large and small angular blocks of a wide variety of Stark Formation lithologies closely packed in a matrix of red mudstone and finely comminuted carbonate detritus. Most of the blocks are carbonate or mudstone, but sandstone blocks occur in breccias near the top of the formation and Stockwell (1932) reports blocks of syenite. The breccias in many sections are hundreds of feet thick, but also occur as beds less than 1-foot thick in unbrecciated red mudstone. Most of the breccias are overlain by unbrecciated beds similar in lithology to the brecciated material.

The Stark Formation overlies the Hearne Formation and the Pekatui Point Formation of the Pethei Group. The contact with the Hearne Formation is structurally conformable. On Blanchet Island (C2) a thin bed of conglomerate containing Pethei Group lithologies occurs at the base of the Stark Formation where it overlies the Pekatui Point Formation, and on the island west of Kry's Point in Stark Lake (P27), the top of the Pekatui Point Formation is highly fractured, and contains chert nodules and ochrous fracture fillings. As much as 30 feet of strata, normally present at the top of the formation, are missing in some sections at this location. The base of the Stark Formation is tentatively interpreted as a disconformity.

The upper contact of the Stark Formation is gradational with the Tochatwi Formation. Red mudstones near the top of the formation contain thin beds of lithic-carbonate conglomerate. These beds are overlain by interbedded sandstone and mudstone. The sandstones include both lithic carbonate and arkosic types, and mixtures of the two. The base of the Tochatwi Formation is placed at the base of the lowest arkosic sandstone bed. In most sections, this horizon corresponds closely with the transition from predominant mudstone to predominant sandstone. The fine-grained, red arkosic sandstones are easily distinguished in the field from the coarse-grained, buff, lithic carbonate sandstones.

Sedimentary structures in the thicker carbonate units and the widespread occurrence of stromatolites strongly suggest a littoral marine environment. The mudstones, lacking sedimentary structures, are more difficult to interpret, but the presence of hopper-shaped halite casts indicates very shallow, saline water and an arid climate.

Thorough discussion of the origin of the breccias is beyond the scope of this paper. The occurrence of breccias overlain by unbrecciated beds of similar lithology proves that most of the brecciation occurred contemporaneously with deposition. The most extensive breccias are associated with disharmonic, almost 'chaotic', folds and are thought to be the result of mass gravity slides. The abundance of halite casts in the mudstone matrix of the breccias shows that the slides were subaerial, or came to rest in not more than a few feet of water. Many of the breccias resemble talus derived from the erosion of carbonate formations in desert regions, but the breccia 'pipes' and breccias with blocks of uniform lithology may be related to the formation of karst topography and/or solution collapse mechanism. It is speculated that the localized, syndepositional uplift ultimately responsible for the breccias was the emplacement of the quartz diorite laccoliths contemporaneous with Stark sedimentation.

Tochatwi Formation

Stockwell (1936) named the Tochatwi Formation after Tochatwi Bay, the eastern extension of McLeod Bay, in the East Arm of Great Slave Lake. He did not designate a specific type section but he presumably considered the south shore of Tochatwi Bay to be the type area. He described (Stockwell, 1932) the formation in this area as consisting of "sandstone . . . red, fine-grained, some layers crossbedded and others ripple marked . . . overlain by about 300 feet of chocolate-coloured argillite, sandy shale, and fine-grained red sandstone". Because the sandstone and the argillite are lithologically distinct mappable units, it is proposed to elevate them both to the rank of formation. It is proposed that the name Tochatwi Formation be retained for the older sandstone unit because it includes most of the strata of the original 'Tochatwi Formation' (see Fig. 2), being much thicker than the overlying shales. Furthermore, the paucity of geographic names makes it difficult to propose two new names derived from locations near the type sections.

The Tochatwi Formation, as here defined, is well-exposed on the north shore of Stark Lake (C17, C21, C24), the south shore of Tochatwi Bay (C12, C22), on the islands in Christie Bay west of Pearson Point (C10, C12),

and on Pointe-à-Tuer (C5) on the north side of Keith Island. On the north limb of the synclinorium the formation is exposed only near the northwest corner of Et-then Island (C6).

The thickness of the formation can only be estimated as the entire formation is nowhere well exposed in an unbroken section. Estimated thickness of the formation at the east end of Stark Lake (C21) is 2,600 feet, 1,870 feet on the island north of Krys Point near the west end of Stark Lake (C17) (see Appendix 17), and a minimum of 1,400 feet on Pointe-à-Tuer (C5) where the top of the formation is not exposed.

The formation consists dominantly of fine-grained, red, lithic and feldspathic sandstone with thin beds of red shale. Near the base beds of coarse-grained lithic carbonate sandstone and conglomerate occur. The sandstone beds are commonly crossbedded, and the tops of the beds are ripple-marked, mudcracked, or have current lincation. Convolute bedding is less abundant. The crossbedding is mostly of the planar type and is of unusually large scale. Single crossbed units 6 feet thick are common, and some as much as 17 feet thick occur 1,000 to 1,500 feet from the base. Shale is most abundant near the base and near the top of the formation.

The feldspathic sandstones consist of about 30 per cent quartz clasts, 30 per cent feldspar, 15 per cent rock fragments and 30 per cent quartz cement. The lithic sandstones are more variable in composition, consisting of 5 to 30 per cent quartz clasts, 40 to 65 per cent rock fragments, less than 5 per cent feldspar, and 30 per cent quartz and carbonate cement. The rock fragments are mostly derived from limestone, dolomite, acidic volcanic rocks and siltstones.

The Tochatwi Formation overlies the Stark Formation conformably. The base of the formation is placed below the lowest feldspathic sandstone bed, an horizon which commonly marks the transition from predominant mudstone to predominant sandstone. The formation underlies the Portage Inlet Formation conformably. This contact is marked by a transition from sandstone to red shale with only minor thin beds of sandstone and siltstone. The transition is abrupt, and is also marked by the appearance of halite crystal casts.

The great thickness of the formation, its textural and compositional immaturity, the ubiquity of unidirectional crossbedding and mudcracks, and the presence of fining-upward sedimentary cycles, make a fluvial origin most plausible. Beds with bimodal paleocurrents near the base of the formation may have been deposited partly in marine tidal channels.

Portage Inlet Formation

The name of the formation is derived from Portage Inlet on the east side of Christie Bay between Snowdrift and Pearson Point. The type section is on the north shore of Portage Inlet near its mouth (latitude 62°29'N, longitude 110°45'W (see Appendix 18). The base of the formation is not well exposed in this section, but may be seen on the northeast end of the island in Stark Lake north of Krys Point (C18).

The formation is exposed only in the area around Stark Lake. In other parts of the East Arm area it has been removed by erosion.

The formation consists of two members. In the type section, the lower member is not completely exposed, but the upper member is 355 feet thick. Elsewhere, the lower member is about 350 feet thick. The formation is therefore about 705 feet thick.

The lower member consists of extensively mudcracked red and brown shale with many ripple-marked and crossbedded, buff, fine-grained sandstone beds mostly less than 1 foot thick. Halite crystal casts are abundant in many of the sandstone beds. The upper member also consists of extensively mudcracked red shale with ripple-marked, brown siltstone beds seldom more than 3 centimetres thick. The shales contain abundant rosette-shaped or single-crystal gypsum casts in the upper part of this member.

The formation conformably overlies the Tochatwi Formation and underlies the Pearson Formation. The lower contact is transitional and is placed where shale replaces sandstone as the predominant lithology. The upper contact is placed at the base of the lowest basalt flow.

The presence of mudcracks and crystal casts after halite and gypsum is indicative of very shallow, highly saline water, and frequent desiccation. The presence of thin beds of coarse-grained, texturally and compositionally immature sandstone indicates proximity to a source area undergoing rapid erosion. There is no evidence of marine beds in the middle and upper parts of the underlying Tochatwi Formation, nor in the overlying Pearson Formation. The Portage Inlet Formation is therefore interpreted as a non-marine playa deposit.

Pearson Formation

The name of the formation is derived from Pearson Point on the southeast side of Christie Bay in the East Arm of Great Slave Lake. It was named and defined by Stockwell (1936) but no specific type section was designated. Pearson Point (C12) is presumably the type area of the formation. The formation is found only in the area around Stark Lake. It has been removed by erosion in other parts of the East Arm area.

Stockwell (1932) measured the formation at two locations, the thicker being 150 feet. Barnes (1953) states that the formation is 550 feet thick but does not specify where this section was measured.

The formation consists of dark brown to black basalt flows with thin interbeds of dark grey argillite and argillite-pebble conglomerate. Most of the flows are massive or have columnar jointing, and many have fine-grained, vesicular contacts. Pillowed flows are reported to be rare by both Stockwell (1932) and Barnes (1953) and were not seen by the writer.

The Pearson Formation conformably overlies the Portage Inlet Formation. This contact is placed at the base of the lowest flow. The formation is unconformably overlain by the Et-thén Group or by unconsolidated Pleistocene or Recent deposits.

The predominance of columnar jointing in the lava flows suggests subaerial rather than submarine extrusion. Their stratigraphic position at the top of a largely non-marine red bed sequence supports this conclusion.

AGE RELATIONS OF THE GREAT SLAVE SUPERGROUP

RELATIONS TO ARCHEAN ROCKS

The Great Slave Supergroup overlies the Archean Wilson Island Group and the granitic rocks formed during the Kenoran Orogeny unconformably. The contact between the Wilson Island Group and the basal Great Slave beds is exposed only on the south side of Wilson Island at the west end of the Inconnu Channel (Stockwell, 1936). Stockwell mapped a similar contact on the island southeast of Union Island, but here the writer found that all the strata belong to the Wilson Island Group. The contact with Archean granitic rocks is exposed at many locations on Simpson Island and on a small island south of Wilson Island at latitude $61^{\circ}45'N$, longitude $113^{\circ}04'W$ (S1).

One mile north of Lac Duhamel (S7), at latitude $62^{\circ}20'N$, longitude $110^{\circ}43'W$, conglomerate beds of the Hornby Channel Formation of the Sosan Group are in contact with granite pegmatite which intrudes amphibolitic migmatite. Stockwell (1936) mapped the plutonic rocks as 'Archean(?)' and considered them to underlie the sedimentary beds unconformably. Barnes (1955), however, stated that the pegmatite intruded and 'granitized' the sedimentary rocks. The writer found that although the conglomerate and overlying sandstones are cut by small quartz stringers and a few thin quartzofeldspathic veinlets, the grade of metamorphism in pelitic beds a few feet from the contact is negligible. The conglomerate contains pegmatite pebbles and detrital muscovite flakes similar to those in the pegmatite, and the bedding of the conglomerate conforms with the contact. There is little doubt that Stockwell's interpretation of the contact as a major unconformity is correct.

RELATIONS TO THE UNION ISLAND GROUP

Stockwell (1932, 1936) described strata around Union Island which overlie Archean granitic rocks and underlie the Et-then Group unconformably but which differ lithologically from the Great Slave Supergroup rocks. Re-examination of these beds confirms his conclusions and a tentative informal stratigraphic sequence was established (see Table of Formations). Field evidence indicates that the Union Island Group underlies the Great Slave Supergroup unconformably.

