GEOLOGICAL SURVEY OF CANADA
COMMISSION GEOLOGIQUE DU CANADA
OPEN FILE 1652

# PRE-CARBONIFEROUS GEOLOGY, M'CLINTOCK INLET MAP AREA, NORTHERN ELLESMERE ISLAND, INTERIM REPORT AND MAP

(340E, H)

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November 1987

CONTENTS

ILLUSTRATIONS

TABLES

## Introduction

A program to complete the reconnaissance of northern Ellesmere Island was carried out from 1975 to 1984. In the M'Clintock Inlet area Trettin (1981a, b; 1987b; Trettin et al., 1982, 1987; Trettin and Parrish, 1987) investigated the pre-Carboniferous succession and some younger intrusions during parts of the 1977, 1979, 1980, 1981, 1982, and 1984 seasons, and Mayr (in prep.) parts of the upper Paleozoic succession during parts of the 1977, 1979 and 1982 seasons. Modern turbine engine helicopters were used from 1977 onward.

The Quaternary geology of parts of the M'Clintock Inlet map-area is being studied by D. Lemmon under the supervision of Dr. J. England of the Department of Geography, University of Alberta.

### Purpose and scope of present report

The purpose of this report is to provide a preliminary map and an up-to-date summary of the pre-Carboniferous bedrock geology with emphasis on factual information and data. Broader tectonic aspects have been discussed in a recent interpretative overview (Trettin, 1987b). The report is not intended for formal publication because additional field work is planned for 1988. The upper Paleozoic and Tertiary geology will be added to the map when Mayr has completed his report.

### Laboratory studies, classification of volcanic rocks, and carbonate terminology

Most samples have been studied in thin section and by whole-rock X-ray diffraction analysis (Appendix 3), and suitable volcanic samples have been analyzed by standard chemical techniques (Appendix 2).

The volcanic rocks are generally too highly altered for

# INTRODUCTION

## Brief history of geological field investigations

The first geological investigations in the M'Clintock Inlet map-area were made by R.L. Christie in 1954 (1957) in the course of an expedition that travelled with dogs and sledges from Ward Hunt Island to Lands Lokk on southern Kleybolte Peninsula. Christie's work was limited to the north coast and to the shores of Disraeli Fiord and M'Clintock Inlet but was very fruitful. He discovered some of the metamorphic rocks here assigned to succcessions I and II of the Pearya Terrane, lower Paleozoic volcanic and sedimentary rocks now included in the Egingwah and Harley Ridge groups, the granitic Cape Richards complex, the mafic-ultramafic Cape Fanshawe Martin intrusion; and some upper Paleozoic sedimentary units. Most important, perhaps, was his recognition of an angular unconformity at the base of upper Middle Ordovician strata west of Bromley Island -- the first evidence for the mid-Ordovician M'Clintock Orogeny.

Some additional geological information was obtained by Lyons and Leavitt who studied the Ward Hunt Ice Shelf and surrounding land in 1960 (1961).

The next phase of geological exploration took place during the 1965 to 1967 field seasons when more extensive parts of northern Ellesmere Island, including northern and central parts of the M'Clintock Inlet map-area, were investigated by an aircraft-supported operation organized by Christie. Frisch (1974) studied plutonic and metamorphic rocks, Trettin (1969b) predominantly sedimentary and volcanic rocks of Proterozoic to Carboniferous age, and Nassichuk sedimentary units of Paleozoic ages. A small airplane, the Piper Super Cub, and piston engine helicopters were used for transportation of fly camps and some airborne traverses.

classifications that are based on major elements (such as Irvine and Baragar, 1971), but the minor or trace elements Y, Nb, Zr, and Ti have proven to be both relatively stable (e.g. Smith and Smith, 1976; Davies et al., 1979) and useful for classification (Winchester and Floyd, 1977) and for tectonic interpretation (e.g. Pearce and Norry, 1979; Meschede, 1986). It has been reported that even these elements can be mobile if $CO_2$ is present in the fluid phase during metamorphism (Murphy and Hynes, 1986) but Mortensen (1981) found that the Winchester-Floyd classification provided consistent and meaningful results for a metamorphosed and highly altered suite of volcanic rocks in the western Cordillera, and results from northern Ellesmere Island and northern Axel Heiberg Island support this conclusion.

For general names of unmetamorphosed carbonate rocks (Appendix 1) the terminology of Dunham (1962) is used; and for the size grade of carbonate crystals a terminology based on Leighton and Pendexter (1962) and Drummond (1963).

## Acknowledgements

The macrofossil identifications were made mainly by B.S. Norford with some coral identifications by A.E.H. Pedder; the conodont identifications by G.S. Nowland, R.S. Tipnis, and T.T. Uyeno; the chemical analyses by the Analytical Chemistry Section of the Geological Survey under the supervision of G.R. Lachance; and the isotopic age determinations by W.D. Loveridge, R. Parrish, R.D. Stevens, R.R. Sullivan, and other members of the Geochronology Section of the Geological Survey. W.W. Nassichuk provided field descriptions and samples of the lower Paleozoic rocks that he investigated in 1966.

# Introduction

Samples from Commonwealth Mountain (west of lower M'Clintock Glacier) were forwarded by Dr. G. Hattersley-Smith (then with the Defence Research Board of Canada). The Director, officers, and pilots of the Continental Polar Shelf Project are thanked for logistic support and numerous courtesies during the 1977 - 1984 field seasons.

## STRATIGRAPHIC-STRUCTURAL FRAMEWORK

The geological setting of the M'Clintock Inlet map-area within the pre-Carboniferous stratigraphic-structural framework of northern Ellesmere Island is shown in figures 1, 2, and 3. Most of the M'Clintock Inlet area is underlain by Pearya, a composite terrane with Caledonian affinities that is divisible into four successions with an overall age range from Neohelikian (or older) to Late Silurian (Trettin, 1987b). The map-area contains significant exposures of successions I (Neohelikian) and II (Hadrynian to Lower Ordovician), all known exposures of succession III (Middle Ordovician and ? older), and the most important exposures of Succession IV (Middle Ordovician to Upper Silurian; Fig. 4). It also includes the type area of the M'Clintock Orogeny (Fig. 3), a Middle Ordovician event, comparable in age and character to the Taconic Orogeny.

The southern part of the map-area is underlain by a narrow outcrop belt of the Clements Markham Fold Belt and a small outcrop area of the Hazen Fold Belt. Both are dominated by lower Paleozoic deep-water sediments, but the Clements Markham Fold Belt also includes volcanic rocks. The linear faults separating the Pearya Terrane from the Clements Markham Fold Belt are well exposed but the faulted contact between the Clements Markham and Hazen fold belts, exposed in the Clements Markham Inlet map-area, is covered by a glacier in the M'Clintock Inlet map-area.

Pearya and the Clements Markham and Hazen fold belts are overlapped by Carboniferous and Permian strata of the Sverdrup Basin. The angular unconformity at the base of the Sverdrup Basin represents major deformations that included the Late Devonian - Early Carboniferous Ellesmerian Orogeny but probably commenced in Late Silurian time. The Sverdrup Basin strata (along with the older rocks) are intruded by mafic dykes and sills and by a minor granitic pluton of Late Cretaceous age. Lower and upper Paleozoic rocks are locally unconformably overlain by conglomerate and breccia of undetermined Paleogene age that were deposited and deformed during different phases of the Eurekan Orogeny.

## PEARYA TERRANE, SUCCESSION I

Succession I comprises sedimentary and (?) volcanic strata of unknown age, deformed, metamorphosed to amphibolite grade, and intruded in late Neohelikian time. It occurs in three major outcrop belts, named the Cape Columbia, Deuchars Glacier and Mitchell Point belts. Parts of the first two, and outliers of the third are exposed in the M'Clintock Inlet map-area.

### CAPE COLUMBIA BELT

The Cape Columbia Belt, extending from Cape Aldrich in the Clements Markham Inlet map-area to Cape Albert Edward in the northeastern extremity of the M'Clintock Inlet area, is about 40 km long in an east-west direction and up to 3.5 km wide. It is best exposed in the vicinity of Cape Columbia (Clements Markham Inlet map-area) where it was first investigated by Blackadar (1954), and subsequently, in more detail, by Frisch (1974); the present brief summary is based on the latter's report. In the Clements Markham Inlet area, the Cape Columbia Belt is in faulted contact with the Mount Disraeli Belt on the south and is unconformably overlain by Upper Paleozoic strata; in the M'Clintock Inlet area the contact with the upper Paleozoic strata is faulted and the contact with the Mount Disraeli Belt is concealed by ice.

The most abundant rock type is banded garnet-biotite gneiss with two generations of feldspar porphyroblasts. Garnetiferous hornblende gneiss and related amphibolite are also common. The persistent compositional layering of the gneisses probably reflects bedding but the nature of the protoliths is uncertain. Chemical characteristics of the amphibolites suggest that they are meta-igneous rocks. The gneisses are cut by numerous granitic and pegmatitic dykes. Less common are schist, quartzite and marble. The original metamorphism was of amphibolite grade but retrograde metamorphism and cataclasis are ubiquitous. The gneissic foliation strikes westerly and either is vertical or dips steeply north or south.

Rb-Sr determinations by Sinha and Frisch (1976) produced a nine-point isochron age of 1060 ± 18 Ma (recalculated). Ages of 980 and 928 Ma were derived from $^{207}Pb/^{206}Pb$ analyses of bulk zircons in two separate samples.

## DEUCHARS GLACIER BELT

The Deuchars Glacier Belt, located between Yelverton Inlet and Milne Glacier, straddles the boundary between the Yelverton Inlet and M'Clintock Inlet map-areas. It is about 30 km long, up to 12 km wide, and crescent-shaped. The belt is composed mainly of metamorphosed granitic intrusions with lesser amounts of schist and very small amounts of amphibolite. The granitic rocks are mainly granite and granodiorite, composed of quartz, microcline, albite, biotite, muscovite, and minor chlorite (cf. Trettin and Frisch, 1987, appendices 2 and 3). Some rocks are massive and others cataclastic and somewhat gneissic, the mica defining discontinuous, undulating, rather irregular S-planes. Augen of relatively large, tectonically abraided feldspar are present in some gneissic rocks. The schists consist mainly of quartz, plagioclase (albite to andesine), and biotite with or without small proportions of muscovite, K-feldspar, and rare chloritoid. Schistosity and foliation are parallel with the overall westerly to northwesterly trend of the belt.

Massive granite of plutonic aspect from two localities was analyzed by the U-Pb zircon method (Trettin and Parrish, 1987). Three collinear analyses defined an upper intercept age of 1037 +25/-20 Ma but cenocrystic zircon was detected in one sample, and there was some evidence for recent Pb loss; the real uncertainty limits therefore are wider.

## OUTLIERS OF MITCHELL POINT BELT

Uplifted fault blocks or slices of granitic gneiss occur northeast of lower Ayles Fiord within map-unit scq. They are aligned with the Mitchell Point Belt and suggest that the latter underlies this area at depth. Four exposures are shown on the map but others are present.

Gneiss in the vicinity of the unnamed small bay on the northeastern coast of Ayles Fiord is a "leucocratic rock of quartz monzonitic composition, in places augen textured and well foliated. The augen consist of perthitic microcline, which continued to grow after the groundmass minerals were formed" (Frisch, 1974, p. 30-32). The groundmass consists of plagioclase ($An_{28-30}$), microcline, biotite, muscovite, minor epidote and green hornblende, and abundant quartz.

The metamorphism of the Mitchell Point Belt is probably of the same age as that of the Cape Columbia and Deuchars Glacier belts although Rb-Sr determinations indicated a somewhat younger age of 726 ± 12 Ma (recalculated from Sinha and Frisch, 1975).

## PEARYA TERRANE, SUCCESSION II

Succession II occurs in six separate belts, three of which (the Mount Disraeli, Disraeli Glacier, and Empire belts) are exposed in the M'Clintock Inlet map-area. The stratigraphy of Succession II is very difficult to resolve because of the absence of fossils and the extremely complex structure. The facts that Succession II has a lower metamorphic grade and few granitic intrusions suggest that it is younger than the 1.0-1.1 Ga (Grenvillian) Orogeny, and hence separated from Succession I by an angular unconformity. However, the contacts between the two successions seem to be faulted everywhere and the base of Succession II has not been identified.

The only part of Succession II that is amenable to conventional stratigraphic treatment is the Milne Fiord assemblage, exposed in the northeastern part of the Yelverton Inlet map-area and adjacent northwestern parts of the M'Clintock Inlet map-area. This major unit, regarded as the precursor of a group, has three divisions that are precursors of formations; introduction of formal names is deferred until the stratigraphy of the entire succession is better known. The Milne Fiord assemblage has been assigned to the Late Cambrian - Early Ordovician on the basis of a U-Pb age determination on zircon from division 2. It probably contains the youngest known strata of Succession II.

The older parts of Succession II, presumably of Hadrynian-Cambrian age, have been mapped by lithology and have not yet been placed into stratigraphic units. In the M'Clintock Inlet map-area, the following conventions are used:

c= carbonate rocks (limestone, dolostone, marble)

p= pelite: slate, phyllite (p*= green and red)

q= quartzite

r= rudite (conglomerate)

s= schist

t= chert

v= volcanics

w= sandy mudrock, argillaceous sandstone (wacke)

x= conglomerate, argillaceous and sandy (diamictite)

The lithological conventions represent: (1) single stratigraphic units (e.g. map-unit r); (2) combinations of two or more stratigraphic units that have yet to be differentiated (e.g. map-unit pxqc); or (3) recurrent rock types that constitute more than one stratigraphic unit (e.g. map-unit c).

Of special importance are the diamictites (x) and commonly associated sandy mudrocks argillaceous sandstones (w, for wacke) which have unique, diagnostic features suggestive of a glacial origin (Trettin and Frisch, 1987). They permit tentative correlation of parts of the Cape Alfred Ernest, Kulutingwak, Empire, Disraeli Glacier, and Mount Disraeli belts with each other and probably also with upper Hadrynian (lower Vendian or Varangian) diamictites in other regions, especially Svalbard (cf. Hambrey, 1983; Hambrey et al., 1981).

The stratigraphic order within the pre-Milne Fiord succession is poorly known but provisional stratigraphic sequences have been established locally.

It is difficult to portray on the map the present state of knowledge in a conventional manner. The approach chosen here was dictated by the following objectives: (1) to convey the basic lithologic information; (2) to use a simple colour scheme that is applicable to other map-areas in northern Ellesmere Island; (3) to indicate tentative age assignments; and (4) to economize letter symbols because of space limitations.

The **lithologic letter symbols** (listed above) provide the basic information, but only relatively abundant rock types are indicated. Rare but significant rock types, not included in the generalized symbol, are shown in brackets at the localities where they were encountered.

Many different **colour schemes** are possible. It is here suggested to use a small number of colours that indicate the predominant or most significant rock type, regardless of age or tentative stratigraphic assignment (see boxes in legend).

**Tentative age assignments** are indicated by capital letters and numerals in brackets and given with question marks where specific interpretations are attempted. They are not part of the map-unit designations. The conventions established for the Yelverton Inlet map-area are listed in Table 1 but not all of these are used in the M'Clintock Inlet map-area.

**Provisional stratigraphic designations** are restricted to the Milne Fiord assemblage and shown in the conventional manner, e.g. $O_{M2}$ (division 2 of Milne Fiord assemblage).

## MOUNT DISRAELI BELT

The Mount Disraeli Belt, extending from the northeastern shore of Clements Markham Inlet to Cape Albert Edward, underlies only a small part of the northeastern extremity of the M'Clintock Inlet map-area. Three

| Ma | Okulitch, in press | | | This map | | adapted from Harland et al., 1982 | |
|---|---|---|---|---|---|---|---|
| 570 +40/−20 – 590 ± 10 | HADRYNIAN | NEO-HADRYNIAN | EDIACARAN | Hl 3 | Hl | EDIACARAN | VENDIAN |
| 590 ± 10 – 700 ± 50 | HADRYNIAN | NEO-HADRYNIAN | | Hl 2(3) | Hl | VARANGIAN(2) | RIPHEAN |
| 700 ± 50 – 1000 ± 50 | HADRYNIAN | PALEO-HADRYNIAN | | Hl 1 | Hl | | RIPHEAN |
| 1000 ± 50 – 1100 ± 10 | HELIKIAN | NEO-HELIKIAN | LATE | nH(1) | | | RIPHEAN |
| 1100 ± 10 – 1200 ± 30 | HELIKIAN | NEO-HELIKIAN | MIDDLE | | | | RIPHEAN |
| 1200 ± 30 – 1400 +30/−100 | HELIKIAN | NEO-HELIKIAN | EARLY | | | | RIPHEAN |

(1) Age of metamorphism and plutonism
(2) Two glacial episodes
(3) Diamictite assemblage (may include younger and/or older strata)



Table 1. Late Proterozoic time-stratigraphic terminology.

map-units are distinguished, the stratigraphic order of which is unknown.

**Map-unit s** extends from the west side of lower Markham Fiord to east of lower Disraeli Fiord and also occurs on Ward Hunt Island. Strata west of Markham Fiord were described by Frisch (1974 p. 23) as "greenish phyllitic schist, some of it garnetiferous, and phyllite with minor amounts of interstratified quartzite." A specimen collected by the writer from locality 80-204i consists mainly of quartz (84% in uncorrected XRD analysis) with small amounts of chlorite (6%), muscovite (6%), albite (6%), and K-feldspar (1%).

Schist and phyllite on Ward Hunt Island (Frisch, 1974, p. 23 f.), interlayered with less abundant amphibolite, are composed of biotite, muscovite, chlorite, epidote, sodic plagioclase ($An_{5-13}$), and quartz. Intensive cataclasis has converted some of these rocks to mylonites. The strata are intruded by syenite of unknown age in an interfingering fashion.

**Map-units c and cp** consist of marble, and interlayered marble and phyllite (or schist), respectively.

**Map-unit cpq** includes marble, phyllite, and quartzite with abundant, unmetamorphosed mafic dykes or sills of presumed Cretaceous age in the southern part. A typical specimen of quartzite from locality 80-204h is fine-grained, well-sorted, and contains rip-up clasts of medium dark grey mudrock. In addition to the predominant quartz, it contains perhaps 20% of feldspar, mainly plagioclase (plagioclase 8%, K-feldspar 2% according to an uncorrected XRD analysis), detrital volcanic material of siliceous composition, chert or microfelsite, and minor amounts of chlorite (5%).

All these strata are of unspecified Hadrynian and/or Cambrian age.

## DISRAELI GLACIER BELT

The Disraeli Glacier Belt is separated from the Empire Belt by a narrow fault block of the Clements Markham Fold Belt (Imina Formation). It extends from east of Disraeli Glacier to west of upper M'Clintock Glacier and also includes a small outlier at Thores River (map-unit pw).

### North of Thores River

Map-unit **pw** occurs north of Thores River where it is in faulted contact with the Zebra Cliffs Formation and bordered by glaciers on two sides. At locality 82-144c it consists of sandy mudrock and argillaceous sandstone occurring in flat beds up to 1 m thick. A typical specimen of mudrock contains unsorted very fine to medium grained quartz sand. An uncorrected XRD analysis indicates: quartz 69%, feldspar 12% (K-feldspar 4%, plagioclase 8%), dolomite 10%, chlorite 6%, and mica 3%. The rock is similar in texture and composition to wacke in diamictite-bearing units of the Empire and Cape Alfred Ernest belts and is tentatively assigned to the Varangian (early Vendian).

### Vicinity of Disraeli Glacier

**Map-unit r** is a ridge-forming conglomerate east of lower Disraeli Glacier. At locality 77-307b it consists of calcareous pebble and cobble conglomerate with phenoclasts up to 20 cm in diameter. The phenoclasts in two specimens of pebble conglomerate consist mainly of lime mudstone, in part sandy and silty, and to a lesser extent of quartzite, calcareous and sandy mudrock, and vein quartz. In one specimen the phenoclasts are closely packed and commonly bounded by solution surfaces; in the other specimen, they are embedded in a sandy matrix of quartz, chert, carbonate grains, and feldspar. The unit is flanked by argillaceous sandstone (wacke) on the north and by calcareous-dolomitic mudrock on the south but the contact relationships have not yet been established. The thickness of the unit has not been determined because of complex folding and faulting.

**Map-unit pqwv**, underlying a relatively large area in the vicinity of lower Disraeli Glacier, is known only fom a few landings east of the glacier. Analyzed samples (XRD analyses in Appendix 3) represent the following types of metasedimentary rocks:

- quartzite, very fine to very coarse grained, pebbly (App. 3, Table 1Aa)
- quartzose metasiltstone (App. 3, Table 1B, # 8, 9)
- slate, phyllite (App. 3, Table 1B, # 1-3)
- calcarous and dolomitic slate or phyllite with 30-50% carbonates (App. 3, Table 1B, # 4 - 6)
- argillaceous sandstone (wacke); poorly sorted but rounded quartz and minor feldspar are embedded in an argillaceous matrix of chlorite and muscovite with or without carbonate (App. 3, Table 1B, # 7)

Clearly identifiable volcanic rocks were encountered at one locality only (77-308b) where they consisted of sand-grade crystal tuff composed of sodic plagioclase, quartz, mica, and chlorite (App. 3, Table 1Ab). However some argillaceous rocks with relatively high chlorite content may also be partly of tuffaceous origin.

The unit is tentatively assigned to the Varangian because of the similarity of the argillaceous sandstones to sandstones elsewhere that are associated with diamictite.

**Map-unit c** flanks pqwv on the south but the contact is concealed by overburden. The unit consists of medium to dark grey dolostone and is estimated to be no less than 300 m thick. Some samples are entirely microcrystalline, others microcrystalline and phanerocrystalline; one shows a relict breccia texture. The rocks are replaced by quartz and chert to a minor extent. No microfossils were obtained from several large samples dissolved in formic acid. The close spatial association with map-units pqwv and p suggests a Hadrynian age.

**Map-unit p** overlies c in a structural sense but stratigraphic tops have not been determined. On the south it is in faulted contact with the Imina Formation of the Clements Markham Fold Belt. On the west side of Disraeli Glacier it has an apparent thickness of 60 - 100 m. The unit consists mainly of medium to dark grey mudrock that is variably calcareous and dolomitic (App. 3, Table 1B, #10 - 12). A specimen from the west side of Disraeli Glacier (near locality 77-315b) contains sand to pebble-grade clasts of chert, siliceous volcanics, carbonate sediments, and mudrock in an argillaceous matrix. This rock is similar in composition and texture to diamictites from the Mount Disraeli Belt in the Clements Markham Inlet map-area, suggesting that the unit is Varangian in age.

### East of upper M'Clintock Glacier

**Map-units p and c** both probably extend to the east side of upper M'Clintock Glacier although the exposures at Disraeli and M'Clintock glaciers are separated by ice. At M'Clintock Glacier, map-unit c is in inferred faulted contact with **map-unit q**, a cliff-forming quartzite, composed of well-rounded and well-sorted quartz at locality 77-236b. This unit is of uncertain Hadrynian or Cambrian age.

## EMPIRE BELT

The Empire Belt underlies central and northwestern parts of the M'Clintock Inlet map-area, and eastern parts of the Yelverton Inlet map-area. Structural trends are semicircular in southwesterly to northeasterly directions in the M'Clintock Glacier - Milne Glacier - Ayles Fiord region; in the northeasternmost part of the map-area they swing back into northerly directions.

### Upper M'Clintock Glacier

**Map-unit qpcv** is exposed on the west side of upper M'Clintock Glacier where it is in faulted contact with the Clements Markham Fold Belt (Imina Formation) on the south and upper Paleozoic strata on the north. Samples from three localities indicate that the unit consists of quartzite, dolostone, slate, and minor amounts of volcanic rocks.

The quartzite ranges in grain size from very fine to medium. The silicate fraction consists mostly of rounded quartz with no more than a few percent each of feldspar, muscovite, and chlorite (App. 3, Table 2Aa). Thin section study, however, suggests that the rock originally contained a larger proportion of feldspar, which has been replaced by muscovite and quartz. Some samples contain up to 23% (uncorrected XRD analysis) of dolomite (App. 3, Table 2Ab).

A specimen of dolostone contains a large proportion of medium to very coarse grained, rounded quartz and very small amounts of feldspar, muscovite, and calcite (App. 3, Table 2B, #4). Some quartz grains have micritic envelopes.

Some mudrocks are sandy and quartzose (App. 3, Table 2B, #3), others calcareous and dolomitic (#1, 2).

A single specimen of volcanic rock is interpreted as a rhyolitic crystal tuff of fine sand grade. It consists of sodic plagioclase, quartz, and small amounts of muscovite and chlorite with some secondary dolomite (App. 3, Table 2B, #5).

The unit is of uncertain Hadrynian and/or Cambrian age.

**Map-unit p**, forming a small fault block south of map-unit qpcv, consists of dark grey mudrock and (?) chert. It is uncertain whether this unit belongs to the Pearya Terrane (Empire Belt) or to the Clements Markham Fold Belt.

**Map-unit pc** is an extensive, ridge-forming unit exposed both east and west of M'Clintock Glacier. On air photographs it looks like a carbonate unit, but a typical sample from locality 77-235c is a laminated slate with only about 34% (uncorrected XRD determination) of combined calcite and dolomite (App. 3, Table 6, #9). More samples are required to determine the overall composition of the unit. This unit is also of uncertain Hadrynian or Cambrian age.

**Lower M'Clintock Glacier to east of Milne Fiord**

**Map-unit sc** comprises pelitic schist of amphibolite or greenschist grade, marble, and minor amounts of amphibolite (App. 3, Table 42B, #6 - 17).

The pelitic schists all contain abundant quartz and lesser amounts of feldspar, mainly plagioclase. Four out of ten specimens, characterized by hornblende, staurolite, or garnet (or combinations of these three minerals), represent the amphibolite facies. In addition, sillimanite was reported by Frisch (1974, p. 28) from upper M'Clintock

Inlet. The greenschist facies is represented by four specimens lacking these minerals and containing biotite with or without muscovite, chlorite, and epidote. Specimens lacking biotite and containing muscovite only probably have undergone retrograde metamorphism. In addition, some rocks contain graphite and pyrite, indicative of reducing depositional or diagenetic environments.

The marbles are both calcareous and dolomitic in composition, and some contain impurities of quartz, muscovite, etc.

Two specimens of amphibolite are composed mainly of hornblende and schist.

Muscovite from schist at locality 80-311a yielded a K-Ar age of 452 $\pm$ 8 Ma, interpreted as a cooling age related to the M'Clintock Orogeny. The unit is of uncertain Hadrynian and/or Cambrian age.

## M'Clintock Inlet to South of Ayles Fiord

**Map-unit s**, located north of Ooblooyah Creek, is in faulted contact with the M'Clintock West body of the ultramafic-mafic Thores Suite and with the Ooblooyah Creek carbonate (map-unit c). It consists of pelitic schist composed mainly of varying proportions of chlorite and chloritoid with lesser amounts of muscovite, plagioclase and K-feldspar (App. 3, Table 2B, #18 - 19) and has an undulating or crenulated cleavage. The unit represents argillaceous sediments metamorphosed in the lower greenschist facies and is of uncertain Hadrynian or Cambrian age.

**Map-unit c** is a distinctive, ridge-forming unit of carbonate rocks and minor phyllite, informally referred to as the Ooblooyah Creek carbonate unit. South of upper Ayles Fiord it forms a large anticlinorium with two arms at right angles that trend north-south and east-west respectively and are the result of at least two major deformations with different stress orientations. The eastern arm extends to the area north of Ooblooyah Creek. Structurally complex carbonate outcrops west of the anticlinorium and north of Ayles Fiord, forming anticlines and thrust sheets within map-unit psvqc, probably represent the same unit.

The thickness of the unit has not yet been determined but probably is no less than a few hundred metres. Samples from two localities (App. 3, Table 2B, #20 - 26) consist mainly of dolostone with lesser proportions of calcareous marble and phyllite. The dolostone is light to dark grey or yellowish grey and contains impurities of quartz and calcite, with small amounts of K-feldspar or muscovite in some specimens. The crystal size of the dolomite ranges from very finely microcrystalline to coarsely crystalline. At least one specimen of phyllite (#26) with a relatively high plagioclase content (24%) may represent a siliceous tuff or tuffaceous sediment.

Structural relationships suggest that the Ooblooyah Creek carbonate unit occurs not far below the Milne Fiord assemblage, from which it is separated only by map-units pc and psvqc. Considering the great thickness of the Cambrian System in the Arctic Islands, the Cordillera, and other regions this may imply a Cambrian age.

**Map-unit pc** comprises recessive, relatively poorly exposed calcareous and dolomitic marble and related phyllite that locally overlie the Ooblooyah Creek carbonate unit (App. 3, Table 2B, #27). The strata are medium grey to medium dark grey, and at some localities weather yellow-brown owing to limonite derived from disseminated pyrite. This unit is also Hadrynian and /or Cambrian, perhaps Cambrian in age.

## Southeast of Milne Glacier

Map-units pwxqc, c, and pvc have been traced from the Yelverton Inlet map-area into the M'Clintock Inlet map-area and are discussed more fully in Trettin and Frisch, 1987.

**Map-unit pwxqc**, which is in faulted contact with the Deuchars Glacier Belt of Succession I, consists of phyllite, sandy phyllite, argillaceous sandstone (wacke), a few carbonate units, and minor amounts of diamictite and quartzite. The diamictite and quartzite appear to be glaciogenic and are tentatively assigned to the Varangian (lower Vendian).

**Map-unit c**, which overlies pwxqc, consists of ridge-forming carbonates (microcrystalline limestone or marble and dolostone) and minor interlaminated siltstone; it is tentatively assigned to the Ediacarian and/or Cambrian.

**Map-unit pcv**, which overlies c, consists of phyllite, locally with intercalated carbonates and volcanics. It is also assigned to the Ediacarian and/or Cambrian.

**Map-unit p** is exposed only in a small area southwest of upper Milne Glacier. The unit consists of greyish red and greenish grey mudrocks that are highly dolomitic and calcareous (App. 3, Table 2Ac) and relatively weakly metamorphosed. It is tentatively assigned to the Varangian because it lies adjacent to map-unit pwxqc and is overthrust by map-unit c.

## Milne Glacier to north of lower Ayles Fiord

### Unnamed older rocks

**Map-unit unit psvqc**, which underlies most of this area, consists mainly of phyllite and schist with smaller proportions of quartzite, metavolcanics and carbonates. In the area north of central Ayles Fiord, known from some foot traverses, two outcrop areas of volcanic rocks have been mapped separately as **map-unit v**. Map-unit psqvc seems to underlie division 1 of the Milne Fiord assemblage with a conformable stratigraphic contact and therefore is tentatively assigned to the Cambrian. It is intruded by abundant metamorphosed mafic dykes that are readily mappable from air photographs because they are more resistant to weathering.

Phyllite and schist (App. 3, Table 2B, #29 - 36) consist mainly of quartz, chlorite, and plagioclase (locally with chloritoid), all characteristic of the greenschist facies, but porphyroblasts of staurolite and garnet are developed at some localities. The protoliths probably were mainly argillaceous sediments, but strata with high chlorite contents (up to 35% in XRD analyses) may contain pyroclastic material.

Quartzite from north of Ayles Fiord is very fine grained and contains minor amounts of plagioclase, mica and chlorite in addition to the predominant quartz (App. 3, Table 2B, #42).

The volcanic rocks comprise volcanic conglomerate or tuff, chlorite-rich phyllite interpreted as tuff, and some metamorphosed volcanic flows (App. 3, Table 2B, #37 - 41). A chemically analyzed flow rock (Appendix 2, Table 1) is a subalkaline basalt according to the stable trace element classification of Winchester and Floyd (1977, Fig. 6) and represents either a within-plate tholeiite or an island arc basalt according to Meschede (1986, Fig. 1).

**Map-unit c** comprises carbonate bodies that are mappable from air photographs (App. 3, Table 2B, #44, 45). Their stratigraphic-structural relationships with map-unit psvqc are uncertain. Outcrops north and south of Ayles Fiord seem to represent an older unit, possibly the Ooblooyah Creek carbonate, that appears both in anticlinal structures and thrust sheets.

**Milne Fiord assemblage**

The Milne Fiord assemblage is an informal stratigraphic unit of group rank, divisible into three units of formational rank, referred to as divisions 1, 2, and 3.

**Division 1** has a minimum thickness of 150 - 200 m at an incomplete section north of Ayles Fiord (NAF) that is bounded by a fault at the top. There the division consists mainly of calcareous marble with small amounts of interstratified dolomitic marble. The strata are medium light grey and weather light grey or reddish. The calcareous marble is nearly pure but contains very small amounts (about 2% in uncorrected XRD analyses) of dolomite, quartz, feldspar and mica (App. 3, Table 2Ad). The calcite crystals are about 10 - 50 micrometres long and commonly twinned. The dolomitic marble is equally pure, containing only very small amounts of calcite. The dolomite is mainly finely and medium crystalline but ranges from microcrystalline to very coarsely crystalline. A flat lamination, due to vertical variations in the concentration of submicroscopic impurities, or to variations in crystal size, are visible in some specimens.

**Division 2** overlies division 1 with an abrupt but seemingly conformable contact. The unit is about 900 m thick according to a photogrammetric section east of Milne Glacier (Yelverton Inlet map-area).

This unit contrasts with division 1 by its recessive weathering profile and darker colour. It consists mainly of phyllite, a smaller proportion of intercalated volcanic rocks, and local carbonate rocks.

The phyllite is medium grey, medium dark grey, or greenish grey and shows a continuous or spaced cleavage. Argillaceous varieties consist of quartz (71%; mean of 8 uncorrected XRD analyses), feldspar 10% (mainly albite with minor amounts of K-feldspar), mica 10% (mainly muscovite), and calcite and dolomite combined 1% (App. 3, Table 2Ae). By contrast, six specimens of calcareous and dolomitic phyllite contain in the average about 20% carbonate but total carbonate content and calcite/dolomite ratio are very variable (App. 3, Table 10b).

Carbonates were encountered in a 68 m thick unit that is 127-195 m below the top of the division at a section southwest of Ayles Fiord (Trettin and Frisch, 1987). It consists mainly of argillaceous and sandy microcrystalline dolostone with lesser amounts of dolomitic lime mudstone (App. 3, Table 2Bc, # 46 - 48). The unit also includes pelitic phyllite and a bed of tuff.

The volcanics encountered all were pyroclastic and included siliceous rocks (including rhyolite) as well as chlorite-rich or plagioclase-rich phyllites that probably represent rocks of mafic or intermediate composition (App. 3, Table 2B, #49 - 53).

A rhyolite bed near the top of the division at the section east of Milne Glacier (Yelverton Inlet map-area) produced a U-Pb zircon age of 503.2 +7.8/-1.7 Ma (Trettin et al., 1987), either Tremadocian (Harland et al., 1982; Palmer, 1983; McKerrow et al., 1985) or Cambrian (Odin, 1985). Accordingly, divisions 1 and 2 are assigned to the Cambrian and/or Early Ordovician.

**Division 3,** consisting of probably more than 540 m of fine to medium grained quartzite, is exposed mainly in the Yelverton Inlet map-area. In the M'Clintock Inlet map-area it seems to be represented only by a thin fault slice of quartzite intercalated between divisions 1 and 2 in an area northeast of Ayles Fiord. This unit is assigned to the Early Ordovician.

## North of Ayles Fiord to Arctic Ocean

**Map-unit scq**, occuring northeast of lower Ayles Fiord and extending into the Yelverton Inlet map-area, consists of greenschist-grade schist, marble, and quartzite (App. 3, Table 2B, #54, 55). These strata probably represent a relatively old part of Succession II, presumably of pre-Varangian age, because they are associated with small fault blocks or slices of Neohelikian gneiss. A few of the gneiss occurrences have been mapped but others are present.

**Map-unit pwqc** extends from north of Ayles Fiord to the coast of the Arctic Ocean. It is in faulted contact with map-unit psvqc in the south, intruded by the Cape Richards Complex, and locally unconformably overlain by the Cape Discovery Formation. The unit consists of phyllite, sandy phyllite, argillaceous quartzite, quartzite, and impure carbonate rocks.

The phyllite is medium dark grey, or, less commonly, greenish grey, and in part laminated. It consists mainly of quartz, feldspar (mainly plagioclase), muscovite, and chlorite, with chloritoid or dolomite in some rocks (App. 3, Table 2B, #56 - 59). Sandy phyllite and argillaceous quartzite are characterized by rounded, very poorly sorted, very fine to very coarse grained quartz sand in an argillaceous matrix (#60 - 63). A specimen of quartzite is medium grained. The carbonate rocks are light grey or light greenish grey and some have a flat or undulating lamination. The samples collected represent argillaceous and dolomitic lime mudstone and dolostone (#64, 65).

This unit is tentatively assigned to the Varangian because of the similarity of the argillaceous quartzites to quartzites associated with diamictite in other areas.

## SUMMARY OF TENTATIVE STRATIGRAPHY

Only in the western part of the Empire Belt has a tentative stratigraphic order been established, which may be summarized as follows:

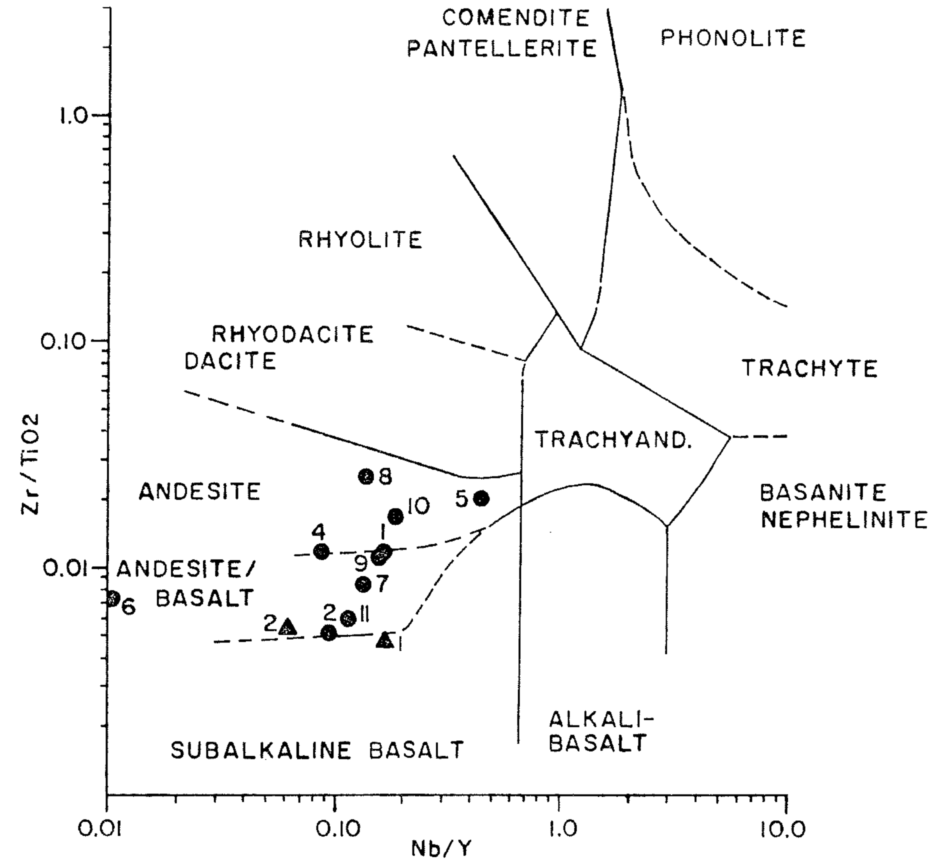



**Figure 5.** Maskell Inlet assemblage volcanics: stable trace element ratios; classification from Winchester and Floyd, 1977, Fig. 6; circles indicate analyses from western outcrop area, triangles analyses from east of M'Clintock East body.