The most complete section of the Union Island Group is on the south shore of Great Slave Lake about 4 miles southwest of McDonald Lake (U4) at latitude $62^{\circ}32'N$, longitude $111^{\circ}32'W$. This section, which was erroneously mapped as 'Kahochella Formation' by Stockwell (1936) consists in ascending order of a basal breccia resting unconformably on granite, granite-pebble conglomerate and arkose with dolomite matrix, dolomite with thin beds of red argillite, black carbonaceous slate with pyritic nodules and parallel-sided beds of massive, dark grey dolomite, dark grey slate with thin greywacke beds, diabase sills with thin interbeds of slate, basic pillow lava and volcanic breccia, and massive dolomite with quartz stringers. This sequence is overlain paraconformably by about 100 feet of quartz-pebble conglomerate that probably belongs to the basal Sosan Group.

The pillow lavas are particularly well exposed on the island southeast of Union Island (U3), where they conformably overlie slate mapped as Union Island Group by Stockwell (1936). Stockwell mapped the pillow lavas as 'Kahochella Formation' and later workers (Henderson, 1939) continued to map all volcanic rocks in this area as 'Kahochella Formation'. Most of the pillow lavas are now known to belong to the Union Island Group, which is more extensively exposed on the islands south of Union Island than shown on most published maps.

On the north side of Union Island (U1), the lower dolomite of the Union Island Group is overlain by the Hornby Channel Formation of the Sosan Group. The contact is not exposed, but there is no shearing normally associated with faults in this area. If this contact is unfaulted, the black slate, grey slate and greywacke, volcanic, and upper dolomite members of the Union Island Group have been removed beneath the sub-Sosan Group unconformity. The Union Island is therefore tentatively considered to underlie the Great Slave Supergroup unconformably.

RELATIONS TO THE QUARTZ DIORITE BODIES

Bodies of massive quartz diorite as much as 15 miles across occur in contact with rocks of the Great Slave Supergroup along a nearly linear belt from Meridian Lake to the Caribou Islands - nearly the entire length of the East Arm. Stockwell (1936) concluded that the bodies intrude the Great Slave Supergroup and are unconformably overlain by the Et-then Group. Barnes (1953), however, claimed that the bodies do not intrude the 'Pethei Formation' or the 'Stark Formation' with which they are usually in contact. He hypothesized that the bodies are basement horsts, emplaced during the deposition of the 'Pethei Formation' which he interpreted to overlie the bodies unconformably and to contain detritus eroded from them.

Careful examination of the contact relations along the south shore of Christie Bay and on Blanchet Island proves that the bodies are sills or laccoliths which intrude the Pethei Group and the Stark Formation of the Christie Bay Group. The critical evidence is as follows:

1. Contact metamorphism is not extensive, but contrary to Barnes (1953), the sedimentary rocks are commonly 'baked' and locally the limestone beds contain calc-silicate minerals of metamorphic origin near the contact.

2. In most outcrops on Blanchet Island, the contact conforms with the bedding in the Pethei Group, but top determinations and the well-established stratigraphic sequence of formations in the Pethei Group prove that the quartz diorite overlies the sedimentary strata. The contact is thus the bottom surface of a sill or laccolith.

3. Where the contact was carefully mapped on the southeast side of Blanchet Island, the quartz diorite was found to be discordant with the sedimentary strata. At the east end of the body about 50 feet of Stark Formation is present beneath the contact, whereas to the north and south, away from the synclinal axis in the sedimentary beds, the quartz diorite is in direct contact with the Pekatui Point Formation of the Pethei Group.

4. The quartz diorite is dissimilar compositionally and texturally from the Archean rocks along the north shore of the East Arm and on Simpson Island.

5. The Blanchet Formation, which contains greywacke sandstones that Barnes (1953) thought to be derived from the unroofing and erosion of the quartz diorite bodies, are now known to be deep water turbidites derived from the west, and their distribution within the East Arm is related to the margin of the carbonate platform sequence of the Pethei Group and not to the distribution of quartz diorite bodies.

On the south shore of Blanchet Island, a 1- to 5-foot thick border phase of the quartz diorite contains angular, coarse-grained blocks set in a matrix of fine-grained igneous rock. This border phase passes into massive quartz diorite and is apparently the 'basal conglomerate' mentioned by Barnes (1953). The blocks are probably pieces of vent material injected and emplaced into the fine-grained border phase of the intrusion.

Stockwell (1936) states that the quartz diorite bodies intrude "all members of the Great Slave Group", but they are nowhere in contact with the Tochatwi, Portage Inlet, or Pearson Formations. The bodies commonly intrude horizons near the contact between the Pethei Group and the Stark Formation. The bodies could have been emplaced prior to the deposition of the upper three formations of the Christie Bay Group. Indeed, the emplacement of the bodies may have been responsible for generating the gravity slide breccias of the Stark Formation if it occurred during the deposition of this formation. The observation of Stockwell (1932) that some of the Stark Formation breccias contain blocks of 'syenite' is important in this regard. If the 'syenite' blocks are derived from the same quartz diorite bodies, emplacement and unroofing of the quartz diorite during the deposition of the Stark Formation is an unavoidable conclusion.

RELATIONS TO THE ET-THEN GROUP

As shown by Stockwell (1936), the Et-then Group unconformably overlies the quartz diorite bodies, the Great Slave Supergroup, and all older rocks. The group consists of two formations, named and defined by Stockwell (1936). The older Murky Formation consists of up to 3,000 feet of red to buff, normally poorly consolidated, boulder conglomerate in massive units 20 to 60 feet thick that contain lenses of pebbly lithic sandstone and are separated by thin beds of mudcracked shale, siltstone, and caliche horizons. On the south side of Preble Island, and on the south shore of Great Slave Lake south of Union Island, massive to amygdaloidal basalt flows are intercalated with the conglomerate (the flows were mapped as 'Kahochella Formation' by Henderson (1939)). The formation is interpreted as an alluvial conglomerate.

The younger Preble Formation consists of a minimum of 10,000 feet of pink to buff arkose and pebbly arkose with crossbedding, current lineation, ripple-marks, mudcracks, convolute bedding, shale-pebble conglomerate, shale partings, and fining-upward cycles of facies characteristic of fluvial sandstones.

The Et-then Group is intruded by shallow dipping diabase dykes and sills, which are in turn cut by northwest-trending, vertically dipping diabase dykes of the Mackenzie Swarm. These last are Paleohelikian in age, and the Et-then Group is therefore either Paleohelikian or late Aphebian.

RELATION TO NONACHO GROUP

Wright (1952) correlated the lower part of the Great Slave Supergroup with the Nonacho Group, which is exposed in the Nonacho Lake and Thekulthili Lake areas about 50 miles south of the East Arm. However, the Nonacho Group, which consists of several thousand feet of polymictic conglomerate and pebbly, crossbedded arkose (McGlynn, 1966), bears little resemblance in sedimentology, stratigraphic sequence or paleocurrent pattern to the Great Slave Supergroup. It is most likely correlative with the Et-then Group in the East Arm as both are continental, fault-controlled, clastic sequences of closely similar lithologies.

SUMMARY

Stockwell (1932) established the name 'Great Slave Group' for a thick sequence of unmetamorphosed Aphebian sedimentary and volcanic rocks exposed in the area of the East Arm of Great Slave Lake. In the course of making the first complete geologic map of the area, he divided the group into six formations (Stockwell, 1936). His stratigraphic nomenclature, although adequate for reconnaissance mapping, does not provide sufficient subdivisions for detailed mapping for interpretive sedimentology. Therefore, an expanded nomenclature is proposed which retains Stockwell's basic divisions.

In the proposed nomenclature, the 'Great Slave Group' becomes the Great Slave Supergroup, which is divided into four groups and twenty formations.

The 'Sosan Formation' of Stockwell becomes the Sosan Group, and is divided into four formations - a thick fluvial sandstone (Hornby Channel Formation) followed by a marine, largely littoral, stromatolitic dolomite (Duhamel Formation) overlain unconformably by a second fluvial sandstone (Kluziai Formation) followed in turn by a deltaic complex of sandstone, siltstone and shale (Akaitcho River Formation).

The 'Kahochella Formation' of Stockwell becomes the Kahochella Group, and is divided into four formations - an andesitic, largely pyroclastic, volcanic complex (Seton Formation) overlain by red, shallow water marine shale (Gibraltar Formation), red shale with abundant calcareous concretions (McLeod Bay Formation) and finally by dark green shale with turbidites of deeper water marine origin (Charlton Bay Formation).

The 'Pethei Formation' of Stockwell becomes the Pethei Group, and is divided into eight formations, of which only a thin, basal, laminated, argillaceous limestone (Douglas Peninsula Formation) occurs throughout the area. On the north limb of the East Arm synclinorium, this unit is overlain by four formations of shallow water, largely littoral, marine origin, collectively called the 'carbonate platform sequence' of the Pethei Group - a highly stromatolitic dolomite (Taltheilei Formation) followed by a mottled, thick-bedded limestone (Utsingi Formation) followed in turn by a stromatolitic and oolitic limestone (Wildbread Formation) and a second mottled limestone (Hearne Formation). On the south side of the synclinorium, the three formations which are stratigraphically correlative with the carbonate platform sequence were deposited in deep water, and are collectively called the terrigenous basinal sequence of the Pethei Group - a thin-bedded, calcareous argillite (McLean Formation) followed by rhythmically interbedded greywacke turbidites, argillite and limestone (Blanchet Formation) and very thinly interbedded, dark, aphanitic limestone and argillite (Pekanatui Point Formation).

The Christie Bay Group is erected to include the strata referred to by Stockwell as the 'Upper Part' of his 'Great Slave Group', and is divided into four formations, three of which were originally defined by Stockwell. Red, shallow-water marine shale with carbonate beds (Stark Formation) is overlain by red, non-marine and marine sandstone (Tochatwi Formation) which is in turn followed by red and brown evaporitic shale and siltstone (Portage Inlet Formation) and columnar basalt (Pearson Formation).

Stockwell's Union Island Group probably underlies the Great Slave Supergroup unconformably, but is also of Apebian age. This group was not formally subdivided into formations and is of very restricted geographic distribution.

Stockwell's conclusions regarding the age relations of the Great Slave Supergroup to various igneous rocks in the area are confirmed. In particular, the widespread quartz diorite bodies are laccoliths which intrude at least all but the three uppermost formations of the Great Slave Supergroup, and are not basement horsts as suggested by Barnes (1953).

The Great Slave rocks are not correlative with the Nonacho Group which is exposed to the south of the East Arm, as had been suggested by Wright (1952). The latter is correlative with the Etthen Group.

REFERENCES

- Aitken, J. D.
1967: Classification and environmental significance of cryptalgal limestones and dolomites, with illustrations from the Cambrian and Ordovician of southwestern Alberta; J. Sed. Petrol., vol. 37, pp. 1163-1178.
- Barnes, F. Q.
1951: Snowdrift map-area, Northwest Territories; Geol. Surv. Can., Paper 51-6 (report and map).
1952: McLean Bay map-area, Northwest Territories; Geol. Surv. Can., Paper 52-5 (report and map).
1953: The Snowdrift and McLean Bay map-areas, Great Slave Lake, Northwest Territories; unpubl. Ph.D. thesis, Univ. Toronto.
- Beales, F. W.
1956: Conditions of deposition of Palliser (Devonian) limestones of southwestern Alberta; Bull. Am. Assoc. Petrol. Geol., vol. 40, pp. 848-870.
- Bell, R.
1902: Report on exploration in the Great Slave Lake region, Mackenzie District; Geol. Surv. Can., Ann. Rept. (New Series), vol. 12, Pt. K, pp. 103-110.
- Brown, I. C.
1950a: Reliance map-area, Northwest Territories; Geol. Surv. Can., Paper 50-15 (report and map).

Brown, I. C. (cont'd)

1950b: Christie Bay map-area, Northwest Territories; Geol. Surv. Can., Paper 50-21 (report and map).

1950c: Fort Resolution map-area, Northwest Territories; Geol. Surv. Can., Paper 50-28 (report and map).

Cloud, P. E., Jr.

1955: Physical limits of glauconite formation; Bull. Am. Assoc. Petrol. Geol., vol. 39, pp. 484-492.

Donaldson, J. A.

1963: Stromatolites in the Dcnault Formation, Marion Lake, Coast of Labrador, Newfoundland; Geol. Surv. Can., Bull. 102.

Fischer, A. G.

1964: The Lofer cyclothems of the Alpine Triassic; in Symposium on cyclic sedimentation (ed. D. F. Merriam), Kansas Geol. Surv., Bull. 169, vol. 1, pp. 107-149.

Dooge, J.

1966: The stratigraphy of an Upper Devonian carbonate-shale transition between the North and South Ram Rivers of the Canadian Rocky Mountains; Ph. D. thesis, Univ. Leiden; Leidse Geologische Mededelingen, No. 39 (53 pages and figures).

Henderson, J. F.

1939: Taltson Lake map-area, Northwest Territories; Geol. Surv. Can., Map 525A (with marginal notes).

Illing, L. V., Wells, A. J. and Taylor, J. C. M.

1965: Penecontemporary dolomite in the Persian Gulf; in Dolomitization and limestone diagenesis (ed. L. C. Pray and R. C. Murray), Soc. Econ. Paleontologists, Mineralogists, Spec. Publ. No. 13, pp. 89-111.

Lausen, C.

1929: A geological reconnaissance of the east end of Great Slave Lake; Bull. Can. Inst. Mining Met., pp. 361-392.

Iogan, B. W., Rezak, R. and Ginsburg, R. N.

1964: Classification and environmental significance of algal stromatolites; J. Geol., vol. 72, pp. 68-83.

McGlynn, J. C.

1966: Thekulthili Lake area; in Report of activities, Geol. Surv. Can., Paper 66-1, Pt. A.

Pettijohn, F.J.

1957: Sedimentary rocks (2nd ed.); Harper and Brothers, New York.

Pray, L.C., Cook, H.E., Mountjoy, E.W. and McDaniel, P.N.

1967: (Abstract) Allochthonous carbonate debris flows at Devonian bank (reef) margins, Alberta, Canada; International Symposium on the Devonian System, Calgary, Alberta.

Rutherford, R.L.

1929: Pre-cambrian algal structures from the Northwest Territories, Canada; Am. J. Sci., 5th Series, vol. 17, pp. 258-259.

Stockwell, C.H.

1932: Great Slave Lake-Coppermine River area, Northwest Territories; Geol. Surv. Can., Ann. Rept., Pt. C, pp. 37-63.

1936: East Arm of Great Slave Lake; Geol. Surv. Can., Map 377A (East Half) and 378A (West Half) (with descriptive notes).

Walker, T.R.

1967: Formation of red beds in modern and ancient deserts; Bull. Geol. Soc. Am., vol. 78, pp. 353-368.

Wright, G.M.

1951: Christie Bay map-area, Northwest Territories; Geol. Surv. Can., Paper 51-25 (report and map).

1952: Reliance map-area, Northwest Territories; Geol. Surv. Can., Paper 51-26 (report and map).

APPENDIX

DESCRIPTIONS OF TYPE SECTIONS 1 - 18

DESCRIPTIONS OF TYPE SECTIONS

Descriptions of the type section of each formation in the Great Slave Supergroup are given in the following appendix. For the most part, the sections were measured over nearly unbroken exposures by means of a 5-foot staff graduated in tenths of feet. Less well exposed units, the thicknesses of which are marked with an asterisk, were estimated by measuring the horizontal distance traversed with a steel tape and correcting for average dip of the strata and change in elevation using 1:50,000 topographic maps with a 50-foot contour interval. Only very thick and lithologically uniform units were measured by this less than satisfactory method. Wherever possible, type sections were selected which were completely exposed, typical of the formation and easily accessible, in that order of priority. The following conventions are used in the descriptions:

- grain size: coarse grained greater than 1 mm diameter
- medium grained 1/4 - 1 mm diameter
- fine grained 1/16 - 1/4 mm diameter
- aphanitic less than 1/16 mm

- bedding: thick bedded over 3 feet thick beds
- medium bedded 3 inches to 3 feet thick
- thin bedded less than 3 inches thick
- (Lamination is distinct of bedding and is described separately.)

The form classification of stromatolites in the described sections follows that of Donaldson (1963). The numbers in parentheses following the location name of each section are keyed to the location maps (Figs. 3, 5, 7, 9) for each group.

1. LAC DUHAMEL (S7)
(Lat. 62°20'N, Long. 110°44'W)

This section traverses a prominent burnt-over ridge about 1 mile south of Lac Duhamel and is the only completely exposed section of the Hornby Channel Formation, Duhamel Formation, and Kluziai Formation.

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
SOSAN GROUP			

Akaitcho River Formation

Unit 2 is recessive and poorly exposed. Its thickness is estimated from air photographs.

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
2	Siltstone, red, micaceous, medium- to thin-bedded, massive to graded; shale partings. . .	1,000	4,116
1	Siltstone, red, micaceous, medium- to thin-bedded, massive to crossbedded; interbeds of white, crossbedded sandstone	10	3,116
<u>Kluziai Formation (type section)</u>			
Unit 1 is resistant and almost totally exposed.			
1	Sandstone, pink to white, medium-grained, even textured, crossbedded, thin greenish shale partings, medium-bedded; minor conglomerate lenses, shale-pebble conglomerate, heavy mineral bands	1,450	3,106
<u>Duhamel Formation (type section)</u>			
128	Dolomite, red-brown, thick-bedded, columnar stromatolites, in part brecciated and sili-cified	48	1,656
127	Covered interval, probably siltstone	10	1,608
126	Siltstone, buff, thin-bedded, friable	8	1,598
125	Dolomite, brown, thick-bedded, stromatolites columnar to digitate at top of unit. . . .	24	1,590
124	Dolomite, grey, massive to crudely bedded, arenaceous ¹	3	1,566
123	Dolomite, light brown, undulatory stromatolites	2	1,563
122	Siltstone, red-brown, thin-bedded, friable	3	1,561
121	Dolomite, brown, bulbous stromatolites	1	1,558
120	Dolomite, grey to brown, massive to crudely bedded, arenaceous; red and white chert nodules	50	1,557

¹'Arenaceous dolomite' refers to dolomite containing sand-sized grains of clastic quartz. Probably these beds are dolomitized calcarenites.

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
119	Dolomite, brown, hemispherical stromatolites	1	1,507
118	Dolomite, brown, undulatory stromatolites.	2	1,506
117	Dolomite, light brown, bulbous stromatolites; minor intraformational conglomerate between stromatolites; oolitic dolomite at top of unit; chert nodules throughout unit	22	1,504
116	Dolomite, light brown, intraformational conglomerates; minor undulatory stromatolites	6	1,482
115	Dolomite, light brown, undulatory stromatolites	2	1,476
114	Dolomite, light brown, bulbous stromatolites	5	1,474
113	Dolomite, light brown, undulatory stromatolites	7	1,469
112	Dolomite, light brown, bulbous stromatolites; chert nodules	2	1,462
111	Dolomite, light brown, undulatory stromatolites, minor bulbous stromatolites; interbedded intraformational conglomerate	5	1,460
110	Dolomite, light brown, intraformational flat-pebble conglomerate, well bedded	11	1,455
109	Dolomite, light brown to grey, intraformational flat-pebble conglomerate grading to oolitic at top of unit; chert nodules	2	1,444
108	Dolomite, light brown, bulbous stromatolites; minor intraformational conglomerate; cross-bedded arenaceous dolomite bed 1 foot above base of unit.	8	1,442
107	Dolomite, grey to light brown crossbedded, highly arenaceous at base of unit, oolites and intraformational flat-pebble conglomerate at top of unit; chert nodules	3	1,434
106	Siltstone, red-brown, thin-bedded, friable	3	1,431
105	Dolomite, light brown, large hemispherical stromatolites up to 4 feet in diameter.	6	1,428

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
104	Dolomite, light brown, undulatory stromatolites	3	1,422
103	Dolomite, light brown, bulbous stromatolites	1	1,419
102	Dolomite, light brown, intraformational flat-pebble conglomerate	2	1,418
101	Siltstone, red-brown, thin bedded friable	5	1,416
100	Dolomite, red-brown, bulbous to digitate stromatolites	4	1,411
99	Dolomite, grey to red-brown, highly arenaceous and crossbedded at base of unit, massive and stylolitic at top of unit	5	1,407
98	Dolomite, red-brown, undulatory stromatolites; intraformational flat-pebble conglomerate lenses; polygonal desiccation prism cracks	6	1,402
97	Siltstone, red-brown, thin-bedded, friable	2	1,396
96	Orthoquartzite, white, calcareous in part, crossbedded	1	1,394
95	Dolomite, light brown, massive and arenaceous with intraformational conglomerate at base of unit, undulatory stromatolites with intraformational conglomerate lenses at top of unit	8	1,393
94	Dolomite, light brown, undulatory stromatolites, desiccation prism cracks	2	1,385
93	Siltstone, red-brown, thin-bedded, friable	3	1,383
92	Dolomite, light brown, large bulbous stromatolites up to 3 feet across	5	1,380
91	Dolomite, light brown, undulatory stromatolites	7	1,375
90	Dolomite, light brown, hemispherical stromatolites with digitate tops at base of unit, undulatory stromatolites with desiccation prism cracks at top of unit	1	1,368
89	Dolomite, light brown, intraformational flat-pebble conglomerate at base of unit, undulatory		