Milne Fiord assemblage

- Division 3 (Lower Ordovician):
  quartzite, minor mudrock (540 m)

- Division 2 (Upper Cambrian? - Tremadocian):
  mudrock, minor carbonates, volcanics (ca. 900 m)

- Division 1 (Upper Cambrian ?)
  limestone, dolostone, marble (150 - 200 m +)

--- conformable contact ? ---

- map-unit psvqc:
  phyllite, schist, metavolcanics, including subalkaline basalt, minor quartzite, carbonates

--- contact not exposed ---

- map-unit pc:
  phyllite, carbonates

--- contact not exposed ---

- map-unit c (Ooblooyah Creek carbonates)
  marble, dolostone, minor phyllite, tuff

--- not in contact, gap (?) ---

- Map-unit pvc southwest of Milne Glacier:
  phyllite, slate, minor volcanics, carbonates

--- conformable contact ? ---

- map-unit c southwest of Milne Glacier:
  ridge-forming limestone, dolostone, marble (400 - 600 m ?)

--- conformable contact ? ---

- map-unit pwxqc (Varangian = lower Neohadrynian ?)
  phyllite, argillaceous quartz sandstone (wacke), minor diamictite, quartzite, carbonates, rare volcanics

## PEARYA TERRANE, SUCCESSION III (MASKELL INLET ASSEMBLAGE)

### Distribution and contact relationships

Succession III is identical with the Maskell Inlet assemblage, an informal unit of group rank comprising sedimentary and volcanic rocks of varying metamorphic grade that differ markedly from those of Succession II. The unit is overlain with angular unconformity by the Cape Discovery Formation (Succession IV; Blackriveran = early Caradoc); its base is not exposed. The thickness and internal stratigraphy of the assemblage have not been established because of intense and very complex deformation and the lack of fossils. The main outcrop area of the unit, considered as the type area, extends from Bromley Island southward to upper Ayles Fiord and thence easterly to the M'Clintock West body of the ultramafic-mafic Thores Suite (see Pearya Terrane, plutonic rocks). Two smaller outcrop areas are associated with the M'Clintock East and Thores River bodies of the same suite. The combined outcrop areas of Maskell Inlet assemblage and Thores Suite (except for the Ootah Bay body) constitute the Bromley Island Belt.

### Lithology

#### Western outcrop area

**The sedimentary rocks** consist mainly of limestone, chert, and mudrock with smaller proportions of tuffaceous mudrock, sandstone, and dolostone. The strata either have a slaty cleavage or a schistosity, the latter commonly crenulated.

The limestones, mainly impure lime mudstone with some calcisiltite and calcarenite, are medium light grey to medium dark grey and rarely reddish or purplish in colour. A few specimens show flat lamination and one shows graded bedding. In the coarse grained calcisiltites and in the calcarenites, aggregates of lime mud have recrystallized to single crystals, but their original polycrystalline texture is apparent under cross-polarized light. The dolomite fraction does not exceed 5% in uncorrected XRD determinations (Appendix 3, Table 3Aa). Siliciclastic impurities are mainly of mud grade and only to a minor extent of silt grade. This material makes up 20-48% of limestone samples from the vicinity of Oakley River according to uncorrected XRD analyses. It consists mainly of quartz (average 19%) with lesser proportions of albite (9%) and chlorite (3%), and very small amounts of muscovite and K-feldspar.

The chert varies in tone from light to dark grey and is commonly medium dark grey. Some strata show a thin flat lamination caused by vertical variations in the concentration of carbonaceous and argillaceous impurities. Skeletal fragments, if present at all, are poorly preserved. One out of seven thin sections shows possible radiolarian tests, and another possible sponge remains.

The mudrock is medium to dark grey and slaty or phyllitic. A typical specimen contains about 80% quartz, 9% chlorite, 5% mica, and 5% feldspar, mainly albite according to an uncorrected XRD determination (App. 3, Table 3B, #5). Rocks with a markedly higher feldspar and chlorite content probably are partly or wholly of pyroclastic origin.

Sandstone appears to be relatively rare. Two specimens collected are very fine and fine grained, respectively, and composed of carbonate crystals, and volcanogenic (?) quartz and feldspar, largely albite (App. 3, Table 3B, #4).

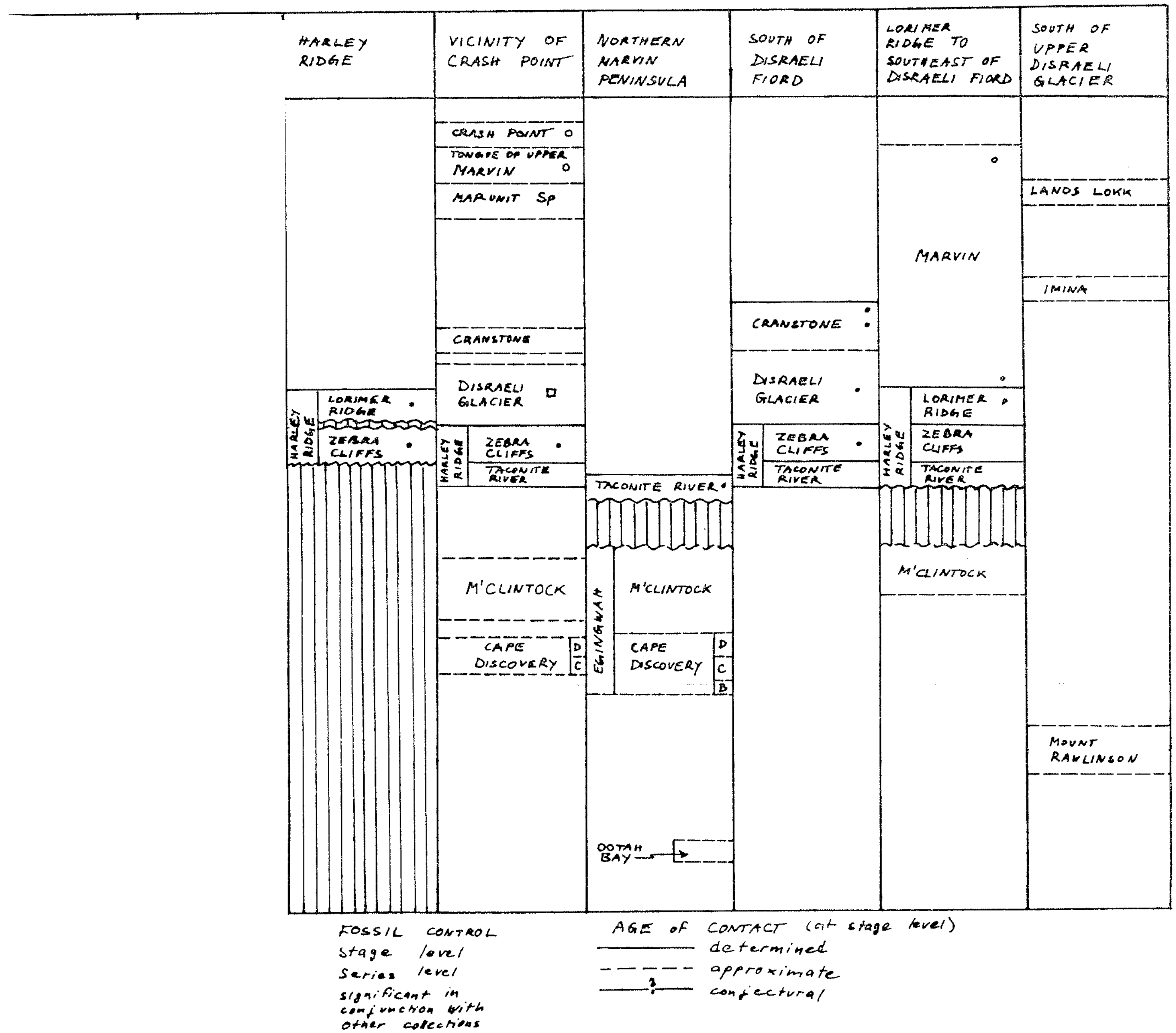
The **volcanic rocks** , mainly tuffs with a relatively small proportion of flows, are greenish grey, dark greenish grey, or dusky red. Eleven samples have been analyzed chemically (Appendix 2, Table 2a) and named on the basis of the stable trace element classification of Winchester and Floyd, 1977 (Fig. 5). All lie in the fields of andesite and undifferentiated andesite/basalt. In addition there are siliceous tuffs or tuffaceous sediments that have not been analyzed chemically because of their alteration state.

Most rocks have been metamorphosed either in the subgreenschist facies or in the greenschist facies and are similar in composition and appearance. The subgreenschist facies is characterized by albite, chlorite and partial preservation of clinopyroxene; prehnite has been observed in one sample only. The greenschist facies is characterized by albite and chlorite with or without actinolite and epidote (Appendix 3, Table 3B, #6, 7). In addition both facies commonly contain quartz and K-feldspar, and secondary calcite and dolomite, present as veinlets or replacement.

The amphibolite facies was encountered only on a nunatak immediately west of the M'Clintock West body. A sample from this locality is composed of andesine (44% according to an uncorrected XRD determination), quartz (23%), hornblende (22%), chlorite (9%), and red-brown biotite (1%). The rock is classified as andesite on the basis of stable trace elements (Fig. 5, # 10),

**Rocks associated with M'Clintock East body**

These outcrops of the Maskell Inlet assemblage occur in an east-west trending belt, about 7 km long and up to 2 km wide, that includes some nunataks. They consist mainly of volcanic rocks with small



HARLEY RIDGE
VICINITY OF CRASH POINT
NORTHERN MARVIN PENINSULA
SOUTH OF DISRAELI FIORD
LORIMER RIDGE TO SOUTHEAST OF DISRAELI FIORD
SOUTH OF UPPER DISRAELI GLACIER
CRASH POINT
TONGUE OF UPPER MARVIN
MARUNIT Sp
CRANSTONE
DISRAELI GLACIER
LORIMER RIDGE
ZEBRA CLIFFS
TACONITE RIVER
HARLEY RIDGE
M'CLINTOCK
CAPE DISCOVERY
D
C
B
EGINGWAH
OOTAH BAY
MARVIN
LANDS LOKK
IMINA
MOUNT RAWLINSON
FOSSIL CONTROL
stage level
Series level
significant in conjunction with other collections
AGE of CONTACT (at stage level)
determined
approximate
conjectural


ian rocks.

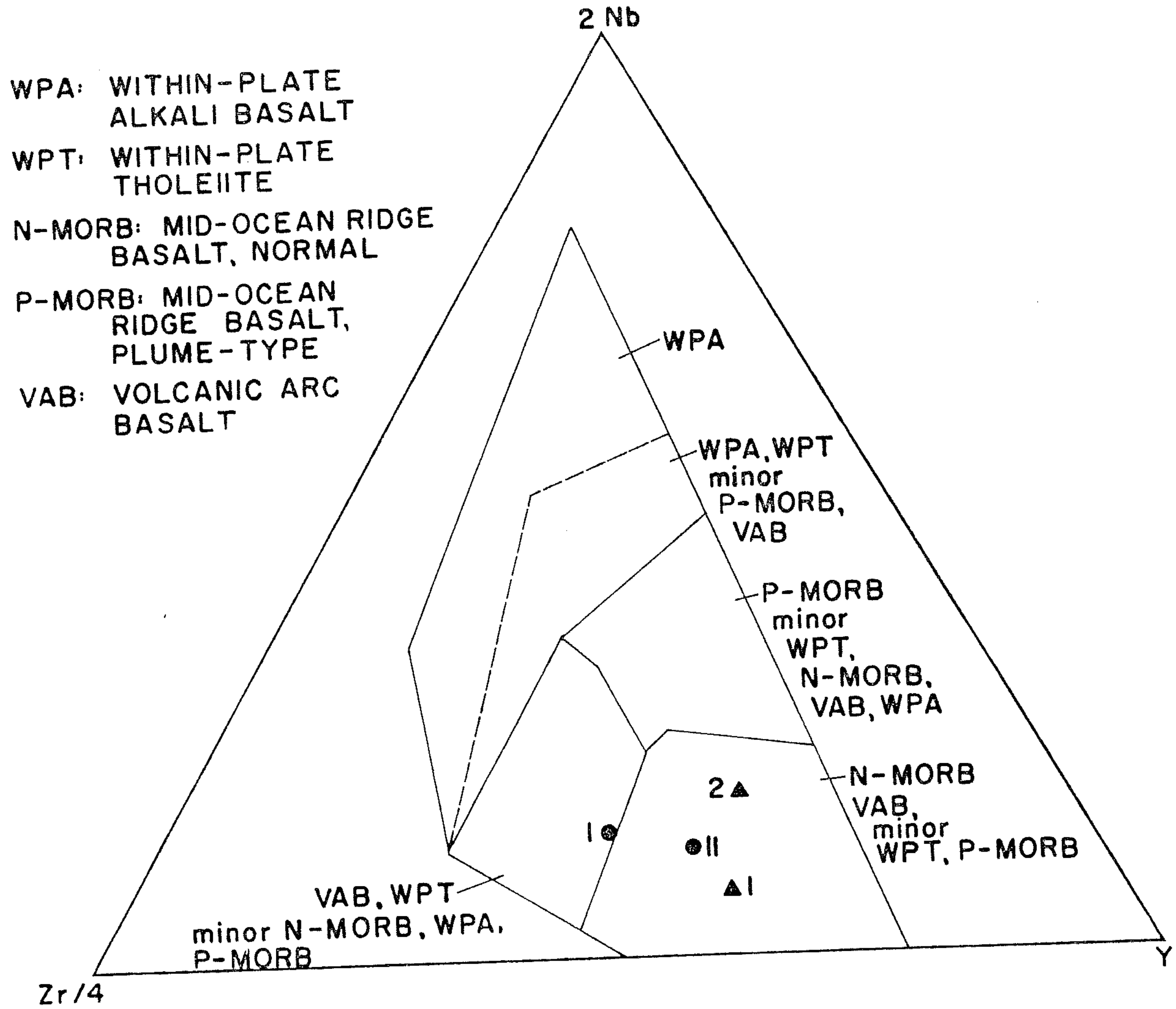



**Figure 6.** Maskell Inlet assemblage: stable trace element ratios of basaltic rocks; tectonic environments from Meschede, 1986, Fig. 1; circles indicate analyses from western outcrop area, triangles analyses from east of M'Clintock East body.

proportions of schist and marble.

Altered but incompletely metamorphosed volcanics form a nunatak at the east end of the belt (77-237a). Two specimens of flow rock are classified as andesite/basalt and subalkaline basalt, respectively, on the basis of their stable trace elements, and as calc-alkaline (high Al) basalt on the basis of major elements (App. 2, Table 2b). One (#1) consists of albite, chlorite, epidote, and opaque material; the other (# 2) of K-feldspar, albite, chlorite, epidote, actinolite and remnants of clinopyroxene.

A fault slice south of the M'Clintock East body consists of felsic tuff, schist, and minor impure marble -- the latter also occurring as a fault slice within the M'Clintock East body. The tuff (App. 3, Table 3Ab) is composed mainly of quartz (mean of uncorrected XRD determinations = 49%) and feldspar (albite 36%, K-feldspar 3.5%) with lesser amounts of chlorite (10%) and mica (3%)

The schist is medium grey and laminated and composed of variable proportions of quartz and feldspar (mainly plagioclase) with smaller amounts of biotite and chlorite (Ap. 3, Table 3B, #10, 11). In addition, very small amounts of garnet are present in one specimen. The crystals are about 0.2 mm in diameter, contain inclusions of quartz, and have been rotated. At least one of the specimens is thought to be of volcanic (pyroclastic) origin because it contains a large percentage of feldspar.

In addition to very finely crystalline to medium crystalline calcite, the marble includes impurities of plagioclase, K-feldspar, tremolite, diopside, epidote, and quartz.

## Rocks associated with Thores River body

A fault slice of schist occurs between the Thores River body and the Zebra Cliffs Formation at locality 80-312d. A sample consists of quartz (58% according to an uncorrected XRD analysis), albite (23%), K-feldspar (2%), chlorite (15%), and very small amounts of muscovite and chlorite (2% combined, including sericite) (Appendix 3, Table 3B, #12). The S-planes, defined mainly by the chlorite, are crenulated. Mineral composition and texture suggest a tuff or tuffaceous sandstone, metamorphosed in the greenschist facies.

### Mode of origin

The volcanic rocks probably represent mainly volcanic arc settings. This is inferred from the predominance of pyroclastic rocks over flows, and from the large proportion of andesite. The stable trace element ratios are compatible with that inference but do not permit distinction from (normal) mid-ocean ridge settings (Fig. 6).

The depositional environment of the sedimentary rocks is poorly known, but the dark grey, flat-laminated chert and associated mudrock, and the graded calcarenite are suggestive of deep-water settings.

### Age

The Maskell Inlet assemblage has not yielded diagnostic fossils and an attempt at zircon dating was unsuccessful. It can only be stated that the unit probably is older than Blackriveran (early Caradoc), the age of the unconformably overlying Cape Discovery Formation. It is speculated that the unit is younger than Succession II, and probably also somewhat younger than the closely associated Thores Suite, which has an Arenig U-

Pb (zircon) age (see Pearya Terrane, plutonic rocks).

## SUCCESSION IV: CHALLENGER MOUNTAINS SUPERGROUP

Succession IV is identical with the Challenger Mountains Supergroup, which comprises the upper Middle Ordovician (Blackriveran) to Upper Silurian sedimentary and volcanic strata of the Pearya Terrane. These strata have been assigned to the Egingwah and Harley Ridge groups; an uppermost Ordovician-Silurian deep-water succession comprising the Disraeli Glacier beds and Cranstone Formation; and an uppermost Ordovician-Silurian shelf succession comprising map-unit Sp, the Marvin Formation, and the Crash Point beds.

### EGINGWAH GROUP

The Egingwah Group (Trettin, 1987b), comprising the Cape Discovery, M'Clintock, and Ayles formations, consists of sedimentary and volcanic rocks of Blackriveran to early Ashgill age. It lies on successions II and III with a high angular unconformity and is truncated at the top by a regional unconformity overlain by the Harley Ridge Group.

#### Cape Discovery Formation

The Cape Discovery Formation (Trettin, 1969b) is a succession of clastic and carbonate strata with minor amounts of volcanics, assigned to four informal members (A to D). The type section for the lower and middle part of the formation is at the unnamed cape north of Bethel Peak (NBP) and that for the upper part on the west side of M'Clintock Inlet, north of Egingwah Bay (NEGB).

##### Distribution, thickness, and contact relationships

The formation occurs in scattered, mostly small outcrop areas west of lower and central M'Clintock Inlet and in the northern half of Marvin

Peninsula. Its total thickness is in the order of 1 km. The base of the formation is an angular unconformity, underlain by different units of the Empire and Bromley Island belts. The Cape Discovery Formation is overlain with abrupt but seemingly conformable contact by the M'Clintock Formation.

**Thickness and lithology, member A**

The thickness of this member, outcrops of which are are restricted to northwestern parts of the map-area, ranges from a few metres and less on western Bromley Island through 44 m on northeastern Bromley Island (section NEB) to 144 m north of Bethel Peak (section NBP). The thickness may be considerably greater east of southern Taconite River but has not been established there because of complex folding and faulting.

The member is divisible into three major units typically developed at section NBP. The **lower unit** consists of conglomerate, about 44 m thick and rather massive at section NBP. Of boulder grade at the base with phenoclasts up to 90 cm in diameter, it fines upwards to pebble conglomerate. Boulder conglomerate is also present in an outcrop belt east of Taconite River, for example at locality 65-H, but on Bromley Island the phenoclasts do not exceed pebble grade.

Overall, the phenoclasts consist mainly of chert and siliceous volcanics, evidently derived from the Maskell Inlet assemblage, and of phyllite derived from Succession II and perhaps also from the Maskell Inlet assemblage. The phenoclasts in the basal conglomerate north of Bethel Peak are similar to phyllite in the unconformably underlying map-unit pwqc. A boulder of highly altered gabbro or ultramafic rock observed at section NBP, and chromite extracted from sandstone north of

Ayles Fiord may have been derived from the Thores Suite.

The **middle unit** consists mainly of mudrock and sandstone with smaller amounts of pebble conglomerate. At section NBP, the lower 18 m, which are dolomitic, show flat bedding, some graded bedding, and some medium-scale cross-bedding. The overlying 70 m are poorly bedded, calcareous and dolomitic, and contain a variety of fossils, including brachiopods, trilobites, corals, bryozoans, and blue-green algae. A similar fauna occurs at two localities on Bromley Island. The phenoclasts of these conglomerates consist mainly of chert (Ap. 3, Table 4a). The sandy matrix of the conglomerates, and the sandstones are composed of variable proportions of chert, quartz, siliceous volcanic rock fragments, feldspar (mainly sodic plagioclase), chlorite, and carbonates (Ap. 3, Table 4b). Analyzed specimens of mudrock are composed mainly of quartz and carbonates with smaller proportions of feldspar (mainly sodic plagioclase), chlorite, and mica (Ap. 3, Table 4c).

The **upper unit,** composed of volcanic rocks, occurs at a few localities only and is absent, for example, on Bromley Island. At section NBP it is 12 m thick and consists of leucocratic tuff that shows some medium-scale cross-bedding. Trace element analyses of four samples from two different localities (Fig. 7) show a range of felsic to mafic compositions (Ap. 2, Table 3a). Two specimens are alkaline (# 1 and # 3) and one is on the boundary between alkaline and normal rocks (# 4).

**Thickness and lithology, member B**

No complete section of member B is known. Minimum thicknesses are 52 m at section NBP (top missing) and 107 m at section NEGB (base missing). The member consists of limestone and dolostone and very small

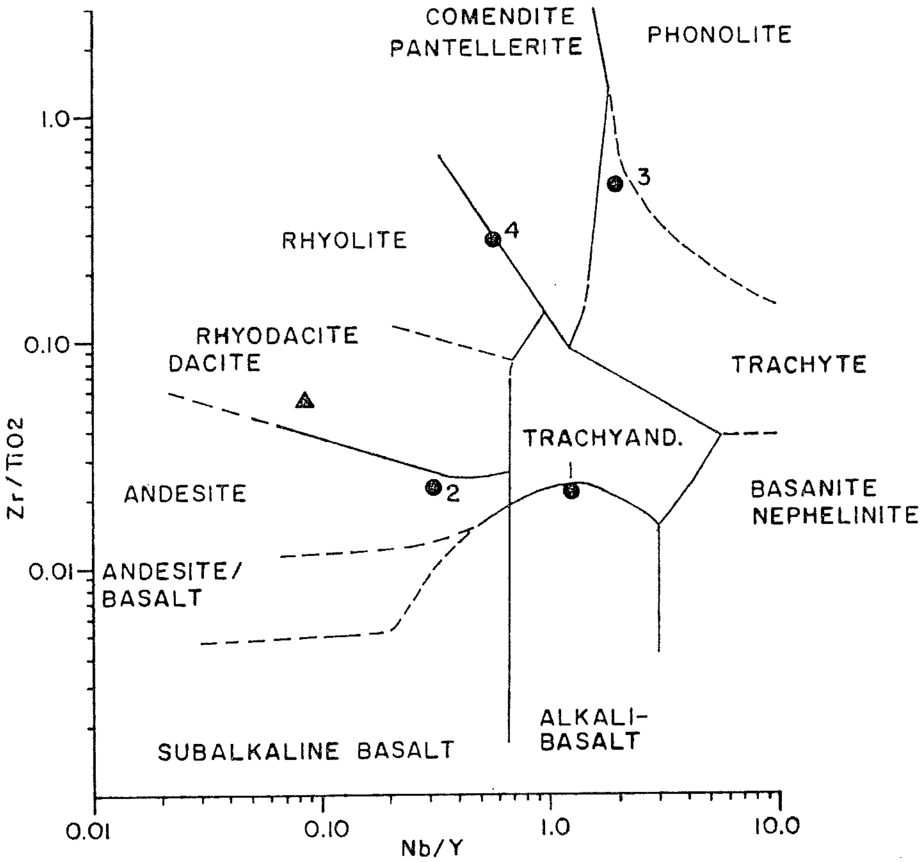



**Figure 7.** Cape Discovery Formation volcanics: stable trace element ratios; classification from Winchester and Floyd, 1976, Fig. 6; circles indicate analyses from member A, triangle analysis from member D.

amounts of calcareous sandstone. Two lithofacies are distinguished.

The **western lithofacies** is characterized by fossiliferous limestone but also includes unfossiliferous limestone and dolostone and minor amounts of calcareous sandstone.

At section NBP it consists of highly argillaceous and dolomitic skeletal lime wackestone. Two representative samples consist of calcite (mean of uncorrected XRD determinations = 53%), dolomite (22%), and quartz (20%) with small amounts of feldspar (4%) and mica (1%). The skeletal fragments were derived from brachiopods, trilobites, gastropods, and algae, including **Girvanella**.

Pelletal packstone with a rich skeletal content is represented by a sample from 77-304b. The skeletal fragments were derived from ostracodes, gastropods, echinoderms, and blue-green algae. The rock is relatively pure, containing only 12% quartz and 4% dolomite (uncorrected XRD determination).

A specimen of oncolitic grainstone, containing **Girvanella**, was collected from the vicinity of Oakley River (loc. 77-304d).

The **eastern facies** is best exposed at section NEGB. There the lower part of the member consists mainly of dolostone and the upper part of unfossiliferous lime mudstone, both with thinly interstratified mudrock. The dolostone is slightly argillaceous and calcareous, finely microcrystalline, and has a thin flat lamination caused by vertical variations in the concentration of lime mud and submicroscopic carbonaceous impurities. The dolostone beds are about 1 - 15 cm thick and separated by argillaceous layers. Some lime mudstones also are laminated. Greenish weathering, calcareous mudrock, interlaminated with the limestone, shows some graded bedding.

**Thickness and lithology, member C**

Member C is 307 m thick at section NEB and uniform in lithology. It consists mainly of pale red to greyish red limestone with siliciclastic impurities of mud to very fine sand grade and also contains small proportions of interlaminated mudrock and sandstone that are similar in colour and composition. The limestone, mudrock and sandstone commonly form intraformational conglomerates with bedding-parallel or moderately to steeply inclined flat pebbles that frequently are in solution contact with each other. Most limestones are lime mudstones but pelletal packstones are also present. Six typical samples of limestone and flat-pebble conglomerate (in some instances with minor amounts of interlaminated mudrock) contain on the average: calcite 73% (uncorrected XRD determination), quartz 23%, feldspar 3% (mainly sodic plagioclase), and trace amounts of mica, chlorite, and dolomite (Appendix 3, Table 4d).

**Thickness and lithology, member D**

Member D, about 468 m thick at section NEB, consists mainly of clastic sediments with small amounts of dolostone and volcanic rocks.

The clastic sediments range from mudrock to fine pebble conglomerate but are mainly of sand grade. Most strata are pale red to greyish red and a minority are medium grey. The stratification is not obvious because the unit is represented mostly by talus or bedrock weathered in place but flat and undulating lamination appear to be common. The sandstones are very fine to very coarse, commonly fine grained. Point count analyses indicate that they are composed mostly of siliceous volcanic rocks fragments (37%) and feldspar (36%; mainly albite, minor K-feldspar according to uncorrected XRD determinations) with smaller amounts of quartz (17%), carbonates (4%), opaques and (?) chert, the latter difficult to distinguished from microfelsite (Ap. 3, tables 4e and 4f). At least part of the quartz is of volcanic origin, judging from the shape of the grains (subhedral with rounded corners; some embayments) and their clarity. Grains generally are subangular to rounded and commonly subrounded to rounded. Most sandstones are well sorted. A typical mudrock consists of quartz 66%, dolomite 20%, feldspar 8% (plagioclase 7%, K-feldspar 1%), and chlorite 6% (uncorrected XRD analysis).

Dolostone is predominant in the lower 9 m of the member and also occurs in the overlying 90 m or so. The dolostone is medium light grey and finely crystalline to predominantly microcrystalline. It contains "floating" grains of silt and sand grade and also some quartz or chert replacement (mean 13% in uncorrected XRD determinations).

A red-weathering, porphyritic volcanic flow is associated with the dolostone in the lower 9 m of section NEGB. In thin section, phenocrysts of albite are seen to be embedded in a groundmass of albite, quartz, and K-feldspar with common opaque minerals. The rock is classified as rhyodacite/dacite on the basis of stable trace elements (Appendix 2, Table 3b; Fig. 7).

**Mode of origin**

The basal conglomerate of **member A** at section NBP is interpreted as a nonmarine, probably alluvial fan deposit because of its boulder grade and occurrence above an unconformity. The middle unit of this member, on the other hand, must be marine in origin because of its fossil content. The clastic sediments, as mentioned, were derived from the Maskell Inlet assemblage and the Empire Belt and to a minor extent probably also from the Thores Suite. An extensional tectonic regime is inferred from the partly alkaline composition of the volcanics.

The occurrence of a diverse and fairly abundant benthonic fauna in the western facies of **member** B suggests an oxygenated subtidal shelf environment of deposition. The eastern, dolomitic facies appears to have been unfavourable for this fauna, perhaps because of shallower water depth and/or higher salinity conditions. The flat-laminated, finely microcrystalline dolostone of that facies suggests evaporitic conditions.

The ubiquitous flat lamination and scarcity or absence of cross-lamination suggests a generally subtidal origin for **member C** but the absence of fossils and presence of flat-pebble conglomerate indicate relatively shallow water. The red colour of the sediments is due to oxidation of terrigenous impurities but it is not clear whether that process occurred in the source area or at the site of deposition.

**Member** D indicates another phase of clastic deposition but not enough is known about the primary structures of this unit to be certain of its depositional environment. However, the presence of dolostone shows that at least the lower part of the member is of shallow (?) marine origin. Petrographic studies show that the sediments were derived almost entirely from siliceous volcanics. Possible sources are volcanics of the Maskell Inlet assemblage or contemporaneous subaerial volcanoes. The absence of significant amounts of chert, schist or phyllite on the one hand, and the occurrence of at least one flow of dacite in member C support the second alternative.

## Age

Member A is dated as Blackriveran (early Caradoc) on the basis of **Gonioceras** sp. collected by R.L. Christie (1957, p. 14) from section NBP (GSC loc. 24 720).

Member B contained corals and conodonts of unspecified Blackriveran-Trentonian (early or middle Caradoc) age on the unnamed peninsula west of Bromley Island (GSC locs. 69206 and C-74987).

No fossils were found in members C and D but stratigraphic relationships with the overlying units suggest a Caradoc age.

## M'Clintock Formation

The name, M'Clintock Group, was introduced by Christie (1957, p. 12; 1964, p. 17) for an assemblage of predominantly volcanic rocks with intercalated subordinate sediments, best exposed on the coast of M'Clintock Inlet. The term group was used in a reconnaissance sense. As the M'Clintock Group could not be divided into mappable units, it was redefined as a formation by Trettin (1969b). The M'Clintock Formation comprises the volcanic and minor sedimentary rocks lying stratigraphically between Cape Discovery and Ayles or Taconite River formations. The type section is on the eastern limb of the Egingwah Creek Syncline. Only the uppermost part of the formation has been measured on the ground; the lower and middle parts have only been traversed.

## Distribution, thickness, and contact relationships

The formation is widely exposed in a belt extending from east of Bromley Island and Taconite River to west and south of Markham Fiord. At the type section the formation has an apparent thickness of 3 km but may be repeated by faulting; the minimum thickness is about 1.4 km.

The M'Clintock Formation overlies the Cape Discovery with an abrupt but probably conformable contact. The upper contact, with the Ayles Formation, is also abrupt and conformable. The contact with the Taconite River Formation on Marvin Peninsula and farther east is a low-angle unconformity.

**Lithology**

The M'Clintock Formation consists mainly of volcanic rocks with smaller amounts of mainly volcanogenic clastic sediments and rare limestone. Numerous dykes and sills are associated with these strata, many of which are probably cogenetic.

Chemical analyses of 17 samples of volcanic rocks are listed in Appendix 2, Table 4. Ten of these have been classified as follows on the basis of stable trace elements (Fig. 8):

- alkali basalt (1 flow)
- subalkaline basalt (1 flow breccia or lithic tuff)
- undifferentiated andesite/basalt (3 flows, 3 tuffs)
- andesite (1 tuff, 1 flow)

Major element analyses suggest that the remaining 7 samples represent the following rock types:

- calc-alkaline rhyolite (1 flow, 1 flow or intrusion)
- calc-alkaline dacite ( 1 tuff)
- calc-alkaline andesite (1 flow or intrusion)
- calc-alkaline rhyolite (1 flow, 1 flow or intrusion)
- calc-alkaline dacite (1 tuff)

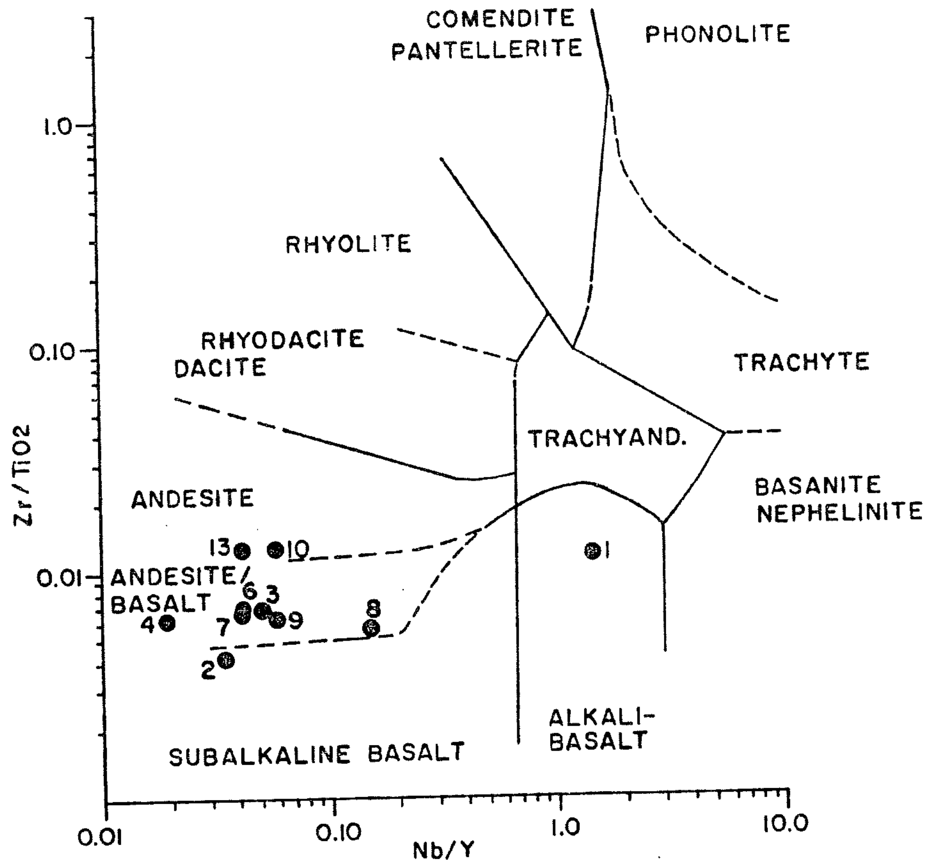



Figure 8. M'Clintock Formation volcanics: stable trace element ratios; classification from Winchester and Floyd, 1977, Fig. 6.

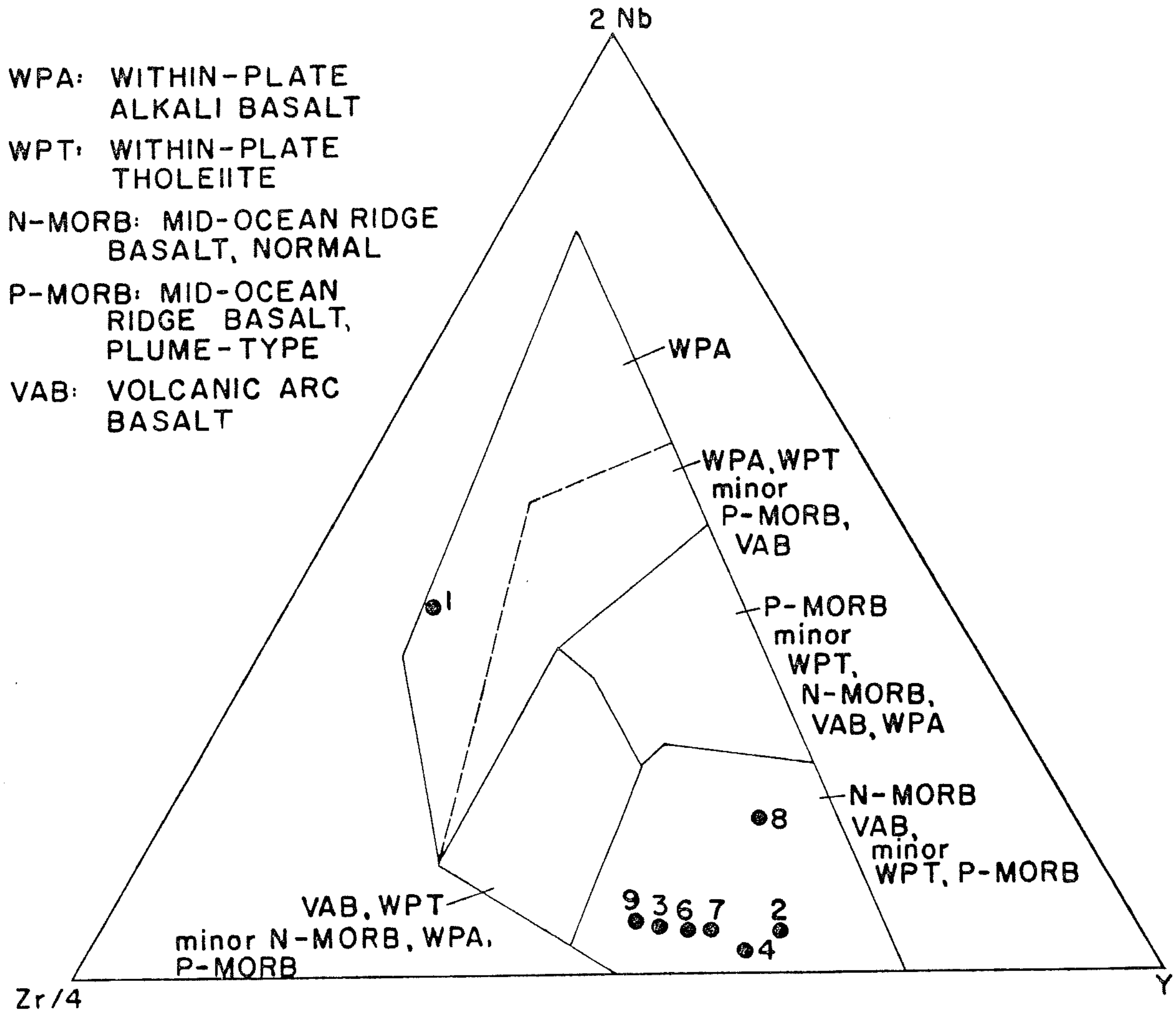



**Figure 9.** M'Clintock Formation: stable trace element ratios of basaltic rocks; tectonic environments from Meschede, 1986, fig. 1.