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
	stromatolites with desiccation prism cracks at top of unit	3	1, 367
88	Dolomite, light brown, bulbous stromato- lites	4	1, 364
87	Dolomite, light brown, undulatory stromato- lites, intraformational conglomerate at base of unit	2	1, 360
86	Dolomite, light brown to red-brown at top of unit, undulatory stromatolites, bulbous strom- atolites at base of unit	3	1, 358
85	Dolomite, light brown, undulatory stromato- lites, desiccation prism cracks, minor hem- ispherical stromatolites	2	1, 355
84	Dolomite, light brown, intraformational con- glomerate, minor undulatory stromatolites . .	2	1, 353
83	Dolomite, light brown, laminated	2	1, 351
82	Dolomite, light brown, hemispherical strom- atolites, digitate stromatolites at top of unit, oolitic and arenaceous dolomite between and overlying stromatolites; chert nodules	2	1, 349
81	Dolomite, light brown, undulatory stromato- lites, intraformational flat-pebble conglom- erate lenses	11	1, 347
80	Dolomite, light brown, intraformational flat- pebble conglomerate, crudely bedded minor undulatory stromatolites	9	1, 336
79	Dolomite, light brown, hemispherical strom- atolites with digitate tops	2	1, 327
78	Siltstone, red-brown, thin bedded, friable, ripple-marked, convolute bedding, lenses of intraformational conglomerate with dolomite clasts	6	1, 325
77	Dolomite, grey to red-brown at top, massive to poorly laminated	6	1, 319
76	Dolomite, grey, highly arenaceous and cross- bedded at base of unit, massive and stylolitic at top of unit; minor intraformational conglom- erate at top of unit	9	1, 313

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
75	Dolomite, light brown, undulatory stromatolites	11	1,304
74	Siltstone, red-brown, thin-bedded, friable . .	5	1,293
73	Dolomite, light brown, bulbous stromatolites	1	1,288
72	Dolomite, grey, highly arenaceous at top of unit, crossbedded	6	1,287
71	Dolomite, light brown, bulbous stromatolites	3	1,281
70	Dolomite, light brown, undulatory stromatolites; minor intraformational conglomerate . .	4	1,278
69	Dolomite, light brown, intraformational conglomerate	3	1,274
68	Dolomite, light brown, undulatory stromatolites	8	1,271
67	Siltstone, red-brown, thin bedded, friable; interbedded intraformational carbonate conglomerate	4	1,263
66	Dolomite, red-brown to light brown, intraformational conglomerate	2	1,259
65	Dolomite, red-brown, bulbous stromatolites, digitate stromatolites at top of unit; minor intraformational conglomerate and cross-bedded dolomite between stromatolites	24	1,257
64	Dolomite, light brown, intraformational conglomerate	3	1,233
63	Siltstone, red-brown, thin-bedded, friable . .	1	1,230
62	Dolomite, light brown, undulatory stromatolites, intraformational conglomerate beds at top of unit	22	1,229
61	Dolomite, light brown, undulatory stromatolites, minor bulbous stromatolites	2	1,207
60	Dolomite, red-brown, arenaceous, oolitic, pisolitic stromatolites, stylolitic, thin-bedded; red chert nodules	18	1,205

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
59	Dolomite, light brown to grey, arenaceous, ripple-marked, mudcracks	8	1, 187
58	Dolomite, light brown, arenaceous, hemispherical stromatolites, digitate stromatolites at top of unit, ripple-marked, mudcracks . . .	14	1, 179
57	Dolomite, light brown, arenaceous, laminated, minor crossbedding	13	1, 165
56	Dolomite, grey, highly arenaceous, cross-bedded	9	1, 152
55	Siltstone, red-brown, thin bedded, friable; interbedded highly arenaceous dolomite	7	1, 143
54	Dolomite, red-brown, thin bedded, interbedded digitate stromatolites and pisolitic stromatolites	16	1, 136
53	Dolomite, red-brown to light brown, undulatory stromatolites; intraformational conglomerate lenses; oolitic dolomite at top of unit; red chert nodules at top of unit	10	1, 120
52	Dolomite, red-brown, pisolitic stromatolites, stylolitic	4	1, 110
51	Siltstone, red-brown, thin-bedded, friable . .	2	1, 106
50	Dolomite, brown, bulbous stromatolites . . .	6	1, 104
49	Siltstone, red-brown, thin-bedded, friable . .	2	1, 098
48	Dolomite, brown, large digitate stromatolites up to 2.5 feet across	10	1, 096
47	Siltstone, red-brown, thin-bedded, friable . .	6	1, 080
46	Dolomite, grey, arenaceous, stylolitic	3	1, 074
45	Siltstone, red-brown, thin bedded, friable . .	15	1, 071
44	Dolomite, grey, arenaceous, stylolitic	3	1, 056
43	Siltstone, red-brown, thin-bedded, friable . .	3	1, 053
42	Dolomite, grey, arenaceous, stylolitic	5	1, 050
41	Dolomite, grey to brown, arenaceous, scattered bulbous stromatolites	10	1, 045

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
40	Dolomite, grey, highly arenaceous at base of unit, crossbedded at base of unit, massive stylolitic at top of unit 21	21	1,035
39	Siltstone, buff, thin bedded, friable	2	1,014
38	Dolomite, brown, massive to irregularly bedded	5	1,012
37	Dolomite, grey to brown, arenaceous, scattered bulbous stromatolites	9	1,007
36	Siltstone, buff, thin-bedded, friable	3	998
35	Dolomite, grey, arenaceous, stylolitic	1	995
34	Siltstone, buff, thin-bedded, friable	2	994
33	Dolomite, grey, arenaceous, crossbedded	1	992
32	Siltstone, buff, thin-bedded, friable	1	991
31	Dolomite, grey, arenaceous, crossbedded	1	990
30	Siltstone, buff, thin-bedded, friable	5	989
29	Dolomite, brown, thin-bedded, digitate stromatolites	16	984
28	Siltstone, pink to green, calcareous, fissile	2	968
27	Dolomite, brown, undulatory stromatolites, lenses of pisolitic stromatolites	5	966
26	Dolomite, brown to grey, arenaceous, undulatory stromatolites	9	961
25	Orthoquartzite, white, calcareous, cross-bedded	3	952
24	Dolomite, brown, undulatory stromatolites, ripple-marks, intraformational conglomerate	1	949
23	Orthoquartzite, white, calcareous, cross-bedded	6	948
22	Dolomite, brown, undulatory stromatolites, ripple-marks	4	942
21	Dolomite, grey, arenaceous, crossbedded	3	938

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
20	Dolomite, brown, undulatory stromatolites, intraformational conglomerate, ripple-marks	16	935
19	Dolomite, brown, digitate stromatolites	6	919
18	Dolomite, brown, undulatory stromatolites	22	913
17	Dolomite, grey, arenaceous, crossbedded	3	891
16	Dolomite, brown, laminated	2	888
15	Dolomite, grey, arenaceous, crossbedded	37	886
14	Dolomite, brown, undulatory stromatolites, ripple-marks, intraformational conglomerate	3	849
13	Dolomite, grey to white, highly arenaceous at base of unit, crossbedded to massive stylonitic at top of unit	17	846
12	Dolomite, brown, laminated	5	829
11	Dolomite, grey to white, massive and stylonitic at base of unit, crossbedded and arenaceous in middle of unit, crossbedded at top of unit	5	824
10	Dolomite, brown, digitate stromatolites	4	819
9	Dolomite, grey to white, massive and stylonitic at base of unit, arenaceous and crossbedded at top of unit	5	815
8	Dolomite, brown, bulbous stromatolites grading to digitate at top of unit	12	810
7	Dolomite, brown, undulatory stromatolites	11	798
6	Dolomite, brown, digitate stromatolites	13	787
5	Sandstone, light grey, subarkosic, thin-bedded, ripple-laminated; interbedded ripple-laminated siltstone lenses with greenish sericitic shale partings	12	774
4	Dolomite, brown, arenaceous, digitate stromatolites	1	762

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
3	Sandstone, light grey, subarkosic thin-bedded; interbedded ripple-laminated lenses of light grey siltstone, friable greenish sericitic sandstone and shale	6	761
2	Dolomite, brown, massive to digitate stromatolites, pock-marked surface	5	755
1	Dolomite, brown, arenaceous, digitate stromatolites in mounds up to 30 feet across; between mounds is a basal bed of red-brown, jasperoid, spherulitic dolomite overlain by thinly interbedded subarkosic sandstone, ripple-laminated siltstone, sericitic shale and massive dolomite	8	750
	Total thickness of Duhamel Formation	914	
<u>Hornby Channel Formation (type section)</u>			
43	Sandstone, white, sericitic, very thinly bedded, shale partings; interbedded ripple-laminated light grey siltstone with shale partings	5	742
42	Siltstone, grey, lenticular and very thinly bedded, ripple-laminated, shale partings . . .	2	737
41	Sandstone, white, very thinly bedded, parallel laminated and ripple-laminated; interbedded coarse-grained, crossbedded sandstone with green shale chips and quartz and feldspar pebbles; ripple-laminated siltstone with shale partings	5	735
40	Siltstone, light grey, lenticular and very thinly bedded, ripple-laminated, shale partings . . .	3	730
39	Sandstone, white, very thinly bedded, cross-bedded, ripple-marked, shale partings	1	727
38	Tuff, arenaceous, vitric, red-brown weathering, green where coarse grained, brown where fine-grained, very thinly bedded, graded bedding, ripple-laminated, graded lapilli tuff; minor interbedded white sandstone	8	726
	Covered interval	3	718
37	Sandstone, white, very thinly bedded, cross-bedded, ripple-marked; interbedded white		

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
	sericitic sandstone in very thin beds with shale partings; interbedded ripple-laminated siltstone with shale partings; minor coarse grained friable quartzose sandstone with detrital muscovite, glauconite, brown limonitic blotches and calcite cement	9	715
36	Sandstone, white, sericitic, fissile, very thinly bedded, shale partings	1	706
35	Sandstone, white, very thinly bedded, cross-bedded, ripple-marked; interbedded ripple-laminated siltstone with shale partings; interbedded fissile sericitic sandstone	4	705
34	Sandstone, white, sericitic, fissile, very thinly bedded, shale partings; interbedded white crossbedded and ripple-marked sandstone; interbedded ripple-laminated siltstone with shale partings	6	701
33	Sandstone, white, thinly bedded, crossbedded, ripple-marked; interbedded white sericitic sandstone; interbedded ripple-laminated siltstone with shale partings	14	695
	Covered interval	10	681
32	Sandstone, white, thinly bedded, crossbedded, ripple-marked; interbedded white sericitic sandstone; interbedded ripple-laminated siltstone with shale partings; minor coarse-grained quartzose friable sandstone with detrital muscovite and glauconite and brown limonitic blotches	14	671
31	Sandstone, white, sericitic, very thinly bedded, shale partings	2	657
30	Sandstone, white, thinly bedded, crossbedded, ripple-marked; interbedded ripple-laminated sericitic fissile sandstone; interbedded coarse-grained friable quartzose sandstone with detrital muscovite and glauconite (?)	12	655
29	Sandstone, white, sericitic, fissile, ripple-laminated, thin-bedded	3	643
28	Sandstone, white, thinly bedded, crossbedded, ripple-marked; interbedded white fissile sericitic sandstone with ripple-lamination	4	640