- calc-alkaline basalt (1 crystal tuff)
- alkali basalt (1 crystal tuff)

These identifications are less reliable because of the alteration state of the rocks. The plagioclase is universally altered to albite, and most mafic minerals are altered to chlorite but clinopyroxene is preserved in some rocks. Epidote is common in some rocks and carbonate veinlets or replacements are ubiquitous.

Tuffaceous sandstones and tuffs on south-central Marvin Peninsula (79-219d) and western Ferbrache Peninsula (80-227k) are similar in texture and composition. The following remarks are based on petrographic and chemical analyses of talus collected during brief landings; the stratigraphic setting and primary structures have not been recorded. The rocks contain particles of silt to pebble grade and are generally poorly sorted. They are composed mainly of quartz and feldspar (albite with small proportions of K-feldspar in some rocks) and relatively small amounts of volcanic rock fragments of siliceous composition. Much of the quartz appears to be of volcanic origin, but small amounts of quartzite and vein quartz (?) are present in a few samples. If these rocks are largely of pyroclastic origin and have not undergone significant contamination or compositional maturation, then they were derived from rhyolitic and dacitic sources.

Two beds of limestone, separated by about 77 m of volcanic rocks, occur at the top of the formation in the area north of Egingwah Creek. The three units combined were previously referred to as member B of the M'Clintock Formation (Trettin, 1969b) but this term is abandoned here because the facies seems to be restricted to a small area. The lower limestone is 4.9 m thick and consists of slightly silty and sandy lime mudstone with sparse favositid corals. Bedding is poor but a fine, wavy lamination is apparent in places. The upper limestone is a laminated, fine to coarse grained, tuffaceous calcarenite. In thin section the calcareous grains are seen to consist mostly of lime mud, but one contains poorly preserved skeletal fragments. The subordinate pyroclastic material consists of chloritized shards.

On northern Marvin Peninsula, outcrops of limestone associated with the M'Clintock Formation have been mapped separately. They appear to occur within the formation but their stratigraphic positions are unknown. The units are no more than a few tens of metres thick and samples from two localities (77-303c, 80-205c) consist of slightly dolomitic lime mudstone that is intensely veined and locally slightly recrystallized.

**Mode of origin**

The chemical classifications according to Winchester and Floyd (Fig. 8) indicate that the M'Clintock Formation represents a volcanic arc (abundant andesite associated with basalt and minor dacite and rhyolite) that has perhaps been affected by extension (alkali basalt). The Nb-Zr-Y ratios (Fig. 9) are compatible with this interpretation. A (normal) mid-ocean ridge environment, which also is permitted by this diagram, can be ruled out because of the stratigraphic setting of the unit. The albitization of the plagioclase and chloritization of most mafic silicates is attributed to hydrothermal alteration rather than to greenschist-grade metamorphism because of the sporadic preservation of clinopyroxene and general absence of schistosity.

## Age and correlation

A coral of Late Ordovician (Ashgill) age was found north of Egingwah Creek, some eighty metres below the top of the formation. These strata can hardly be younger than earliest Richmondian because, regionally, they are succeeded by a thick succession of Upper Ordovician strata (Ayles Formation, Harley Ridge Group, and lowermost Marvin Formation) that is older than Gamachian (see Marvin Formation). The base of the formation must be younger than Blackriveran, the age of member A of the Cape Discovery Formation.

# Ayles Formation

The Ayles Formation (Trettin, 1969b) is a prominent carbonate unit that lies stratigraphically between the M'Clintock and Taconite River formations. The type area comprises Mount Ayles and the Egingwah Creek Syncline; a type section has not yet been established because of the structural complexity of the unit.

## Distribution, thickness, and contact relationships

Outcrops appear to be restricted to the area west of lower and central M'Clintock Inlet, although two down-faulted blocks of dolostone east of Crash Point, tentatively assigned to the upper Paleozoic, may in fact represent the Ayles Formation. The absence of the formation in other areas east of M'Clintock Inlet is attributed to erosion at the unconformity that forms the base of the Harley Ridge Group.

The formation has a minimum thickness of about 240 m in a fault slice on the north slope of Mount Ayles. Photogrammetric determinations on the east flank of the Egingwah Creek Syncline indicate possible thicknesses of 600 or 1200 m, depending on the presence or absence of faults within the formation.

The contact with the M'Clintock Formation is covered but probably conformable because of the occurrence of carbonate rocks in the uppermost part of the M'Clintock Formation at Egingwah Creek. The upper contact, with the Taconite River Formation, is a low-angle (regional) unconformity.

**Lithology**

The Ayles Formation consists mainly of calcareous dolostone and dolomitic limestone. From a distance, medium light grey, very resistant sets of strata, more than a few metres thick, are seen to alternate with slightly darker, more recessive beds. Hand specimens of the dolomitic strata have yellowish grey weathering colours. Their stratification has mostly been obliterated by dolomitization and/or bioturbation. Where preserved, it varies from laminated to thin-bedded and commonly shows shallow undulations, a few centimetres to a few tens of centimetres in wave length.

The specimens of limestone examined in thin section consisted of microcrystalline calcite (lime mudstone or microsparite). The limestone is replaced to varying extent, and partly in a mottled fashion, by dolomite ranging in size grade from microcrystalline to medium crystalline. The difference in the darkness of the strata is due to differences in the concentration of submicroscopic carbonaceous (?) impurities. Siliciclastic impurities, mainly quartz and muscovite of silt and sand grade, are present only in small amounts both in the limestone and the dolostone. Macrofossils are rare.

## Mode of origin and age

The Ayles Formation was deposited in shelf environments of unknown water depth. Three fossil collections, combined with the fossils from the M'Clintock Formation, Harley Ridge Group, and Marvin Formation, indicate a Late Ordovician (Ashgill) age.

## HARLEY RIDGE GROUP

The Harley Ridge Group consists of Upper Ordovician clastic and carbonate sediments that overlie the Egingwah Group with a low-angle unconformity, and locally Succession II (Empire Belt) with a high-angle unconformity. Clastic sediments predominate in the lower and upper parts of the group (Taconite River and Lorimer Ridge formations), and carbonate sediments in the middle part (Zebra Cliffs Formation), but all three formations are of mixed composition. In some areas, the top of the group (Lorimer Ridge Formation) is overlain by Upper Ordovician and younger shelf carbonates (Marvin Formation); in others the middle part (Zebra Cliffs Formation) by Upper Ordovician deep-water sediments (Disraeli Glacier beds).

### Taconite River Formation

The Taconite River Formation (Trettin, 1969b) is a unit of clastic and subordinate carbonate sediments of Late Ordovician age that overlies a regional unconformity underlain by rocks of different ages. Its type section is on the east limb of the Egingwah Creek Syncline.

#### Distribution, thickness and contact relationships

Scattered outcrops of the formation extend from west and southwest of M'Clintock Inlet to southeast of Markham Fiord in the northwestern part of the Clements Markham Inlet map-area. To round off the overall picture of the unit, these exposures are included in the following description of the formation.

The formation appears to be thickest in the northeastern part of its distributional area, an incomplete section on a nunatak south of Markham Fiord (Clements Markham Inlet map-area) containing no less than 600 m of strata. At the type section at Egingwah Creek the unit has a minimum thickness of about 287 m and a probable thickness of 437 m (reinterpretation of 1965 field data). Photogrammetry indicates a thickness of about 180 m west of uppermost M'Clintock Inlet (WUMI). From that point, the formation wedges out in a southeasterly direction; it decreases to a few tens of metres or less on the west side of lower M'Clintock Glacier, and is absent on the east side of the glacier where the Zebra Cliffs Formation forms the base of Challenger Mountains Supergroup and Harley Ridge Group.

The base of the formation is a regional unconformity, underlain by the Ayles Formation west of central and lower M'Clintock Inlet; by schist and marble of Hadrynian and/or Cambrian age west of lowermost M'Clintock Inlet; and by the M'Clintock Formation in most of the remaining area.

**Lithology**

The Taconite River Formation consists mainly of interbedded sandstone and mudrock with lesser amounts of limestone, conglomerate, and intraformational conglomerate.

Sandstone and mudrock are coloured in hues of red, brown, green, and grey, red beds being most abundant on southern Marvin Peninsula.

The sandstones range in grain size from very fine to very coarse but are mostly very fine and fine grained. Primary structures are generally well preserved in spite of the fact that trace fossils are present in the formation and that bioturbation is common in the specimens collected. Flat lamination or undulating lamination and small-scale cross-lamination are the characteristic primary structures.

The means of uncorrected XRD analyses of three groups of samples

(App. 3, tables 5a, b, c) have the following ranges: quartz 71 - 77%, carbonate 13 - 19% (calcite 10 - 13%, dolomite 1 - 6 %), feldspar 6 - 7 % (K-feldspar 1 - 2%, plagioclase 4 - 6%), mica 0 - 2%, chlorite 2 - 4%. Petrographic studies and point count analyses (App. 3, Table 5g) indicate that the sediments are composed mainly of quartz and limestone fragments, with smaller proportions of chert, feldspar, schist, muscovite, biotite, chlorite, and opaque minerals. Volcanic rock fragments occur in some specimens.

The mudrocks usually are thinly interstratified with the sandstones and show the same colours and primary structures. XRD analyses of three groups of mudrock samples (App. 3, tables 15e-g) have values similar to those of the sandstones, except that mica and chlorite are slightly more abundant and that quartz is less abundant. Thin sections show that the rocks consist mainly of quartz, carbonate particles, feldspar, mica, and chlorite.

Intraformational flat-pebble conglomerates consist mainly of mudrock. A conglomerate of fossiliferous limestone at a section on southern Marvin Peninsula (SMP, unit 21) probably is also of intraformational origin because it contains the same kind of fossils as overlying limestone.

Limestone is interbedded with sandstone and mudrock at the type section and at various localities on Marvin Peninsula. At section SMP individual limestone units range in thickness from a few decimetres to nearly 10 metres. Most are skeletal lime wackestones and related lime mudstones that are variably argillaceous and sandy. The skeletal material was derived from corals, echinoderms, brachiopods, gastropods, trilobites, cephalopods, and dasycladacean algae.

Conglomerate is prominent at the base of the formation west of uppermost M'Clintock Inlet. The lowest strata are composed of poorly rounded boulders of marble and schist that seem to have been derived from the immediately underlying Proterozoic metasediments. They are overlain by an upward-fining sequence of cobble conglomerate, pebble conglomerate, pebbly sandstone, and sandstone.

Reddish cobble conglomerate with phenoclasts up to about 15 cm in diameter occurs at the base of the formation in an anticline in the northern part of the Zebra Cliffs.

Pebble conglomerate with boulders up to 70 cm in diameter forms the base of the formation near section SMP on southern Marvin Peninsula. It contains fragments of carbonate rocks and chert as well as mostly siliceous volcanic clasts feldspar, and quartz.

A conspicuous, reddish weathering conglomerate occurs in the uppermost part of the formation on the nunatak south of Markham Fiord mentioned above. The phenoclasts are of pebble and cobble grade and range in diameter up to about 25 cm. The conglomerate is poorly stratified but contains lenses of pebbly sandstone, a few metres long, that show trough cross-bedding.

**Mode of origin**

The conglomerates and associated conglomeratic sandstones probably were deposited in nonmarine settings such as alluvial fans and braided streams, an inference based on their coarse grade and the fact that they overlie an unconformity. The fossiliferous limestones, on the other hand, probably are of subtidal shelf origin since they contain a rich and varied fauna. The sandstones and mudrocks must represent the entire environmental range from alluvial fan to subtidal shelf because they are associated with both conglomerate and limestone. The majority, however, are probably marine, judging from the common flat lamination, and the presence of bioturbation and trace fossils. It is uncertain whether the red colour of the clastic sediments was inherited from the source rocks or acquired at the site of deposition.

The petrographic studies show that the Taconite River Formation was derived from a variety of metamorphic, volcanic, and sedimentary rocks that may have included parts of successions II and III, and perhaps some older and younger rocks. A major source area for the Taconite River Formation probably existed south of the head of M'Clintock Inlet where deep erosion (down to the upper greenschist facies) occurred prior to Late Ordovician deposition but other source areas probably existed. The conglomerate south of Markham Fiord, for example, may have been derived northerly or northeasterly sources.

### Age

At least one of the six fossil collections made, C-54938 from the section on southern Marvin Peninsula, is of Late Ordovician age. The others have a wider possible age range but are compatible with the same age assignment. Fossil collections from underlying (M'Clintock and Ayles) and overlying (Zebra Cliffs, Lorimer Ridge and Marvin) formations imply that the unit is entirely Richmondian in age.

## Zebra Cliffs Formation

The Zebra Cliffs Formation was established at a time (Trettin, 1969b) when only the geology west of lower and central M'Clintock Inlet was known. It was defined as a carbonate unit of Late Ordovician age lying conformably between the Taconite River Formation and Silurian flysch, then assigned to the Imina Formation (but now to the Cranstone). The type section was placed at the Zebra Cliffs, the only area known where the entire formation is exposed, although the cliffs are complex structurally and difficult of access. There the formation was divided into three informal subunits, referred to as members A, B, and C. Members A and B are shelf carbonate units, but member C is a mixed carbonate-mudrock unit of deep-water origin. This member is now recognized as a separate unit of formational rank, informally referred to as the Disraeli Glacier beds (Trettin, 1987b). The redefined Zebra Cliffs Formation is overlain by deep-water sediments (the Disraeli Glacier beds) at some localities and by clastic and carbonate shelf sediments (Lorimer Ridge Formation) at others.

**Distribution, thickness, and contact relationships**

The Zebra Cliffs Formation is exposed in numerous, generally small, areas in the central and central eastern part of the M'Clintock Inlet map-area, and adjacent western parts of the Clements Markham Inlet map-area. Photogrammetric determinations indicate a minimum thickness of about 570 m at the Zebra Cliffs, where the upper contact is faulted, and of 302 m on the west side of Harley Ridge, where it is unconformable (see below).

In most of the M'Clintock Inlet and Clements Markham Inlet map-areas the Zebra Cliffs Formation lies conformably on the Taconite River Formation, but southeast of lower M'Clintock Inlet (Harley Ridge) it lies on schist and marble of undifferentiated Hadrynian-Cambrian age

(Succession II, Empire Belt). The contact, which is covered by a thin veneer of talus, was previously interpreted as a low-angle normal fault (Trettin in Trettin and Balkwill, 1979). However, the fact that the Taconite River Formation is very thin east of lowermost M'Clintock Inlet suggests that its absence on Harley Ridge is due to nondeposition on a paleotopographic high.

The Zebra Cliffs Formation, as mentioned, is overlain by two different units, the Disraeli Glacier beds or the Lorimer Ridge Formation. The contact with the Disraeli Glacier beds is conformable southwest of Disraeli Fiord (section SWDF) and probably also northeast of Crash Point where it is covered but is faulted on the Zebra Cliffs. The contact with the Lorimer Ridge Formation appears to be conformable east and south of Disraeli Fiord but is a low-angle unconformity on Harley Ridge. Considering the thickness of the Upper Ordovician succession in the M'Clintock Inlet area and the short duration of the Late Ordovician (roughly 10 Ma), this unconformity probably represents a relatively brief emergence.

**Lithology**

Four associations of sediment types ("lithofacies") are presently recognized in the Zebra Cliffs Formation.

(1) **Thinly stratified limestone and minor dolostone and siliciclastic sediments.** This is the most abundant lithofacies, well exposed on the Zebra Cliffs, on Harley Ridge, and south of Disraeli Fiord. The predominant rock type is a limestone that forms extensive thin beds that are commonly 2 - 20 cm thick. Fresh surfaces are medium to medium dark grey, weathered surfaces show hues of grey and yellow. The

stratification is caused by vertical variations in the concentration of clastic impurities and submicroscopic carbonaceous matter. Common macrofossils include relatively abundant colonial corals and lesser numbers of cephalopods, gastropods, and bryozoans. The most common rock types identified in thin section are skeletal lime wackestone, and lime mudstone with skeletal content. The skeletal material is diverse, representing not only the macrofossils mentioned but also trilobites, ostracodes and algae (mainly cyclocrinitid dasycladaceans).

Lime grainstone seems to be rare but is represented by a specimen from Harley Ridge. It consists of a variety of skeletal fragments derived from corals, brachiopods, trilobites, molluscs, and dasycladacean algae, as well as oncolites. The latter consist of a skeletal fragment that is surrounded by algal filaments, some of which can be identified as **Girvanella**.

The dolomite content of these limestones is small, ranging from 1 to 6% in uncorrected XRD analyses. The siliclastic impurities are mainly of mud grade but include some very fine and fine grained sand. Uncorrected XRD analyses of seven specimens from two localities indicate: quartz 3 - 15%, K-feldspar 0 - 1%, plagioclase 0 - 4%, mica 0 - 2%, and chlorite 0 - 4% (Ap. 3, Table 6a, b).

The following rock types are thinly interstratified with these limestones in different areas and at different stratigraphic levels: highly argillaceous limestone; calcareous and dolomitic mudrock; very fine grained , calcareous sandstone; and microcrystalline dolostone that locally is cherty. Typical specimens of mudrock from Harley Ridge average 54% (uncorrected XRD determination) clastic impurities, mainly quartz, but with 6 - 7% each of feldspar, mica, and chlorite. The remainder of the rock consists of calcite and minor dolomite (Ap. 3, Table 6c). Skeletal fragments are present in some of these rocks.

(2) **Thick-bedded and massive limestones**, recognizable by their relatively high resistance to weathering, make up a lesser proportion of the formation.

East and west of central M'Clintock Inlet, the lower 22 - 23 m of the formation constitute a resistant, mappable marker, originally designated member A (Trettin, 1969b). East of the inlet this unit consists mainly of limestone that is locally rich in fossils. Two samples examined in thin section represent pelletal packstone with scarce skeletal fragments, and pelletal-peloidal grainstone, both with small amounts of skeletal matter.

Thick-bedded and massive limestones on the west side of Harley Ridge form highly resistant units, some of which are lenticular in cross-section and look like reefs from a distance. They have not yet been investigated.

(3) **Dolostone** appears to be a minor component. On the west side of M'Clintock Inlet, the original member A consists mainly of brecciated dolostone with lenses and stringers of chert. A typical sample is composed of microcrystalline to very finely crystalline dolomite with some interstitial calcite.

Dolostone is also common in fault blocks west of lower Disraeli Fiord that lie between upper Palezoic strata and the Lorimer Ridge Formation (77-311a). Dolostone associated with a tennantite showing is discussed below.

(4) **Discrete units of siliciclastic sediments.** South of Disraeli

Fiord (section SDF), a 39 m thick unit of mainly red mudrock and sandstone occurs about 56 m above the base of the formation. The mudrock is mostly coarse and in part sandy, and the sandstone is very fine and fine grained, and in part argillaceous. Beds are 0.5 - 1 m thick and commonly bioturbated but some flat and undulating lamination is preserved. Most strata are pale red or greyish red but some are medium light grey.

A similar unit of mudrock and very fine and fine grained sandstone occurs on the Zebra Cliffs, but it is red and greenish grey and stratigraphically somewhat higher: in the lower or middle part of the original member B. The sandstones and mudrock all are composed predominantly of quartz and carbonate grains, with lesser proportions of feldspar, chlorite, and mica (Ap. 3, Table 6d-h).

Pebble conglomerate, very fine to medium grained sandstone, and minor amounts of red mudrock occur in the lower part of a thrust sheet of the Zebra Cliffs Formation in the area west of lower Disraeli Fiord (77-312a, b). The sandstone is medium grey to medium light grey and shows flat lamination and some small-scale cross-lamination. Two specimens analyzed by XRD consist of about one third carbonates and two thirds siliciclastic material (Ap. 3, Table 6h). The carbonate material comprises roughly equal proportions of calcite and dolomite and occurs as variably rounded, sand-sized grains that represent single crystals or polycrystalline aggregates. The siliclastic material consists mainly of quartz with small proportions of feldspar, chert, low-grade metamorphic rock fragments, muscovite, chlorite, and biotite.

The pebbles are up to 1.5 cm in diameter and represent the following rock types:

- chert, massive, in part calcareous
- chert, sheared
- chert with sponge spicules (?)
- limestone, sandy, oolitic, with some vadose features
- lime mudstone, dolomitic
- dolostone, calcareous
- sandstone, very fine grained, calcareous, dolomitic
- vein quartz, strained
- schist, quartzose, highly calcareous; submicroscopic carbonaceous (?) matter concentrated in clots
- quartzite, medium grained, poorly sorted
- basalt, porphyritic, altered
- brachiopod fragment

**Tennantite showing north of Thores River**

A small replacement deposit of tennantite occurs in an oval outcrop area of the Zebra Cliffs Formation that is surrounded by the Lorimer Ridge Formation and probably represents a minor dome (Trettin, 1981b). The surface area of the deposit, perhaps 10 m in diameter, is strewn with fragments of dolostone weathered in place that contain scattered crystals, or lumps of crystals, of tennantite, surrounded by haloes of malachite and minor azurite. The tennantite content of the specimens collected varies from trace amounts to an estimated 5-10% by volume. The crystals are euhedral, mostly tetrahedral in habit, and vary in edge length from 0.7 mm to about 3 cm.

Semiquantitative X-ray fluorescence analysis revealed the following composition:

- major elements (more than 2%): Cu, As, Sb, S, Zn, Fe
- minor elements (0.1-2%): Ca, Al
- trace elements (less than 0.1%): Ag, Cd

As is considerably more abundant than Sb, and Zn is fairly common.

The host rock of the tennantite is dolostone, ranging in crystal size approximately from 0.01 to 1.6 mm, with coarser crystals present in veinlets. The cryptocrystalline texture of the limestone predecessor is apparent under cross-polarized light in the extinction position. Organic matter is concentrated in small, irregular solution zones. Scattered euhedral quartz crystals, about 0.08-1.44 mm long with very small inclusions of euhedral dolomite, make up perhaps 10 - 15% of the rock. Such quartz is absent from normal dolostone of the Zebra Cliffs Formation in this area, and is evidently related to the mineralization. The tennantite has replaced the dolomite, but not the quartz, which impinges on it or forms inclusions. The paragenesis is: (1) sedimentary calcite, (2) dolomite, (3) quartz, (4) tennantite.

**Mode of origin**

Most of the thinly stratified limestones and associated siliclastic sediments probably were deposited in quiet, subtidal shelf environments that were oxygenated and well supplied with nutrients. This is inferred from the abundant and diverse fauna and the predominance of lime wackestone and lime mudstone among the carbonate rocks. Rare grainstones, however, show that higher energy conditions existed locally, for example at Harley Ridge. Possible reefs at Harley Ridge remain to be investigated.

The discrete siliciclastic units probably are partly of shallower origin, especially the pebble conglomerate. The composition of the conglomerate suggests derivation from Ordovician formations of Succession IV and older rock units.

### Age and correlation

Some of the more diagnostic faunules have been assigned to the "Richmondian" (undifferentiated Richmondian and Gamachian in terms of present nomenclature), others to the undifferentiated late Maysvillian to "Richmondian" or Edenian to "Richmondian" stages but fossil collections from underlying and overlying units (especially from the Marvin Formation) imply that that the formation is entirely Richmondian in age.

## Lorimer Ridge Formation

The Lorimer Ridge Formation (Trettin, 1981a, 1987b) is a multicoloured, commonly red unit composed mainly of mudrock and sandstone with small amounts of limestone and rare conglomerate that lies stratigraphically between the Zebra Cliffs and Marvin formations. The type section is on Lorimer Ridge (LR), about 9 km southeast of Disraeli Fiord.

### Distribution, thickness, and contact relationships

Outcrops of the formation lie in a belt, 90 km long and up to 27 km wide, that extends from Harley Ridge northeastwards to the ice fields south of Markham Fiord (Clements Markham Inlet map-area). At the type section, the formation is 768 m thick according to staff measurement. On Harley Ridge, where it is unconformably overlain by Pennsylvanian strata, the formation has a thickness of 279 m according to a photogrammetric determination.

Lithology

On **Harley Ridge**, the lowermost part of the formation consists of highly calcareous mudrock and/or argillaceous limestone that is richly fossiliferous in places (field notes by W.W. Nassichuk, 1966; stratigraphic position inferred from air photo interpretation). Strata roughly 150 to 350 m above the base of the formation were sampled by the writer at two localities. They consist mainly of mudrock, which is commonly coarse grained and sandy; lesser amounts of sandstone, very fine grained and generally argillaceous; and small amounts of limestone. Mudrock and sandstone are calcareous and slightly dolomitic. Some strata show flat lamination and small-scale cross-lamination, commonly at low angles, but most are bioturbated. The rock colours, in order of abundance, are greyish green, medium grey, and greyish red. The limestones are medium grey, impure lime mudstones that contain quartz silt of very fine sand grade and some skeletal material. Colonial corals are common and gastropods are also present.

An interval of 48 m in the middle part of the formation was studied in detail in an area **north of Thores River** (NTR1). This section is composed mainly of interstratified mudrock and sandstone with four units of limestone that are 1.0 - 2.0 m thick. Most mudrocks are coarse grained and variably sandy, and most sandstones are very fine grained and argillaceous. The majority of the sandstones and mudrocks (46% of the section) are greenish grey, a lesser proportion is greyish red or brownish grey, and only one unit is grey. Most strata are thoroughly bioturbated but flat, undulating, or lenticular lamination is preserved here and there. Mudrock and sandstone are similar in mineral composition, the average being quartz 58%, carbonate 22% (mainly calcite with 5% dolomite), feldspar 9% (mainly plagioclase), chlorite 7%, and mica 4% (muscovite and minor biotite; uncorrected XRD determinations, Ap. 3, Table 7a). The limestones are argillaceous and slightly sandy. In addition to macrofossils, mainly favositid corals, they contain skeletal material derived from trilobites, ostracodes, corals, bryozoans, and echinoderms. Some limestone samples are classified as lime wackestone, and the rest as lime mudstone with skeletal content.

The uppermost 48 m of the formation, studied **southeast of Disraeli Fiord** (section SEDF), are similar except that red coloration is restricted to the lowermost 0.6 m. The predominant rock type is a coarse, commonly sandy mudrock, that is greenish grey or medium grey, and mostly bioturbated although some flat lamination is preserved. Light grey to medium grey or greenish grey sandstone is also present. The sandstone is very fine grained and argillaceous and either shows flat or undulating lamination or cross-lamination or is bioturbated. The average mineral composition of the mudrocks and most sandstones (Ap. 3, Table 7d) is comparable to that in section NTR1, except that quartz is more abundant (71%) and feldspar, mica, and chlorite are less common; the average carbonate content (22%) is comparable (uncorrected XRD determinations). In addition, there is a highly calcareous sandstone transitional to limestone (Ap. 3, Table 7e). Four limestone units were recorded, the thickest of which is 4.3 m thick. The rocks are medium grey to medium dark grey and contain dolomite, concentrated mainly in burrows. Three specimens studied in thin section are skeletal lime wackestones, derived from gastropods, ostracodes, trilobites, echinoderms, etc.

The **type section** is known only from reconnaissance work by R. Gardner and D. Jones in 1977 and requires restudy. It consists of roughly equal proportions of mudrock and sandstone with only a few beds of limestone and one unit of conglomerate. The mudrocks commonly are sandy and grade into argillaceous sandstone. Many are massive owing to bioturbation but some are flat-laminated. The sandstones range in size grade from very fine to medium. Many are thick-bedded or massive; others are thinly interstratified with mudrock. One unit in the upper part (unit 34 at 565.5 - 646.5 m) consists of upward-fining sequences, about 25 - 50 cm thick, that are composed of massive sandstone, overlain by flat-laminated mudrock. Three sandstone samples have an average composition of quartz 78%, carbonate 10% (mainly calcite), plagioclase 7%, chlorite 3%, and mica 2% (uncorrected XRD determinations, Ap. 3. Table 7b). One highly calcareous (47%) sandstone also has an unusually high plagioclase content (16% uncorrected, the true valued may be twice that much; Table 7c), suggestive of a partly volcanic (tuffaceous ?) origin.

Most mudrocks and a lesser proportion of the sandstones are greyish red and weather greyish to dusky red; the remainder are coloured in hues of grey and green.

A conglomerate occurs 109.5 - 111.5 m above the base of the formation. Beds are about 30 cm thick, lenticular, and cross-bedded with some foresets dipping southwest. It is composed of granules and pebbles, 2 - 10 mm in diameter, that are poorly sorted and embedded in a sandy matrix. The following types of phenoclasts were identified in thin section: chert, massive, sheared, or spicular; quartzite, micaceous; calcareous sandstone, very fine grained, transitional to siltstone; and mudrock, sandy calcareous (cf. Ap. 3, Table 7g).

The limestone samples collected represent skeletal lime wackestone and lime mudstone. Some are pure and medium grey, others argillaceous and greenish. The most common macrofossils are colonial corals, stromatoporoids, and brachiopods. In addition, fragments of echinoderms, gastropods, and ostracodes are present in thin section.

**In summary**, the Lorimer Ridge Formation consists mainly of mudrock and very fine and fine grained sandstone with lesser amounts of medium grained sandstone, still lesser amounts of limestone, and very rare pebble conglomerate. It is coloured in hues of red, green and grey, red being prevalent in the eastern parts of the outcrop area.

**Mode of origin**

Because of their rich fauna, the limestones of the Lorimer Ridge Formation are judged to have been deposited mainly in subtidal shelf environments, and the same probably applies to associated sandstones and mudrocks. If so, the red coloration more likely was acquired in the source area of the clastic sediments than at their depositional site. The graded sandstone-mudrock units described by Gardner and Jones from the type section are suggestive of deposition by turbidity currents, possibly caused by storms in a shelf environment; the cross-bedded pebble conglomerate at the same section suggests nearshore or nonmarine environments.

**Age and correlation**

The most diagnostic fossil obtained is the coral **Sibiriolites sibiricus** Sokolov from the lower part of the formation on Harley Ridge (C-75 494), which is Richmondian in age in terms of previous nomenclature

(Norford, 1971), i.e. Richmondian-Gamachian or Ashgill in terms of present nomenclature (see Appendix V, Introduction). **Paratetradium** sp. and **Calapoecia** sp. from the uppermost part of the formation at the type section (C-70106 and C-70093), of unspecified Middle or Late Ordovician age, confirm that the top of the unit still is Ordovician. The occurrence of conodont Fauna 12 in the basal Marvin Formation restricts the Lorimer Ridge Formation to the Richmondian.

## UPPER ORDOVICIAN - SILURIAN DEEP-WATER SUCCESSION

A deep-water succession, developed in the southern part of the Pearya Terrane, consists of two major rock-units, the Upper Ordovician Disraeli Glacier beds and the Lower Silurian (Landovery and ? Wenlock) Cranstone Formation, which are both divisible into eastern and western facies.

### Disraeli Glacier beds

The informal name, Disraeli Glacier beds, is used for a unit of resedimented carbonates and mudrock lying stratigraphically between the Zebra Cliffs and Cranstone formations. The unit is divisible into a proximal eastern facies exposed south of Disraeli Fiord (i.e. north of Disraeli Glacier), and a distal western facies, exposed northeast of Crash Point and on the Zebra Cliffs. The exposures on the Zebra Cliffs are identical with the original member C of the Zebra Cliffs Formation.

#### Contact relationships, thickness, and lithology

The **eastern facies** is known only from exposures at section SDF. The lower contact, with the Zebra Cliffs Formation, is conformable. The upper contact, with the Cranstone Formation, is abrupt and either conformable or marks a submarine disconformity. The unit is 56 m thick and divisible into three lithofacies:

(1) A single bed of lime packstone, 5.5 m thick, composed mainly of lime mudstone clasts with lesser amounts of skeletal material derived from dasycladacean algae and trilobites.

(2) Beds of medium dark grey, moderately argillaceous and sandy lime wackestone, 2 to 20 cm thick, are separated by laminae of highly argillaceous limestone and/or calcareous mudrock. The lime wackestone and

argillaceous laminae both are rich in calcareous sponge spicules and the wackestone also contains some trilobite debris. A typical specimen contains: carbonate 54% (calcite 50%, dolomite 4%), quartz 44%, plagioclase 2% (uncorrected XRD determination).

(3) A single bed of medium dark grey, highly argillaceous lime mudstone, 80 cm thick, showing flat lamination. A specimen from this unit comprises: carbonate 67% (calcite 64 %, dolomite 3%), quartz 31%, plagioclase 2%.

**Western facies.** On the Zebra Cliffs the lower contact of the Disraeli Glacier beds, with the Zebra Cliffs Formation, clearly is faulted. The upper contact, with the Cranstone Formation, is abrupt and probably also faulted because fossil evidence indicates that the lower - middle Llandovery part of the Cranstone Formation is absent or uncharacterstically thin (see Cranstone Formation). Northeast of Crash Point both contacts seem to be concealed.

On the Zebra Cliffs, about 400 m of the unit are exposed. The lower 240 m or so, weathering yellowish grey, contain a relatively high proportion of calcareous beds. The next 15 m weather greenish, and the remainder of the section weathers mainly dark grey.

The unit consists of mudrock, lime mudstone and calcarenite. The mudrock is medium dark grey and weathers medium dark grey to olive grey. Three analyzed samples consist mainly of quartz (44%) and carbonate (calcite 26%, dolomite 10%), with lesser amounts of feldspar (10%, mainly plagioclase), muscovite (5%) and chlorite (5%; uncorrected XRD determinations, Ap. 3, Table 8a).

The lime mudstone and calcarenite are also medium dark grey on fresh surfaces but weather in hues of grey and yellow. They consist mainly of calcite (mean 82%) with subordinate quartz (12%) and small amounts of dolomite (2%), feldspar (2%), mica, and chlorite (2% combined; uncorrected XRD determinations; Ap. 3, Table 8b). The calcite occurs mainly as single crystals of coarse silt to very fine sand grade that seem to have formed by recrystallization of microcrystalline aggregates. Skeletal material is rare; only one thin section contained ostracode shells.

Northeast of Crash Point only rubble and sparse outcrop of medium dark grey calcareous mudrock and of laminated lime mudstone and calcarenite were seen. A specimen of the latter rock is composed of clasts of lime mudstone and single crystals (recrystallized aggregates ?) of coarse silt to very fine sand grade with some indeterminable skeletal material.

**Mode of origin**

The Disraeli Glacier beds are typical of slope and basinal deposits fringing a carbonate shelf. Characteristic of such deposits are evenly bedded alternations of predominantly calcareous or argillaceous strata with or without lenses of carbonate conglomerate or breccia. The eastern facies is interpreted as proximal because of its high carbonate content and absence of graptolites, and the western facies as distal because of a higher proportion of argillaceous material and presence of graptolites.

The argillaceous mud and at least part of the lime mud probably were derived from nepheloid layers or very dilute turbidity currents generated by storms on the adjacent shelf. The lime wackestone rich in calcareous sponge spicules probably was derived from contemporaneous sponge mounds on the slope and transported by turbidity currents caused by slope failure. The presence of a conodont no younger than Whiterockian (C-96701) indicates that failure of the shelf margin or upper slope also involved older strata. Of particular interest is the occurrence of the conodont **Hamarodus europaeus** (Serpagli) which is of "North Atlantic Province affinity" (C-96700) and very rare in North America. It probably signifies outer shelf - upper slope conditions (G.S. Nowlan, pers. com., 1987).

### Age and correlation

The most diagnostic graptolites from the Zebra Cliffs are Late Ordovician (Ashgill) in age and represent either the **complanatus ornatus** Zone or the **pacificus** Zone (GSC locs. C-59, C-60). The most diagnostic conodonts from south of Disraeli Fiord are also Late Ordovician in age (C-96700).

The stratigraphic position above the Zebra Cliffs Formation implies a Richmondian age for at least the lower part of the unit; the age of its top is uncertain.

## Cranstone Formation

The Cranstone Formation (Trettin, 1987b) is a thick unit of deep-water clastic sediments that overlies the Disraeli Glacier beds; its top is not preserved. Its type section is south of the head of Disraeli Fiord (section SDF). Outcrops on the Zebra Cliffs were previously included in the Imina Formation, which now is restricted to the Clements Markham Fold Belt.

## Distribution, thickness, and contact relationships

Like the Disraeli Glacier beds, the Cranstone Formation is divisible into a proximal eastern facies and a distal western facies. The eastern facies is exposed in a triangular area north of Thores River, which includes the type section in its northern part, and in a northeasterly trending belt of nunataks in the adjacent Clements Markham Inlet map-area. At the type section (SDF) the formation is about 1 km thick and overlies the Disraeli Glacier beds with an abrupt contact that either is conformable or signifies a submarine disconformity. The contact with the Marvin Formation north of Thores River is problematic but tentatively interpreted as a fault (see Marvin Formation).

The western facies is exposed northeast of Crash Point and on the Zebra Cliffs. Northeast of Crash Point the contact with the Disraeli Glacier beds is covered and the thickness of the unit is unknown. On the Zebra Cliffs where both the upper and the lower contact of the unit appear to be faulted, a minimum of 232 m of strata are present.

## Stratigraphy and lithology, eastern facies

In the area north of Thores River, the Cranstone Formation consists of conglomerate, mudrock, and sandstone. Conglomerate and sandstone are medium grey and weather in hues of olive grey and greyish brown; the mudrock is medium dark grey and weathers in hues of olive grey. Here the formation is divisible into two members, informally referred to as members A and B. The members are mappable from air photographs because B is much more resistant to weathering than is A.

Member A

The thickness of member A is not known precisely because of structural complexities in its upper part. A thickness of 416 m was obtained by staff measurement in fog and rain.