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
27	Sandstone, white, sericitic, fissile, ripple laminated	3	636
26	Sandstone, light brown, coarse grained, friable; interbedded white crossbedded sandstone; interbedded very thinly bedded sericitic fissile sandstone; interbedded ripple-laminated siltstone with shale partings	9	633
25	Sandstone, white, sericitic, fissile, ripple-laminated, shale partings	3	624
24	Sandstone, feldspathic, very coarse grained, crossbedded	7	621
23	Sandstone, white, medium-grained, thinly bedded, crossbedded, ripple-marked	4	614
22	Sandstone, feldspathic, very coarse grained, ripple-marked	2	610
21	Siltstone, light grey, ripple-laminated, lenticular or very thinly bedded, shale partings; interbedded white crossbedded and ripple-marked sandstone	7	608
20	Sandstone, feldspathic, very coarse grained, crossbedded	17	601
19	Sandstone, white, thin-bedded, ripple-laminated or parallel laminated, shale partings; interbedded pebbly beds; minor ripple-laminated siltstone	31	584
18	Conglomerate, feldspathic, friable, graded bedding	2	553
17	Sandstone, white, thin-bedded, crossbedded, ripple-marked, shale partings	19	551
16	Conglomerate, feldspathic, friable, parallel bedded and crossbedded	9	532
15	Sandstone, white, thin-bedded, crossbedded, ripple-marked; coarse-grained pebbly sandstone beds; interbedded ripple-laminated siltstone with shale partings	20	523
14	Sandstone, white, thin-bedded, crossbedded, ripple-marked, shale partings	38	503

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
13	Siltstone, red to buff, friable, massive, shale chips, recessive	24	465
12	Sandstone, white, thin-bedded, crossbedded, ripple-marked, shale partings	148	441
11	Siltstone, red-brown to buff, friable, massive, shale chips, recessive	20	293
10	Sandstone, white, thin-bedded, crossbedded, ripple-marked, shale partings	44	273
9	Siltstone, red-brown to buff, friable, massive, shale chips, recessive	4	229
8	Sandstone, white, thin-bedded, crossbedded, ripple-marked, shale partings; minor friable grey sandstone with knobably weathering surface	42	225
7	Siltstone, red-brown to buff, friable, massive, recessive	45	183
6	Sandstone, white, thin-bedded, crossbedded, ripple-marked, shale partings; minor friable sandstone	61	138
5	Siltstone, red-brown to buff, friable, massive, recessive	31	77
4	Sandstone, light grey, medium-bedded, cross-bedded to massive, in part pebbly and friable	12	46
3	Conglomerate, crudely bedded, pebbles predominantly quartz with minor feldspar and granite pegmatite pebbles, arkosic matrix well-sorted, detrital muscovite flakes, friable	9	34
2	Sandstone, coarse-grained, pink to red, crossbedded, well-indurated	5	25
1	Conglomerate, crudely bedded, pebbles predominantly quartz with minor feldspar and granite pegmatite pebbles, matrix arkosic, well-sorted, detrital muscovite, friable, maximum pebble diameter 0.5 feet	20	20
	Unit 1 rests with erosional unconformity on very coarse grained granite pegmatite which intruded amphibolitic and biotitic migmatite gneiss.		
	Total thickness of Hornby Channel Formation	742	
	Total thickness of Sosan Group	4,116	

2. KLUZIAI ISLAND (S6)
(Lat. 62°50' N, Long. 111°01'W)

This section occurs on the steep northern slope of Kluziai Island in McLeod Bay. Only the lower part of the Akaitcho River Formation is exposed.

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
	Diabase sill		
	<u>Akaitcho River Formation (type section)</u>		
3	Siltstone, red, micaceous, medium-bedded, massive to thin-bedded, flaggy with low angle crossbedding, ripple-marks, mudcracks, convolute bedding, channel-fill; minor red-brown shale	235±	260
2	Sandstone, interbedded red micaceous sandstone and white sandstone, crossbedded, ripple-marks	5	25
1	Sandstone, white, crossbedded, ripple-marked, greenish shale-pebble intraformational conglomerate near middle of unit; thin greenish sericitic shale partings	20	20
	Total exposed thickness of Akaitcho River Formation	260	

Kluziai Formation

Sandstone, pink, medium to thin lenticular beds, crossbedded, heavy mineral bands; minor sericitic shale partings

(Base of unit not exposed.)

Total exposed thickness of Kluziai Formation 140

3. SETON ISLAND AND KEITH ISLAND (K3)
(Lat. 62°02'N, Long. 112°06'W to Lat. 62°10'N, Long. 111°48'W)

This section occurs along the north shores of Seton Island and Keith Island and is the only well-exposed section of the entire Kahochella Group including the Seton Formation, for which this is the type section. Thicknesses of most of the recessive sedimentary units have been calculated from air photographs and are only approximate. There may be repetition by faulting in some of these units.

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
<u>Douglas Peninsula Formation</u>			
1	Mudstone, red-brown, laminated, closely spaced lenticles of argillaceous limestone . . .	95	9, 350
	Total thickness of Douglas Peninsula Formation	95	
<u>Charlton Bay Formation</u>			
2	Argillite, dark green and red, finely laminated, fissile, beds of calcareous concretions	30	9, 255
	Dykes of rhyolitic feldspar porphyry intrude unit 2		
1	Argillite, dark green, finely laminated, fissile, beds of oblate spheroidal calcareous concretions, concretions larger and less abundant than in red shales below, minor jasper nodules near base; 20-foot red concretionary shale bed about 100 feet above the base of the unit	425	9, 225
	Total thickness of Charlton Bay Formation . . .	455	
<u>McLeod Bay Formation</u>			
2	Shale, red, abundant oblate calcareous concretions	795*	8, 800
1	Shale, red, beds of oblate calcareous concretions, lenses of edgewise concretion conglomerate, convolute lamination; minor granular hematite	255*	8, 005
	Total thickness of McLeod Bay Formation . . .	1, 050	
<u>Gibraltar Formation</u>			
9	Shale, red, minor boudinaged calcareous beds, scattered jasper nodules at base of unit and calcareous concretions at top	620*	7, 750
8	Argillite, dark green, fissile, jasper nodules at base of unit and white pyritic nodules at top	105	7, 130

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
7	Shale, red; interbedded granular hematite, hematitic argillite and hematitic calcareous argillite with white chert and jasper nodules	195*	7, 025
6	Argillite, dark green, fissile, laminated, ripple-laminated, scattered white pyritic chert nodules; minor calcareous argillite, very large calcareous concretions as much as 2.5 feet in diameter near base of unit	470*	6, 830
5	Shale, red, scattered calcareous concretions .	35	6, 360
4	Argillite, dark green, fissile, calcareous concretions	30	6, 325
3	Shale, red, thin calcareous beds	30	6, 295
2	Argillite, dark green, fissile	25	6, 265
1	Mudstone, red, medium-bedded, lenses and thin beds of graded or ripple-laminated green tuffaceous siltstone	1, 940*	6, 240
	Total thickness of Gibraltar Formation	3, 450	
<u>Seton Formation (type section)</u>			
23	Breccia, fragments of tuffaceous siltstone, chert, and volcanic flow rocks very poorly sorted in a tuffaceous mudstone matrix	5	4, 300
22	Mudstone, red, tuffaceous; thin graded beds of tuffaceous siltstone	20	4, 295
	Section moved 1 mile east from Seton Island to Keith Island.		
21	Andesite, massive to columnar flows, amygdaloidal at top of unit, green to red-brown weathering	610*	4, 275
20	Siltstone, red, ferruginous, laminated to massive, medium- to thin-bedded, ripple-marked, convolute bedding; interbedded green basic vitric tuff, tuffaceous shale, and granular hematite with jasper nodules	1, 390*	3, 665
19	Andesite, massive to columnar flows, bands of andesite breccia with carbonate cement . . .	460*	2, 275

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
18	Tuff, brown to maroon, fine-grained, feldspar crystal clasts, thin-bedded with lenses and channel fill of rounded volcanic pebbles at base of unit, thick bedded and conglomeratic with vesicular andesite and dacite boulders as much as 4.5 feet in diameter at top of unit	50	1,815
17	Breccia, angular blocks of massive and vesicular andesite in carbonate cement, silicified phases	40	1,765
16	Andesite, ropy flow with large fragments of basic tuff incorporated into flow from the underlying beds, pockets of basic green tuff and acidic maroon tuff deposited in place, light green and silicified at top of unit	70	1,725
15	Tuff, green, medium- to coarse-grained, well-bedded; interbedded red tuffaceous siltstone and red acid welded tuff; beds form large wedge-shaped units with inclined bedding up to 50 feet thick and separated by discordant erosion surfaces	165	1,655
14	Tuff, green, basic, vitric, thin-bedded, graded bedding with ripple-laminated tops; interbedded with red, well-indurated, tuffaceous siltstone with calcareous concretions at top of unit	10	1,490
13	Agglomerate, medium- to thin-bedded; interbedded fine-grained, welded, maroon, acid tuff with green chlorite clasts and fine- to medium-grained, green, basic tuff	65	1,480
12	Agglomerate, thick-bedded, poorly sorted, angular pebbles of porphyritic and amygdaloidal basic to acid flow rock, basic to acid tuff, and crystal clasts, pebbles up to 0.8-foot in diameter	135	1,415
11	Tuff, green, basic, vitric and crystal, medium-bedded, coarsest at top of unit	85	1,280
10	Tuff, maroon to orange, very fine grained to welded, coarse-grained feldspar crystal clasts; minor interbedded green basic vitric tuff	105	1,195

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
9	Tuff, green, basic, vitric, thick-bedded, coarse-grained; interbeds of thin-bedded, laminated, fine-grained green basic tuff and red, well-indurated, tuffaceous siltstone	250*	1,090
8	Siltstone, red, well-indurated, thin- to medium-bedded; minor interbedded green tuff	10	840
7	Tuff, green, basic, vitric with large feldspar crystal clasts, scattered large angular lithic clasts, thin lenticular bedding, cross-bedded; interbedded red well-indurated siltstone	210*	830
6	Sandstone, red, well-indurated, medium-bedded, massive to graded; interbedded buff to green shale	200	620
	Large, medium-grained, acidic, porphyry intrusive plug.		
5	Sandstone, red, medium-bedded, massive to laminated, green sericitic shale partings . . .	130	420
4	Tuff, maroon to orange, welded, acid, feldspar crystal clasts	10	290
3	Andesite, massive to vesicular flows, in part brecciated; minor tuff beds	95	280
	Coarse grained, porphyritic, meta-gabbro sill.		
2	Andesite, thin vesicular flows with ropy flow-top breccia; minor tuffaceous interbeds	120*	185
1	Tuff, green, basic, coarse grained, large blocks of black, basic, feldspar porphyry . . .	65	65
	Total thickness of Seton Formation	4,300	

Kluziai Formation

1	Sandstone, pink, medium bedded, crossbedded, ripple-marked, shale chip intraformational conglomerate, sericitic shale partings	+360	
	Base of unit not exposed.		