Member A fines upwards and is divisible into two major units. **Subdivision A1**, the lower unit, is 218.5 m thick and composed of mudrock, sandstone, and conglomerate. The lower 45 m consists of about 51% mudrock, 41% conglomeratic beds, and 8% sandstone. The conglomeratic beds range in thickness from 0.5 m to 3 m and consist of roughly equal proportions of conglomerate, conglomeratic sandstone, and conglomeratic mudrock. Phenoclasts are mainly of pebble grade but include cobbles up to 15 cm in diameter. The phenoclasts support each other in the conglomerates but are matrix-supported in the conglomeratic sandstones and mudrocks. The lateral extent of the conglomeratic beds has not been determined because of the restricted outcrop. Graded bedding, from pebble conglomerate upwards to pebbly sandstone, has been observed but seems to be rare. Most conglomeratic units are structureless but one showed a discontinuous, irregular lamination.

The sandstone occurs in units that are 0.4 m to 3 m thick and contain interlaminated mudrock in some instances. A 1.5 m thick sandy unit consisted of sandstone beds that were 20 - 30 cm thick.

A short partial section, about 61.5 m above the base of the formation and member, was studied in detail. It consists mainly of coarse to very fine grained sandstone with lesser proportions of mudrock and conglomeratic sandstone. Graded bedding is the rule. Some strata are structureless and others flat-laminated. Small-scale cross-lamination is absent from this partial section and scarce or absent in the entire member. The strata are interpreted as turbidites of $T_{ab}$ type with a mean thickness of 39 cm.

The overlying parts of subdivision A1 have been examined only cursorily. It appears that conglomeratic units become less frequent and thinner upward in the section and that the proportion of sandstone also decreases.

**Subdivision A2**, which comprises the upper 197.5 m or so, consists mostly of mudrock, which commonly is flat-laminated, with small amounts of sandstone, and rare beds of pebble conglomerate or pebbly mudrock in the lower part. The most prominent unit of sandstone and pebble conglomerate, about 261 m above the base of the formation, is 2.5 m thick. Other sandstone beds are mostly 0.5 m thick and at least one of these is a channel deposit.

Interlaminated mudrock and argillaceous lime wackestone with abundant calcareous sponge spicules and sparse graptolites occur 14 - 21 m below the top of the member east of section SDF.

Member B

Member B has a minimum thickness of about 600 m and is divisible into four major units, referred to as subdivisions B1 to B4.

**Subdivision B1** is 403.5 m thick according to staff measurement and consists of approximately 64% conglomerate, 20% mudrock, and 16% sandstone.

Conglomerate units range in thickness from 1 cm to 19.5 m. Most form thick-bedded or structureless beds of uncertain lateral extent. However, lenticular bed shapes, low-angle, concave cross-bedding of foreset type, and graded bedding are also present. Most conglomerates are clast-supported but some are matrix-supported. In well stratified beds, elongate clasts may show imbricate structure. Most phenoclasts are of pebble grade but carbonate cobbles up to about 12 cm in diameter are fairly common and coarser boulders and cobbles, up to 40 cm in diameter, have been observed.

The sandstones occur in flat beds or lenses that are about 1 to 50 cm thick and either show a thin flat stratification or low-angle, concave cross-bedding. Some lenses are only a few metres wide or long.

The mudrocks occur as discrete, perhaps extensive units up to 26.5 m thick; as lenses within conglomeratic units; and thinly interstratified with sandstone.

**Subdivision B2** is 37.5 m thick and consists of mudrock that commonly is flat-laminated.

**Subdivision B3** is about 43 m thick at section SDF and there consists almost entirely of phenoclast-supported conglomerate with only a few lenses of mudrock, sandstone, and pebbly sandstone. Mudrock lenses are 0.3 to 1.3 cm thick. The conglomerate occurs as flat-lying beds 0.5 to 4 m thick. About 1.2 km east of the line of section, the subdivision consists of conglomeratic sandstone, conglomeratic mudrock, and mudrock.

**Subdivision B4** is estimated to be 150 m thick on the basis of measurements on air photographs. It consists largely of flat-laminated mudrock, represented by felsenmeer, which is similar to the mudrock of subdivision 2, with minor amounts of very fine to medium grained sandstone in an interval 20.5 - 36.5 m above the base of the subdivision.

Compositional and textural features of constitutent rock types

**Sandstone.** The composition of 5 specimens of sandstone was established by point count after leaching of carbonates. The percentage of carbonate particles and ratio of feldspar types were obtained from XRD analyses. The results of these combined analyses are given in Appendix 3, Table 8g (cf. Table 8d).

Briefly, silica recorded as quartz (mean 40%), quartzite (8%), and chert (10%) is predominant (total 58%). The "quartz" comprises single-crystal grains and semicomposite aggregates of vein quartz and/or recrystallized chert. The metaquartzite is pure or includes small amounts of muscovite, and, rarely feldspar. The chert is pure or argillaceous, unmetamorphosed or stretched and recrystallized, recrystallized chert being difficult to distinguish from metaquartzite.

The feldspar (mean 13 %) consists mainly of sodic plagioclase that is altered by sericite to varying degrees.

The carbonate grains (12%) are mainly of lime mudstone and dolostone, but also include rare skeletal fragments derived from brachiopods, corals and echinoderms.

Metamorphic rock fragments (10 %) represent phyllites and low-grade schists composed mainly of muscovite and quartz with lesser amounts of chlorite and feldspar.

Volcanic rock fragments (4%) and related hypabyssal rock fragments consist mainly of siliceous rocks (rhyolite, dacite) but also include fragments composed largely of plagioclase with minor chlorite (trachyte ?), and chlorite-rich rocks of intermediate or mafic composition.

Minor constituents (0-2% in individual analyses; means less than 1%) include granitic gneiss, muscovite, biotite and mudrock.

Most grains are subangular or angular but some quartz grains are subrounded to rounded. Pressure solution is evident in many grains.

**Conglomerate.** The matrix consists of sand, identical in composition with the sandstones described. Cobbles are mostly of limestone and dolostone, and one limestone clast contained a favositid coral.

Pebbles consist of: limestone, dolostone, chert, vein quartz, metaquartzite, volcanics, hypabyssal rocks, granitic rocks, calcareous sandstone, and dolomitic siltstone. One granitic fragment composed of feldspar, quartz, and biotite was reminiscent of the gneissic basement of the Pearya Terrane (Succession I).

**Mudrock.** Uncorrected XRD determinations reveal a rather homogenous composition averaging: quartz 66%, carbonates 12% (about equal proportions of calcite and dolomite), chlorite 10%, feldspar 6% (mainly plagioclase), and (white) mica 6%.

**Lithology, western facies**

On the Zebra Cliffs the formation consists mainly of sandstone and mudrock and rare pebble conglomerate, coloured in hues of yellowish grey, light olive grey, or greenish grey, and weathering predominantly yellowish grey. The strata show Bouma sequences, commonly of $T_{a-c}$ type, with A- divisions ranging in thickness from about 2 to 40 cm. Sole markings, such as grooves, ridges, and flute casts are present at the base of some graded intervals, and some strata are bioturbated.

Point count analyses of 7 specimens of very fine to medium grained sandstone (from Trettin, 1969b, p. 89) are listed in Appendix 3, Table 8h (cf. Table 8f). These analyses average carbonate (+ masked argillaceous matter) 42%, quartz 37%, feldspar 8%, chert (± microfelsite) 6%, volcanic rock fragments 5%, chlorite 1%, muscovite and muscovite schist 1%, and trace amounts of biotite. One specimen consisted mostly of carbonates (87%), with small amounts of quartz (10%), volcanic rock fragments (2%), and feldspar (1%).

Several types of carbonate fragments were distinguished, for example:

- individual, sand-sized crystals of calcite that may represent recrystallized lime mudstone since a relict cryptocrystalline texture is apparent in some of them;
- cryptocrystalline and microcrystalline, partly recrystallized limestone fragments
- a small proportion of skeletal material, including echinoderm columnals and ostracode shells
- a small proportion of microcrystalline calcite

Quartz is present as single crystals; semi-composite aggregates, probably derived from veins and/or recrystallized chert; and as quartzite fragments, in some instances with small amounts of muscovite. The feldspar includes sodic plagioclase, microcline, and microperthite. Most samples contain less than 4 % of volcanic rock fragments, but one has 21%. The fragments appear to be of intermediate composition and have sodic plagioclase.

The grain size of the sandstones varies from very fine to very coarse, fine and medium-grained rocks perhaps being most common. The roundness of the grains varies from subrounded to predominantly subangular. The sand and coarse silt grains are embedded in a matrix composed of carbonate and argillaceous material.

A conglomerate near the base of the exposures consists mainly of limestone pebbles (lime mudstone, pelletal limestone, skeletal lime mudstone or wackestone) up to about 1.5 cm in diameter with lesser amounts of chert pebbles, echinoderm fragments, and sand-sized quartz and feldspar in a matrix of detrital and precipitated calcite.

**Mode of origin**

**Eastern facies.** The deep-water character of the entire facies is apparent from its graptolitic fauna and the occurrence of Bouma sequences in part of member A that are indicative of turbidity currents. Pebbly mudrocks in both members probably were deposited by subaqueous debris flows. The clast-supported conglomerates of member B and associated sandstones, on the other hand, appear to have been deposited by tractive currents. The siliciclastic sediments were derived from terrestrial sources that included sedimentary, volcanic, and metamorphic rocks but outsized cobbles and boulders with favositid corals probably came from submarine exposures of Upper Ordovician - Silurian strata, most likely of the Marvin Formation.

The present structural setting combined with a few paleocurrent determinations suggests a submarine valley, flanked by carbonate shelves on two sides, that received sediments from northeasterly sources (Fig. 10). However, a future palinspastic reconstruction, which is not feasible as yet, may indicate a somewhat different configuration.

**The western facies** probably was deposited on middle or lower parts of a submarine fan that probably was not connected with the eastern facies, since there are significant differences in detrital composition.

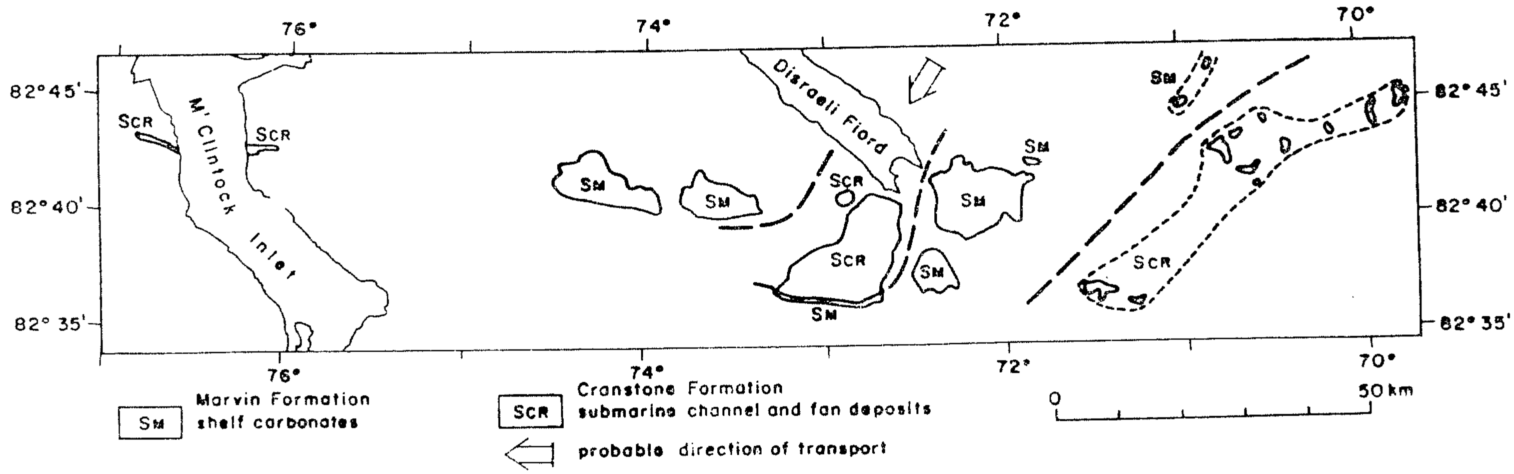



Figure 10. Setting of Cranstone Formation.

## Age and correlation

The most diagnostic graptolite collections from members A and B (C-75497, C-75496) of the eastern facies are both of middle Llandovery age. On the Zebra Cliffs graptolites of unspecified late Llandovery or Wenlock age were found "a few hunded feet" (i.e. 100 m $\pm$) above the base of the exposures. The absence or unusual thinness of the early and middle Llandovery part of the unit suggests that the contact with the Disraeli Glacier beds here is a south-dipping normal fault. In conclusion, the formation probably is mainly Llandovery in age but may include strata of Late Ordovician and/or Wenlock ages.

## UPPERMOST ORDOVICIAN TO UPPER SILURIAN SHELF CARBONATE AND CLASTIC UNITS

This informal group includes three units; a Silurian mudrock unit that underlies a tongue of the upper Marvin Formation at Crash Point; the Marvin Formation, a predominantly carbonate unit which ranges in age from latest Ordovician to Late Silurian in the vicinity of Disraeli Fiord; and the Crash Point beds, a mixed clastic and carbonate unit of Late Silurian age, which overlies the Marvin Formation at Crash Point.

### Silurian mudrock unit at Crash Point (map-unit Sp)

Northeast of Crash Point, the Marvin Formation is underlain by a mudrock unit that is difficult in access where well exposed. The contact with the Marvin Formation appears to be abrupt but probably is conformable because both units are of marine origin. The base of the unit is not exposed but age relationships suggest that it may overlie the Cranstone Formation. The thickness has not been determined; it is estimated to be greater than 100 m.

Three specimens from locality 81-131a are coarse grained mudrock (siltstone) that contains very fine grained sand. The specimens are greenish grey and medium grey, weather in hues of olive green and brownish grey, and have a flat lamination. The average mineral composition is quartz 68%, carbonates 10% (dolomite 7%, calcite 3%), feldspar 8% (K-feldspar 1%, plagioclase 7%), chlorite 8%, mica 7% (uncorrected XRD determinations, Ap. 3, Table 9a).

No fossils were found in the unit. Its age is bracketted by that of the Marvin Formation (Late Silurian, probably Ludlow here) and of the Cranstone Formation (Llandovery and ? Wenlock). It is tentatively interpreted as a subtidal shelf deposit.

## Marvin Formation

The name Marvin Formation was first applied (Trettin, 1969b) to a unit of limestone and minor sandstone northeast of Crash Point that is underlain by mudrock (originally map-unit 9A, now map-unit Sp) and overlain by clastic and carbonate sediments (originally map-unit 9C, now the Crash Point beds). Macrofossils from that area indicated a late Wenlock and/or early Ludlow age.

Subsequent mapping and stratigraphic studies showed that the carbonate and clastic strata at Crash Point are correlative with the upper part of a thicker carbonate succession southeast and west of lower Disraeli Fiord that overlies the Lorimer Ridge Formation and ranges in age from Late Ordovician to Late Silurian; the top of the unit is not preserved in that area. This succession is fairly homogenous, and it is impossible to distinguish within it that part correlative with the section at Crash Point. Consequently, the Marvin Formation has been redefined to embrace the entire carbonate succession (Trettin in Mayr et al., 1982; Trettin, 1987b), and the strata in the type area at Crash Point are now considered as a tongue of the upper Marvin Formation. Tongues of the upper Marvin Formation (with different lithology) also are recognized in two different parts of the Clements Markham Inlet map-area northwest of Markham River, and in the vicinity of Barrier Glacier and northern Piper Pass.

In summary, the Marvin Formation is now understood as a unit composed mainly of carbonate rocks (limestone and/or dolostone), locally with clastic sediments and chert, that has an overall age range from Late

Ordovician to Late Silurian. However, strata older than Late Silurian are exposed only in a belt extending from southern Marvin Peninsula to south of Markham Fiord whereas tongues of Late Silurian age are extensive. The reference section for the redefined formation is located southeast of lowermost Disraeli Fiord (SEDF).

The oldest known diagnostic fossils, conodonts of Fauna 12 (Richmondian), occur in a fault slice (or tongue ?) of the lower Marvin Formation north of Thores River (C-54986 from section NTR 2). The next diagnostic fossils are conodonts of late Llandovery age (**inconstans** Zone) from west of lower Disraeli Fiord (C-75387). The problem whether or not strata of latest Ordovician (Gamachian) and earliest Silurian age are present has yet to be resolved. The youngest known diagnostic fossils, conodonts of late Ludlow age (probably **latialata** Zone) occur northeast of Piper Pass (Clements Markham Inlet map-area). The top of the unit has not yet been dated precisely but can be no younger than Pridoli.

### South-central Marvin Peninsula and vicinity of Disraeli Fiord

Distribution, contact relationships, and thickness

The exposures discussed here include major outcrop areas on southeastern Marvin Peninsula, and less extensive outcrops south and southeast of Disraeli Fiord. In this region the Marvin Formation overlies the Lorimer Ridge Formation with a conformable contact placed at the top of the uppermost sandstone bed present here, and its top is not preserved. About 750 m of strata are present near section SEDF according to staff measurement by R. Gardner and D. Jones in 1977. Section SEDF (Appendix 5) describes the lower 576 m, measured along a slightly different route.

Lithofacies: description and origin

At section SEDF the Marvin Formation consists of about 80% limestone and 20% dolostone. The limestones have been assigned to five lithofacies described below in the order of increasing energy conditions in the depositional environment. However, the origin of many rocks is uncertain because of recrystallization and veining. Originally cryptocrystalline (micritic) calcite now commonly has crystal sizes of 10 to 20, but up to 50 micrometres.

**Lithofacies** S consists of medium dark grey lime wackestone containing abundant sponge spicules that are mainly calcareous and to a lesser extent siliceous (cherty), and lesser amounts of skeletal fragments derived from other organisms, such as ostracodes, brachiopods, trilobites, and echinoderms. Stringers of microcrystalline dolomite also are common in this lithofacies and lenses of chert occur in some strata.

This lithofacies appears to have been deposited in quiet water, probably below wave base because of the medium dark grey colour of the rocks. (The sponge spicules are not diagnostic for the depositional environment).

**Lithofacies** P is characterized by pelletal packstone with skeletal fragments, and of related lime wackestone and lime mudstone. The rocks vary in tone from medium grey to medium dark grey.

Skeletal material is rare to abundant and generally common in this lithofacies. It was derived from a considerable variety of organisms, including brachiopods, trilobites, ostracodes, echinoderms, gastropods, unidentified molluscs, and corals. In addition to abundant fecal pellets, peloids of uncertain origin are present. Stringers and irregular patches of microcrystalline dolomite are common.

The lithofacies occurs throughout the section, except for the uppermost 54 metres.

This facies is also interpreted to be of subtidal shelf origin because of the abundance and variety of skeletal material and lack of shallow water features.

**Lithofacies F** consists of pelletal packstone with fenestral structures. The rocks vary in tone from medium grey to (predominant) medium dark grey. The fenestrae are laminar or irregular, and some rocks show a faint or distinct flat lamination.

Skeletal matter is scarce and restricted to fragments of trilobites and (?) ostracodes. Peloids of uncertain origin are present in addition to the predominant fecal pellets. Stringers of microcrystalline dolomite are less common than in lithofacies P.

This lithofacies occurs only in two units in the upper part of the formation.

The fenestral structures suggest predominantly intertidal settings.

**Lithofacies G** comprises grainstone, and pelletal packstone transitional to grainstone. The strata vary in tone from medium dark grey to predominantly medium grey. The rocks are composed of abundant fecal pellets; common skeletal fragments, derived mainly from brachiopods and echinoderms; and of peloids of uncertain origin, perhaps intraclasts. Large shells of pentamerid brachiopods (largely or entirely **Kirkidium** sp.) are common in this facies but are not restricted to it. Stringers of microcrystalline dolomite are less common than in lithofacies P.

Samples of this rock type have been obtained from five intervals, occurring between 30 m and 509 m above the base of the section.

The abundance of grainstone and of thick-shelled brachiopods indicates deposition on shoals that had current and/or wave action.

**Dolostone** occurs in thirteen major units, distributed throughout the section except for the upper 112 m. The rocks are medium light to medium dark grey, predominantly medium grey in tone. The dolomite crystals are bimodal in size, one population being mainly microcrystalline and the other ranging from microcrystalline to very coarsely crystalline. The microcrystalline population occurs as stringers and irregular patches, similar to the stringers and patches in the limestone.

Age

Conodonts from the base of the formation at section SEDF (C-54977) are Late Ordovician, probably Ashgill in age. Conodonts of late Llandovery age were obtained from strata on south-central Marvin Peninsula (C-75386 to C-75389). The brachiopod **Kirkidium** sp. was collected 82, 107, and 113 m above the base of the formation at section SEDF but it may occur below and above these levels. It is considered to range in age from middle Wenlock to early Pridoli (cf. Boucot and Johnson, 1979, Fig. 1). If so, the Llandovery - early Wenlock interval should be condensed in the present area. However, the absence of lithological evidence for condensation suggests that the genus here may have a longer age range here. Strata 573 - 574 m above the base of the formation are dated as Ludlow or Pridoli on the basis of conodonts (C-54982, C-54983).

## North of Thores River

North of Thores River a limestone unit, about 90 m thick, lies between the Lorimer Ridge and Cranstone formations. The contact with the Lorimer Ridge Formation is abrupt but probably conformable. The contact with the Cranstone Formation (member A) also appears to be abrupt but was covered where examined; the problem whether it is a stratigraphic contact or a fault is discussed below.

The limestone occurs in beds that are 10 to 50 cm thick and show some dolomitic burrow-mottling. Large brachiopods are common 33 - 53 m above the base of the unit. Samples are classified as pelletal packstone and lime mudstone (both with skeletal content) and as skeletal lime wackestone. The skeletal material was derived from brachiopods, echinoderms, ostracodes, gastropods, and trilobites.

Conodonts from strata 3 - 5 m above the base of the limestone (C-54986) probably represent Fauna 12 (Richmondian), conodonts from strata 30 - 33 m above the base (C-54987) the undifferentiated faunas 11 to 13 (Edenian to Gamachian). Elsewhere in this belt, brachiopods identified as **Kirkidium** sp. were collected from strata of undetermined stratigraphic height, presumably more than 33 m above the base of the unit. This brachiopod, as mentioned, is generally considered to be late Wenlock to Pridoli in age but may be older in the present area.

The adjacent Cranstone Formation, as mentioned, has yielded fossils of middle Llandovery age some distance above the base of member A. The contact between the Cranstone Formation and the limestone unit could be stratigraphic if the top of the limestone is no younger than middle Llandovery, an assignment compatible with the conodonts from its lower part and its thickness of only 90 m, but not with the conventional age assignment for **Kirkidium** sp.

Two alternative stratigraphic interpretations are possible. Either the limestone north of Thores River represents a tongue of the lower Marvin Formation overlain by deep-water sediments of the Cranstone Formation, or it represents a fault slice of the Marvin Formation, truncated on the north by a south-dipping normal fault. The second interpretation has to be accepted if **Kirkidium** indeed is no older than late Wenlock, and it is also consistent with the fact that a major normal fault occurs farther south, on the north side of Thores River. The contact is shown on the map as an assumed fault but requires further investigation.

**Northeast of Crash Point**

A tongue of the upper Marvin Formation, underlain by map-unit Sp and conformably overlain by the Crash Point beds, is exposed in the core of a syncline northeast of Crash Point. The thickness of the unit has not been established precisely; combination of a reconnaissance section measured in 1966 with a restudy of the lower part gives an estimate of 154 m.

The lower 104 m consists of limestone, which is cliff-forming and thick-bedded to massive in the lower 39 m and alternatingly resistant and recessive in the next 65 m or so. The limestone is a relatively pure (see Ap. 3, Table 9b) pelletal and peloidal packstone with skeletal content that is transitional in texture to grainstone or lime wackestone. Scarce to abundant skeletal fragments were derived from a considerable variety of organisms including brachiopods, echinoderms, trilobites, ostracodes, corals, gastropods, pelecypods, stromatoporoids, and blue-green and red algae. Many fragments have irregular cryptocrystalline rims; others, forming the core of oncoids, have laminar algal coatings, some of which are identifiable as **Girvanella**. Large pelecypods (**Megalamoidea** sp.) and brachiopods (including **Kirkidium** sp.) are common in some beds.

The upper 50 m or so of the tongue are known only from reconnaissance. This unit consists of about two thirds limestone and one third interbedded sandstone. Ledge-forming limestone units are 3 - 6 m thick and composed of beds that are 12 - 15 cm thick. Some are rich in macrofossils, such as corals, brachiopods, echinoderms, gastropods, and stromatoporoids. Samples studied in thin section represent skeletal lime wackestone and calcareous oncolite with a matrix of fine grained sand and silt.

The sandstones examined were fine-grained and flat-laminated. A typical specimen analyzed by XRD consists of quartz (83%), lesser amounts of carbonate (calcite 6%, dolomite 3%) and feldspar (5%) with very small amounts of mica and chlorite (1% each; uncorrected XRD determination, Ap. 3, Table 9c). Part of the mica, chlorite, and quartz occur in fragments of phyllite and schist.

The abundance and variety of fossils throughout this exposure suggest subtidal shelf environments, well supplied with oxygen and nutrients. The skeletal lime wackestone and related pelletal packstone may have originated in quiet settings, whereas the oncolite formed in somewhat agitated waters.

Conodonts from strata 0 - 1 m above the base of the formation are dated as probably Silurian (Ludlovian (?)) on the basis of conodonts (C-54988). A sample from the middle part of the tongue contains conodonts of early Ludlow to Emsian age (C-774917). Six other (2 kg) samples contained no diagnostic material. Three macrofossil collections (75421, 75422, 69288) contained **Kirkidium**, now considered to range in age from mid-

Wenlock to early Pridoli although occurrences in the Disraeli Fiord region could be older (see above). Conodonts from the overlying Crash Point beds are of unspecified Wenlock to Pridoli age (see below). Thus the strata at Crash Point are probably Ludlow and (?) Pridoli in age.

### Crash Point beds

This informal unit of formational rank (Trettin, 1987b) occurs in two structural settings. The first is in the centre of the syncline northeast of Crash Point where it overlies the Marvin Formation with a conformable, gradational contact, placed where sandstone becomes more abundant than limestone. These strata were originally referred to as map-unit 9C (Trettin, 1969b).

The second setting is a steeply dipping fault block on the southern flank of the syncline. These strata were originally miscorrelated with map-unit 9A (now Sp) but in fact are mostly younger than 9C.

The erosional remnant in the core of the syncline is about 83 m thick and consists mainly of sandstone with three units of limestone ranging in thickness from 0.9 to 2.1 m.

The sandstones are mostly flat-laminated and fine grained. Three specimens analyzed by XRD contain in the average 84% quartz, 8% feldspar, 5% carbonate, mainly calcite with minor dolomite, and 2% each of mica (muscovite and biotite) and chlorite (uncorrected XRD determination, Ap. 3, Table 9d). Again, part of the mica, chlorite, and quartz occur in fragments of phyllite and schist. Also present is highly calcareous sandstone, transitional to limestone (Ap. 3, Table 9e).

The lowest of the three limestone units consists of pelletal packstone that contains a large proportion of siliciclastic silt and very fine grained sand (quartz 29%, feldspar 4%, mica 3%, chlorite 3%; uncorrected XRD determination, Ap. 3, Table 9f). It shows a slightly undulating lamination that may be of algal origin.

The limestone in the upper part is a sandy skeletal packstone. An analyzed specimen contains 20% quartz, 2% feldspar, 2% mica, and 3% chlorite (uncorrected XRD determination, Ap. 3, Table 9f). The skeletal fragments, commonly in solution contact, were derived from echinoderms, brachiopods, bryozoans, ostracodes, and trilobites.

The stratigraphic thickness of the rocks on the southern flank of the syncline has not been determined because of complex folding. No less than a few tens of metres and perhaps more than 100 m may be present.

Three lithofacies are distinguished. The predominant one consists of interstratified sandstone and mudrock. The sandstone is mainly very fine grained and argillaceous and the mudrock coarse grained and sandy. Flat lamination is common but has been destroyed by bioturbation in some strata. The sandstones are medium grey and the mudrocks medium or medium dark grey and both weather medium grey with hues of olive, or rusty brown if pyritic. Sandstone and mudrock have about the same composition, averaging quartz 69%, carbonate 10% (calcite 5%, dolomite 5%), mica 8% (muscovite and biotite), feldspar 7% (mainly plagioclase) chlorite 7% (uncorrected XRD determinations, Ap. 3, Table 9g). However, in the sandstones some of the quartz, mica, and chlorite occur in fragments of phyllite or schist.

The second lithofacies consists of fine to medium grained sandstone, and sandy limestone transitional to calcareous sandstone. A typical specimen of fine to medium grained sandstone differs from the finer grained sandstones by having a larger percentage of quartz (81%), and smaller percentages of feldspar (5%), mica (3%) and chlorite (5%). The carbonate fraction consists mainly of calcite (7 %) with small amounts of dolomite (1%; uncorrected XRD determination, Ap. 3, Table 9h). The limestones are skeletal packstones composed mainly of echinoderms and lesser proportions of other organisms such as brachiopods, trilobites, bryozoans, and ostracodes. In addition, there are relatively large echinoderm stems, up to 1.5 cm in diameter and 5.5 cm long. The rocks show both flat bedding and trough cross-bedding, the troughs being 10 to 50 cm deep and up to 3 m long.

The third lithofacies is a relatively pure limestone, occurring in massive units, 1 to 16 m thick. The rocks are intensely recrystallized and contain numerous calcite veinlets. Some strata contain large pelecypods.

The flat-laminated mudrock and sandstone probably are of subtidal shelf origin. The sandy limestone and associated sandstone showing trough cross-bedding, probably were deposited in a nearshore high-energy environment.

The Crash Point beds have yielded no diagnostic macrofossils and are poor in diagnostic conodonts. One sample (C-54997) yielded conodonts of unspecified Wenlock to Pridoli age; three had only highly fragmented or undiagnostic conodonts, and four had no conodonts at all. Considering the age of the Marvin Formation, the Crash Point beds can be no older than Ludlow, i.e. they are Ludlow and/or Pridoli in age.

## CLEMENTS MARKHAM FOLD BELT

Formations of the Clements Markham Fold Belt are exposed on nunataks in the southern part of the M'Clintock Inlet map-area but are here known only from brief landings; the stratigraphy and age of these units have been established in other map-areas. Three major units are distinguished: metamorphosed volcanic and sedimentary rocks of supposed Hadrynian and/or Early Cambrian age assigned to the Yelverton assemblage; Ordovician sedimentary and volcanic rocks assigned to the Mount Rawlinson assemblage; and Silurian flysch assigned to the Imina and Lands Lokk formations.

### Yelverton Assemblage

The Yelverton assemblage underlies a northeasterly trending area, 93 km long and up to 8 km wide, that extends from south of Phillips Inlet (Otto Fiord map-area) across uppermost Yelverton Inlet (Tanquary Fiord map-area) into the southwestern extremity of the M'Clintock Inlet map-area. The belt is in faulted contact with upper Paleozoic units or Silurian flysch on the northwest. On the southeastern side, it has been thrust over the Grant Land Formation in the Otto Fiord map-area, and is unconformably overlain by upper Paleozoic strata in the Tanquary Fiord and M'Clintock Inlet map-areas. The stratigraphic bottom or top of the unit are not known to be exposed and its thickness is uncertain because of its structural complexity. More than 1 km of strata are estimated to be present, and 464 m have been measured in detail in the Otto Fiord map-area.

In the region south of Phillips Inlet, the assemblage consists of intercalated sedimentary and volcanic rocks that have been metamorphosed to varying degree. The sedimentary units range in thickness from a few to perhaps a few hundred metres. They are composed of limestone, dolostone or marble; argillaceous sediments metamorphosed to slate, phyllite, or schist; and lesser proportions of chert. Lime mudstone is predominant among the carbonate rocks, but oolitic grainstone has also been observed.

The volcanic rocks, forming units up to several hundred metres thick, comprise tuffs and flows (some with pillow structure) and have petrographically related sills associated with them. Stable trace element ratios together with major element analyses indicate that most of these rocks are subalkaline basalt, but small amounts of andesite are also present. The Nb-Zr-Y ratios permit both mid-ocean ridge or island arc settings but the presence of some shallow marine carbonate rocks seems to exclude the first of these environments. The samples collected from the Otto Fiord and Tanquary Fiord map-areas generally show metamorphism of subgreenschist to greenschist grade. Plagioclase has been altered to albite, and most mafic minerals have been altered to chlorite or actinolite, but remnants of clinopyroxene are commonly preserved.

In the M'Clintock Inlet map-area, the unit is known from brief landings at two localities (77-330b and c) where it consists of impure calcareous marble, impure dolomitic marble, quartzose schist, and schists rich in plagioclase (17 - 32%) and chlorite (18 - 26% in uncorrected XRD determinations) that probably represent tuff or tuffaceous sediments.

The fact that the Yelverton assemblage has been thrust over the Grant Land Formation may indicate that it is of earliest Cambrian or Hadrynian age but no age relationship can be inferred from the present structural configuration if the unit is exotic. To date, no arc-type volcanics of Late Hadrynian - Early Cambrian age have been reported from

from North America, Scandinavia or Svalbard, suggesting that the unit is somewhat younger. On the other hand, the metamorphic state of the unit and the absence of skeletal material from its carbonate rocks, suggest a pre - Late Ordovician age. The Yelverton assemblage is comparable in lithology and setting to the Jaeger Lake assemblage of northern Axel Heiberg Island which has also been thrust over the Grant Land Formation (Trettin, 1987a).

### Mount Rawlinson assemblage

The type area of the Mount Rawlinson assemblage lies northwest of Markham River in the central western part of the Clements Markham Inlet map-area. There the unit forms a fault slice that is intercalated between the Imina Formation on the northwest and the Lands Lokk and Marvin formations on the southeast. It consists of altered and sheared volcanic flows and tuff, marble, and chert. Four analyzed samples of volcanic rocks are classified as andesite, rhyodacite/dacite, and trachyandesite on the basis of stable trace elements. A dacite from the lower part of the exposures has a U-Pb zircon age of 454.7 +9.7 -4.6 Ma (Trettin et al., 1987), Llandeilo according to the time scales of McKerrow (1985) and Odin (1985).

Chert and tuff in the southeastern part of the M'Clintock Inlet map-area are assigned to the Mount Rawlinson assemblage on the basis of structural setting and gross lithology, in spite of some lithological differences. These strata lie on trend with the type area and are also in faulted contact with the Imina Formation on the northwest and the Lands Lokk formation on the southeast. In addition, they are unconformably overlain by upper Paleozoic strata on one nunatak. The chert is medium dark grey and contains identifiable radiolaria. The tuffs consist mainly of lithic fragments of mafic and siliceous composition with smaller proportions of quartz and feldspar crystals. The lithic pyroclasts are extensively replaced by carbonate and unsuitable for chemical analysis.

### Imina Formation

In the Clements Markham Fold Belt, the name Imina Formation (Christie, 1957; Trettin 1969a) designates a uniform succession of interstratified calcareous and dolomitic sandstone and mudrock and rare fine pebble conglomerate. Sandstone and mudrock are commonly associated in Bouma squences, but sandstone and pebble conglomerate also occur frequently as structureless beds that show graded bedding only in the uppermost few millimetres or so. The type area is at Imina Inlet in the Cape Stallworthy map-area but a type section or suitable reference sections have not yet been established because of the complex structure and generally poor exposure of the unit. In the Otto Fiord map-area, the Imina Formation underlies the Lands Lokk with conformable contact; elsewhere the contact is faulted or concealed. A single graptolite collection, and stratigraphic relationships with the Kulutingwak Fiord assemblage and Lands Lokk Formation suggest that the unit is restricted in age to the late Llandovery. Previously, flysch in the Hazen and Central Ellesmere fold belts was also included in the Imina Formation. These deposits are similar in lithology and detrital composition but have a longer age range (latest Ordovician or Llandovery to Early Devonian). They will be asigned to a different unit (Danish River Formation) for stratigraphic and tectonic reasons (Trettin, in prep.).

In the M'Clintock Inlet map-area, the unit has been briefly examined at ten localities. Uncorrected XRD analyses of 12 sandstone samples from the vicinity of M'Clintock and Disraeli Glaciers are listed in Appendix 3, tables 10a and 10b. The sandstones are mainly very fine grained but range up to medium grained, and fine pebble conglomerate is also present. Both sandstone and conglomerate consist mainly of quartz, with lesser amounts of carbonate particles, feldspar (mainly plagioclase), mica (mainly muscovite) and chlorite, and trace amounts of low-grade metamorphic rock fragments and chert. Dolomite is predominant over calcite in samples from Disraeli Glacier, and subordinate in samples from M'Clintock Glacier. The fine pebble (or granule) conglomerate contains fragments of dolostone, chert (with vague radiolarian structures), schist, quartzite, and phyllitic sandstone (Ap. 3, Table 10c).

## Lands Lokk Formation

The name Lands Lokk Formation was introduced for a succession of clastic sediments and minor volcanic and carbonate rocks in northwestern Ellesmere Island that overlies the Imina Formation with conformable contact (Trettin, 1969a, 1987a). Three members were distinguished in the type area around Emma Fiord. Member A, ranging in age from late Llandovery to Ludlow, consists of probably more than 1 km of dark grey mudrock with minor proportions of tuff and tuffaceous sediments. Member B, of Ludlow age, is composed of mudrock,volcanics, and minor amounts of carbonate rocks. It is a local facies, restricted to the vicinity of upper Emma Fiord. Member C, ranging in age from late Llandovery or Wenlock to Ludlow, consists of 1 km or more of interstratified sandstone, mudrock, and minor pebble conglomerate showing primary structures indicative of deposition by sediment gravity flows. Although member C overlies A locally, fossil collections indicate that the two are different facies of widely overlapping age, member A representing basin floor and member C submarine fan environments. These two members have not been mapped separately east of Yelverton Inlet, i.e. in the M'Clintock and Clements Markham Inlet map-areas. The sandstone and mudrock of the Lands Lokk Formation differ from those of the Imina Formation in a relatively high content of silica (mainly quartz with increasing proportions of chert in the coarse grades), and a low content of carbonate material. On air photographs and in the field, the Lands Lokk Formation is distinguished from the Imina by its darker tone.

In the M'Clintock Inlet map-area the unit was examined at seven localities. Four samples of sandstone contain in the average quartz 83% (includes quartz and minor chert), carbonate 6% (calcite and/or dolomite), chlorite 6%, feldspar 4% (mostly plagioclase), and mica 2% (uncorrected XRD determinations; Ap. 3, Table 10d). Similar values were obtained for four samples of coarse mudrock (quartz 80%, chlorite 7%, feldspar 6%, mica 4%, and carbonate 2%; Table 10e), but a sample of fine mudrock had far less quartz (49%), and far more chlorite (24%) and mica (20%), feldspar (7%) being comparable, and carbonate absent (Table 10f).

## HAZEN FOLD BELT

Two nunataks in the southwestern extremity of the M'Clintock Inlet map-area are inferred to be underlain by the Grant Land Formation on the basis of air photo interpretation and alignment with known outcrops in the Clements Markham Inlet map-area. In the Otto Fiord and Tanquary Fiord map-areas, the Grant Land Formation consists of perhaps 2 km of interbedded quartzite and phyllite or slate with minor amounts of pebble conglomerate and intraformational and flat-pebble conglomerate. The unfossiliferous unit is probably Early Cambrian in age and correlative with the Ellesmere Group of the Central Ellesmere Fold Belt. It it is inferred to have been derived from the North American craton and to have been deposited in submarine fan environments (Trettin et al., 1987).

## INTRUSIONS

Plutonic rocks of felsic to ultramafic composition intrude strata of successions II and IV of the Pearya Terrane or are in faulted contact with Succession III. They are described here in a tentative chronological order although only three bodies have so far been dated reliably. The established or supposed ages range from Hadrynian or Cambrian to Late Cretaceous, but the majority appear to be Ordovician in age.

Metamorphosed and unmetamorphosed dykes and sills of different ages occur throughout the Neohelikian to Permian column. These rocks have not been investigated systematically and are discussed only very briefly.

### Ward Hunt Intrusion

On Ward Hunt Island, schist and phyllite of the Mount Disraeli Belt (map-unit s) are intruded in an interfingering pattern by a syenite, described as follows by Frisch (1974, p. 24). "The syenite is pink, medium to coarse grained, and consists of microcline perthite, interstitial quartz (estimated to be 5-7% by volume), and mafic minerals, which are now highly altered to green biotite and black opaque material. Most of the syenite has been crushed and rendered gneissic. However, the appearance of the undeformed rock and the manner in which it veins the schist, both on the scale of the hand specimen and in outcrop, leave no doubt that the syenite is an intrusive rock younger than the schist." "Where syenite has been injected into schist and cataclasis has occurred, a peculiar hybrid gneissic rock has resulted. Angular grains of albite and microcline perthite, which appear to be fragments of larger grains, lie in a granular matrix of feldspar and quartz. Chlorite is generally abundant and, with muscovite, defines an excellent foliation. The perthite is thought to have been contributed by the syenite, and the plagioclase by the schist".

The age of the Ward Hunt Intrusion is unknown as no isotopic determinations have been made. Frisch (1974) regarded it as part of the Cape Columbia Complex, subsequently dated as late Neohelikian (Sinha and Frisch, 1976). However, the schist and phyllite are aligned with and lithologically comparable to strata of the Mount Disraei Belt, tentatively assigned to the undifferentiated Hadrynian-Cambrian in this report. If the assumed age of the Mount Disraeli Belt is correct, then the Ward Hunt Intrusion can be no older than Hadrynian. On the other hand, its metamorphic state suggests that it predates the mid-Ordovician M'Clintock Orogeny. Perhaps it is related to a Hadrynian or Cambrian rifting event, also suggested by alkaline felsic volcanics at Yelverton Bay that have been assigned to Succession II (Trettin and Frisch, 1987).

## Thores Suite

The Thores Suite comprises five occurrences of predominantly ultramafic and mafic rocks some of which have small proportions of felsic rocks associated with them. All are bounded by faults and may be fragments of one or several ophiolite sheets and therefore are referred to as bodies rather than plutons. The M'Clintock West and East bodies were previously called massifs (Frisch, 1974) but the latter is too small to merit this name.

### Location, contact relationships, and structure

M'Clintock West body

The M'Clintock West body underlies a glacier-covered ridge west of upper M'Clintock Inlet that rises to an altitude of 1400 m. It is 13 km long in a westerly to northwesterly direction and up to 6.8 km wide. On the east side of the ridge, the ultramafic and mafic rocks are nonconformably overlain by clastic sediments of Middle Pennsylvanian age. The western contact of the body, with metamorphosed volcanic rocks of the Maskell Inlet assemblage, is covered by ice. On the north and south the M'Clintock West body is terminated by linear faults. The southern fault is bordered on the south by carbonate (map-unit c) and schist (map-unit s) of undifferentated Hadrynian-Cambrian age (Succession II, Empire Belt). Exposures of the contact have not been seen but serpentinite in its vicinity is intensely brecciated. Air photo interpretation suggests that the fault dips steeply to the north. The northern fault is bordered on the north by carbonate rocks of the Upper Ordovician Ayles Formation that dip steeply to the north. This fault, which is covered, is tentatively interpreted as a north-dipping normal fault.

M'Clintock East body

This body, located about 8 km east of upper M'Clintock Inlet, is about 3.8 km long in an easterly direction and 1.2 km wide. On the north it is separated from upper Paleozoic sediments by a fault of uncertain attitude, presumably a north-dipping normal fault. On the south it is bounded by an arcuate thrust fault that places it on the Maskell Inlet assemblage, which in turn has been thrust southward over carbonate and clastic sediments of the Upper Ordovician Harley Ridge Group. The presence of a fault slice of metasediments within the predominantly ultramafic mass indicates that the body consists of two or more thrust sheets. The internal and external thrust faults dip north at moderate angles as does the primary igneous layering.

### Thores River body

This body, occurring about 13 km west of the mouth of Thores River, is about 2.5 km long and up to 160 m wide and consists of sheets of ultramafic and mafic rocks that dip north at moderate angles. On the north side it is overthrust by a thin sheet of metavolcanic schist assigned to the Maskell Inlet assemblage, which is in faulted contact with the Upper Ordovician Zebra Cliffs Formation farther north. On the south side it is in faulted contact with dolostone of Late Carboniferous age. The body pinches out on the east and is bordered by a glacier on the west.

### Bromley Island body

Located on the west side of Bromley Island, this body is about 2 km long in a northerly direction and up to 1 km wide. On the west side it is separated from a carbonate unit of the Maskell Inlet assemblage by a steeply dipping fault. The concealed contacts with other rock types of the Maskell Inlet assemblage (volcanics, chert, etc.) on the north and east are also interpreted as faults.

A northeastern part of the Bromley Island body is nonconformably overlain by a flat-lying dolostone, assigned to member B of the Cape Discovery Formation on the basis of attitude and the presence of coated grains of algal origin. Blue-green algae are common in the western facies of that unit but have not been seen in the metamorphosed carbonates of the Maskell Inlet assemblage. The absence of member A at this locality is attributed to nondeposition on a topographic high. Farther south the body is bordered by another erosional patch of the Cape Discovery

Formation that includes a very thin and local, fossiliferous development of member A and more extensive strata of member B.

Ootah Bay body

The Ootah Bay body crops out on central Marvin Peninsula, about 3 km east of Ootah Bay. It is the smallest of the five bodies discussed, being about 1 km long in a northerly direction and up to about 170 m wide. It occurs in an area characterized by extremely complex faulting and is in faulted contact with the Cape Discovery, M'Clintock and Taconite River (?) formations.

**Lithology**

M'Clintock West body

The M'Clintock West body consists mainly of an ultramafic association (Oub) that is intruded by small bodies of mafic to felsic composition (g for granitic). The following summary description is based on earlier publications by Frisch (1974) and Trettin (1969b) and some additional petrographic work.

The **ultramafic-mafic** association is composed mainly of serpentinite with small proportions of gabbro, wehrlite, and clinopyroxenite.

The **mafic-felsic** association occurs mainly in sheets or groups of sheets that are up to about 10 m thick and up to several hundred metres long. One body is oval in plan with a diameter of about 300 m. The following rock types have been recognized:

- clinopyroxene-hornblende diorite, melanocratic
- hornblende diorite, melanocratic and average, in part pegmatitic; this rock type also forms a nunatak west of the M'Clintock West body, within the area underlain mainly by the Maskell Inlet assemblage (80-207b)

- monzodiorite
- quartz monzodiorite
- tonalite, leucocratic (trondjhemite)
- granodiorite

M'Clintock East body

This body consists mostly of ultramafic and mafic rocks; rocks of felsic composition are limited to the southeastern extremity of the outcrop area.

The **ultramafic-mafic association** is fine to coarse, predominantly medium grained and layered. The common occurrence of monomineralic cumulates indicates that much of the layering is primary. The predominant primary minerals of the ultramafic rocks are clinopyroxene and hornblende (although some hornblende is secondary) with rare olivine and phlogopitic biotite. Some rocks contain also small amounts of plagioclase. The mafic rocks differ by containing larger proportions (more than 10%) of plagioclase. The plagioclase in all samples studied is altered to albite, and a distinction between gabbro and diorite cannot be made with assurance. The mafic rocks are called gabbro (rather than diorite) because they are more closely associated with ultramafic rocks than with felsic rocks. The rock types identified and their characteristics are listed below.

- Serpentinite:
  seems to be confined to the vicinity of felsic intrusions.
- Wehrlite:
  represented only by one specimen collected by Frisch (1974, p. 63); it is comparable to wehrlite in the M'Clintock West body.
- Olivine clinopyroxenite:

one specimen analyzed by point count contains clinopyroxene 75%, olivine 10%, serpentine 14%, and small amounts of opaques; the serpentine occurs interstitially and in veinlets.

- Clinopyroxenite:
  in addition to the predominant clinopyroxene, very small amounts of opaques are present generally, and trace amounts of phlogopitic biotite in one specimen. Some specimens are unaltered, others contain varying proportions of actinolite and/or chlorite; one is altered completely to actinolite and chlorite.

- Hornblende clinopyroxenite:
  clinopyroxene is predominant over hornblende; opaques (probably magnetite) are fairly common in interstices; primary hornblende is also present in interstices.

- Clinopyroxene hornblendite:
  similar to hornblende clinopyroxenite, except that hornblende is more abundant than clinopyroxene.

- Plagioclase-clinopyroxne hornblendite:
  contains less than 10 % albite.

- Gabbro:
  one sample contains clinopyroxene alone as the principal mafic silicate; others have varying proportions of clinopyroxene and hornblende; red, phlogopitic biotite occurs in one specimen; some by chlorite (and sericite) alteration.

- Hornblende gabbro (melanocratic):
  a semiquantitative XRD determination, combined with thin section inspection, indicates hornblende 59%, chlorite 17%, sericitized albite 19%, mica (mainly sericite, trace amounts of phlogopitic biotite) 2%, epidote 3%, + opaques.

The **felsic rocks** occur as sheets that are separated by serpentinite. A typical specimen represents an altered, medium-grained, leuco-monzodiorite. It consists mainly of albite (56% in uncorrected XRD determination) and perthitic K-feldspar (19%) with a few percent of biotite, partly altered to chlorite, and trace amounts of brownish, twinned and zoned hornblende. The feldspar is altered by sericite (total sericite and biotite 9%), epidote (7%), and calcite (6%).

Thores River body

Specimens collected during a brief traverse of the eastern extremity (82-312c, d), represent the following rock types.

- Clinopyroxenite, fine and medium grained.

- Hornblende diorite, pegmatitic:
  hornblende phenocrysts up to 1.5 cm long in a groundmass of hornblende (total hornblende 44% according to uncorrected XRD determination), sericitized albite (19 %), prehnite (28 %), and minor muscovite (total mica 9 %), occuring partly in veinlets.

- Monzodiorite, leucocratic, highly altered, fine grained:
  albite 31% (according to uncorrected XRD analysis), K-feldspar 5%, quartz 2%; feldspar extensively replaced by epidote (37%) and calcite 15%; mafic silicates replaced by chlorite (5%) and actinolite (5%).

- Quartz diorite, fine grained, sheared:
  quartz 47% (uncorrected XRD analysis), albite 34%, K-feldspar 1%, chlorite 15%, green biotite 1%.

Bromley Island body

This body consists of gabbro and serpentinized ultramafic rocks, prevalent in the westernmost part. An ultramafic rock specimen from locality 65-220a consists mainly of serpentine with 11% clinopyroxene, 1% each of phlogopitic biotite and actinolite, and trace amounts of talc (?) and opaque minerals. Much of the serpentine shows mesh structure, suggesting replaced olivine. The clinopyroxene occurs interstitially. Dolomite and calcite replacement are common near the contact with overlying and adjacent carbonate rocks.

Ootah Bay body

Two specimens from locality 77-237c represent medium-grained, partly serpentinized wehrlite and serpentinite, respectively. The wehrlite consists mainly of fosterite and clinopyroxene (XRD ratio 3:2) with small amounts of phlogopitic biotite, primary and secondary opaque minerals, and considerable serpentine. The clinopyroxene occurs interstitially and encloses the olivine. In the serpentinite the olivine is entirely replaced by serpentine, carbonate, and magnetite, but its former presence is recognizable by the mesh structure in the serpentine. The clinopyroxene, which occurs interstitially, is partly preserved.

Summary

A total of 14 major rock types, not counting leucocratic and melanocratic varieties, are recognized (Table 2). Five of these: serpentinite, wehrlite, clinopyroxenite, gabbro, and monzodiorite occur in three or four bodies, the remaining nine rock types in one or two bodies only.

**Mode of origin**

Elucidation of the origin of the Thores Suite requires detailed petrological and chemical studies and systematic comparison with other suites of ultramafic to felsic composition. Suffice it to state that the suite is markedly different from layered intrusions, such as Bushveld, Stillwater, Skaergaard etc. (e.g. Wyllie, 1967; Wager and Brown, 1967) but that it has features in common with (1) standard ophiolites probably representing most mid-ocean ridges or back-arc basins (Coleman, 1977); (2) the ultramafic and gabbroic floor of the Ligurian Tethys (Lemoine et al., 1987); and (3) plutons associated with ensimatic arcs, for example in California (Snoke et al., 1981, 1982) Alaska (e.g. Taylor, 1967; Irvine, 1974; Himmelberg et al., 1986), and British Columbia

| | M'Clintock West | M'Clintock East | Thores River | Bromley Island | Ootah Bay |
|---|---|---|---|---|---|
| Serpentinite | X | X | | X | X |
| Wehrlite | X | X | | X | X |
| Olivine clinopyroxenite | | X | | | |
| Clinopyroxenite | X | X | X | | |
| Hornblende clinopyroxenite | | X | | | |
| Clinopyroxene hornblendite | | X | | | |
| Plagioclase-clinopyroxene hornblendite | | X | | | |
| Gabbro | X | X | | X | |
| Hornblende gabbro | | X | | | |
| Clinopyroxene-hornblende diorite | X | | X | | |
| Hornblende diorite | X | | | | |
| Monzodiorite | X | X | X | | |
| Quartz monzodiorite | X | | | | |
| Tonalite (leucocratic = trondjhemite) | X | | | | |
| Granodiorite | X | | | | |

**Table 2.** Thores Suite, distribution of rock types.

(Findley, 1969).

Briefly, the peridotite tectonite of Coleman may be represented by the serpentinite of the M'Clintock West body but is not identifiable here because of the serpentinization; Coleman's "cumulate complexes" by the cumulates of the M'Clintock East body and similar rock types in the other bodies; and his "leucocratic associates" by the subordinate felsic rocks of the Thores Suite, the absence of orthopyroxene from the cumulates, and the presence of minor amounts of K-feldspar in the felsic associates notwithstanding. The absence of the upper two members of the standard ophiolite, sheeted dykes and pillow basalt, may be attributable to faulting.

Alternatively, the absence of sheeted dykes and basalt may be an original feature of a genuine oceanic mantle-crust assemblage, as is the case in the Ligurian Thethys of Alps, Corsica and Apennines (Lemoine et al., 1987). There, serpentinite and gabbro are directly overlain by sediments.

Important properties in common with the Alaska intrusions are the absence of orthopyroxene and the common occurrence of hornblende in a variety of rock types, including pegmatitic hornblende diorite; important differences are the absence of concentric zoning and presence of felsic differentiates in the Thores Suite.

## Age

Relationships with nonconformably overlying sedimentary rocks indicate that the M'Clintock West body is older than Middle Pennsylvanian, and the Bromley Island body older than Blackriveran (early Caradoc).

A K-Ar determination on hornblende from a felsic rock in the M'Clintock West body gave an apparent age of 398 ± 20 Ma (recalculated from Wanless et al., 1967), which was difficult to reconcile with the stratigraphic evidence on Bromley Island. A more satisfactory result was obtained from a U/Pb zircon determination on the same outcrop (Trettin et al., 1982). The age obtained, 481 +7/-6 Ma falls into the Arenig according to the time scales of Harland et al. (1982), Palmer (1983), McKerrow et al. (1985) and Odin (1985).

## Small granitic intrusions in Succession II

### North of upper Ayles Fiord

A small, concordant sheet of granodiorite intrudes the axial region of a recumbent fold formed in marble and schist of the Empire Belt (map-unit psvqc) north of upper Ayles Fiord (loc. 77-219e). A specimen analyzed by point count and XRD consists of plagioclase 39% (andesine - sodic oligoclase), microcline 21%, quartz 20%, biotite 20%, and trace amounts of chlorite and muscovite. Accessories include opaque minerals, apatite, and zircon (?). Myrmekitic intergrowths of feldspar and quartz are common. The rock is medium grained, relatively unaltered, and not cataclastic but shows microscopic sigmoidal folds that involve feldspar.

This clearly syntectonic intrusion is tentatively correlated with the peak of the mid-Ordovician M'Clintock Orogeny. The development of staurolite and garnet in pelitic rocks, not only adjacent to this sheet but also about 150 m to the north, suggests that the sheet observed is an offshoot of a larger syntectonic body at depth.

### East of lower Disraeli Glacier

In this area, a small granitic plug intrudes map-unit pqwv of presumed Late Hadrynian age. Different rock types are represented by two samples. One is a leucocratic granite composed of quartz, albite, microcline (in part perthitic) and small amounts of muscovite and opaque minerals. Accessories include apatite and fairly common tourmaline. The other is a monzodiorite composed mainly of albite and chlorite and minor amounts of microcline and apatite. The rock is altered by sericite, epidote, and calcite. This plug may also be related to the M'Clintock Orogeny and to the Markham Fiord Pluton of the Clements Markham Inlet map-area, dated at 462 ± 11 Ma (Trettin et al., 1982).

### Cape Richards Intrusive Complex

The Cape Richards intrusive complex (Frisch, 1974) has two outcrop areas that are separated by a narrow belt of country rock. It intrudes map-unit pwqc of the Empire Belt presumed to be Late Hadrynian in age. In the complex Frisch distinguished "outer zone" rocks, chiefly quartz monzonite close to granodiorite, and "inner zone" rocks, chiefly hornblende syenite, which become progressively more felsic outward from the centre and contain riebeckite-bearing dykes. The cauldron-like outline of the two exposures, and the slightly alkaline composition suggest emplacement during an extensional regime.

The age of crystallization probably is defined by a concordant sphene age of 463 ± 5 Ma, Llanvirn according to the time scales of McKerrow (1985) and Odin (1985). Xenocrystic zircon had an upper intercept age of 1450 ±400 Ma, suggesting derivation of the magma from the crystalline basement of Pearya (Trettin et al., 1987). An earlier K-Ar determination on biotite with a Devonian apparent age of 383 ± 16 Ma (recalculated from Frisch, 1974) must reflect a later thermal event that also affected the M'Clintock West body and the Cape Fanshawe Martin intrusion.

## Cape Fanshawe Martin Intrusion

The Cape Fanshawe Martin Intrusion (Frisch, 1974) straddles the boundary between the Yelverton Inlet and M'Clintock Inlet map-areas. In the M'Clintock Inlet area it intrudes map-units scq and pwqc of the Empire Belt. The intrusion is layered and was divided by Frisch into an olivine-rich central zone of peridotite and gabbro and a larger outer zone of gabbro. Cryptic zoning is shown by olivine and plagioclase, which are more magnesian and calcic, respectively, in the inner zone than in the outer. Igneous layering, steeply inclined to vertical, and fluxion cumulate texture are especially common in the inner zone.

A K-Ar determination on biotite from the outer zone yielded a Middle Devonian age of 383 $\pm$ 16 Ma (recalculated from Frisch, 1974) that probably reflects a later thermal event, as do comparable K-Ar ages from the M'Clintock West body and Cape Richards intrusive complex. This intrusion clearly indicates a major extensional event and may be correlative with either the Thores Suite or the Cape Richards complex; the relatively unaltered state of preservation may support the second alternative.

## Pluton on southwestern Marvin Peninsula

A small pluton on southwestern Marvin Peninsula, about 2.9 km long and up to 1.3 km wide with a topographic relief of 300 - 400 m, intrudes the Upper Ordovician Taconite River Formation. Reconnaissance work indicates that the pluton is massive and rather homogenous. Analyzed specimens from different localities are fine to medium grained and similar in texture and mineral composition, lying in the boundary field of quartz monzodiorite, quartz monzonite, and granodiorite. Zoned plagioclase (commonly oligoclase - andesine) predominates over K-feldspar, the latter frequently associated with quartz in graphic intergrowths. Most of the quartz, however, occurs as separate crystals and in interstices. The predominant mafic silicate is green hornblende, with clinopyroxene present in smaller proportions and biotite in very small amounts.

A large sample of quartz diorite did not contain zircon. Two concentrates of little-altered hornblende yielded apparent ages of 94.2 ± 10 Ma, and 91.6 ±9.6 Ma, averaging 92.9 Ma (Stevens et al., 1982). This age is accepted as the age of cooling after intrusion because it is close to the U-Pb age of 92.0 ±1.0 Ma obtained for the bimodal Wootton Intrusion on Wotton Peninsula, Yelverton Inlet map-area (Trettin and Parrish, 1987).

## Mafic dykes and sills

Mafic dykes and sills of different ages and metamorphic grades occur throughout the Neohelikian to Permian column. No attempts have been made to date them but the following broad categories can be distinguished:

(1) Amphibolites in Succession I that probably predate the Grenvillian Orogeny.

(2) Amphibolites and greenschist-grade intrusions in successions II and III that probably predate the M'Clintock Orogeny.

(3) Generally unmetamorphosed intrusions in Upper Ordovician to Permian strata that may range in age from Middle Ordovician to Late

Cretaceous. This group consists mainly of diabase but also includes other rock types. A biotite-rich lamprophyre with subequal amounts of microcline and plagioclase (oligoclase ?), considerable calcite and some quartz and chlorite, forms a knob on northeasternmost Marvin Peninsula, adjacent to the mouth of Disraeli Fiord (80-205a). Mafic sills with alkaline composition occur on south-central Marvin Peninsula (79-213a), east of section SMP; the study of these rocks has not yet been completed.

## OUTLINE OF STRUCTURAL HISTORY

Parts of the M'Clintock Inlet map-area have been affected by up to five orogenies, briefly summarized below.

1. Succession I was affected by granitic intrusion and amphibolite-grade metamorphism at 1.0 - 1.1 Ga.

2. Successions I, II, and III were affected by the Middle Ordovician M'Clintock Orogeny, inferred from an angular unconformity at the base of Succession IV. The structures formed during this event are difficult to separate from younger deformations, but complex folding and faulting is apparent beneath the unconformity on Bromley Island and north of Ayles Fiord. The most important structure attributable to this event is a fault that places the Bromley Island Belt (Maskell Inlet assemblage and Thores Suite) on the north and east against Succession II (Empire Belt) on the south and west. The fault has been interpreted as a suture that places an arc and its underlying oceanic crust upon a miogeocline (cf. Trettin, 1987b, Fig. 20).

The orogeny was accompanied by Barrovian metamorphism up to amphibolite grade, developed locally in successions II and III. A K-Ar (muscovite) age of 452 ± 8 Ma on schist west of the head of M'Clintock Inlet (map-unit sc) is interpreted as a cooling age that postdates the metamorphism. Different kinds of granitic plutons were intruded during and after the main deformation. The Markham Fiord pluton of the Clements Markham Inlet map-area probably resulted from subduction (cf. Trettin et al., 1982; Trettin, 1987b) and the Cape Richards intrusive complex from post-orogenic rifting that also initiated the deposition of Succession IV. The alkalic felsic volcanics in member A of the Cape Discovery Formation may be genetically related to the alkalic rocks in the Cape

Richards complex.

The main event, the age of which which is bracketted by the Arenig U-Pb age of the M'Clintock West body and by Blackriveran (early Caradoc) fossils from member A of the Cape Discovery Formation, was followed by a minor event in Richmondian time, which produced an unconformity at the base of the Harley Ridge Group. It is a low-angle, "regional" unconformity where the Harley Ridge Group overlies the Egingwah Group, and an angular unconformity southeast, south, and west of the head of M'Clintock Inlet where it lies on Succession II. In the latter area it caused a certain tectonic stabilization evident from the fact that the Upper Ordovician and upper Paleozoic units here are only slightly deformed.

(3) The next two events occurred in the interval between the deposition of the Crash Point beds (Late Silurian, late ? Ludlow or Pridoli) and that of the basal units of the Sverdrup Basin in early Late Carboniferous (Moscovian) time. They cannot be distinguished and dated in the M'Clintock Inlet area alone but require broader regional considerations (Trettin, 1987b).

The Pearya Terrane is inferred to have been accreted to the Clements Markham Fold Belt, as a number of fault slices, by means of sinistral strike slip on southwesterly trending linear faults, such as the M'Clintock Glacier and Mount Rawlinson faults. Both were reactivated in post-Carboniferous (presumably early Tertiary) time and the M'Clintock Glacier Fault also has been offset by two (or more) cross-faults that are covered by glaciers. Three slices are recognized in the M'Clintock Inlet map-area, comprising (1) the Cape Columbia Belt, (2) the combined Cape

Discovery, Empire and Bromley Island belts and the unconformably overlying strata of Succession IV ("Southeast Pearya"), and (3) the Disraeli Glacier Belt. The latter is interpreted as a sliver of Southeast Pearya but the structural relationships between Southeast Pearya and the Disraeli Glacier Belt in the vicinity of lower Disraeli Glacier remain to be clarified.

The curvature of structural trends in the western part of Southeast Pearya is thought to have developed during the last stages of movement when Southeast Pearya was squeezed between the Mitchell Point Belt and the Clements Markham Fold Belt. Rather indirect evidence suggests that this accretion occurred in the Late Silurian with deformation (and granitic plutonism in northwestern Ellesmere Island) continuing into the Early Devonian.

(4) A major phase of southeasterly to southerly directed compression, the Ellesmerian Orogeny **sensu stricto**, affected the entire Franklinian mobile belt in Late Devonian - Early Carboniferous time. It must have accentuated the curvature of trends in the western part of the map-area and may account for southeast-directed thrust faults in the vicinity of Ayles Fiord and Taconite River.

(5) The Eurekan Orogeny of early Tertiary age affected the Carboniferous and lower Tertiary strata, along with the older rocks. It involved compressional thrust faulting, normal faulting and probably also dextral strike slip between the Clements Markham and Hazen fold belts along the Porter Bay Fault, which probably extends into the southeastern part of the M'Clintock Inlet map-area although it is covered here by a glacier. The effects of this event can only be assessed when the structure of the Carboniferous and Tertiary units has been plotted.

The orogeny was followed by isostatic uplift(s) and erosion during the Neogene, which produced the present topography. Maskell Inlet, M'Clintock Inlet, and Disraeli Fiord appear to be erosional features that may have been localized by faults and fractures, but there is no evidence that they are the site of Tertiary grabens comparable to Lancaster Sound and other Tertiary downwarps in the southeastern parts of the Arctic Archipelago.

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# APPENDIX 1

## TERMS USED TO DESCRIBE THE SIZE RANGES OF CARBONATE CRYSTALS

The grades distinguished correspond to the Wentworth scale, and the names used have been adapted from Leighton and Pendexter (1962) and Drummond (1963). In this nomenclature, carbonate grains of sand size are described in terms of sand grades (i.e. very fine, fine, etc.), those of silt size are termed microcrystalline, and those of clay size, cryptocrystalline. Although the cryptocrystalline grains are visible in thin section under the highest power objective, the term seems justified as optical tests cannot be made on these crystals.

2-1 mm......................very coarsely crystalline

1-0.5 mm....................coarsely crystalline

0.5-0.25 mm.................medium crystalline

0.25-0.12 mm................finely crystalline

0.12-0.06 mm................very finely crystalline

0.06-0.004 mm...............microcrystalline

0.06-0.03 mm................coarsely microcrystalline

0.03-0.004 mm...............finely microcrystalline

0.004 mm or less.............cryptocrystalline

# APPENDIX 2

## CHEMICAL ANALYSES

Generally, major elements have been analyzed by wave-length dispersive X-ray fluorescence on fused discs (method 1), in combination with rapid techniques (method 4) for FeO, $H_2O$ and $CO_2$, and with optical emission spectography (method 3) for low values of MnO, MgO, and CaO.

Of special importance for the classification and interpretation of volcanic rocks are the stable trace elements Nb, Y, and Zr, which have been determined by energy-dispersive X-ray fluorescence (method 2), and Ti, which has been analyzed by a variety of methods (1, 3, and 5= colorimetric spectography). In those cases where duplicate analyses have been made by method 2 for Nb, Y, and Zr, the arithmetic mean is recorded, regardless of confidence limits. Where two or more methods have been used to determine $TiO_2$ a value has been selected (by G.R. Lachance) that appeared most approriate in view of the observed scatter and the reliability of given methods for certain concentrations.

Other trace elements have been determined by methods 1, 2, or 3. The lower detection limit is shown by the symbol , which does not necessarily imply that the trace elements actually are present.

Table 1. Analytical methods and estimated maximum error.

Method 1: wave-length dispersive X-ray fluorescence.

Method 2: energy dispersive X-ray fluorescence using Compton scatter.

Method 3: spectometric analysis, using direct reading of emission spectra.

Method 4: rapid chemical techniques.

Method 5: colorimetric spectroscopy.

| | Methods 1, 4 | | Method 3 | |
|---|---|---|---|---|
| | Relative % * | Absolute % (= detection limit) | Relative % | Detection limit % |
| $SiO_2$ | 1 | 0.40 | | |
| $Al_2O_3$ | 1 | 0.40 | | |
| $TiO_2$ | 1 | 0.02 | | 0.015 |
| $Fe_2O_3$ | 1 | 0.10 | | |
| $FeO$ | 2 | 0.20 | | |
| $MnO$ | 2 | 0.01 | | 0.0065 |
| $MgO$ | 1 | 0.01 | | 0.080 |
| $CaO$ | 1 | 0.10 | | 0.0030 |
| $Na_2O$ | 1 | 0.50 | | |
| $K_2O$ | 1 | 0.05 | | |
| $P_2O_5$ | 1 | 0.02 | | |
| $CO_2$ | 3 | 0.05 | | |
| $H_2O$ | 5 | 0.10 | | |

* of concentration

| | Method 1 | | Method 3 | | Method 2 | |
|---|---|---|---|---|---|---|
| | Relative % * | Absolute ppm (= detection limit) | Relative % * | Detection limit ppm | Relative % * | Absolute ppm (= detection limit) |
| As | | | 15 | 2000 | 10 | 30 |
| B | | | 15 | 50 | | |
| Ba | 2 | 20 | 15 | 5 | | |
| Br | | | | | 10 | 10 |
| Co | | | 15 | 10 | | |
| Cr | | | 15 | 5 | | |
| Cu | | | 15 | 7 | | |
| La | | | 15 | 100 | 10 | 10 |
| Mo | | | 15 | 50 | | |
| Nb | | | | | 10 | 10 |
| Ni | 10 | 20 | 15 | 10 | | |
| Pb | | | 15 | 700 | 10 | 30 |
| Rb | 2 | 20 | | | 10 | 10 |
| Sr | 10 | 20 | 15 | 10 | 10 | 10 |
| Th | | | | | 10 | 10 |
| U | | | | | 10 | 30 |
| V | | | 15 | 20 | | |
| Y | | | 15 | 40 | 10 | 10 |
| Yb | | | 15 | 4 | | |
| Zn | 10 | 20 | 15 | 200 | | |
| Zr | 10 | 20 | 15 | 20 | 10 | 10 |

Appendix 2 Table 1

M'Clintock Inlet map-area, map-unit psvqc-V

| Field # | 77TM218A3 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| An. # | 56-80-8, 86-83-51 | | | | | | | | | | | |
| # | | Meth. | | Meth. | | Meth. | | Meth. | | Meth. | | Meth. |
| $SiO_2$ % | 45.4 | 1 | . | 1 | . | 1 | . | 1 | . | 1 | . | 1 |
| $Al_2O_3$ | 14.5 | 1 | . | 1 | . | 1 | . | 1 | . | 1 | . | 1 |
| $TiO_2$ | 2.82 | 5, 1 | . | | . | | . | | . | | . | |
| $Fe_2O_3$ | 4.6 | 1 | . | 1 | . | 1 | . | 1 | . | 1 | . | 1 |
| FeO | 8.5 | 4 | . | 4 | . | 4 | . | 4 | . | 4 | . | 4 |
| MnO | 0.14 | 3 | . | | . | | . | | . | | . | |
| MgO | 5.33 | 1 | . | | . | | . | | . | | . | |
| CaO | 6.82 | 1 | . | | . | | . | | . | | . | |
| $Na_2O$ | 2.5 | 1 | . | 1 | . | 1 | . | 1 | . | 1 | . | 1 |
| $K_2O$ | 0.05 | 1 | . | 1 | . | 1 | . | 1 | . | 1 | . | 1 |
| $P_2O_5$ | 0.69 | 1 | . | 1 | . | 1 | . | 1 | . | 1 | . | 1 |
| $CO_2$ | 3.0 | 4 | . | 4 | . | 4 | . | 4 | . | 4 | . | 4 |
| $H_2O$ | 4.6 | 4 | . | 4 | . | 4 | . | 4 | . | 4 | . | 4 |
| Total | 99.0 | | . | | . | | . | | . | | . | |

| | | |
|---|---|---|
| As ppm | 14.5 | 2 |
| B | <50 | 3 |
| Ba | 21 | 3 |
| Br | 4 | 2 |
| Co | 24 | 3 |
| Cr | 96 | 3 |
| Cu | 58 | 3 |
| La | <100 | 3 |
| Mo | 2.5 | 2 |
| Nb | 23 | 2 |
| Ni | 48 | 3 |
| Pb | 20.5 | 2 |
| Rb | 0.5 | 2 |
| Sr | 273 | 2 |
| Th | 7.5 | 2 |
| U | 0 | 2 |
| V | 210 | 3 |
| Y | 50.5 | 2 |
| Yb | 9.1 | 3 |
| Zn | 100 | 1 |
| Zr | 232.5 | 2 |

Appendix 2 Table 1

M'Clintock Inlet map-area, map-unit PSvqc-v

| Field # | Anal. # | # | $TiO_2$ % Meth. 1 | Meth. 3 | Meth. 5 | chosen value | Nb ppm a | b | $\bar{x}$ | Y ppm a | b | $\bar{x}$ | Zr ppm a | b | $\bar{x}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 77TM 218 A3 | 86-83-51 | 1 | 2.85 | 4.17 | 2.80 | 2.82 | 21 | 25 | 23 | 49 | 52 | 50.5 | 230 | 235 | [illegible] |

Appendix 2 Table 2a
Maskell Inlet assemblage (W. of M'Clintock Inlet)

| Field # | 77 TM 302 C2 | | 77 TM 301 C1 | | 66 TM 308 E4 | | 77 TM 301 C2 | | 77 TM 302 C1 | | 77 TM 301 B1 | | 77 TM 233 C1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| An. # | 57-79-14, 86-83-6 | | 57-79-13, 86-83-3 | | 56-80-7 | | 2-82-5, 86-83-4 | | 10-79-11, 86-83-5 | | 57-79-12, 86-83-1 | | 10-79-12, 86-83-2 | |
| # | 1 | Meth. | 2 | Meth. | 3 | Meth. | 4 | Meth. | 5 | Meth. | 6 | Meth. | 7 | Meth. |
| $SiO_2$ % | 48.6 | 1 | 50.1 | 1 | 51.3 | 1 | 51.8 | 1 | 54.2 | 1 | 54.9 | 1 | 55.6 | 1 |
| $Al_2O_3$ | 16.9 | 1 | 16.5 | 1 | 16.1 | 1 | 17.0 | 1 | 17.4 | 1 | 16.3 | 1 | 14.9 | 1 |
| $TiO_2$ | 1.02 | 5, 3, 1 | 0.96 | 3, 1 | 1.29 | 1 | 0.99 | 5, 1 | 0.90 | 5, 3, 1 | 0.71 | 5, 1 | 1.24 | 5, 1 |
| $Fe_2O_3$ | 6.0 | 1 | 3.9 | 1 | 5.8 | 1 | 6.3 | 1 | 1.0 | 1 | 0.8 | 1 | 3.6 | 1 |
| FeO | 3.0 | 4 | 6.6 | 4 | 5.6 | 4 | 4.6 | 4 | 6.5 | 4 | 5.6 | 4 | 6.4 | 4 |
| MnO | 0.17 | 3 | 0.19 | 3 | 0.16 | 3 | 0.21 | 1 | 0.16 | 1 | 0.18 | 3 | 0.27 | 3 |
| MgO | 3.66 | 1 | 5.73 | 1 | 2.80 | 1 | 4.44 | 1 | 4.27 | 1 | 3.48 | 1 | 4.29 | 1 |
| CaO | 9.54 | 1 | 6.35 | 1 | 2.81 | 1 | 4.15 | 1 | 4.60 | 1 | 4.66 | 1 | 5.32 | 1 |
| $Na_2O$ | 4.0 | 1 | 4.2 | 1 | 4.4 | 1 | 4.7 | 1 | 3.5 | 1 | 6.8 | 1 | 3.0 | 1 |
| $K_2O$ | 1.59 | 1 | 1.02 | 1 | 4.03 | 1 | 0.77 | 1 | 3.28 | 1 | 0.31 | 1 | 0.42 | 1 |
| $P_2O_5$ | 0.29 | 1 | 0.12 | 1 | 1.03 | 1 | 0.10 | 1 | 0.32 | 1 | 0.13 | 1 | 0.17 | 1 |
| $CO_2$ | 0.3 | 4 | 0.4 | 4 | 0.5 | 4 | 0.2 | 4 | 0.3 | 4 | 3.5 | 4 | 0.2 | 4 |
| $H_2O$ | 4.4 | 4 | 4.7 | 4 | 3.4 | 4 | 4.2 | 4 | 3.5 | 4 | 3.3 | 4 | 4.6 | 4 |
| Total | 99.5 | | 100.77 | | 99.2 | | 99.5 | | 99.9 | | 100.6 | | 100.0 | |

| | 1 | Meth. | 2 | Meth. | 3 | Meth. | 4 | Meth. | 5 | Meth. | 6 | Meth. | 7 | Meth. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| As ppm | 21 | 2 | 14 | 2 | <2000 | 3 | 19 | 2 | 0.5 | 2 | 4.5 | 2 | 6.5 | 2 |
| B | | ND | | ND | <50 | 3 | <50 | 3 | <50 | 3 | | ND | <50 | 3 |
| Ba | 800 | 3 | 230 | 1 | 990 | 3 | 87 | 3 | 1430 | 3 | 80 | 3 | 300 | 3 |
| Br | 3 | 2 | 4.5 | 2 | | ND | 7 | 2 | 7.5 | 2 | 3 | 2 | 6.5 | 2 |
| Co | 23 | 3 | 24 | 3 | <10 | 3 | 27 | 3 | 38.3 | 3 | 17 | 3 | 42 | 3 |
| Cr | 25 | 3 | 55 | 3 | 9 | 3 | 7 | 3 | 47 | 3 | 58 | 3 | 22 | 3 |
| Cu | 110 | 3 | 220 | 3 | 37 | 3 | 57 | 3 | 110 | 3 | 67 | 3 | 80 | 3 |
| La | 58 | 3 | <30 | 3 | 100 | 3 | <100 | 3 | 110 | 3 | <30 | 3 | <100 | 3 |
| Mo | 1.5 | 2 | 3 | 2 | <50 | 3 | 1.5 | 2 | 1 | 2 | 0.5 | 2 | 1 | 2 |
| Nb | 4.5 | 2 | 2 | 2 | | ND | 3.5 | 2 | 10 | 2 | 2 | 2 | 5 | 2 |
| Ni | 19 | 3 | 22 | 3 | <10 | 3 | <10 | 3 | 40 | 3 | 31 | 3 | 25 | 3 |
| Pb | 20 | 2 | 19 | 2 | <700 | 3 | 10 | 2 | 45 | 2 | 4 | 2 | 13.5 | 2 |
| Rb | 33.5 | 2 | 7.5 | 2 | 40 | 1 | 9 | 2 | 77 | 2 | 2.5 | 2 | 6 | 2 |
| Sr | 274.5 | 2 | 119.5 | 2 | 410 | 3 | 93 | 2 | 976 | 2 | 229 | 2 | 157 | 2 |
| Th | 16.5 | 2 | 4.5 | 2 | | ND | 3.5 | 2 | 30.5 | 2 | 4.5 | 2 | 6 | 2 |
| U | 3.5 | 2 | 1.5 | 2 | | ND | 1 | 2 | 0 | 2 | 0 | 2 | 3.5 | 2 |
| V | 330 | 3 | 340 | 3 | <26 | 3 | 250 | 3 | 220 | 3 | 190 | 3 | 300 | 3 |
| Y | 27.5 | 2 | 21.5 | 2 | <40 | 3 | 40.5 | 2 | 22 | 2 | 24.5 | 2 | 37.5 | 2 |
| Yb | 4 | 3 | 4.3 | 3 | 6.3 | 3 | 6.2 | 3 | <4 | 3 | 2.9 | 3 | <4 | 3 |
| Zn | 100 | 1 | 100 | 1 | 180 | 1 | 70 | 1 | 80 | 1 | <200 | 3 | 110 | 1 |
| Zr | 118 | 2 | 49.5 | 2 | 430 | 3 | 115.5 | 2 | 180.5 | 2 | 73 | 2 | 103.5 | 2 |