4. GIBRALTER POINT (K8)
(Lat. 62°49'N, Long. 110°44'W)

This section is exposed on a cliff face on the north side of Kahochella Peninsula about 10 miles east of Gibraltar Point. It is the type section of the Gibraltar Formation.

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
<u>McLeod Bay Formation</u>			
1	Shale, red, calcareous concretions	+20	485
	Top of unit 1 not exposed in this section.		
<u>Gibraltar Formation (type section)</u>			
1	Shale, red, no calcareous concretions; thin beds of ripple-marked granular hematite with jasper nodules, intraformational conglomerate, gypsum crystal casts, calcareous stromatolites and 'caliche' (?) horizons	450 *	465
	The hematitic beds of this formation are best seen at the southwest end of Shelter Bay 2 miles southwest of the type section.		
<u>Akaitcho River Formation</u>			
1	Siltstone, red, thin-bedded, ripple-marked; minor red and green shale and argillaceous limestone	+15	15
	Base of unit 1 not exposed in this section.		
5. TALTHEILEI NARROWS (K6) (Lat. 62°37'N, Long. 111°27'W)			
This section is exposed on the north shore of Pethei Peninsula 4 miles northeast of Taltheilei Narrows at the west end of McLeod Bay. It is the type section of the McLeod Bay Formation.			
<u>Charlton Bay Formation</u>			
1	Argillite, dark green, fissile, large calcareous concretions	not measured	

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
<u>McLeod Bay Formation (type section)</u>			
2	Shale, red, abundant calcareous concretions and concretion conglomerate beds	545*	560
	Unit 2 only partly exposed in upper 200 feet.		
1	Shale, red, beds of intraformational flat-pebble conglomerate and concretion conglomerate; minor calcareous stromatolites	5	15
<u>Gibraltar Formation</u>			
1	Shale, red, no concretions; minor intraformational flat-pebble conglomerate	+10	10
	Base of unit 1 not exposed in this section.		
6. CHARLTON BAY (K12) (Lat. 62°37'N, Long. 109°19'W)			
This section is exposed along the north shore of Charlton Bay 1/2 mile southeast of Meridian Lake. It is the type section of the Charlton Bay Formation.			
<u>Douglas Peninsula Formation</u>			
1	Marlstone, red-brown, closely spaced argillaceous limestone lenticles surrounded by terrigenous mudstone, very thinly bedded	110	250
<u>Charlton Bay Formation (type section)</u>			
4	Argillite, dark green, large very closely spaced or coalescent calcareous white concretions	4	140
3	Argillite, dark green, fissile, laminated, scattered large oblate spheroidal brown-weathering white calcareous concretions	55	136
2	Argillite, dark green, fissile, abundant discoidal calcareous concretions	6	81
1	Argillite, dark green with dark red bands, scattered large oblate spheroidal calcareous concretions	55	75

<u>Unit</u>	Lithology	<u>Thickness in Feet</u>	
		Unit	Total from Base
<u>McLeod Bay Formation</u>			
1	Shale, red, abundant calcareous concretions smaller than in overlying beds	+20	20
Base of unit 1 not exposed in this section.			
7. DOUGLAS PENINSULA (P29) (Lat. 62°45'N, Long. 110°20'W)			
This section is exposed along the north shore of Douglas Peninsula 2 1/2 miles east of the Gap. It is the type section of the Douglas Peninsula Formation which is completely exposed and also contains excellent exposures of the lower half of the Utsingi Formation.			
<u>Utsingi Formation</u>			
2	Limestone, blue-grey, crystalline, medium-grained, thick-bedded, vertical mottling of red-brown siliceous dolomite	196	374
1	Limestone, blue-grey, crystalline, medium-grained, medium-bedded, discontinuous laminations of red-brown to greenish brown dolomite	46	178
<u>Douglas Peninsula Formation (type section)</u>			
3	Marlstone, red-brown, fissile terrigenous mudstone with closely spaced lenticles of argillaceous limestone	60	132
2	Mudstone, red-brown, massive with calcareous concretions and gypsum crystal casts	0.5	72
1	Marlstone, red-brown, fissile terrigenous mudstone with closely spaced lenticles of argillaceous limestone	22.5	71.5
Total thickness of Douglas Peninsula Formation		83	
<u>Charlton Bay Formation</u>			
2	Argillite, dark green, fissile, scattered large calcareous concretions	31	49

<u>Unit</u>	Lithology	<u>Thickness in Feet</u>	
		Unit	Total from Base
1	Argillite, dark green, fissile, scattered large calcareous concretions; minor dark red argillite with scattered concretions . . .	13	18
	Total thickness of Charlton Bay Formation . .	44	

McLeod Bay Formation

1	Shale, red, abundant calcareous concretions .	+5	5
	Base of unit 1 not exposed in this section.		

8. TALTHEILEI NARROWS (P21)
(Lat. 62°38'N, Long. 111°25'W)

The Taltheilei Formation is completely exposed on a climbable cliff face on the north side of Pethei Peninsula 4 1/2 miles northeast of Taltheilei Narrows.

Utsingi Formation

Limestone, grey, medium to thick bedded, crystalline, dolomite mottling and lamination

Taltheilei Formation (type section)

80	Limestone, grey, brown dolomite laminations, entire unit composed of closely spaced columnar stromatolites, stromatolite columns poorly linked, rarely branching and about 1 foot across in lower 25 feet of unit, branching and up to 3 feet across 25 to 30 feet from base of unit, and repeatedly branching and less than 0.5-foot across in upper 15 feet of unit, coarse-grained and recrystallized in uppermost 2 feet of unit, dolomite concentrated in the centres of the stromatolite columns throughout unit	47	390
79	Dolomite, thin-bedded, interlaminated undulatory stromatolites and intrasparrudite	3	343
78	Dolomite, brown, closely spaced branching columnar stromatolites	6	340

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
77	Dolomite, brown, thinly interbedded undulatory stromatolites and intra-sparrudite	3.5	334
76	Dolomite, brown, fine-grained, crystalline, massive	3	330.5
75	Dolomite, brown, undulatory stromatolites	2	327.5
74	Dolomite, brown, massive	4	325.5
73	Dolomite, brown, undulatory stromatolites, intraformational flat-pebble conglomerate, poorly laminated at top of unit	1	321.5
72	Dolomite, brown, closely spaced poorly laminated bulbous stromatolites	3.5	320.5
71	Dolomite, brown, undulatory stromatolites, intraformational flat-pebble conglomerate, massive beds.	6	317
70	Dolomite, brown, massive	3	311
69	Dolomite, brown, undulatory stromatolites	2	308
68	Dolomite, brown, branching columnar stromatolites	5.5	306
67	Dolomite, brown, branching columnar stromatolites	3.5	300.5
66	Dolomite, brown, undulatory stromatolites, intraformational flat-pebble conglomerate	2	297
65	Dolomite, brown, poorly laminated bulbous stromatolites	1.5	295
64	Dolomite, brown, massive	2.5	293.5
63	Dolomite, brown, poorly laminated undulatory stromatolites, quartz stringers	1.5	291
62	Dolomite, brown, poorly laminated bulbous stromatolites	1.5	289.5
61	Dolomite, brown, undulatory stromatolites, intraformational flat-pebble conglomerate	5	288

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
60	Dolomite, brown, poorly laminated bulbous stromatolites	2	283
59	Dolomite, brown, undulatory stromatolites at base of unit grading to massive at top . . .	1	281
58	Dolomite, brown, undulatory stromatolites, intraformational flat-pebble conglomerate . .	1	280
57	Dolomite, brown, massive to stylolitic, scattered poorly laminated bulbous stromatolites	9	279
56	Dolomite, brown, massive, scattered poorly laminated bulbous stromatolites, quartz stringers	1	270
55	Dolomite, brown, undulatory stromatolites .	2	269
54	Dolomite, brown, scattered columnar stromatolites	3.5	267
53	Dolomite, brown, undulatory stromatolites, teepee structure, quartz stringers	18	263.5
52	Dolomite, brown, massive	1.5	245.5
51	Dolomite, brown, undulatory stromatolites and intraformational flat-pebble conglomerate at base of unit grading to poorly laminated and ripple-laminated at top of unit	1.5	244
50	Dolomite, brown, massive, scattered poorly laminated bulbous stromatolites, quartz stringers	1	242.5
49	Dolomite, brown, undulatory stromatolites, intraformational flat-pebble conglomerate, quartz stringers	2.5	241.5
48	Dolomite, brown, poorly laminated bulbous stromatolites	1.5	239
47	Dolomite, brown, poorly laminated undulatory stromatolites	1.5	237.5
46	Dolomite, brown, poorly laminated bulbous stromatolites	1.5	236
45	Dolomite, brown, undulatory stromatolites, intraformational flat-pebble conglomerate,		

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
	discoidal pisolitic stromatolites, quartz stringers	3.5	234.5
44	Dolomite, brown, massive	1	231
43	Dolomite, brown, undulatory stromatolites	3.5	230
42	Dolomite, brown, poorly laminated bulbous stromatolites	3	226.5
41	Dolomite, brown, undulatory stromatolites	3.5	223.5
40	Dolomite, brown, closely spaced bulbous stromatolites	3	220
39	Dolomite, brown, undulatory stromatolites	3	217
38	Dolomite, brown, bulbous stromatolites with eroded upper surfaces, quartz stringers	0.5	214
37	Dolomite, brown, undulatory stromatolites	1	213.5
36	Dolomite, brown, columnar stromatolites with eroded upper surfaces	6	212.5
35	Dolomite, brown, undulatory stromatolites	9	206.5
34	Dolomite, brown, massive	3	197.5
33	Dolomite, brown, undulatory stromatolites, discoidal pisolitic stromatolites, quartz stringers	10	194.5
32	Dolomite, brown, undulatory stromatolites, teepee structures, quartz stringers, grading to massive at top of unit	10	184.5
31	Dolomite, brown, massive	2	174.5
30	Dolomite, brown, undulatory stromatolites, intraformational flat-pebble conglomerate, teepee structure, quartz stringers	7	172.5
29	Dolomite, brown, columnar stromatolites, quartz stringers	3.5	165.5