Appendix 2 Table 2a

Maskell Inlet assemblage (W. of M'Clintock Inlet)

| Field # | 80TM 207A1 | | 80 TM 207B1 | | 80 TM 207D | | 80 TM 227H1 | | 65TM H21 | |
|---|---|---|---|---|---|---|---|---|---|---|
| An. # | 92-80-3, 86-83-7 | | 96-83-3 | | 96-83-4 | | 96-83-5 | | GSB 183 | |
| # | 8 | Meth. | 9 | Meth. | 10 | Meth. | 11 | Meth. | 12 | Meth. |
| $SiO_2$ % | 60.1 | 1 | 51.7 | 1 | 56.2 | 1 | 50.6 | 1 | 69.9 | 1 |
| $Al_2O_3$ | 15.4 | 1 | 19.2 | 1 | 17.5 | 1 | 16.1 | 1 | 10.1 | 1 |
| $TiO_2$ | 0.89 | 5,1 | 0.54 | 1 | 1.09 | 1 | 1.30 | 1 | 0.56 | 1 |
| $Fe_2O_3$ | 3.4 | 1 | 4.7 | 1 | 1.4 | 1 | 3.1 | 1 | 5.9 | 1 |
| FeO | 3.7 | 4 | 3.0 | 4 | 5.4 | 4 | 6.3 | 4 | 1.1 | 4 |
| MnO | 0.30 | 3 | 0.19 | 1 | 0.17 | 1 | 0.26 | 1 | 0.26 | 1 |
| MgO | 2.78 | 3,1 | 4.12 | 1 | 4.70 | 1 | 8.95 | 1 | 3.4 | 1 |
| CaO | 1.57 | 1 | 6.87 | 1 | 5.80 | 1 | 3.48 | 1 | 1.5 | 1 |
| $Na_2O$ | 3.5 | 1 | 2.9 | 1 | 4.4 | 1 | 4.5 | 1 | 3.3 | 4 |
| $K_2O$ | 3.5 | 1 | 4.04 | 1 | 0.80 | 1 | 0.73 | 1 | 1.9 | 1 |
| $P_2O_5$ | 0.16 | 1 | 0.17 | 1 | 0.19 | 1 | 0.14 | 1 | 0.07 | 4 |
| $CO_2$ | 1.2 | 4 | 0.1 | 4 | 0.0 | 4 | 0.1 | 4 | 0.9 | 4 |
| $H_2O$ | 3.5 | 4 | 2.4 | 4 | 1.6 | 4 | 3.6 | 4 | 2.3 | 4 |
| Total | 100.0 | | 0.2 | 4 | 0.2 | 4 | 0.1 | 4 | 101.2 | |

| ppm | 8 | Meth. | 9 | Meth. | 10 | Meth. | 11 | Meth. | 12 | Meth. |
|---|---|---|---|---|---|---|---|---|---|---|
| As | 2 | 2 | 18 | 2 | 8 | 2 | 7 | 2 | | ND |
| B | <50 | 3 | | | | | | | | " |
| Ba | 620 | 3 | | | | | | | | " |
| Br | 4 | 2 | 16 | 2 | 4 | 2 | 8 | 2 | | " |
| Co | 13 | 3 | | | | | | | | " |
| Cr | 15 | 3 | | | | | | | | " |
| Cu | 28 | 3 | | | | | | | | " |
| La | <100 | 3 | | | | | | | | " |
| Mo | 0 | 2 | 1 | 2 | 0 | 2 | 2 | 2 | | " |
| Nb | 6 | 2 | 3 | | 5 | 2 | 3 | 2 | | " |
| Ni | 12 | 3 | | | | | | | | " |
| Pb | 16.5 | 2 | 5 | 2 | 5 | 2 | 0 | 2 | | " |
| Rb | 63.5 | 2 | 140 | 2 | 26 | 2 | 26 | 2 | | " |
| Sr | 265 | 2 | 590 | 2 | 200 | 2 | 170 | 2 | | " |
| Th | 15.5 | 2 | 16 | 2 | 14 | 2 | 8 | 2 | | " |
| U | 3.5 | 2 | 3 | 2 | 8 | 2 | 7 | 2 | | " |
| V | 110 | 3 | | | | | | | | " |
| Y | 44 | 2 | 19 | 2 | 27 | 2 | 26 | 2 | | " |
| Yb | 5.4 | 3 | | | | | | | | " |
| Zn | 90 | 1 | | | | | | | | " |
| Zr | 223 | 2 | 67 | 2 | 180 | 2 | 78 | 2 | | " |

Appendix 2 Table 2a

Maskell Inlet assemblage (W. of M'Clintock Inlet)

| Field # | Anal. # | # | TiO2 % Meth. 1 | TiO2 % Meth. 3 | TiO2 % Meth. 5 | TiO2 % chosen value | Nb ppm a | Nb ppm b | Nb ppm x̄ | Y ppm a | Y ppm b | Y ppm x̄ | Zr ppm a | Zr ppm b | Zr ppm x̄ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 77TM302C2 | 86-83-6 | 1 | 0.98 1.02 | 1.07 | 1.13 | 1.02 | 2 | 7 | 4.5 | 26 | 29 | 27.5 | 121 | 115 | 118 |
| 77TM301C1 | 86-83-3 | 2 | 0.95 0.96 | 0.98 | 1.08 | 0.96 | 2 | 2 | 2 | 22 | 21 | 21.5 | 49 | 50 | 49.5 |
| 77TM301C2 | 86-83-4 | 4 | 0.99 | | 0.98 | 0.99 | 1 | 6 | 3.5 | 41 | 40 | 40.5 | 117 | 114 | 115.5 |
| 77TM302C1 | 86-83-5 | 5 | 0.88 | 0.88 | 0.92 | 0.90 | 11 | 9 | 10 | 22 | 22 | 22 | 179 | 182 | 180.5 |
| 77TM301B1 | 86-83-1 | 6 | 0.71 | 0.75 | 0.71 | 0.71 | 3 | 1 | 2 | 26 | 23 | 24.5 | 75 | 71 | 73 |
| 77TM233C1 | 86-83-2 | 7 | 1.25 | 1.15 | 1.23 | 1.24 | 4 | 6 | 5 | 36 | 39 | 37.5 | 101 | 106 | 103.5 |
| 80TM207A1 | 86-83-7 | 8 | 0.86 | 0.78 | 0.91 | 0.89 | 4 | 8 | 6 | 42 | 46 | 44 | 223 | 223 | 223 |
| 80TM207D | 96-83-4 | 10 | 1.09 | | | | 5 | | | 27 | | | 180 | | |
| 80TM227H | 96-83-5 | 11 | 1.30 | | | | 3 | | | 26 | | | 78 | | |

Appendix 2 Table 2b

Maskell Inlet assemblage (E. of M'Clintock Inlet)

| Field # | 77TM 237A2 | | 77TM 237A1 | |
|---|---|---|---|---|
| An. # | 10-79-10, 86-83-9 | | 10-79-9, 86-83-8 | |
| # | 1 | Meth. | 2 | Meth. |
| $SiO_2$ % | 47.5 | 1 | 49.9 | 1 |
| $Al_2O_3$ | 18.9 | 1 | 15.1 | 1 |
| $TiO_2$ | 0.90 | 5, 1 | 0.79 | 5, 3 |
| $Fe_2O_3$ | 9.1 | 1 | 7.4 | 1 |
| FeO | 2.5 | 4 | 3.9 | 4 |
| MnO | 0.26 | 3, 1 | 0.36 | 3, 1 |
| MgO | 6.19 | 1 | 8.13 | 1 |
| CaO | 1.42 | 1 | 3.11 | 1 |
| $Na_2O$ | 2.1 | 1 | 2.4 | 1 |
| $K_2O$ | 5.72 | 1 | 4.72 | 1 |
| $P_2O_5$ | 0.28 | 1 | 0.23 | 1 |
| $CO_2$ | 0.1 | 4 | 0.1 | 4 |
| $H_2O$ | 5.4 | 4 | 3.9 | 4 |
| Total | 100.4 | | 100.0 | |
| As ppm | 26 | 2 | 32 | 2 |
| B | 58 | 3 | <50 | 3 |
| Ba | 3100 | 3 | 2000 | 3 |
| Br | 5 | 2 | 10 | 2 |
| Co | 37 | 3 | 58 | 3 |
| Cr | 27 | 3 | 30 | 3 |
| Cu | 16 | 3 | 26 | 3 |
| La | <100 | 3 | <100 | 3 |
| Mo | 3 | 2 | 3.5 | 2 |
| Nb | 3 | 2 | 1 | 2 |
| Ni | 29 | 3 | 37 | 3 |
| Pb | 21.5 | 2 | 18 | 2 |
| Rb | 215.5 | 2 | 75.5 | 2 |
| Sr | 410 | 2 | 193.5 | 2 |
| Th | 4 | 2 | 6.5 | 2 |
| U | 1 | 2 | 1.5 | 2 |
| V | 350 | 3 | 180 | 3 |
| Y | 18 | 2 | 16.5 | 2 |
| Yb | <4 | 3 | <4 | 3 |
| Zn | 140 | 1 | 180 | 1 |
| Zr | 42.5 | 2 | 43 | 2 |

Appendix 2 Table 2b

Maskell Inlet assemblage C.E. of M'Clintock Inlet

| | | | $TiO_2$ % | | | | Nb ppm | | | Y ppm | | | Zr ppm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Field # | Anal. # | # | Meth. 1 | Meth. 3 | Meth. 5 | chosen value | a | b | $\bar{x}$ | a | b | $\bar{x}$ | a | b | $\bar{x}$ |
| 77TM237A1 | 86-83-8 | 1 | 0.76 | 0.77 | 0.81 | 0.79 | 1 | 1 | 1 | 17 | 16 | 16.5 | 43 | 43 | 43 |
| 77TM237A2 | 86-83-9 | 2 | 0.91 | 0.81 | 0.88 | 0.90 | 4 | 2 | 3 | 14 | 22 | 18 | 40 | 45 | 42.5 |

Appendix 2 Table 3a

Cape Discovery Formation, member A

| Field # | 77TM 233 B4 | Meth. | 66TMB5-1 | Meth. | 77TM 233 B5 | Meth. | 66TM B 5-3 | Meth. |
|---|---|---|---|---|---|---|---|---|
| An. # | 57-79-16, 86-83-12 | | 57-79-22, 86-83-10 | | 10-79-13, 86-83-13 | | 57-29-23, 86-83-11 | |
| # | 1 | | 2 | | 3 | | 4 | |
| $SiO_2$ % | 55.6 | 1 | 74.2 | 1 | 79.5 | 1 | 80.9 | 1 |
| $Al_2O_3$ | 19.0 | 1 | 13.2 | 1 | 11.4 | 1 | 9.8 | 1 |
| $TiO_2$ | 1.72 | 6,3,1 | 0.23 | 5,3,1 | 0.16 | 5,3 | 0.12 | 5,3,1 |
| $Fe_2O_3$ | 3.3 | 1 | 0.6 | 1 | 1.5 | 1 | 0.0 | 1 |
| FeO | 2.4 | 4 | 2.1 | 4 | 0.3 | 4 | 1.6 | 4 |
| MnO | 0.07 | 3 | 0.01 | 3 | 0.02 | 3 | 0.01 | 3 |
| MgO | 0.88 | 3 | 1.23 | 3 | 0.22 | 3 | 0.78 | 3 |
| CaO | 1.93 | 1 | 0.03 | 1 | 0.42 | 1 | 0.14 | 3 |
| $Na_2O$ | 8.8 | 1 | 1.0 | 1 | 4.1 | 1 | 3.1 | 1 |
| $K_2O$ | 0.76 | 1 | 3.16 | 1 | 1.52 | 1 | 1.23 | 1 |
| $P_2O_5$ | 0.65 | 1 | 0.01 | 1 | 0.01 | 1 | 0.00 | 1 |
| $CO_2$ | 1.4 | 4 | 0.0 | 4 | 0.7 | 4 | 0.0 | 4 |
| $H_2O$ | 2.8 | 4 | 3.3 | 4 | 1.1 | 4 | 1.3 | 4 |
| Total | 99.3 | | 99.7 | | 101.0 | | 99.0 | |
| As ppm | 10.5 | 2 | 6 | 2 | 9.5 | 2 | 11 | 2 |
| B | | ND | 30 | 3 | <50 | 3 | <50 | 3 |
| Ba | 70 | 3 | 190 | 3 | 77.5 | 3 | 80 | 3 |
| Br | 4 | 2 | 0.5 | 2 | 3 | 2 | 3.5 | 2 |
| Co | 8 | 3 | <7 | 3 | <10 | 3 | <7 | 3 |
| Cr | 10 | 3 | 9 | 3 | <5 | 3 | 14 | 3 |
| Cu | 6 | 3 | 10 | 3 | <7 | 3 | 13 | 3 |
| La | 87 | 3 | 60 | 3 | <100 | 3 | 37 | 3 |
| Mo | 0 | 2 | 0 | 2 | 0 | 2 | 0 | 2 |
| Nb | 59.5 | 2 | 54 | 2 | 121 | 2 | 36.5 | 2 |
| Ni | <10 | 3 | <10 | 3 | <10 | 3 | <10 | 3 |
| Pb | 8.5 | 2 | 9.5 | 2 | 7 | 2 | 10.5 | 2 |
| Rb | 33 | 2 | 145 | 2 | 65.5 | 2 | 59.5 | 2 |
| Sr | 136.5 | 2 | 59.5 | 2 | 77.5 | 2 | 242.5 | 2 |
| Th | 10 | 2 | 31 | 2 | 33 | 2 | 30 | 2 |
| U | 4 | 2 | 11.5 | 2 | 13.5 | 2 | 55 | 2 |
| V | 140 | 3 | 12 | 3 | 20 | 3 | <10 | 3 |
| Y | 48 | 2 | 163.5 | 2 | 65 | 2 | 63.5 | 2 |
| Yb | 4.2 | 3 | 9 | 3 | 7.4 | 3 | 3.2 | 3 |
| Zn | <200 | 3 | 100 | 1 | 20 | 1 | <200 | 3 |
| Zr | 377 | 2 | 524.5 | 2 | 777 | 2 | 338 | 2 |

Appendix 2 Table 3a

Cape Discovery Formation, member A

| | | | $TiO_2$ % | | | | Nb ppm | | | Y ppm | | | Zr ppm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Field # | Anal. # | # | Meth. 1 | Meth. 3 | Meth. 5 | chosen value | a | b | $\bar{x}$ | a | b | $\bar{x}$ | a | b | $\bar{x}$ |
| 77TM233B4 | 86-83-12 | 1 | 1.67 | 1.83 | 1.72 | 1.72 | 61 | 58 | 59.5 | 48 | 48 | 48 | 376 | 378 | 377 |
| 66 TMB-5-1 | 86-83-10 | 2 | 0.20 | 0.23 | 0.25 | 0.23 | 55 | 53 | 54 | 166 | 161 | 163.5 | 531 | 518 | 524.5 |
| 77 TM 233 B5 | 86-83-13 | 3 | 0.15 | 0.16 | 0.16 | 0.16 | 120 | 122 | 121 | 64 | 66 | 65 | 779 | 775 | 777 |
| 66 TM-B5-3 | 86-83-11 | 4 | 0.10 | 0.11 | 0.15 | 0.12 | 36 | 37 | 36.5 | 65 | 62 | 63.5 | 341 | 335 | 338 |

Appendix 2 Table 3b

Cape Discovery Formation, member D

| Field # | 65 TM F40 | Meth. |
|---|---|---|
| An. # | 10-84-10 | |
| # | 1 | |
| $SiO_2$ % | 64.9 | 1 |
| $Al_2O_3$ | 15.2 | 1 |
| $TiO_2$ | 0.86 | 1 |
| $Fe_2O_3$ | 5.5 | 1 |
| FeO | 1.0 | 4 |
| MnO | 0.08 | 1 |
| MgO | 0.99 | 1 |
| CaO | 0.87 | 1 |
| $Na_2O$ | 5.0 | 1 |
| $K_2O$ | 3.11 | 1 |
| $P_2O_5$ | 0.26 | 1 |
| $CO_2$ | 0.4 | 4 |
| $H_2O$ | 1.1 | 4 |
| Total | 99.3 | |

| | | |
|---|---|---|
| As ppm | 0 | 2 |
| B | | ND |
| Ba | 730 | 1 |
| Br | 4 | 2 |
| Co | | ND |
| Cr | | ND |
| Cu | | ND |
| La | | ND |
| Mo | 0 | 2 |
| Nb | 6 | 2 |
| Ni | <3000 | |
| Pb | 0 | 2 |
| Rb | 49 | 2 |
| Sr | 68 | 2 |
| Th | 14 | 2 |
| U | 8 | 2 |
| V | | ND |
| Y | 71 | 2 |
| Yb | | ND |
| Zn | <200 | 1 |
| Zr | 470 | 2 |

Appendix 2 Table 4

M'Clintock Formation

| Field # | 65TM3A1 | | 80TM225C4 | | 65TM2D2 | | 65TM2D1 | | 80TM200D1 | | 79TM218C2 | | 79TM218C4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| An. # | 56-80-4, 86-83-16 | | 92-80-7, 86-83-21 | | 56-80-3, 86-83-15 | | 56-80-2, 86-83-14 | | 92-80-5 | | 100-79-6, 86-83-19 | | 100-79-7, 86-83-20 | |
| # | 1 | Meth. | 2 | Meth. | 3 | Meth. | 4 | Meth. | 5 | Meth. | 6 | Meth. | 7 | Meth. |
| $SiO_2$ % | 44.3 | 1 | 48.3 | 1 | 48.7 | 1 | 49.0 | 1 | 49.1 | 1 | 49.1 | 1 | 49.9 | 1 |
| $Al_2O_3$ | 13.9 | 1 | 14.1 | 1 | 15.7 | 1 | 16.6 | 1 | 15.9 | 1 | 14.1 | 1 | 15.6 | 1 |
| $TiO_2$ | 2.21 | 5, 3, 1 | 0.73 | 3, 1 | 1.02 | 1 | 1.04 | 5, 3, 1 | 1.65 | 1 | 2.24 | 5, 1 | 2.63 | 5, 1 |
| $Fe_2O_3$ | 6.5 | 1 | 9.6 | 1 | 8.5 | 1 | 4.0 | 1 | 8.4 | 1 | 7.1 | 1 | 5.6 | 1 |
| FeO | 5.3 | 4 | 4.4 | 4 | 0.8 | 4 | 4.6 | 4 | 0.3 | 4 | 5.1 | 4 | 5.8 | 4 |
| MnO | 0.13 | 3 | 0.16 | 1 | 0.11 | 3 | 0.12 | 3 | 0.05 | 3 | 0.17 | 3 | 0.18 | 3 |
| MgO | 8.37 | 1 | 8.82 | 1 | 9.16 | 1 | 7.9 | 1 | 10.4 | 1 | 4.31 | 1 | 3.99 | 1 |
| CaO | 5.27 | 1 | 3.50 | 1 | 7.39 | 1 | 8.01 | 1 | 1.92 | 1 | 5.72 | 1 | 4.85 | 1 |
| $Na_2O$ | 4.5 | 1 | 2.1 | 1 | 1.7 | 1 | 2.3 | 1 | 2.4 | 1 | 4.9 | 1 | 5.5 | 1 |
| $K_2O$ | 0.35 | 1 | 1.39 | 1 | 1.04 | 1 | 1.29 | 1 | 3.58 | 1 | 0.30 | 1 | 0.23 | 1 |
| $P_2O_5$ | 0.53 | 1 | 0.10 | 1 | 0.19 | 1 | 0.22 | 1 | 0.83 | 1 | 0.43 | 1 | 0.55 | 1 |
| $CO_2$ | 3.7 | 4 | 1.3 | 4 | 0.4 | 4 | 0.3 | 4 | 0.8 | 4 | 1.5 | 4 | 1.0 | 4 |
| $H_2O$ | 5.1 | 4 | 5.1 | 4 | 5.3 | 4 | 5.0 | 4 | 4.5 | 4 | 3.2 | 4 | 3.2 | 4 |
| Total | 100.2 | | 99.6 | | 100.0 | | 100.4 | | 99.7 | | 98.2 | | 99.0 | |

| | 1 | Meth. | 2 | Meth. | 3 | Meth. | 4 | Meth. | 5 | Meth. | 6 | Meth. | 7 | Meth. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| As ppm | 3 | 2 | 31 | 2 | 9 | 2 | 12 | 2 | <2000 | 3 | 24.5 | 2 | 8.5 | 2 |
| B | <50 | 3 | <50 | 3 | <50 | 3 | <50 | 3 | <60 | 3 | <50 | 3 | <50 | 3 |
| Ba | 150 | 3 | 510 | 3 | 320 | 3 | 480 | 3 | 820 | 3 | 110 | 3 | 92 | 3 |
| Br | 0 | 2 | 4.5 | 2 | 2 | 2 | 5 | 2 | | ND | 8.5 | 2 | 8 | 2 |
| Co | 37 | 3 | 56 | 3 | 17 | 3 | 18 | 3 | 18 | 3 | 30 | 3 | 29 | 3 |
| Cr | 300 | 3 | 1100 | 3 | 380 | 3 | 250 | 3 | 250 | 3 | 11 | 3 | 13 | 3 |
| Cu | 24 | 3 | 18 | 3 | 48 | 3 | 77 | 3 | 19 | 3 | 13 | 3 | 75 | 3 |
| La | <100 | 3 | <100 | 3 | <100 | 3 | <100 | 3 | <100 | 3 | <100 | 3 | <100 | 3 |
| Mo | 0 | 2 | 1.5 | 2 | 3 | 2 | 0 | 2 | <50 | 3 | 0.5 | 2 | 0.5 | 2 |
| Nb | 26.5 | 2 | 0.5 | 2 | 1 | 2 | 0.5 | 2 | | ND | 2 | 2 | 2.5 | 2 |
| Ni | 200 | 3 | 250 | 3 | 210 | 3 | 100 | 3 | 160 | 3 | 10 | 3 | 19 | 3 |
| Pb | 13.5 | 2 | 25 | 2 | 8 | 2 | 6.5 | 2 | <700 | 3 | 16.5 | 2 | 17 | 2 |
| Rb | 1.5 | 2 | 54 | 2 | 11.5 | 2 | 10.5 | 2 | 50 | 1 | 5.5 | 2 | 5.5 | 2 |
| Sr | 392.5 | 2 | 324.5 | 2 | 244 | 2 | 307.5 | 2 | 230 | 3 | 327 | 2 | 260 | 2 |
| Th | 7.5 | 2 | 7 | 2 | 2.6 | 2 | 3 | 2 | | ND | 5.5 | 2 | 5 | 2 |
| U | 0 | 2 | 0 | 2 | 1 | 2 | 0 | 2 | | ND | 0 | 2 | 0 | 2 |
| V | 160 | 3 | 310 | 3 | 160 | 3 | 240 | 3 | 150 | 3 | 330 | 3 | 360 | 3 |
| Y | 18.5 | 2 | 14.5 | 2 | 20 | 2 | 26 | 2 | <40 | 3 | 48 | 2 | 60.5 | 2 |
| Yb | 5.9 | 3 | <4 | 3 | <4 | 3 | 4.5 | 3 | 4.4 | 3 | <4 | 3 | 57 | 3 |
| Zn | 110 | 1 | 90 | 1 | 80 | 1 | 80 | 1 | 80 | 1 | 120 | 1 | 130 | 1 |
| Zr | 256 | 2 | 31 | 2 | 69 | 2 | 68 | 2 | 190 | 3 | 147.5 | 2 | 170.5 | 2 |

Appendix 2 Table 4

M'Clintock Formation

| Field # | 77 TM 315 E1 | | 79 TM 211 D1 | | 80 TM 228 A2 | | 80 TM 228 B4 | | 79 TM 213 A3 | | 80 TH 228 B1 | | 65 TM 2C1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| An. # | 10-79-8, 86-83-17 | | 100-79-1, 86-83-18 | | 92-80-9, 86-83-22 | | 92-80-11 | | 100-79-4 | | 92-80-10, 86-83-23 | | GSB 183 | |
| # | 8 | Meth. | 9 | Meth. | 10 | Meth. | 11 | Meth. | 12 | Meth. | 13 | Meth. | 14 | Meth. |
| $SiO_2$ % | 50.5 | 1 | 50.8 | 1 | 50.8 | 1 | 54.4 | 1 | 55.1 | 1 | 55.4 | 1 | 56.4 | 1 |
| $Al_2O_3$ | 15.4 | 1 | 15.4 | 1 | 14.9 | 1 | 15.7 | 1 | 16.4 | 1 | 16.2 | 1 | 17.6 | 1 |
| $TiO_2$ | 0.75 | 5,3,1 | 2.66 | 1,3,5 | 2.13 | 5,1 | 0.86 | 3 | 0.78 | 3 | 0.75 | 5,1 | 0.72 | 1 |
| $Fe_2O_3$ | 7.4 | 1 | 6.9 | 1 | 7.5 | 1 | 7.5 | 1 | 6.8 | 1 | 5.1 | 1 | 3.8 | 1 |
| FeO | 3.4 | 4 | 6.9 | 4 | 5.5 | 4 | 2.9 | 4 | 0.8 | 4 | 2.7 | 4 | 3.4 | 4 |
| MnO | 0.34 | 3 | 0.14 | 1 | 0.25 | 1 | 0.16 | 3 | 0.09 | 3 | 0.1 | 3 | 0.09 | 1 |
| MgO | 7.8 | 1 | 4.67 | 1 | 4.65 | 1 | 5.98 | 1 | 1.47 | 1 | 3.35 | 1 | 4.4 | 1 |
| CaO | 3.04 | 1 | 1.60 | 1 | 5.93 | 1 | 5.00 | 1 | 8.97 | 1 | 3.25 | 1 | 0.8 | 1 |
| $Na_2O$ | 2.3 | 1 | 4.3 | 1 | 5.6 | 1 | 3.8 | 1 | 6.0 | 1 | 6.8 | 1 | 3.2 | 4 |
| $K_2O$ | 5.06 | 1 | 0.33 | 1 | 0.29 | 1 | 0.26 | 1 | 0.87 | 1 | 0.13 | 1 | 5.1 | 1 |
| $P_2O_5$ | 0.25 | 1 | 0.52 | 1 | 0.32 | 1 | 0.17 | 1 | 0.17 | 1 | 0.20 | 1 | 0.23 | 4 |
| $CO_2$ | 0.2 | 4 | 0.6 | 4 | 0.2 | 4 | 0.3 | 4 | 0.3 | 4 | 1.8 | 4 | 0.1 | 4 |
| $H_2O$ | 3.9 | 4 | 3.8 | 4 | 2.4 | 4 | 3.6 | 4 | 1.9 | 4 | 2.6 | 4 | 3.5 | 4 |
| Total | 100.3 | | 98.6 | | 100.5 | | 100.6 | | 99.7 | | 98.4 | | 99.3 | |
| As ppm | 31 | 2 | 15 | 3 | 6 | 2 | <2000 | 3 | <2000 | 3 | 12 | 2 | | ND |
| B | <50 | 3 | <50 | 3 | <50 | 3 | <50 | 3 | <50 | 3 | <50 | 3 | | " |
| Ba | 2070 | 3 | 4300 | 3 | 150 | 3 | 120 | 3 | 100 | 3 | 83 | 3 | | " |
| Br | 8.5 | 2 | 7.5 | 2 | 9 | 2 | | ND | | ND | 1 | 2 | | " |
| Co | 45 | 3 | 39 | 3 | 28 | 3 | 19 | 3 | <10 | 3 | 11 | 3 | | " |
| Cr | 24 | 3 | 22 | 3 | 19 | 3 | 200 | 3 | 130 | 3 | 27 | 3 | | " |
| Cu | 24 | 3 | 23 | 3 | 180 | 3 | 15 | 3 | 32 | 3 | 13 | 3 | | " |
| La | <100 | 3 | <100 | 3 | <100 | 2 | <100 | 3 | <100 | 3 | <100 | 3 | | " |
| Mo | 6.5 | 2 | 0 | 2 | 0 | 2 | <50 | 3 | <50 | 3 | 0.5 | 2 | | " |
| Nb | 3 | 2 | 2.5 | 2 | 1.5 | 2 | | ND | | ND | 11 | 2 | | " |
| Ni | 25 | 3 | 21 | 3 | 29 | 3 | 44 | 3 | 62 | 3 | 13 | 3 | | " |
| Pb | 17.5 | 2 | 16.5 | 2 | 20 | 2 | <700 | 3 | <700 | 3 | 18.5 | 2 | | " |
| Rb | 82 | 2 | 3.5 | 2 | 3 | 2 | 20 | 1 | 40 | 1 | 2 | 2 | | " |
| Sr | 207 | 2,3 | 223.5 | 2 | 344 | 2 | 870 | 3 | 180 | 3 | 219 | 2 | | " |
| Th | 5.5 | 2 | 8 | 2 | 10 | 2 | | ND | | ND | 7.5 | 2 | | " |
| U | 1 | 2 | 1.5 | 2 | 1 | 2 | | ND | | ND | 0.5 | 2 | | " |
| V | 150 | 3 | 410 | 3 | 370 | 3 | 350 | 3 | 140 | 3 | 150 | 3 | | " |
| Y | 20 | 2 | 43 | 2 | 40 | 2 | <40 | 3 | <40 | 3 | 26.5 | 2 | | " |
| Yb | <4 | 3 | <4 | 3 | 43 | 3 | <4 | 3 | <4 | 3 | <4 | 3 | | " |
| Zn | 180 | 1 | 110 | 1 | <200 | 3 | 90 | 1 | 60 | 1 | 90 | 1 | | " |
| Zr | 42.5 | 2 | 161.5 | 2 | 124 | 2 | 45 | 3 | 110 | 3 | 124.5 | 2 | | " |

Appendix 2 Table 4

M' Clintock Formation

| Field # | 80TM 227K6 | Meth. | 65TM F61 | Meth. | 80TM 225C3 | Meth. |
|---|---|---|---|---|---|---|
| An. # | 92-80-8 | | GSB 183 | | 92-80-6 | |
| # | 15 | | 16 | | 17 | |
| $SiO_2$ % | 61.6 | 1 | 64.3 | 1 | 78.1 | 1 |
| $Al_2O_3$ | 18.3 | 1 | 14.6 | 1 | 10.8 | 1 |
| $TiO_2$ | 0.25 | 3 | 0.88 | 1 | 0.14 | |
| $Fe_2O_3$ | 2.0 | 1 | 3.2 | 1 | 1.1 | 1 |
| FeO | 1.3 | 4 | 2.1 | 4 | 1.1 | 4 |
| MnO | 0.05 | 3 | 0.10 | 1 | 0.01 | |
| MgO | 0.95 | 3 | 2.2 | 1 | 1.81 | |
| CaO | 1.35 | 1 | 1.9 | 1 | 0.11 | |
| $Na_2O$ | 6.9 | 1 | 6.5 | 4 | 4.8 | 1 |
| $K_2O$ | 2.84 | 1 | 0.1 | 1 | 0.21 | 1 |
| $P_2O_5$ | 0.12 | 1 | 0.25 | 4 | 0.03 | 1 |
| $CO_2$ | 1.1 | 4 | 1.1 | 4 | 0.2 | 4 |
| $H_2O$ | 1.8 | 4 | 1.8 | 4 | 1.5 | 4 |
| Total | 98.6 | | 99.0 | | 99.9 | |
| As ppm | <2000 | 3 | ND | | <2000 | 3 |
| B | <50 | 3 | " | | <50 | 3 |
| Ba | 260 | 3 | " | | 40 | 3 |
| Br | | ND | " | | | ND |
| Co | <10 | 3 | " | | 10 | 3 |
| Cr | <5 | 3 | " | | <5 | 3 |
| Cu | 45 | 3 | " | | 48 | 3 |
| La | <100 | 3 | " | | <100 | 3 |
| Mo | <50 | 3 | " | | <50 | 3 |
| Nb | | ND | " | | | ND |
| Ni | <10 | 3 | " | | <10 | 3 |
| Pb | <700 | 3 | " | | <700 | 3 |
| Rb | 130 | 1 | " | | 10 | 1 |
| Sr | 230 | 3 | " | | 50 | 3 |
| Th | | ND | " | | | ND |
| U | | ND | " | | | ND |
| V | 52 | 3 | " | | <20 | 3 |
| Y | <40 | 3 | " | | 58 | 3 |
| Yb | <4 | 3 | " | | 11 | 3 |
| Zn | 60 | 1 | " | | 70 | 1 |
| Zr | 290 | 3 | " | | 550 | 3 |

Appendix 2 Table 4

M' Clintock Formation

| Field # | Anal. # | # | $TiO_2$ % Meth. 1 | Meth. 3 | Meth. 5 | chosen value | Nb ppm a | b | $\bar{x}$ | Y ppm a | b | $\bar{x}$ | Zr ppm a | b | $\bar{x}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 65 TM 3A1 | 86-83-16 | 1 | 2.21 | 2.10 | 2.34 | 2.21 | 25 | 28 | 26.5 | 16 | 21 | 18.5 | 255 | 257 | 256 |
| 80 TM 225 C4 | 86-83-21 | 2 | 0.71<br>0.70 | 0.67 | 0.77 | 0.73 | 0 | 1 | 0.5 | 13 | 16 | 14.5 | 30 | 32 | 31 |
| 65 TM 2TD2 | 86-83-15 | 3 | 1.02<br>1.01 | 0.88 | 1.11 | 1.02 | 1 | 1 | 1 | 21 | 19 | 20 | 70 | 68 | 69 |
| 65 TM T D1 | 86-83-14 | 4 | 1.04 | 0.98 | 1.08 | 1.04 | 0 | 1 | 0.5 | 26 | 26 | 26 | 69 | 67 | 68 |
| 79 TM 218 C2 | 86-83-19 | 6 | 2.26 | 2.00 | 2.22 | 2.24 | 3 | 1 | 2 | 50 | 46 | 48 | 146 | 149 | 147.5 |
| 79 TM 218 C4 | 86-83-20 | 7 | 2.68 | 2.50 | 2.59 | 2.63 | 2 | 3 | 2.5 | 59 | 62 | 60.5 | 169 | 172 | 170.5 |
| 77 TM 315 E1 | 86-83-17 | 8 | 0.75 | 0.70 | 0.77 | 0.75 | 3 | 3 | 3 | 21 | 19 | 20 | 42 | 43 | 42.5 |
| 79 TM 211 D1 | 86-83-18 | 9 | 2.68 | 2.67 | 2.63 | 2.66 | 2 | 3 | 2.5 | 43 | 43 | 43 | 163 | 160 | 161.5 |
| 80 TM 228 A2 | 86-83-22 | 10 | 2.08 | | 2.17 | 2.13 | 2 | 1 | 1.5 | 43 | 37 | 40 | 123 | 125 | 124 |
| 80 TM 228 B1 | 86-83-23 | 13 | 0.75 | 0.70 | 0.75 | 0.75 | 11 | 11 | 11 | 26 | 27 | 26.5 | 122 | 127 | 124.5 |

Appendix 2 Table 4

M'Clintock Formation

| Field # | Anal. # | # | TiO2 % Meth. 1 | Meth. 3 | Meth. 5 | chosen value | Nb ppm a | b | $\bar{x}$ | Y ppm a | b | $\bar{x}$ | Zr ppm a | b | $\bar{x}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 65 TM 3A1 | 86-83-16 | 1 | 2.21 | 2.10 | 2.34 | 2.21 | 25 | 28 | 26.5 | 16 | 21 | 18.5 | 255 | 257 | 256 |
| 80TM 225 C4 | 86-83-21 | 2 | 0.71<br>0.70 | 0.67 | 0.77 | 0.73 | 0 | 1 | 0.5 | 13 | 16 | 14.5 | 30 | 32 | 31 |
| 65TM 2TD2 | 86-83-15 | 3 | 1.02<br>1.01 | 0.88 | 1.11 | 1.02 | 1 | 1 | 1 | 21 | 19 | 20 | 70 | 68 | 69 |
| 65TM T D1 | 86-83-14 | 4 | 1.04 | 0.98 | 1.08 | 1.04 | 0 | 1 | 0.5 | 26 | 26 | 26 | 69 | 67 | 68 |
| 79 TM 218 C2 | 86-83-19 | 6 | 2.26 | 2.00 | 2.22 | 2.24 | 3 | 1 | 2 | 50 | 46 | 48 | 146 | 149 | 147.5 |
| 79 TM 218 C4 | 86-83-20 | 7 | 2.68 | 2.50 | 2.59 | 2.63 | 2 | 3 | 2.5 | 59 | 62 | 60.5 | 169 | 172 | 170.5 |
| 77 TM 315 E1 | 86-83-17 | 8 | 0.75 | 0.70 | 0.77 | 0.75 | 3 | 3 | 3 | 21 | 19 | 20 | 42 | 43 | 42.5 |
| 79 TM 211 D1 | 86-83-18 | 9 | 2.68 | 2.67 | 2.63 | 2.66 | 2 | 3 | 2.5 | 43 | 43 | 43 | 163 | 160 | 161.5 |
| 80 TM 228 A2 | 86-83-22 | 10 | 2.08 | | 2.17 | 2.13 | 2 | 1 | 1.5 | 43 | 37 | 40 | 123 | 125 | 124 |
| 80 TM 228 B1 | 86-83-23 | 13 | 0.75 | 0.70 | 0.75 | 0.75 | 11 | 11 | 11 | 26 | 27 | 26.5 | 122 | 127 | 124.5 |

# APPENDIX 3

## X-RAY DIFFRACTION AND THIN-SECTION ANALYSES

The values listed for individual minerals represent the relative height of the principal peak as percentage of the sum of all minerals identified. This value is roughly proportional to the abundance of the mineral but is also affected by other factors. All mineral identifications in the diffractograms have been checked, and in some instances modified, by thin section study. For example, in standard X-ray diffractograms, illite cannot be distinguished from mica, and chlorite cannot be distinguished from kaolinite, but the thin sections show that the peaks must have been caused by mica and chlorite.