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
28	Dolomite, brown, massive, poorly laminated scattered bulbous stromatolites at top of unit	3	162
27	Dolomite, brown, undulatory stromatolites, quartz stringers	5	159
26	Dolomite, brown, massive at base of unit grading to undulatory stromatolites with scattered bulbous stromatolites	4.5	154
25	Dolomite, brown, undulatory stromatolites	0.5	149.5
24	Dolomite, brown, columnar stromatolites.	3.5	149
23	Dolomite, brown, massive	1.5	145.5
22	Dolomite, brown, undulatory stromatolites, intraformational flat-pebble conglomerate, quartz stringers	1.5	144
21	Dolomite, brown, columnar stromatolites.	3	142.5
20	Dolomite, brown, undulatory stromatolites, intraformational flat-pebble conglomerate, discoidal pisolitic stromatolites, quartz stringers	5.5	139.5
19	Dolomite, brown, large columnar branching stromatolites, columns up to 3 feet across near top of unit	19	134
18	Dolomite, brown, poorly laminated undulatory stromatolites	2	115
17	Dolomite, brown, undulatory stromatolites	3	113
16	Dolomite, brown, branching columnar stromatolites	10	110
15	Dolomite, brown, poorly laminated undulatory stromatolites	1.5	100
14	Dolomite, brown, undulatory stromatolites, scattered bulbous stromatolites at base of unit	3.5	98.5
13	Dolomite, brown, undulatory stromatolites	2.5	95
12	Dolomite, brown, massive	1	92.5

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
11	Dolomite, brown, large branching columnar stromatolites	6	91.5
10	Dolomite, brown, bulbous stromatolites digitate at top	6	85.5
9	Dolomite, brown, undulatory stromatolites, intraformational flat-pebble conglomerate, discoidal pisolitic stromatolites, quartz stringers	10	79.5
8	Dolomite, brown, columnar stromatolites at base of unit grading to bulbous stromatolites at top	3	69.5
7	Dolomite, brown, bulbous stromatolites at base of unit grading to massive dolomite with quartz stringers grading to undulatory stromatolites	5	66.5
6	Dolomite, brown, undulatory stromatolites, intraformational flat-pebble conglomerate, quartz stringers	3	61.5
5	Dolomite, brown, massive intrasparrudite	1.5	58.5
4	Dolomite, brown, large branching columnar stromatolites in bioherms 20 feet across and 24 feet thick separated by 5 to 10 feet of massive dolomite, bioherms are located above those in unit 1	24	57
3	Dolomite, brown, undulatory stromatolites with large lenses of intraformational flat edgewise pebble conglomerate above bioherms in unit 1, above the areas between the bioherms of unit 1 lenses of edgewise conglomerate is surrounded by massive dolomite	9	33
2	Dolomite, brown, bioherms 20 feet across and 24 feet thick, lower 12 feet of bioherms have small digitate stromatolites and upper 10 feet linked columnar stromatolites, 5 to 10 feet of massive to laminated dolomite with scattered bulbous stromatolites between bioherms	22	24
1	Dolomite, brown, undulatory stromatolites	2	2
	Total thickness of Taltheilei Formation	390	

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base

Douglas Peninsula Formation

Mudstone, red-brown, closely spaced lenticles of argillaceous limestone, micro-breccia

9. UTSINGI POINT (P18)
(Lat. 62°25'N, Long. 111°36'W)

This section is exposed along the eastern shore of the largest and most northerly of the islands on the east side of Pethei Peninsula about 4 1/2 miles north of Utsingi Point. It is the type section of the Utsingi Formation and in addition the lower part of the Wildbread Formation is very well exposed. Superb bedding plane exposures of the thick, uppermost stromatolitic unit in the Taltheilei Formation occur on this island and those to the south.

Wildbread Formation

14	Limestone, blue-grey, undulatory stromatolites	3	373
13	Limestone, blue-grey, hemispherical stromatolites	2	370
12	Limestone, blue-grey to white, oolitic, ripple-marked, white chert nodules at top of unit	4.5	368
11	Limestone, blue-grey to white, oolitic, ripple-marked, undulatory stromatolites; thin dolomite beds	6.5	363.5
10	Dolomite, brown laminations separated by blue-grey limestone, hemispherical stromatolites, oncolites, intraformational flat pebble conglomerate beds at top of unit	16	357
9	Limestone, blue-grey, hemispherical stromatolites	10	341
8	Limestone, blue-grey, crinkly siliceous laminations with elliptical domal bedding morphology	15	331
7	Limestone, blue-grey at base of unit grading to brown dolomite at top of unit, undulatory stromatolites, ripple-marks, oncolites, intraformational conglomerate	5	316

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
6	Dolomite, brown, undulatory stromatolites, oncolites, ripple-marks	3.5	311
5	Limestone, blue-grey, undulatory to hemispherical stromatolites, chert nodules, dolomitic at top of unit	12	307.5
4	Limestone, blue-grey, ripple-marked, undulatory stromatolites, intraformational conglomerate	2.5	295.5
3	Limestone, blue-grey, oolitic, ripple-marked, intraformational conglomerate, undulatory stromatolites	3	294
2	Limestone, blue-grey, crinkly brown siliceous laminations, elliptical domal bedding morphology	25	290
1	Limestone, white, undulatory and hemispherical stromatolites	5	265
	Total exposed thickness of Wildbread Formation	113	

Utsingi Formation (type section)

9	Limestone, white, closely spaced crinkly brown siliceous laminations, crystalline, medium-grained	35	260
	Unit 9 forms a prominent low ridge at the base of the highest scarp along the entire length of Pethei and Douglas Peninsula. The unit breaks into distinctive large angular blocks.		
8	Covered interval (probably part of unit 9) . .	40 *	225
7	Limestone, grey, crystalline, medium-grained, brown dolomitic mottling	90 *	185
6	Limestone, grey, crystalline, medium-grained, laminated, crossbedded	2	95
5	Limestone, grey, crystalline, medium-grained, brown dolomitic mottling	21	93
4	Limestone, grey with brown dolomite laminations, bulbous stromatolites	1	72

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
3	Limestone, grey, crystalline, medium-grained, brown dolomitic mottling.	5	71
2	Limestone, grey, with brown dolomite laminations, bulbous stromatolites	2	66
1	Limestone, grey to white, crystalline, medium-to coarse-grained, brown dolomitic mottling.	14	64
	Total thickness of Utsingi Formation	210	
<u>Taltheilei Formation</u>			
1	Limestone, grey with brown dolomite laminations, closely spaced branching columnar stromatolites	50	50

10. WILDBREAD BAY (P27)
(Lat. 62°44'N, Long. 110°30'W)

This section was measured on the north side of Pethei Peninsula 1 mile west of the Gap joining Wildbread Bay and Tochatwi Bay. It is the type section of the Wildbread Formation and offers a complete section of the Utsingi Formation in an area in which it directly overlies the Douglas Peninsula Formation. The Taltheilei Formation is missing in this section.

Hearne Formation

Only the lower part of the Hearne Formation is exposed beneath the diabase sill which caps the highest ridge on Pethei Peninsula.

3	Limestone, grey, crystalline, medium-grained, thick-bedded to massive, brown dolomitic mottling	10	1,345
2	Limestone, grey, medium-bedded, brown dolomitic laminations, scattered bulbous stromatolites at base of unit, well-laminated hemispherical stromatolites at top of unit; intraformational flat-pebble conglomerate	25	1,335
1	Limestone, grey to white, medium-to coarse-grained, massive, brown dolomitic mottling	19	1,310

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
<u>Wildbread Formation (type section)</u>			
12	Limestone, grey to white, coarse-grained, crystalline, stylolitic, poorly defined outlines of stromatolites continuous from unit 11	2	1, 291
11	Limestone, grey, brown dolomitic laminations, closely spaced branching columnar stromatolites	50	1, 289
10	Limestone, white to grey, medium- to coarse-grained, stylolitic, poorly defined outlines of stromatolites continuous to unit 11 at top of unit; minor beds of dark grey limestone with 'caliche'-like radial and 'birds-eye' structure	8	1, 239
9	Limestone, grey to white, medium- to coarse-grained, laminated, hemispherical stromatolites, oncolites, intraformational edgewise conglomerate	9	1, 231
8	Limestone, white, oolitic, ripple-marked, minor stromatolitic laminations at base of unit, coarsely recrystallized at top of unit	45	1, 222
7	Limestone, grey, fine-grained, well-laminated, hemispherical stromatolites, oncolites, intraformational edgewise flat-pebble conglomerate; thin dolomitic beds	10	1, 177
6	Limestone, white, oolitic, ripple-marked, coarsely recrystallized at top of unit	18	1, 167
5	Covered interval	3	1, 149
4	Limestone, grey, fine-grained, hemispherical stromatolites, oncolites; thin dolomitic beds	8	1, 146
3	Limestone, white, oolitic, ripple-marked, coarsely recrystallized at top of unit	20	1, 138
2	Limestone, white, oolitic, ripple-marked, minor stromatolitic laminations at base of unit, coarsely recrystallized at top of unit	20	1, 118
1	Limestone, white, fine-grained, hemispherical stromatolites	5	1, 098
	Total thickness of Wildbread Formation	198	

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
<u>Ütsingi Formation</u>			
9	Limestone, grey, medium-grained, crystalline, massive, closely spaced crinkly brown dolomitic laminations	75	1,093
8	Covered interval	5	1,018
7	Limestone, grey, medium-grained, crystalline, thick-bedded, brown dolomitic mottling	72	1,013
6	Limestone, grey, medium-grained crystalline, massive, brown crinkly dolomitic laminations	35	941
5	Limestone, grey, medium-grained, crystalline, thick-bedded, brown dolomitic mottling	153	906
4	Covered interval	70*	753
3	Limestone, grey, medium-grained, crystalline, thick-bedded, brown dolomitic mottling, very large elliptical domal bedding morphology near top of unit	550*	683
2	Limestone, grey, medium-grained, crystalline, medium-bedded, yellow-brown dolomitic mottling and discontinuous laminations	32	133
1	Limestone, interbedded grey limestone with yellow-brown mottling and laminations and pink limestone with red-brown argillaceous laminations	6	101
	Total thickness of Ütsingi Formation	998	
<u>Douglas Peninsula Formation</u>			
1	Marlstone, red-brown, terrigenous mudstone with closely spaced lenticles of argillaceous limestone	95	95

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
11. HEARNE CHANNEL (P10) (Lat. 62°05'N, Long. 112°14'W)			
The section is located on the south side of the long peninsula which protrudes from the northeast end of Blanchet Island south of Hearne Channel. It is the type section of the Hearne Formation which is completely exposed.			
<u>Stark Formation</u>			
Mudstone, red with greenish yellow patches, massive to brecciated, hematite-lined fractures, halite crystal casts.			
<u>Hearne Formation (type section)</u>			
6	Dolomite, brown, well-laminated hemispherical stromatolites with nearly triangular outlines in plan view	4	300
5	Limestone, grey, brown dolomitic laminations, well-laminated hemispherical stromatolites with nearly triangular outlines in plan view, stromatolitic bioherms separated by ripple-laminated and undulatory stromatolite beds, intraformational flat-pebble conglomerate at base	6	296
4	Limestone, grey, laminated to crinkly laminated, cone-in-cone structure	15	290
3	Limestone, massive to thick-bedded, grey, medium- to coarse-grained, crystalline, indistinct brown to reddish dolomitic mottling and discontinuous laminations, domal bedding 5 feet from base of unit	134*	275
2	Limestone, grey, brown dolomitic laminations, branching columnar stromatolites.	6	141
1	Limestone, grey, massive to thick-bedded, medium- to coarse-grained, crystalline, indistinct brown to reddish dolomitic mottling and discontinuous laminations, domal bedding 15 feet and 95 feet from base of unit	135*	135
	Total thickness of Hearne Formation	300	

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base

Wildbread Formation

Limestone, grey, brown dolomitic laminations, large branching columnar stromatolites.

12. McLEAN BAY (P28)
(Lat. 62°25'N, Long. 110°31'W)

The section is located near the west end of the narrow island west of Krys Point in Stark Lake. It is the type section for the McLean Formation.

Pekantui Point Formation

Limestone, light grey, aphanitic, closely spaced laterally continuous laminations of brown dolomitic argillite and dolomite.

McLean Formation (type section)

3	Mudstone, dolomitic, grey to brown weathering, fissile, laminated, thin-bedded, ellipsoidal nodules of grey limestone	25	415
2	Mudstone, red-brown, thin-bedded, fissile, pink to light grey limestone nodules with flat bottoms and convex-upward tops	95*	395
1	Mudstone, red-brown, thin-bedded, fissile, crumulated thin beds of pink to grey limestone; minor mudstone with nodular limestone as in unit 2; commonly dolomitized . . .	195*	300
	Total thickness of McLean Formation	315	

Douglas Peninsula Formation

1	Mudstone, red-brown, very thin bedded, fissile, hematitic, discoidal jasper nodules, very thin argillaceous limestone beds uncommon	105*	105
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Charlton Bay Formation

Argillite, dark green, fissile, scattered oblate brown weathering calcareous concretions, concretions closely spaced in uppermost 3 feet of unit.

13. BLANCHET ISLAND (P5)
(Lat. 61°56'N, Long. 112°40'W)

This section is exposed along the south shore of Blanchet Island. It is the type section of the Blanchet Formation.

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
<u>Pekantui Point Formation</u>			
Limestone, grey, aphanitic, very thinly interbedded with dark green or brown mudstone, mostly even bedded with minor beds of mudstone with nodular limestone.			
<u>Blanchet Formation (type section)</u>			
13	Greywacke, red-brown to dark green, medium- to thin-bedded, graded to shale at top of beds, beds parallel	55	695
12	Limestone, grey to white, aphanitic, very thinly interbedded with dark green mudstone, minor limestone nodules	8	640
11	Greywacke, medium- to thin-bedded, graded to shale at top of beds, beds parallel	32	632
10	Limestone, white, aphanitic, very thinly interbedded with dark green mudstone	5	600
9	Greywacke, medium- to thin-bedded, graded to shale at top of beds, beds parallel	165	595
8	Limestone, white, aphanitic, interlaminated with dark green mudstone	35	430
7	Limestone, grey, thin-bedded, crinkly brown dolomitic argillite laminations, minor dolomitic argillite with nodular limestone, scattered thin parallel-sided beds of red, greenish brown weathering graded dolomite rarely with ripple-drift laminations	10	395
6	Limestone, grey, thin-bedded, crinkly brown laminations of dolomitic argillite; minor nodular limestone	25	385
5	Limestone, grey, aphanitic, very thinly interbedded with dark green mudstone; mudstone with nodular limestone; mudstone with flat-limestone-pebble conglomerate	55	360

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
4	Greywacke, dark red, thin- to medium-bedded, graded to red shale at top of beds; minor very thinly interbedded limestone and mudstone.	60	305
3	Mudstone, red-brown, nodules and thin beds of grey limestone; minor graded parallel-sided greywacke beds	20	245
2	Mudstone, red-brown, nodules of pink to grey limestone, thin beds of ripple-laminated argillaceous limestone	75	225
1	Greywacke, medium- to thin-bedded, red-brown, graded to red shale at top of beds, beds parallel minor mudstone with nodular limestone.	+150	150
<p>Base of unit 1 not exposed in this section. Near the southwest end of Blanchet Island unit 1 is about 450 feet thick and overlies about 400 feet of mudstone with nodular limestone of the McLean Formation.</p>			
Total thickness of the Blanchet Formation . .		995	

14. PEKANATUI POINT (P19)
(Lat. 62°08'N, Long. 111°35'W)

This section is exposed in a small bay on the south shore of Great Slave Lake 2 miles east of Pekanatui Point. It is the type section of the Pekanatui Point Formation.

Stark Formation

Dolomite, yellow-brown to red-brown, thin- to thick-bedded, massive to ripple-laminated, mostly brecciated or intensely fractured.

Pekanatui Point Formation (type section)

13	Greywacke, dark red-brown, medium- to fine-grained, thin- to medium-bedded, beds parallel and graded to shale at top. . . .	7	340
12	Limestone, grey, crinkly laminations of dark green argillite	7	333

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
11	Mudstone, dark green, ripple-laminated siltstone concretions, calcareous concretions	3	326
10	Greywacke, medium- to fine-grained, medium- to thin-bedded, beds parallel and graded to shale at top; minor bedded very thinly interbedded grey to white aphanitic limestone and dark green mudstone	34	323
9	Limestone, grey, crinkly lamination of dark green argillite	8	289
8	Mudstone, dark green to dark grey, thin bedded, calcareous concretions	15	281
7	Limestone, grey, thin-bedded, crinkly siliceous laminations	155	266
6	Limestone, blue-grey to brown, dolomitic, thin evenly bedded, alternating beds of massive and laminated limestone	60	111
5	Limestone, grey, closely spaced laminations of dark grey argillite	20	51
4	Limestone, grey, crinkly laminations of argillaceous dolomite	5	31
3	Limestone, grey, medium- to thick-bedded, very irregular siliceous laminations, scattered mounds with radial or vertical internal structure	8	26
2	Mudstone, dark green, very thinly interbedded with grey aphanitic limestone	3	18
1	Mudstone, dark green, thin beds and nodules of white limestone	15	15
	Total thickness of Pekanatui Point Formation.	340	

Blanchet Formation

Greywacke, dark red-brown to dark green, medium- to thin-bedded, beds graded to shale at top; minor thinly interbedded dark green mudstone and white aphanitic limestone.

15. BELLE ILE (C28)
 (Lat. 62°41'N, Long. 109°08'W)

This section is exposed on the south side of Belle Ile in Charlton Bay. Although not completely exposed, the section nevertheless contains a complete Kahochella Group, the terrigenous basal sequence of the Pethei Group and the Stark Formation of the Christie Bay Group. The latter part of the section is described here.

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
<u>Stark Formation</u>			
5	Mudstone, red with pale greenish yellow patches, hematite-lined fractures, massive to ripple-marked, in part silty; minor thin red-brown massive dolomite and argillaceous dolomite beds.	+ 100	460
	Top of unit 5 not exposed in this section.		
4	Limestone, blue, aphanitic, interlaminated yellow-brown dolomite, thin-bedded, ripple-marked, crossbedded, intraformational conglomerate, convolute bedding, well developed stromatolites and stromatolite bioherms; red-brown argillaceous dolomite at top and base of unit.	135	360
3	Mudstone, red with pale greenish yellow patches, hematite-lined fractures, massive to ripple-marked; minor massive brown dolomite beds.	150	225
2	Dolomite, yellow-brown, interlaminated blue-grey limestone, thin-bedded, ripple-marked, crossbedded, fewer stromatolites than unit 4; red-brown argillaceous dolomite at top and base of unit	75	75
1	Mudstone, red to red-brown, brecciated; minor breccia with angular dolomite blocks	not measured	
<u>Pekantui Point Formation</u>			
1	Limestone, grey to white, very thinly bedded, dark siliceous laminations		

16. STARK LAKE (C23)
 (Lat. 62°32 1/2'N, Long. 109°57'W)

This section is exposed on the west side of an island 3 miles from the east end of Stark Lake. The contact between the Stark Formation and Tochatwi Formation is well-exposed, as is the upper carbonate member of the Stark Formation.

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
<u>Tochatwi Formation</u>			
2	Sandstone, red, fine-grained, lithic to feldspathic, medium- to thin-bedded; interbedded mudstone and shale	+100	735
	Top of unit 2 is not exposed in this section.		
1	Mudstone, red, massive; thin beds of angular lithic conglomerate and red sandstone	255	635
<u>Stark Formation</u>			
3	Mudstone, red with pale greenish yellow patches, halite crystal casts; minor thin beds and lenses of lithic conglomerate and siltstone.	135	380
2	Limestone, blue-grey, interlaminated with yellow-brown dolomite, thin-bedded, ripple-marks, stromatolitic bioherms, crossbedding, intraformational conglomerate, convolute bedding; red-brown dolomite and argillaceous dolomite at top and bottom of unit	145	245
1	Mudstone, red with pale greenish yellow patches, hematite-lined fractures, halite crystal casts	100	100
	Base of unit 1 not exposed in this section.		

17. KRYS POINT (C17)
 (Lat. 62°29'N, Long. 110°25'W)

This section is exposed along the north shore of an island in the western half of Stark Lake 3 miles north of Krys Point. Although not completely exposed, it is nevertheless the only complete section of the Tochatwi Formation. Thickness of the section was calculated from air photographs.

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
<u>Portage Inlet Formation</u>			
1	Shale, red to brown, mudcracked; very thin beds of ripple-marked siltstone and sandstone	+690*	2,660
Top of unit 1 not exposed in this section.			
<u>Tochatwi Formation</u>			
1	Sandstone, red to buff, fine-grained, lithic to feldspathic, thick- to thin-bedded, crossbedded, ripple-marked, mudcracked, convolute bedded; minor lithic conglomerate and shale	1,870 *	1,970
<u>Stark Formation</u>			
1	Mudstone, red with pale greenish yellow patches, in part silty and brecciated, massive to ripple-marked, hematite-lined fractures; minor lithic conglomerate beds and lenses; basic diatreme breccia intrudes the unit near the southwest end of the island	+100	100
Base of unit not exposed in this section.			

18. PORTAGE INLET (C14)
(Lat. 62°29'N, Long. 110°42'W)

This section is exposed on the north side of Portage Inlet near its entrance to Christie Bay. It is the type section of the Portage Inlet Formation.

Pearson Formation

Basalt, dark green to black, massive to vesicular, calcite-filled columnar jointing prominent in some flows, argillite-pebble conglomerate occurs at the base of some flows; minor dark grey argillite interbedded with basalt flows.

Portage Inlet Formation (type section)

2 Shale, red to brown, fissile, mudcracked, gypsum crystal casts most abundant in upper part of unit, rare calcareous concretions; minor very thin beds of flesh-coloured,

Unit	Lithology	Thickness in Feet	
		Unit	Total from Base
	ripple-marked, feldspathic sandstone with shale chip conglomerate	355	605
1	Shale, red to brown, fissile, mudcracked, rare calcareous concretions; thin beds of flesh-coloured, ripple-laminated or cross-bedded feldspathic sandstone with halite crystal casts	+ 250*	250
	Base of unit 1 is not exposed in this section but elsewhere it rests on sandstone of the underlying Tochatwi Formation.		
	Total exposed thickness of the Portage Inlet Formation	605	