Peak height ratios of selected mineral pairs are useful because they permit comparisons between rock units or rock types. The following ratios therefore are listed in all those cases where the minerals concerned are present in sufficient quantity (e.g. P/ P+K only where F/ F+ Q 5 %):

F/ F+Q = (total feldspar/ quartz + total feldspar) x 100

P/ P+K = (plagioclase/ plagioclase + K-feldspar) x 100

D/ D+C = (dolomite/ dolomite + calcite) x 100

(The ratios have been calculated from the peak heights and not from the rounded-off percentages.)

The following correction factors were obtained for medium to coarse grained, slightly metamorphosed (lower greenschist facies or less) sandstones of the Lower Cambrian Grant Land Formation by comparison with point count analyses of stained thin sections:

| Ratio | Conversion factor (to be applied to XRD data) | Range in analyzed samples |
|---|---|---|
| F/ F+Q | x 1.9 | 2 - 31 % |
| P/ P+Q | x 0.95 | 55 - 100 % |

These conversion factors may be applicable to suites with similar grain size, concentration, and alteration states, but are not valid universally. Royse et al. (1971) demonstrated that the weight percentage of dolomite can be obtained by adding 2.3 % to D/ D+C, but Lumsden (1979) inferred a more complex relationship.

TABLE 1A

| | a) XRD analyses (in %) map-unit p9 WV Disraeli Glacier Belt E. of Disraeli Glacier quartzite | | | | b) XRD analyses (in %) map-unit p9 WV Disraeli Glacier Belt E. of Disraeli Glacier crystal tuff | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Range | $\bar{x}$ | $\sigma$ | N | Range | $\bar{x}$ | $\sigma$ | N | Range | $\bar{x}$ | $\sigma$ |
| Quartz | 5 | 90-97 | 92.4 | | 3 | 24-26 | 25.0 | | | | | |
| K-Feldspar | " | 0-1 | 0.2 | | | | | | | | | |
| Plagioclase | " | tr-5 | 1.6 | | " | 30-58 | 45.3 | | | | | |
| Mica | " | 1-3 | 2.0 | | " | 9-40 | 24.0 | | | | | |
| Chlorite | " | 1-6 | 3.8 | | " | 4-7 | 6.0 | | | | | |
| Calcite | | | | | | | | | | | | |
| Dolomite | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| F/F+Q | " | 1-5 | 1.8 | | " | 56-69 | 63.0 | | | | | |
| P/P+K | 1 | | 100 | | " | 100-100 | 100 | | | | | |
| D/D+C | | | | | | | | | | | | |

| | N | Range | $\bar{x}$ | $\sigma$ | N | Range | $\bar{x}$ | | N | Range | $\bar{x}$ | $\sigma$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quartz | | | | | | | | | | | | |
| K-feldspar | | | | | | | | | | | | |
| plagioclase | | | | | | | | | | | | |
| Mica | | | | | | | | | | | | |
| Chlorite | | | | | | | | | | | | |
| Calcite | | | | | | | | | | | | |
| Dolomite | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| F/F+Q | | | | | | | | | | | | |
| P/P+K | | | | | | | | | | | | |
| D/D+C | | | | | | | | | | | | |

| | N | Range | $\bar{x}$ | $\sigma$ | N | Range | $\bar{x}$ | $\sigma$ | N | Range | $\bar{x}$ | $\sigma$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quartz | | | | | | | | | | | | |
| K-feldspar | | | | | | | | | | | | |
| Plagioclase | | | | | | | | | | | | |
| Mica | | | | | | | | | | | | |
| Chlorite | | | | | | | | | | | | |
| Calcite | | | | | | | | | | | | |
| Dolomite | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| F/F+Q | | | | | | | | | | | | |
| P/P+K | | | | | | | | | | | | |
| D/D+C | | | | | | | | | | | | |

TABLE 1B. XRD analyses [in %] with thin section data

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Belt | Disraeli Glacier | " | " | " | " | " | " | " | " | " | " | " |
| Location | E. of Disraeli Glacier | " | " | " | " | " | " | " | " | " | " | E. of upper M'Clintock Glacier |
| Rock type | slate/phylli, argillaceous | " | " | slate/phylli, Calc./dol. | " | " | argillaceous quartz sandst. | metasiltstone | " | Slate, calc./dol. | " | " |
| Unit | map-unit P9wv | " | " | " | " | " | " | " | " | map-unit P | " | " |
| Field # | 77TM 308c2 | 77TM 308b2 | 77TM 308d2 | 77TM 30b3 | 77TM 308b3 | 77TM 308a1 | 77TM 308e4 | 77TM 308d1 | 77TM 308d2 | 77TM 315b1 | 77TM 315b2 | 77TM 235c |
| # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Quartz | 53 | 64 | 71 | 56 | 54 | 38 | 58 | 94 | 94 | 55 | 54 | 37 |
| K-feldspar | 3 | 2 | 1 | 1 | | 1 | 2 | tr | 1 | 2 | 2 | 1 |
| Plagioclase | 5 | 6 | 1 | 6 | 7 | 2 | 3 | 1 | 1 | 6 | 5 | 7 |
| Mica | 26 | 6 | 3 | 5 | 3 | 6 | 8 | 1 | 2 | 10 | 11 | 9 |
| - Muscovite | | | X | X | | X | | | X | | X | X |
| - Biotite | | | | | | | | | | | | |
| Chlorite | 13 | 18 | 24 | 1 | 3 | 1 | 28 | 5 | 2 | 16 | 18 | 13 |
| Chloritoid | | | | | | | | | | | | |
| Amphibole | | | | | | | | | | | | |
| - Tremolite | | | | | | | | | | | | |
| - Actinolite | | | | | | | | | | | | |
| - Hornblende | | | | | | | | | | | | |
| Epidote | | | | | | | | | | | | |
| Staurolite | | | | | | | | | | | | |
| Garnet | | | | | | | | | | | | |
| Diopside | | | | | | | | | | | | |
| Graphite | | | | | | | | | | | | |
| Calcite | | 2 | | 17 | 22 | 20 | | | 1 | | | 19 |
| Dolomite | | 3 | | 15 | 10 | 31 | | | | 11 | 10 | 15 |
| F/F+Q | 12 | 10 | 3 | 10 | 11 | 8 | 8 | 1 | 1 | 12 | 10 | 18 |
| P/P+K | 64 | 78 | | 89 | 100 | | 58 | | | 71 | 75 | 82 |
| D/D+C | | 64 | | 46 | 32 | 60 | | | | 100 | 100 | 44 |

X = thin section identification

# TABLE 2A

a) XRD analyses (in %)
map-unit 9PCV
Empire Belt, W. of upper M'Clintock Glacier
quartzite

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 4 | 95 - 99 | 96.3 | |
| K-Feldspar | " | 0 - tr | tr | |
| Plagioclase | " | 0 - 3 | 1.5 | |
| Mica | " | 0 - 3 | 1.8 | |
| Chlorite | " | 0 - 1 | 0.3 | |
| Calcite | | | | |
| Dolomite | " | 0 - tr | tr | |
| | | | | |
| | | | | |
| F/F+Q | " | 0 - 3 | 1.3 | |
| P/P+K | | | | |
| D/D+C | | | | |

b) XRD analyses (in %)
map-unit 9pcv
Empire Belt, W. of upper M'Clintock Glacier
sandstone, dolomitic

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 3 | 76 - 82 | 78.7 | |
| K-Feldspar | " | 0 - 1 | 0.7 | |
| Plagioclase | " | 0 - 1 | 0.3 | |
| Mica | " | 0 - 5 | 2.3 | |
| Chlorite | " | 0 - 6 | 3.7 | |
| Calcite | " | 0 - 1 | 0.3 | |
| Dolomite | " | 10 - 23 | 14.7 | |
| | | | | |
| | | | | |
| F/F+Q | " | tr - 2 | 1.0 | |
| P/P+K | | | | |
| D/D+C | " | 98 - 100 | 99.3 | |

c) XRD analyses (in %)
map-unit p*
Empire Belt, SW of Milne Glacier
mudrock, red and green

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 2 | 48 - 52 | 50.0 | |
| K-Feldspar | " | 1 - 1 | 1.0 | |
| Plagioclase | " | 3 - 4 | 3.5 | |
| Mica | " | 6 - 7 | 6.5 | |
| Chlorite | " | 4 - 7 | 5.5 | |
| Calcite | " | 12 - 12 | 12.0 | |
| Dolomite | " | 17 - 25 | 21.0 | |
| | | | | |
| | | | | |
| F/F+Q | " | 7 - 8 | 7.5 | |
| P/P+K | " | 77 - 85 | 81.0 | |
| D/D+C | " | 58 - 67 | 62.5 | |

d) XRD analyses (in %)
Milne Fiord ass., div. 1
section N. of lower Ayles Fiord
marble

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 6 | 0 - 1 | 0.8 | |
| K-feldspar | " | 0 - 1 | 0.2 | |
| Plagioclase | | | | |
| Mica | " | 0 - 2 | 0.3 | |
| Chlorite | | | | |
| Calcite | " | 96 - 99 | 97.7 | |
| Dolomite | " | 0 - 2 | 1.0 | |
| | | | | |
| | | | | |
| F/F+Q | | | | |
| P/P+K | | | | |
| D/D+C | | | | |

e) XRD analyses (in %)
Milne Fiord ass., div. 2
section SW of lower Ayles Fiord
Phyllite, calc./dolomitic

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 6 | 62 - 77 | 60.0 | |
| K-feldspar | " | 0 - 2 | 1.0 | |
| Plagioclase | " | 3 - 10 | 6.5 | |
| Mica | " | 2 - 10 | 6.2 | |
| Chlorite | " | 2 - 16 | 7.0 | |
| Calcite | " | 0 - 19 | 6.5 | |
| Dolomite | " | 0 - 25 | 12.7 | |
| | | | | |
| | | | | |
| F/F+Q | " | 7 - 18 | 11.0 | |
| P/P+K | " | 9 - 100 | 72.7 | |
| D/D+C | " | 0 - 100 | 63.5 | |

| | N | Range | $\bar{x}$ | σ | N | Range | $\bar{x}$ | σ | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quartz | | | | | | | | | | | | |
| K-feldspar | | | | | | | | | | | | |
| Plagioclase | | | | | | | | | | | | |
| Mica | | | | | | | | | | | | |
| Chlorite | | | | | | | | | | | | |
| Calcite | | | | | | | | | | | | |
| Dolomite | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| F/F+Q | | | | | | | | | | | | |
| P/P+K | | | | | | | | | | | | |
| D/D+C | | | | | | | | | | | | |

TABLE 2B. XRD analyses (in %) with thin section data

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Belt | Empire | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 |
| Location | W. of upper M'Clintock Glacier | 〃 | 〃 | 〃 | 〃 | W. of M'Clintock Glacier & upper M'Clintock Inlet | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | N. of Oobloyah Creek | 〃 |
| Rock type | mudrock, calc./dolom. | 〃 | mudrock, sandy | dolostone, sandy | felsic tuff or tuffac. sed. | schist, greensch. facies | 〃 | 〃 | 〃 | 〃 | 〃 | schist, amphibol. fac. | 〃 | 〃 | 〃 | amphibolite | 〃 | schist | 〃 |
| Unit | map-unit gPcV | 〃 | 〃 | 〃 | 〃 | map-unit SC | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | 〃 | map-unit S | 〃 |
| Field # | 77TM 240e1 | 77TM 240e3 | 77TM 240f2 | 77TM 240e4 | 77TM 240f5 | CB67 20-3 | 67TM 2C | 80TM 311a | CB67 20-1 | CB67 20-2 | CB67 22 | 77TM 252b1 | CB67 21-3 | 77TM 232i1 | 77TM 321a2 | CB67 21-1 | CB67 21-2 | 65TM 14a | 80TM 311b |
| # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| Quartz | 55 | 60 | 71 | 47 | 69 | 58 | 85 | 73 | 66 | 55 | 57 | 58 | 67 | 81 | 46 | | | 44 | 54 |
| K-feldspar | | 1 | | tr | 1 | 5 | | | | 1 | 3 | 3 | 2 | | | | | 2 | 2 |
| Plagioclase | 10 | 4 | 11 | 1 | 17 | 23 | 7 | 9 | 6 | 9 | 6 | 14 | 5 | 9 | 20 | 22 | 38 | 2 | 5 |
| Mica | 5 | 7 | 6 | | 2 | 7 | 7 | 15 | 22 | 26 | 32 | 5 | 12 | 3 | 25 | 21 | 23 | 7 | 11 |
| - Muscovite | x | x | x | | x | x | x | x | | | x | | x | | x | | | x | |
| - Biotite | x | | | | | | | x | x | x | x | x | x | x | x | x | x | | |
| Chlorite | 8 | 16 | 13 | | 4 | 6 | | 3 | | 3 | 2 | 15 | | 3 | 9 | 2 | 3 | 2 | 24 |
| Chloritoid | | | | | | | | | | | | | | | | | | 43 | 4 |
| | | | | | | | | | | | | | | | | | | | |
| Amphibole | | | | | | | | | | | | 6 | 4 | | | 54 | 37 | | |
| - Tremolite | | | | | | | | | | | | | | | | | | | |
| - Actinolite | | | | | | | | | | | | | | | | | | | |
| - Hornblende | | | | | | | | | | | | x | x | | | x | x | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| Epidote | | | | | | 2 | | | 2 | 2 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| Staurolite | | | | | | | | | | | | | | x | | | | | |
| Garnet | | | | | | | | | | | | | 3 | 3 | x | | | | |
| | | | | | | | | | | | | | | | | | | | |
| Diopside | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| Graphite | | | | | | | | | | | | | | | | | | | |
| Calcite | 18 | 3 | | 1 | tr | | x | | 5 | 4 | | | 2 | | | | | | |
| Dolomite | 5 | 10 | | 51 | 8 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| F/F+Q | 15 | 69 | 13 | 2 | 20 | 32 | 8 | 11 | 10 | 16 | 14 | 22 | 9 | 10 | 30 | 100 | 100 | 9 | 11 |
| P/P+K | 100 | 80 | 100 | | 97 | 88 | 100 | 100 | 100 | 90 | 68 | 83 | 69 | 100 | 100 | 100 | 100 | | 72 |
| D/D+C | 21 | 77 | | 98 | | | | | | | | | | | | | | | |

X = thin section identification

TABLE 2B ctd.

| # | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Belt | Empire | " | " | " | " | " | " | " | " | " | " | " | " | " | " | " | " | " | " |
| Location | S. of Ayles Fiord | N. of Ooblooyah Creek | S. of Ayles Fiord | " | " | " | " | " | E. of M'Clintock Glacier | N. an S. of Ayles Fiord | " | " | " | " | " | " | " | N. of Ayles Fiord | " |
| Rock type | calcareous marble | " | dolostone | " | " | phyllite | felsic tuff ? | impure marble | slate calc./dolom. | schist, phyllite | " | " | " | " | " | " | " | tuff. congl. or tuff | phyllite, tuffac. ? |
| Unit | map-unit C (Oobloyah Creek carbonate) | " | " | " | " | " | " | map-unit PC | " | map-unit PSV9C | " | " | " | " | " | " | " | map-units PSV9C and V | " |
| Field # | 66TM NF2-13 | 80TM 311c | 66TM NF2-14a | 66TM NF2-16 | 66TM NF2-15 | 66TM NF2-15a | 66TM NF2-14 | 77TM 320c3 | 77TM 235c1 | 77TM 232F1 | 77TM 232b2 | 77TM 232e2 | 77TM 223a3 | 77TM 220c2 | 77TM 219c1 | 77TM 220c3 | 77TM 219d1 | 77TM 3-0m | 77TM 218a2 |
| Quartz | 2 | 8 | 17 | 3 | 13 | 87 | 68 | 39 | 37 | 56 | 61 | 64 | 78 | 89 | 37 | 87 | 70 | 46 | 63 |
| K-feldspar | | | | 2 | | | | | 1 | 3 | 1 | | 1 | | 1 | | | 3 | 3 |
| Plagioclase | | | | | | 2 | 24 | | 7 | 4 | 7 | 6 | 5 | 7 | 4 | | 9 | 21 | 6 |
| Mica | | | 2 | | | 6 | 4 | | 9 | 13 | 16 | 6 | 3 | 2 | 22 | 2 | 10 | 1 | 8 |
| – Muscovite | | | X | | | X | X | | | X | X | X | X | X | X | X | | | X |
| – Biotite | | | | | | | | | | | | | | | | X | X | | |
| Chlorite | | | | | | 5 | 4 | 13 | 13 | 3 | 14 | 21 | 9 | 2 | 35 | 4 | 5 | 28 | 21 |
| Chloritoid | | | | | | | | | | 20 | | | | | | | | | |
| Amphibole | | | | | | | | | | | | | | | | | | | |
| – Tremolite | | | | | | | | | | | | | | | | | | | |
| – Actinolite | | | | | | | | | | | | | | | | | | | |
| – Hornblende | | | | | | | | | | | | | | | | | | | |
| Epidote | | | | | | | | | | | | | | | | | | | |
| Staurolite | | | | | | | | | | | | | | | X | | 6 | | |
| Garnet | | | | | | | | | | | | | | | | 6 ? | | | |
| Diopside | | | | | | | | | | | | | | | | | | | |
| Graphite | | | | | | | | | | | | | | | | | | | |
| Calcite | 98 | 92 | 32 | 27 | 2 | | | 12 | 19 | | | 3 | | 1 | | | | 1 | |
| Dolomite | | | 49 | 68 | 85 | | | 37 | 15 | | | | 5 | | | | | | |
| F/F+Q | | | 0 | 36 | 0 | 3 | 26 | 0 | 18 | 11 | 12 | 9 | 7 | 7 | 11 | 0 | 1 | 35 | 11 |
| P/P+K | | | | | | | 100 | | 82 | 62 | 86 | 100 | 76 | 100 | 89 | | 100 | 86 | 68 |
| D/D+C | 0 | 0 | 60 | 71 | 98 | | | 76 | 44 | | | | | | | | | | |

TABLE 2B ctd.

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Belt | Empire | " | " | " | " | " | " | " | " | " | " | " | " | " | " | " | " | " | " |
| Location | N. and S. of Ayles Fiord | " | " | " | " | " | " | Section SW of lower Ayles Fiord | " | " | " | " | " | " | " | NE of lower Ayles Fiord | " | N of Ayles Fiord to Arctic Ocean | " |
| Rock type | phyllite, tuffac.? | basalt | Volc. flow or intrusion | quartzite | impure marble | " | " | marble | dolostone | " | phyllitic tuff | " | " | tuff or tuff. mudr., phyllitic | volc. flow or sill | quartzite | schist | phyllite | " |
| Unit | | " | " | map-unit PSv9c | " | map-unit C | " | Mike Fiord ass., div. 2 | " | " | " | " | " | " | " | map-unit SCqn | " | map-unit PW9c | " |
| Field # | 77TM 223a2 | 77TM 218a3 | 77TM 224b1 | 77TM 220c2 | 77TM 219e3 | 77TM 220a2 | 77TM 223g1 | 77TM 4-396m | 77TM 4-391.5m | 77TM 4-412.9m | 77TM 4-100m | 77TM 4-126m | 77TM 4-290m | 77TM 4-393m | 77TM 4-462m | 77TM 225e | 77TM 224f | 80TM 227a2 | 80TM 227a1 |
| # | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 |
| Quartz | 18 | 50 | 4 | 89 | 2 | 27 | 43 | 11 | 25 | 28 | 29 | 25 | 22 | 45 | 29 | 87 | 72 | 51 | 63 |
| K-feldspar | | 3 | 6 | | | | | 3 | 3 | 1 | 3 | 3 | 5 | 5 | 3 | 5 | | 2 | 4 |
| Plagioclase | 18 | 13 | 26 | 7 | | 2 | | tr | 1 | 1 | 13 | 13 | 14 | 1 | 38 | 2 | 22 | 4 | 5 |
| Mica | 1 | | | 2 | 1 | 5 | | 1 | 1 | 1 | | 13 | 5 | 2 | 14 | 3 | 6 | 8 | 12 |
| - Muscovite | x | | | x | x | x | | x | x | x | | | | x | x | x | | x | x |
| - Biotite | | | | | | | | | | | | x | | | | x | x | | |
| Chlorite | 32 | 24 | 20 | 2 | | 2 | | 1 | | | 43 | 27 | 20 | 34 | 1 | 2 | | 11 | 16 |
| Chloritoid | | | | | | | | | | | | | | | | | | 24 | |
| Amphibole | 22 | | 33 | | | | | | | | | | 6 | | | | | | |
| - Tremolite | x | | x | | | | | | | | | | | | | | | | |
| - Actinolite | | | | | | | | | | | | | x | | | | | | |
| - Hornblende | | | | | | | | | | | | | | | | | | | |
| Epidote | 7 | 6 | 12 | | | | | | | | | | | | | | | | |
| Staurolite | | | | | | | | | | | | | | | | | | | |
| Garnet | | | | | | | | | | | | | | | | | | | |
| Diopside | | | | | | | | | | | | | | | | | | | |
| Graphite | | | | | | | | | | | | | | | | | | | |
| Calcite | 2 | 4 | | 1 | 97 | 64 | 39 | 56 | 1 | | 12 | 19 | 26 | 12 | | 1 | | | |
| Dolomite | | | | | | | 18 | 28 | 68 | 69 | | | | 1 | 14 | | | | |
| F/F+Q | 51 | 25 | 89 | 7 | | 7 | 0 | 24 | 15 | 5 | 36 | 38 | 45 | 11 | 59 | 8 | 23 | 10 | 13 |
| P/P+K | 100 | 81 | 82 | 100 | | 100 | | | | | 83 | 82 | 74 | 11 | 93 | 25 | 100 | 63 | 54 |
| D/D+C | | | | | 0 | 0 | 31 | 34 | 99 | 100 | | | | | | | | | |

TABLE 2B ctd.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Belt | " | " | " | " | " | " | " | " |
| Location | " | " | " | " | " | " | " | " |
| Rock type | " | " | phyllite, sandy & sandst., argill. | " | " | " | limestone | " |
| Unit | " | " | " | " | " | " | " | " |
| Field # | 80TM 227c1 | 77TM 304e | 80TM 227d3 | 80TM 227a3 | 80TM 227d1 | 80TM 227c1 | 80TM 227d2 | 77TM 233a1 |
| # | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 |
| Quartz | 68 | 72 | 86 | 89 | 92 | 93 | 22 | 23 |
| K-feldspar | 1 | 1 | 1 | 1 | | | | 1 |
| Plagioclase | 11 | 3 | 8 | | 7 | 1 | 7 | 2 |
| Mica | 11 | 7 | 2 | | | 4 | 4 | |
| - Muscovite | X | | x | | X | | X | |
| - Biotite | | | x | | | | | |
| Chlorite | 8 | 7 | 2 | 10 | 2 | 2 | 3 | |
| Chloritoid | | | | | | | | |
| Amphibole | | | | | | | | |
| - Tremolite | | | | | | | | |
| - Actinolite | | | | | | | | |
| - Hornblende | | | | | | | | |
| Epidote | | | | | | | | |
| Staurolite | | | | | | | | |
| Garnet | | | | | | | | |
| Diopside | | | | | | | | |
| Graphite | | | | | | | | |
| Calcite | | 1 | | | | | 64 | 37 |
| Dolomite | | 10 | | | | | | 36 |
| F/F+Q | 16 | 5 | 10 | 1 | 7 | 1 | 23 | 11 |
| P/P+K | 89 | | 89 | | 100 | | 100 | |
| D/D+C | | 99 | | | | | 0 | 49 |

TABLE 3A

| | a) XRD analyses (in %) Maskell Inlet ass. Western outcrop area impure limestone | | | | b) XRD analyses (in %) Maskell Inlet ass. Vicinity of M'Clintock East body Felsic tuff | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Range | $\bar{x}$ | σ | N | Range | $\bar{x}$ | σ |
| Quartz | 8 | 9 – 29 | 19.0 | | 4 | 42 – 53 | 48.8 | |
| K-Feldspar | " | 0 – 3 | 0.5 | | " | 2 – 5 | 3.5 | |
| Plagioclase | " | 1 – 20 | 8.6 | | " | 31 – 42 | 36.0 | |
| Mica | " | 0 – 2 | 0.8 | | " | 1 – 4 | 2.5 | |
| Chlorite | " | 0 – 14 | 2.9 | | " | 6 – 13 | 9.5 | |
| Calcite | " | 52 – 80 | 63.9 | | | | | |
| Dolomite | " | 0 – 5 | 4.5 | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| F/F+Q | " | 9 – 62 | 29.9 | | " | 39 – 53 | 44.6 | |
| P/P+K | 6 | 74 – 100 | 94.5 | | " | 90 – 93 | 91.3 | |
| D/D+C | 8 | 0 – 7 | 6.1 | | | | | |

TABLE 3B XRD analyses (in %) with thin section data.

| Belt | Bromley Island | " | " | " | " | " | " | " | " | " | " | " |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Western outcrop area | " | " | " | " | " | " | Vicinity of McClintock East body | " | " | " | Vicinity of Thores River body |
| Rock type | impure dolostone | " | " | Sandstone, calc., tuffac. | slate | Schist | " | marble | " | Schist | " | " |
| Unit | Maskell Inlet ass. | " | " | " | " | " | " | " | " | " | " | " |
| Field # | 77TM 302d6 | 77TM 304a5 | 77TM 304a7 | 77TM 239b3 | 77TM 304a6 | 80TM 207c1 | 80TM 227h2 | 80TM 203g3 | 80TM 203a5 | 80TM 202e1 | 80TM 203g2 | 80TM 212d3 |
| # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Quartz | 12 | 21 | 33 | 24 | 80 | 39 | 31 | | 2 | 62 | 79 | 58 |
| K-feldspar | | 1 | 1 | | 1 | 7 | 4 | 2 | 12 | 2 | 3 | 2 |
| Plagioclase | 1 | 4 | 5 | 17 | 4 | 32 | 39 | 6 | 21 | 30 | 10 | 23 |
| Mica | 1 | 1 | 3 | | 5 | | | | | 1 | 6 | |
| - Muscovite | | | | | x | | | | | | | x |
| - Biotite | | | | | x | | | | | x | x | x |
| Chlorite | | | 1 | | 9 | 18 | 26 | | | 5 | 2 | 15 |
| Chloritoid | | | | | | | | | | | | |
| Amphibole | | | | | | 4 | | | | | | |
| - Tremolite | | | | | | | | 7 | | | | |
| - Actinolite | | | | | | x | | | | | | |
| - Hornblende | | | | | | | | | | | | |
| Epidote | | | | | | | 1 | | 5 | | | |
| Staurolite | | | | | | | | | | | | |
| Garnet | | | | | | | | | | | x | |
| Diopside | | | | | | | | | 9 | | | |
| Graphite | | | | | | | | | | | | |
| Calcite | | 35 | 23 | 49 | | | | 84 | 50 | | | |
| Dolomite | 87 | 38 | 35 | 10 | | | | | | | | |
| F/F+Q | 5 | 18 | 13 | 42 | 6 | 50 | 58 | | | 34 | 14 | 30 |
| P/P+K | | | 89 | 100 | | 83 | 91 | 73 | 64 | 94 | 76 | 91 |
| D/D+C | 100 | 52 | 61 | 17 | | | | 0 | 0 | | | |

x = thin section identification

# TABLE 4

**a) XRD analyses (in %)**
Cape Discovery Fm., mbr. A
pebble conglomerate

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 6 | 52-86 | 72.5 | |
| K-Feldspar | " | 0-1 | 0.2 | |
| Plagioclase | " | 1-11 | 5.2 | |
| Mica | " | 0-3 | 1.2 | |
| Chlorite | " | 0-10 | 4.0 | |
| Calcite | " | 0-39 | 14.2 | |
| Dolomite | " | 0-12 | 3.2 | |
| | | | | |
| | | | | |
| F/F+Q | " | 1-12 | 6.3 | |
| P/P+K | 3 | 80-100 | 93.3 | |
| D/D+C | 4 | 0-16 | 18.0 | |

**b) XRD analyses (in %)**
Cape Discovery Fm., mbr. A
section N. of Bethel Peak
pebbly sandstone

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 3 | 68-73 | 70.0 | |
| K-Feldspar | " | 0-1 | 0.3 | |
| Plagioclase | " | 6-10 | 8.3 | |
| Mica | " | 2-2 | 2.0 | |
| Chlorite | " | 7-15 | 9.7 | |
| Calcite | " | 0-5 | 3.0 | |
| Dolomite | " | 3-10 | 7.0 | |
| | | | | |
| | | | | |
| F/F+Q | " | 8-13 | 11.0 | |
| P/P+K | " | 89-100 | 96.3 | |
| D/D+C | " | 36-100 | 66.7 | |

**c) XRD analyses (in %)**
Cape Discovery Fm., mbr. A
section N. of Bethel Peak
mudrock

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 3 | 57-62 | 59.0 | |
| K-Feldspar | " | 0-1 | 0.7 | |
| Plagioclase | " | 2-10 | 5.3 | |
| Mica | " | 2-3 | 2.3 | |
| Chlorite | " | 6-11 | 8.0 | |
| Calcite | " | 0-17 | 5.7 | |
| Dolomite | " | 2-32 | 19.3 | |
| | | | | |
| | | | | |
| F/F+Q | " | 3-16 | 9.0 | |
| P/P+K | 2 | 81-94 | 87.5 | |
| D/D+C | 3 | 10-100 | 70.0 | |

**d) XRD analyses (in %)**
Cape Discovery Fm., mbr. C
argillaceous limestone etc.

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 6 | 16-36 | 23.3 | |
| K-feldspar | " | 0-1 | 0.3 | |
| plagioclase | " | 0-5 | 3.0 | |
| Mica | " | 0-1 | 0.2 | |
| Chlorite | " | 0-1 | 0.3 | |
| Calcite | " | 64-81 | 72.7 | |
| Dolomite | " | 0-1 | 0.2 | |
| | | | | |
| | | | | |
| F/F+Q | " | 0-19 | 13.3 | |
| P/P+K | 2 | 100-100 | 100 | |
| D/D+C | 6 | 0-1 | 0.2 | |

**e) XRD analyses (in %)**
Cape Discovery Fm., mbr. D
N. of Egingwah Bay
sandstone

| | N | Range | $\bar{x}$ | |
|---|---|---|---|---|
| Quartz | 7 | 65-76 | 71.6 | |
| K-feldspar | " | 0-4 | 1.0 | |
| plagioclase | " | 19-29 | 23.3 | |
| Mica | " | 0-4 | 1.3 | |
| Chlorite | " | 1-3 | 2.1 | |
| Calcite | " | 0-2 | 0.3 | |
| Dolomite | " | 0-2 | 0.3 | |
| | | | | |
| | | | | |
| F/F+Q | " | 20-34 | 25.4 | |
| P/P+K | " | 88-100 | 95.9 | |
| D/D+C | | | | |

N | Range | $\bar{x}$ | σ

**f) Point count analyses**
Cape Discovery Fm., mbr. D
N. of Egingwah Bay
sandstone (1)

| | N | Range | $\bar{x}$ |
|---|---|---|---|
| Quartz | 3 | 11-22 | 16.5 |
| Chert (2) | " | 1-1 | 1.0 |
| Feldspar | " | 35-36 | 35.5 |
| Muscovite | " | 0-tr | |
| Carbonate | " | 0-8 | |
| Volcanics | " | 33-40 | 36.5 |
| Opaques (3) | " | 0-13 | 6.5 |

(1) From Trettin, 1969b, p. 87; ≈ 300 points per section

(2) May include microfelsite (volcanic)

(3) "Ore" and stained rock fragments

TABLE 5

| | a) XRD analyses (in %) | | | | b) XRD analyses (in %) | | | | c) XRD analyses (in %) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Taconite River Fm. | | | | Taconite River Fm. | | | | Taconite River Fm. | | | |
| | southern Marvin Peninsula | | | | W. of Disraeli Fiord | | | | nunatak S. of Markham Fiord | | | |
| | sandstone | | | | sandstone | | | | sandstone, V.F., silty | | | |
| | N | Range | $\bar{x}$ | σ | N | Range | $\bar{x}$ | σ | N | Range | $\bar{x}$ | σ |
| Quartz | 8 | 62-87 | 73.8 | | 5 | 52-86 | 70.6 | | 2 | 76-78 | 77.0 | |
| K-Feldspar | " | 0-12 | 0.8 | | " | 0-4 | 2.2 | | " | 1-2 | 1.5 | |
| Plagioclase | " | 1-10 | 5.4 | | " | 1-8 | 4.4 | | " | 5-6 | 5.5 | |
| Mica | " | 1-3 | 1.6 | | " | 1-4 | 1.8 | | | | | |
| Chlorite | " | 1-4 | 2.0 | | " | 1-5 | 2.4 | | " | 3-5 | 4.0 | |
| Calcite | " | 0-25 | 10.1 | | " | 0-29 | 13.4 | | " | 9-14 | 11.5 | |
| Dolomite | " | 0-15 | 6.3 | | " | 0-10 | 5.6 | | " | 0-2 | 1.0 | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| F/F+Q | " | 1-13 | 7.8 | | " | 1-13 | 8.6 | | " | 8-8 | 8.0 | |
| P/P+K | 6 | 75-100 | 86.8 | | 4 | 52-88 | 69.3 | | " | 76-83 | 79.6 | |
| D/D+C | 6 | 21-59 | 34.8 | | 4 | 0-62 | 27.5 | | 1 | | 10 | |

| | d) XRD analyses (in %) | | | | e) XRD analyses (in %) | | | | f) XRD analyses (in %) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Taconite River Fm. | | | | Taconite River Fm. | | | | Taconite River Fm. | | | |
| | southern Marvin Peninsula | | | | W. of Disraeli Fiord | | | | nunatak S. of Markham Fiord | | | |
| | mudrock (partly sandy) | | | | mudrock | | | | mudrock | | | |
| | N | Range | $\bar{x}$ | σ | N | Range | $\bar{x}$ | | N | Range | $\bar{x}$ | σ |
| Quartz | 6 | 43-64 | 52.8 | | 6 | 52-81 | 67.2 | | 2 | 63-74 | 68.5 | |
| K-feldspar | " | 0-2 | 0.3 | | " | 0-3 | 1.3 | | " | 0-2 | 1.0 | |
| plagioclase | " | 2-7 | 4.2 | | " | 1-14 | 7.8 | | " | 6-8 | 7.0 | |
| Mica | " | 2-15 | 5.7 | | " | 1-6 | 3.0 | | " | 0-2 | 1.0 | |
| Chlorite | " | 3-9 | 5.3 | | " | 2-5 | 3.3 | | " | 6-9 | 7.5 | |
| Calcite | " | 2-32 | 13.2 | | " | 0-28 | 11.2 | | " | 9-15 | 12.0 | |
| Dolomite | " | 9-25 | 18.7 | | " | 0-14 | 6.0 | | " | 4-4 | 4.0 | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| F/F+Q | " | 3-15 | 8.0 | | " | 13-19 | 11.3 | | " | 7-14 | 10.5 | |
| P/P+K | 4 | 82-100 | 93.3 | | 5 | 57-100 | 86.4 | | " | 76-100 | 88.0 | |
| D/D+C | 3 | 23-91 | 62.2 | | 5 | 27-100 | 44.4 | | " | 29-71 | 50.0 | |

| | g) Point count analyses (in %) | | |
|---|---|---|---|
| | Taconite River Fm. | | |
| | southern Marvin Peninsula | | |
| | sandstone (1) | | |
| | 1 | 2 | 3 |
| | 79TM 7-66.3m | 79TM 7-66.5m | 79TM 7-108.0m |
| Quartzite | 37 | 34 | 58 |
| Feldspar | 7 | 4 | 11 |
| Chert | 7 | 7 | 7 |
| Quartzite | 2 | 0 | 1 |
| Muscovite | 1 | 1 | 1 |
| Biotite | 1 | 1 | |
| Chlorite | 1 | tr | |
| Carbonate (2) | 41 | 47 | 18 |
| Schist | 1 | 3 | 2 |
| Volcanics | | tr? | tr? |
| Igneous ? | 1 | tr | |
| Mudrock (3) | | | |
| Opaque | 1 | 2 | 1 |

(1) 300-500 points per section

(2) includes masked material

(3) may include altered feldspar

TABLE 6

a) XRD analyses (in %)
Zebra Cliffs Fm.
Harley Ridge
limestone

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 4 | 7 - 15 | 10.3 | |
| K-Feldspar | | | | |
| Plagioclase | " | 0 - 4 | 1.5 | |
| Mica | " | 0 - 2 | 1.0 | |
| Chlorite | " | 0 - 4 | 1.0 | |
| Calcite | " | 76 - 90 | 83.0 | |
| Dolomite | " | 1 - 6 | 3.3 | |
| | | | | |
| | | | | |
| F/F+Q | " | 0 - 29 | 10.5 | |
| P/P+K | | | | |
| D/D+C | " | 1 - 7 | 3.5 | |

b) XRD analyses (in %)
Zebra Cliffs Fm.
W. and SW of Disraeli Fiord
limestone

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 3 | 3 - 13 | 8.0 | |
| K-Feldspar | " | 0 - 1 | 0.3 | |
| Plagioclase | " | 1 - 3 | 1.7 | |
| Mica | " | 0 - 2 | 1.0 | |
| Chlorite | | | | |
| Calcite | " | 80 - 92 | 85.7 | |
| Dolomite | " | 2 - 5 | 3.3 | |
| | | | | |
| | | | | |
| F/F+Q | 2 | 11 - 21 | 16.0 | |
| P/P+K | | | | |
| D/D+C | 3 | 3 - 5 | 3.7 | |

c) XRD analyses (in %)
Zebra Cliffs Fm.
Harley Ridge
mudrock, highly calc.

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 2 | 33 - 36 | 34.5 | |
| K-Feldspar | " | 0 - 1 | 0.5 | |
| Plagioclase | " | 5 - 6 | 5.5 | |
| Mica | " | 6 - 6 | 6.0 | |
| Chlorite | " | 6 - 8 | 7.0 | |
| Calcite | " | 44 - 45 | 44.5 | |
| Dolomite | " | 2 - 2 | 2.0 | |
| | | | | |
| | | | | |
| F/F+Q | " | 14 - 15 | 14.5 | |
| P/P+K | " | 88 - 100 | 94.0 | |
| D/D+C | " | 4 - 4 | 4.0 | |

d) XRD analyses (in %)
Zebra Cliffs Fm.
S of Disraeli Fiord
mudrock

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 1 | | 49 | |
| K-feldspar | " | | tr | |
| Plagioclase | " | | 3 | |
| Mica | " | | 7 | |
| Chlorite | " | | 9 | |
| Calcite | " | | 21 | |
| Dolomite | " | | 11 | |
| | | | | |
| | | | | |
| F/F+Q | " | | 6 | |
| P/P+K | | | | |
| D/D+C | " | | 35 | |

e) XRD analyses (in %)
Zebra Cliffs Fm.
S. of Disraell Fiord
mudrock + sandst., v.f.

| | N | Range | $\bar{x}$ | |
|---|---|---|---|---|
| Quartz | 2 | 53 - 59 | 56.0 | |
| K-feldspar | " | 1 - 1 | 1.0 | |
| Plagioclase | " | 5 - 6 | 5.5 | |
| Mica | " | 4 - 5 | 4.5 | |
| Chlorite | " | 6 - 10 | 8.0 | |
| Calcite | " | 12 - 14 | 13.0 | |
| Dolomite | " | 10 - 14 | 12.0 | |
| | | | | |
| | | | | |
| F/F+Q | " | 10 - 10 | 10.0 | |
| P/P+K | " | 89 - 90 | 89.5 | |
| D/D+C | " | 41 - 55 | 48.0 | |

f) XRD analyses (in %)
Zebra Cliffs Fm.
Zebra Cliffs
mudr., cs. + sandst., v.f.

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 3 | 64 - 67 | 65.7 | |
| K-feldspar | " | 2 - 4 | 3.0 | |
| Plagioclase | " | 5 - 10 | 8.3 | |
| Mica | " | 2 - 4 | 2.7 | |
| Chlorite | " | 4 - 6 | 5.0 | |
| Calcite | | | | |
| Dolomite | " | 12 - 19 | 14.7 | |
| | | | | |
| | | | | |
| F/F+Q | " | 11 - 16 | 14.3 | |
| P/P+K | " | 56 - 81 | 71.0 | |
| D/D+C | " | 100 - 100 | 100 | |

g) XRD analyses (in %)
Zebra Cliffs Fm.
W. of Disraeli Fiord
sandstone

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 2 | 60 - 61 | 60.5 | |
| K-feldspar | " | 1 - 2 | 1.5 | |
| Plagioclase | " | 4 - 4 | 4.0 | |
| Mica | " | 0 - 2 | 1.0 | |
| Chlorite | " | 1 - 2 | 1.5 | |
| Calcite | " | 15 - 24 | 19.5 | |
| Dolomite | " | 10 - 14 | 12.0 | |
| | | | | |
| | | | | |
| F/F+Q | " | 8 - 8 | 8.0 | |
| P/P+K | " | 65 - 83 | 74.0 | |
| D/D+C | " | 29 - 48 | 38.5 | |

h) XRD analyses (in %)
Zebra Cliffs Fm.
S. of Disraeli Fiord
sandstone

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 2 | 64 - 67 | 65.5 | |
| K-feldspar | " | 0 - tr | tr | |
| Plagioclase | " | 11 - 12 | 11.5 | |
| Mica | " | 2 - 3 | 2.5 | |
| Chlorite | " | 3 - 5 | 4.0 | |
| Calcite | " | 8 - 14 | 11.0 | |
| Dolomite | " | 4 - 5 | 4.5 | |
| | | | | |
| | | | | |
| F/F+Q | " | 15 - 15 | 15.0 | |
| P/P+K | " | 97 - 100 | 98.5 | |
| D/D+C | " | 28 - 35 | 31.5 | |

i) XRD analyses (in %)
Zebra Cliffs Fm.
W. of Disraeli Fiord
pebble conglomerate

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 2 | 49 - 63 | 56.0 | |
| K-feldspar | " | 1 - 2 | 1.5 | |
| Plagioclase | " | 3 - 3 | 3.0 | |
| Mica | | | | |
| Chlorite | " | 0 - 2 | 1.0 | |
| Calcite | " | 22 - 27 | 24.5 | |
| Dolomite | " | 5 - 24 | 14.5 | |
| | | | | |
| | | | | |
| F/F+Q | " | 6 - 10 | 8.0 | |
| P/P+K | 1 | | 60 | |
| D/D+C | 2 | 16 - 52 | 34.0 | |

TABLE 7

a) XRD analyses (in %)
Lorimer Ridge Fm.
Section N. of Taconite River
Mudrock, sdy–sandst., v.f., arg.

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 9 | 46 – 65 | 57.8 | |
| K-feldspar | " | 0 – 1 | 0.1 | |
| Plagioclase | " | 6 – 12 | 8.8 | |
| Mica | " | 2 – 7 | 4.1 | |
| Chlorite | " | 4 – 14 | 7.3 | |
| Calcite | " | 10 – 34 | 16.8 | |
| Dolomite | " | 3 – 8 | 5.0 | |
| | | | | |
| | | | | |
| F/F+Q | " | 10 – 19 | 13.3 | |
| P/P+K | " | 94–100 | 99.3 | |
| D/D+C | " | 8 – 39 | 24.1 | |

b) XRD analyses (in %)
Lorimer Ridge Fm.
Lorimer Ridge
sandstone

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 3 | 69 – 88 | 78.0 | |
| K-feldspar | | | | |
| Plagioclase | " | 5 – 8 | 6.7 | |
| Mica | " | 1 – 2 | 1.7 | |
| Chlorite | " | 3 – 4 | 3.3 | |
| Calcite | " | 3 – 17 | 9.7 | |
| Dolomite | " | 0 – 1 | 0.3 | |
| | | | | |
| | | | | |
| F/F+Q | " | 5 – 11 | 8.0 | |
| P/P+K | " | 100 – 100 | 100 | |
| D/D+C | 1 | | 6 | |

c) XRD analyses (in %)
Lorimer Ridge Fm.
Lorimer Ridge
sandst., calc., tuffac. (?)

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 1 | | 34 | |
| K-feldspar | | | | |
| Plagioclase | " | | 16 | |
| Mica | | | | |
| Chlorite | " | | 3 | |
| Calcite | " | | 47 | |
| Dolomite | | | | |
| | | | | |
| | | | | |
| F/F+Q | " | | 31 | |
| P/P+K | " | | 100 | |
| D/D+C | " | | 0 | |

d) XRD analyses (in %)
Lorimer Ridge Fm.
Section SE of Disraeli Fiord
sandst., vf. & f. & mudr., sdy

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 5 | 61 – 74 | 70.6 | |
| K-feldspar | " | tr – 1 | 0.2 | |
| Plagioclase | " | 2 – 6 | 3.8 | |
| Mica | " | 1 – 5 | 1.4 | |
| Chlorite | " | 2 – 4 | 2.4 | |
| Calcite | " | 2 – 17 | 12.8 | |
| Dolomite | " | 4 – 25 | 9.0 | |
| | | | | |
| | | | | |
| F/F+Q | " | 3 – 8 | 5.8 | |
| P/P+K | 1 | | 94 | |
| D/D+C | 5 | 22 – 94 | 38.2 | |

e) XRD analyses (in %)
Lorimer Ridge Fm.
Section SE of Disraeli Fiord
sandst., calc.

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 1 | | 46 | |
| K-feldspar | | | | |
| Plagioclase | " | | 1 | |
| Mica | | | | |
| Chlorite | " | | 2 | |
| Calcite | " | | 46 | |
| Dolomite | " | | 4 | |
| | | | | |
| | | | | |
| F/F+Q | " | | 3 | |
| P/P+K | | | | |
| D/D+C | " | | 8 | |

f) XRD analyses (in %)
Lorimer Ridge Fm
W. of Disraeli Fiord
sandstone

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 3 | 65 – 79 | 70.0 | |
| K-feldspar | " | 0 – 3 | 1.0 | |
| Plagioclase | " | 3 – 6 | 4.7 | |
| Mica | " | 0 – 2 | 1.0 | |
| Chlorite | " | 0 – 2 | 1.3 | |
| Calcite | " | 14 – 20 | 16.7 | |
| Dolomite | " | 2 – 9 | 6.0 | |
| | | | | |
| | | | | |
| F/F+Q | " | 6 – 9 | 7.3 | |
| P/P+K | " | 50 – 100 | 81.0 | |
| D/D+C | " | 10 – 36 | 24.3 | |

g) XRD analyses (in %)
Lorimer Ridge
Lorimer Ridge
pebble congl., sandy

| | N | Range | $\bar{x}$ | σ |
|---|---|---|---|---|
| Quartz | 1 | | 88 | |
| K-feldspar | | | | |
| Plagioclase | " | | 5 | |
| Mica | " | | 1 | |
| Chlorite | " | | 3 | |
| Calcite | " | | 3 | |
| Dolomite | | | | |
| | | | | |
| | | | | |
| F/F+Q | " | | 5 | |
| P/P+K | " | | 100 | |
| D/D+C | " | | 0 | |

TABLE 8

| | a) XRD analyses (in %) — Disraeli Glacier beds, Zebra Cliffs — lime mudstone | | | | b) XRD analyses (in %) — Disraeli Glacier beds, Zebra Cliffs — mudrock | | | | c) XRD analyses (in %) — Cranstone Fm., mbrs. A & B, S. of Disraeli Fiord — mudrock | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Range | x̄ | σ | N | Range | x̄ | σ | N | Range | x̄ | σ |
| Quartz | 3 | 7 - 21 | 11.7 | | 3 | 38 - 54 | 44.0 | | 8 | 59 - 70 | 65.5 | |
| K-Feldspar | " | 0 - 1 | 0.7 | | " | 1 - 1 | 1.0 | | " | 0 - 2 | 0.6 | |
| Plagioclace | " | 1 - 2 | 1.7 | | " | 6 - 14 | 9.0 | | " | 4 - 6 | 5.4 | |
| Mica | " | tr - 1 | 0.7 | | " | 2 - 7 | 4.7 | | " | 4 - 9 | 5.9 | |
| Chlorite | " | tr - 2 | 1.0 | | " | 4 - 7 | 5.3 | | " | 7 - 14 | 10.0 | |
| Calcite | " | 72 - 87 | 82.0 | | " | 23 - 31 | 26.0 | | " | 3 - 10 | 7.3 | |
| Dolomite | " | 1 - 3 | 2.0 | | " | 4 - 17 | 9.7 | | " | 3 - 7 | 4.9 | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| F/F+Q | " | 11 - 28 | 17.7 | | " | 13 - 27 | 18.7 | | " | 6 - 11 | 8.6 | |
| P/P+K | | | | | " | 81 - 92 | 87.7 | | " | 76 - 100 | 90.3 | |
| D/D+C | " | 2 - 3 | 2.3 | | " | 14 - 42 | 25.3 | | " | 28 - 51 | 41.5 | |

| | d) XRD analyses (in %) — Cranstone Fm., eastern facies, S. of Disraeli Fiord — sandstone | | | | e) XRD analyses (in %) — Cranstone Fm., stern facies, S. of Disraeli Fiord — mudrock | | | | f) XRD analyses (in %) — Cranstone Fm., western facies, Zebra Cliffs — sandstone | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Range | x̄ | σ | N | Range | x̄ | | N | Range | x̄ | σ |
| Quartz | 13 | 60 - 85 | 74.8 | 6.9 | 8 | 59 - 70 | 65.5 | | 2 | 60 - 69 | 64.5 | |
| K-feldspar | " | 0 - 4 | 0.7 | 1.2 | " | 0 - 2 | 0.6 | | " | 5 - 7 | 6.0 | |
| Plagioclase | " | 4 - 10 | 6.3 | 1.9 | " | 4 - 6 | 5.4 | | " | 5 - 12 | 8.5 | |
| Mica | " | 0 - 4 | 1.4 | 1.4 | " | 4 - 9 | 5.9 | | " | 1 - 3 | 2.0 | |
| Chlorite | " | 2 - 12 | 5.4 | 2.7 | " | 7 - 14 | 10.0 | | " | 1 - 4 | 2.5 | |
| Calcite | " | 3 - 22 | 9.7 | 4.8 | " | 3 - 10 | 7.3 | | " | 0 - 26 | 13.0 | |
| Dolomite | " | 0 - 5 | 1.5 | 1.5 | " | 3 - 7 | 4.9 | | " | 2 - 6 | 4.0 | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| F/F+Q | " | 5 - 23 | 9.5 | 4.6 | " | 6 - 11 | 8.6 | | " | 14 - 21 | 17.5 | |
| P/P+K | 12 | 64 - 100 | 90.6 | 13.1 | " | 76 - 100 | 90.3 | | " | 45 - 64 | 54.5 | |
| D/D+C | 13 | 0 - 58 | 14.1 | 15.1 | " | 28 - 51 | 41.5 | | " | 6 - 100 | 53.0 | |

| | g) POINT COUNT ANAL. (in %)[1] — Cranstone Fm., eastern facies, S. of Disraeli Glacier — sandstone | | | h) POINT COUNT ANAL. (in %)[3] — Cranstone Fm., western facies, Zebra Cliffs — sandstone | | |
|---|---|---|---|---|---|---|
| | N | Range | x̄ | N | Range | x̄ |
| Quartz | 5 | 35 - 46 | 40.4 | 7 } | 9 - 52 | 36.5 |
| Quartzite | " | 2 - 12 | 7.6 | | | |
| Chert | " | 4 - 16 | 9.6 | " | 0 - 4 | 3.2 |
| Undiff. chert & microfelsite | | | | " | 0 - 6 | 2.8 |
| Feldspar | " | 4 - 23 | 12.6 | " | 1 - 3 | 8.2 |
| Chlorite | " | 1 - 2 | 1.2 | " | 0 - 4 | 1.3 |
| Biotite | " | tr - 1 | tr | " | 0 - tr | tr |
| Muscovite | " | tr - 1 | 0.8 | 7 } | } 0 - 3 | 0.8 |
| Metamorphics | " | 3 - 19 | 10.2 | | | |
| Volcanics | " | 1 - 9 | 3.8 | " | 2 - 21 | 5.3 |
| "Granite," gneiss | " | 0 - 2 | 0.6 | " | | 0 |
| Carbonates[2] | " | 7 - 17 | 12.4 | "[4] | 30 - 87 | 41.5 |
| Mudrock | " | tr - 1 | tr | " | | 0 |

(1) 400+ points per section

(2) from XRD

(3) ≈ 300 points per section (from Trettin, 1969b)

(4) includes masked material

TABLE 9

**a) XRD analyses (in %)**
map-unit Sp
NE of Crash Point, E-side, M'Clintock Inlet
Siltstone

| | N | Range | x̄ | σ |
|---|---|---|---|---|
| Quartz | 3 | 65-73 | 68.0 | |
| K-feldspar | " | 0 - 3 | 1.3 | |
| Plagioclase | " | 6 - 8 | 7.0 | |
| Mica | " | 5 - 9 | 6.7 | |
| Chlorite | " | 6 - 9 | 7.7 | |
| Calcite | " | 2 - 3 | 2.7 | |
| Dolomite | " | 6 - 8 | 7.3 | |
| | | | | |
| | | | | |
| F/F+Q | " | 8 - 13 | 10.7 | |
| P/P+K | " | 74-100 | 88.7 | |
| D/D+C | " | 69 - 77 | 77.3 | |

**b) XRD analyses (in %)**
tongue of upper Marvin Fm.
NE of Crash Point
limestone

| | N | Range | x̄ | σ |
|---|---|---|---|---|
| Quartz | 3 | 0-5 | 3.0 | |
| K-feldspar | | | | |
| Plagioclase | " | 0 - 1 | 0.3 | |
| Mica | " | 0 - 1 | 0.7 | |
| Chlorite | | | | |
| Calcite | " | 95-98 | 6.3 | |
| Dolomite | | | | |
| | | | | |
| | | | | |
| F/F+Q | " | 0 - 10 | 3.3 | |
| P/P+K | | | | |
| D/D+C | " | 0 - 0 | 0 | |

**c) XRD analyses (in %)**
tongue of upper Marvin Fm.
NE of Crash Point
Sandstone

| | N | Range | x̄ | σ |
|---|---|---|---|---|
| Quartz | 1 | | 83 | |
| K-feldspar | " | | 1 | |
| Plagioclase | " | | 4 | |
| Mica | " | | 1 | |
| Chlorite | " | | 1 | |
| Calcite | " | | 6 | |
| Dolomite | " | | 3 | |
| | | | | |
| | | | | |
| F/F+Q | " | | 6 | |
| P/P+K | " | | 80 | |
| D/D+C | " | | 33 | |

**d) XRD analyses (in %)**
Crash Point beds
Crash Point Syncline
sandstone

| | N | Range | x̄ | σ |
|---|---|---|---|---|
| Quartz | 3 | 81 - 87 | 83.7 | |
| K-feldspar | " | 2 - 4 | 2.7 | |
| plagioclase | " | 4 - 6 | 5.0 | |
| Mica | " | 1 - 3 | 1.7 | |
| Chlorite | " | 2 - 2 | 2.0 | |
| Calcite | " | 2 - 5 | 3.7 | |
| Dolomite | " | 1 - 2 | 1.3 | |
| | | | | |
| | | | | |
| F/F+Q | " | 6 - 10 | 8.3 | |
| P/P+K | " | 58 - 78 | 66.3 | |
| D/D+C | " | 20 - 42 | 30.3 | |

**e) XRD analyses (in %)**
Crash Point beds
Crash Point Syncline
sandstone, highly calc.

| | N | Range | x̄ | σ |
|---|---|---|---|---|
| Quartz | 1 | | 40 | |
| K-feldspar | " | | 1 | |
| Plagioclase | " | | 3 | |
| Mica | " | | 4 | |
| Chlorite | " | | 5 | |
| Calcite | " | | 45 | |
| Dolomite | " | | 2 | |
| | | | | |
| | | | | |
| F/F+Q | " | | 10 | |
| P/P+K | | | | |
| D/D+C | " | | 4 | |

**f) XRD analyses (in %)**
Crash Point beds
Crash Point Syncline
limestone

| | N | Range | x̄ | σ |
|---|---|---|---|---|
| Quartz | 2 | 20-29 | 24.5 | |
| K-feldspar | " | 1 - 1 | 1.0 | |
| Plagioclase | " | 1 - 3 | 2.0 | |
| Mica | " | 2 - 3 | 2.5 | |
| Chlorite | " | 3 - 3 | 3.0 | |
| Calcite | " | 58 - 70 | 64.0 | |
| Dolomite | " | 3 - 4 | 3.5 | |
| | | | | |
| | | | | |
| F/F+Q | " | 10 - 11 | 10.5 | |
| P/P+K | | | | |
| D/D+C | " | 4 - 4 | 4.0 | |

**g) XRD analyses (in %)**
Crash Point beds
Fault block S. of Crash Point syncline
mudrock & sandst., v.f., argill.

| | N | Range | x̄ | σ |
|---|---|---|---|---|
| Quartz | 5 | 66 - 75 | 68.5 | |
| K-feldspar | " | 0 - 2 | 0.8 | |
| Plagioclase | " | 4 - 10 | 6.6 | |
| Mica | " | 7 - 10 | 7.8 | |
| Chlorite | " | 6 - 8 | 6.8 | |
| Calcite | " | 3 - 7 | 4.8 | |
| Dolomite | " | 3 - 7 | 4.6 | |
| | | | | |
| | | | | |
| F/F+Q | " | 7 - 11 | 10.2 | |
| P/P+K | " | 75 - 100 | 87.4 | |
| D/D+C | " | 34 - 62 | 49.0 | |

**h) XRD analyses (in %)**
Crash Point beds
Fault block S. of Crash Point Syncline
sandstone, f.-m.

| | N | Range | x̄ | σ |
|---|---|---|---|---|
| Quartz | 1 | | 81 | |
| K-feldspar | " | | 2 | |
| Plagioclase | " | | 3 | |
| Mica | " | | 3 | |
| Chlorite | " | | 5 | |
| Calcite | " | | 7 | |
| Dolomite | " | | 1 | |
| | | | | |
| | | | | |
| F/F+Q | " | | 5 | |
| P/P+K | " | | 67 | |
| D/D+C | " | | 13 | |

**i) XRD analyses (in %)**
Crash Point beds
Fault block S. of Crash Point Syncline
limeston

| | N | Range | x̄ | σ |
|---|---|---|---|---|
| Quartz | 1 | | 2 | |
| K-feldspar | | | | |
| Plagioclase | | | | |
| Mica | | | | |
| Chlorite | | | | |
| Calcite | " | | 97 | |
| Dolomite | " | | 1 | |
| | | | | |
| | | | | |
| F/F+Q | | | | |
| P/P+K | | | | |
| D/D+C | " | | 0.5 | |

TABLE 10

a) XRD analyses (in %)
Imina Fm.
E. and W. of upper M'Clintock Glacier
Sandstone

| | N | Range | $\bar{x}$ | $\sigma$ |
|---|---|---|---|---|
| Quartz | 7 | 49-67 | 60.6 | |
| K-Feldspar | " | 0-1 | 0.7 | |
| Plagioclase | " | 4-11 | 6.9 | |
| Mica | " | 4-7 | 5.3 | |
| Chlorite | " | 0-5 | 2.7 | |
| Calcite | " | 0-21 | 3.3 | |
| Dolomite | " | 7-34 | 20.3 | |
| | | | | |
| | | | | |
| F/F+Q | " | 8-18 | 11.1 | |
| P/P+K | " | 83-100 | 90.3 | |
| D/D+C | " | 24-100 | 88.1 | |

b) XRD analyses (in %)
Imina Fm.
E. of Disraeli Glacier
Sandstone

| | N | Range | $\bar{x}$ | $\sigma$ |
|---|---|---|---|---|
| Quartz | 5 | 57-77 | 69.0 | |
| K-Feldspar | " | 0-1 | 0.8 | |
| Plagioclase | " | 1-6 | 4.2 | |
| Mica | " | 2-4 | 2.8 | |
| Chlorite | " | 2-7 | 4.6 | |
| Calcite | " | 1-16 | 8.6 | |
| Dolomite | " | 9-15 | 10.0 | |
| | | | | |
| | | | | |
| F/F+Q | " | 1-10 | 7.0 | |
| P/P+K | " | 82-87 | 84.5 | |
| D/D+C | " | 25-92 | 57.4 | |

c) XRD analyses (in %)
Imina Fm.
E. of Disraeli Glacier and E. of M'Clintock Glc.
granule conglomerate

| | N | Range | $\bar{x}$ | $\sigma$ |
|---|---|---|---|---|
| Quartz | 2 | 72-79 | 75.5 | |
| K-Feldspar | " | 1-1 | 1.0 | |
| Plagioclase | " | 2-4 | 3.0 | |
| Mica | " | 3-3 | 3.0 | |
| Chlorite | " | 0-1 | 0.5 | |
| Calcite | | | | |
| Dolomite | " | 15-20 | 17.5 | |
| | | | | |
| | | | | |
| F/F+Q | " | 3-6 | 4.5 | |
| P/P+K | 1 | | 85 | |
| D/D+C | 2 | 100-100 | 100 | |

d) XRD analyses (in %)
Lands Lokk Fm.
S. part, M'Clintock Inlet map-area
Sandstone

| | N | Range | $\bar{x}$ | $\sigma$ |
|---|---|---|---|---|
| Quartz | 4 | 73-86 | 82.8 | |
| K-Feldspar | " | 0-tr | | |
| Plagioclase | " | 2-7 | 4.0 | |
| Mica | " | 2-3 | 2.3 | |
| Chlorite | " | 4-6 | 5.5 | |
| Calcite | " | 0-15 | 4.0 | |
| Dolomite | " | 0-4 | 1.5 | |
| | | | | |
| | | | | |
| F/F+Q | " | 3-8 | 5.0 | |
| P/P+K | | | | |
| D/D+C | | | | |

e) XRD analyses (in %)
Lands Lokk Fm.
S. part, M'Clintock Inlet map-area
mudrock, cs., in pt. sandy

| | N | Range | $\bar{x}$ | $\sigma$ |
|---|---|---|---|---|
| Quartz | 4 | 74-83 | 79.5 | |
| K-Feldspar | " | 1-1 | 1.0 | |
| Plagioclase | " | 3-9 | 5.3 | |
| Mica | " | 3-5 | 4.0 | |
| Chlorite | " | 5-9 | 7.3 | |
| Calcite | " | 0-4 | 0.8 | |
| Dolomite | " | 0-6 | 1.2 | |
| | | | | |
| | | | | |
| F/F+Q | " | 5-12 | 7.5 | |
| P/P+K | 3 | 79-89 | 84.3 | |
| D/D+C | | | | |

f) XRD analyses (in %)
Lands Lokk Fm.
S. part, M'Clintock Inlet map-area
mudrock, f.

| | N | Range | $\bar{x}$ | $\sigma$ |
|---|---|---|---|---|
| Quartz | 1 | | 49 | |
| K-Feldspar | " | | 2 | |
| Plagioclase | " | | 5 | |
| Mica | " | | 20 | |
| Chlorite | " | | 24 | |
| Calcite | | | | |
| Dolomite | | | | |
| | | | | |
| | | | | |
| F/F+Q | " | | 13 | |
| P/P+K | " | | 71 | |
| D/D+C | | | | |

## APPENDIX 4

## STRATIGRAPHIC SECTIONS

## SECTION NORTH OF BETHEL PEAK (NBP)

Location: M'Clintock Inlet map-area (340E), northwest side of unnamed cape north of Bethel Peak and west of Bromley Island; UTM Zone 17 X, 531000E, 9209800N.

Measured by H.P. Trettin, 1966.

Base of section: angular unconformity, underlain by phyllite, greenish, calcareous.

**CAPE DISCOVERY FORMATION**
**Member A**

unit 1, 0 - 43.6 m (43.6 m)
Conglomerate, massive, grading up to pebbly sandstone; lower ten metres or so are of boulder grade; phenoclasts of phyllite, highly altered volcanic rocks, vein quartz, etc.; also present at least one boulder of serpentinized and carbonated gabbro or ultramafic rock.

unit 2, 43.6 - 61.9 m (18.3 m)
Mainly mudrock with lesser amounts of sandstone and pebble conglomerate, all variably dolomitic; medium light grey to medium grey; some flat lamination, graded bedding, and medium-scale cross-bedding; concave foresets dip 15 - 20 degrees; pebbles consist mainly of chert, in part replaced by carbonates, sand fraction of quartz, chert, phyllite, carbonates, etc.

unit 3, 61.9 - 132.0 m (70.1 m)
Mudrock, medium to medium dark grey, and sandstone, in part pebbly, medium grey; all variably calcareous and slightly dolomitic; poorly bedded, fossiliferous unit with trilobites, colonial corals, straight cephalopods, bryozoans, ostracodes, etc.

Fossil collection 75418: Middle Ordovician to Middle Devonian; probably also source of 24720, Blackriveran (?)(Christie, 1964, p. 21).

unit 4, 132.0 - 143.6 m (11.6 m)
Tuff or tuffaceous sandstone, felsic; laminated to medium-bedded with some medium-scale cross-stratification.

**Member B**

unit 5, 143.6 - 195.4 m (51.8 m)
Lime wackestone, argillaceous, dolomitic; trilobites, gastropods, colonial corals, brachiopods, oncoids with **Girvanella** envelopes.

Top of section: fault.

## SECTION ON NORTHEASTERN BROMLEY ISLAND (NEBI)

Location: M'Clintock Inlet map-area (340E), northeastern Bromley Island; UTM Zone 17X, 539100E, 9209700N.

Measured by H.P. Trettin, 1966.

Base of section: ungular unconformity, underlain by volcanics, chert,marble, etc. of Maskell Inlet assemblage

### CAPE DISCOVERY FORMATION
**Member A**

unit 1, 0 - 9.1 m (9.1 m)
Covered

unit 2, 9.1 - 10.44 m (1.3 m)
Breccia-conglomerate; subrounded to angular phenoclasts up to 9cm long in sandy matrix; beds 30 - 80 cm thick; phenoclasts mainly of chert, massive or schistose, rarely with vague radiolarians (?), less commonly of felsic volcanic rocks; sandy matrix mainly of chert, with lesser amounts of quartz, feldspar, chlorite, chalcedony; commonly altered by carbonate.

unit 3, 10.4 - 42.4 m (32.0 m)
Covered.

unit 4, 42.4 - 44.0 m (1.6 m)
Pebble-grade breccia-conglomerate with abundant calcareous and dolomitic matrix; phenoclasts consist mainly of chert (with rare radiolarians ?) in matrix of sand- and silt-sized quartz, fossil fragments, lime mud, and microcrystalline dolomite; fossil fragments derived from blue-green algae (?), trilobites, brachiopods.

Fossil collection 75417: Middle Ordovician (probably Blackriveran) to Late Silurian (Ludlow).

Top of section: approximate top of member A; contact with member B covered.

## SECTION NORTH OF EGINGWAH BAY (NEGB)

Location: M'Clintock Inlet map-area (340E), west side of M'Clintock Inlet, 3.5 km north of Egingwah Bay;
UTM Zone 18X, 472100E, 9195250N.

Measured by H.P. Trettin, 1965.

Base of section: base of outcrop near sea level; level within member B of Cape Discovery Formation.

### CAPE DISCOVERY FORMATION
**Member B**

unit 1, 0 - 18 m (18 m)
Dolostone, strongly fractured and contorted; beds up to about 15 cm thick; some lamination.

unit 2, 18 - 107 m (89 m)
Lower part: dolostone, finely microcrystalline, silty,slightly calcareous; beds about 1 - 15 cm thick with very thin flat lamination and argillaceou partings; some brecciation.
Upper part: lime mudstone, quartz silty, partly laminated; and mudrock, calcareous, graded interlaminated with peloidal limestone.

**Member C**

unit 3, 107 - 414 m (307 m)
Limestone, minor mudrock, flat-pebble conglomerate.
Limestone: variably argillaceous, commonly laminated, pale red to greyish red.
Mudrock: thinly interlaminated with limestone; calcareous, pale red to greyish red.
Flat-pebble conglomerate: composed of limestone and minor mudrock as described; flat pebbles bedding-parallel to steeply inclined, commonly in solution contact with each other.

**Member D**

unit 4, 414 - 423 m (9 m)
Dolostone, finely crystalline, medium light grey; beds 1 - 8 cm thick; stringers of chert; ledge-forming, vuggy weathering.

unit 5, 423 - 882 m (459 m)
Mainly sandstone, minor mudrock and fine pebble conglomerate with a few beds of dolostone in lower part.
Sandstone: very fine to very coarse, predominantly fine grained; flat lamination common; mostly pale to greyish red, rarely medium

grey; derived from felsic volcanics.
Mudrock and conglomerate: similar to sandstone in colour and composition.
Dolostone: microcrystalline, variably silty and very fine grained sandy.

Thickness of member D: 468 m.

Top of section: base of M'Clintock Formation; contact conformable.

## EGINGWAH CREEK SECTION (EC)

Location: M'Clintock Inlet map-area (340E);
base 4.8 km northeast of head of Egingwah Bay,
UTM 18X, 468300E, 9191200N;
top 7.1 km northeast of head of Egingwah Bay,
UTM 18X, 466100E, 9191600N.

Measured by H.P. Trettin, 1965 with photogrammetric determinations by Veezay Geodata Ltd., 1985.

(Uppermost M'Clintock Formation shown as EC1, photogrammetric sections of Ayles Formation as EC2, ground section of Taconite River Formation as EC3).

Base of section: level in uppermost M'Clintock Formation.

### M'CLINTOCK FORMATION

unit 1, 0 - 6.1 m (6.1 m)
Calcarenite, tuffaceous, medium grey, light olive grey weathering, very fine to very coarse grained, laminated, well sorted; composed of cryptocrystalline to microcrystalline lime mudstone with some skeletal content and a smaller proportion of chloritized shards.

unit 2, 6.1 - 83.2 m (77.1 m)
Volcanic flows, green-brown weathering (probably mainly andesite and basalt).

unit 3, 83.2 - 88.1 m (4.9 m)
Lime mudstone, medium light grey, yellowish grey weathering, microcrystalline to cryptocrystalline; bedding generally poor, but fine, wavy, possibly algal laminations present; small amounts of silt and sand; rare macrofossils.

Fossil collection 69207: Upper Ordovician, Richmondian or Silurian (chain coral).

- conformable contact -

### AYLES FORMATION

(thickness unknown because of structural uncertainties; photogrammetry suggests minimum thickness of 600 $\pm$, maximum thickness of 1200 $\pm$ m)
Dolostone, minor limestone.

Fossil collections 69204 and 69213: Barneveldian (Trentonian) to Richmondian;
69213: Richmondian.

- low-angle unconformity (?) -

**TACONITE RIVER FORMATION**

unit 1, 0 - 182.9 m (182.9 m)
Mudrock, fine to predominantly coarse and sandstone, very fine grained, argillaceous to fine grained; both calcareous and dolomitic, medium to medium dark grey fresh, commonly olive grey weathering; some flat and undulating lamination; locally some authigenic pyrite; unit includes minor covered intervals.

unit 2, 182.9 - 286.5 m (103.6 m)
Covered.

unit 3, 286.5 - 308.5 m (22.0 m)
Rubble of limestone, medium dark grey.

unit 4, 308.5 - 354.8 m (46.3 m)
Covered.

unit 5, 354.8 - 429.2 m (74.4 m)
Mudrock and sandstone; includes medium grained, quartzose and cherty sandstone at 360 m.

unit 6, 429.2 - 429.8 m (0.6 m)
Dolostone, microcrystalline, calcareous, silty and sandy, stylolites common

unit 7, 429.8 - 437.1 m (7.3 m)
Mudrock and sandstone, minor pebbly sandstone - sandy pebble conglomerate at 1432 m, with pebbles mainly of chert, up to 1. 5 cm in diameter.

Top of section: conformable contact with Zebra Cliffs Formation.

## ZEBRA CLIFFS SECTION (ZC)

Location: M'Clintock Inlet map-area (340E), west side of central Clintock Inlet, Zebra Cliffs and west of cliffs;
section of Zebra Cliffs Formation (ZC1) at UTM Zone 18X, 475300E, 918800N;
section of Disraeli Glacier beds (ZC2) at UTM Zone 18X, 476200E, 9185300N;
section of Cranstone Formation (ZC3) at UTM Zone 18X, 532250E, 9174700N.

Field notes and measurements by H.P. Trettin, 1965, 1967, 1982;
photogrammetric determination by Geophoto Ltd., 1967?

Base of section: base of Zebra Cliffs Formation, conformable contact with Taconite River Formation.

### ZEBRA CLIFFS FORMATION

unit 1 (formerly member A) 0-22 m (22 m)
Ledge-forming unit of dolostone, calcareous, and limestone, dolomitic; pale to dark yellowish brown, in part brecciated, containing stringers of chert; sparse corals; parting thickness 20 - 30 cm.

Fossil collection 69203: Richmondian.

unit 2 (formerly member B), 22 - 572 + m (550+ m, according to photogrammetric determination)
Mainly limestone (skeletal lime wackestone and lime mudstone with skeletal content), medium to medium dark grey, well bedded; beds commonly 2 - 20 cm thick; rich and diverse macrofauna dominated by colonial corals; minor sandstone, very fine and fine grained, and mudrock, both calcareous, green and red (distinct unit, perhaps 20 ± m thick, in lower part).

- fault contact -

### DISRAELI GLACIER BEDS

402 m
Interstratified mudrock, lime mudstone and calcarenite, commonly laminated, with fairly common graptolites. Carbonate rocks predominant in lower 244 m, mudrock in upper 158 m.
Mudrock: mainly medium dark grey freash and weathered but with greenish and brownish beds at 244 - 259 m; variably calcareous and dolomitic with some concretions; in part fissile.
Lime mudstone and calcarenite: medium dark grey, weathering in hues of grey and yellow; variably argillaceous and sandy; both composed of single crystals of silt to fine sand grade that probably represent recrystallized aggregates of lime mud with

very rare skeletal matter.
Fossil collection C-59: Late Ordovician, Ashgill.

- abrupt, probably faulted contact -

**CRANSTONE FORMATION**

232 m
Mainly interstratified sandstone and mudrock with minor fine pebble conglomerate with skeletal content in lowermost part; sandstone and mudrock are calcareous and dolomitic and occur mainly in Bouma sequences with A divisions abouty 2 - 40 cm thick; sole marks occur at base of some graded intervals; bedding-parallel burrow casts observed in lower part of unit.
Fossil collection C-68 from middle part of unit: late Llandovery or Wenlock.

Top of section: fault contact with Upper Carboniferous clastic strata.

## SECTION WEST OF UPPER M'CLINTOCK INLET (WUMI)

Location: M'Clintock Inlet map-area (340F), cliffs west of uppermost part of M'Clintock Inlet;
UTM Zone 18X, 485300E, 9168300N.

Field notes by H.P. Trettin, 1979; photogrammtric determination by V. Zay Smith Associates Ltd., 1980.

Base of section: angular unconformity at top of map-unit sc (Hadrynian and/or Cambrian) here consisting of marble.

### TACONITE RIVER FORMATION

0 - 3.0 m (3.0 m)
Boulder conglomerate, massive; boulders of marble, somewhat rounded, up to 50 cm in diamter, tightly packed

3.0 - 3.3 m (0.3 m)
Sandstone, pebbly, greenish grey; flat lamination

3.3 - 11.0 m (7.7 m)
Boulder conglomerate, poorly sorted with slumped blocks of sandstone, up to about 4 m long; maximum diameter of boulders about 80 cm in lower part, 40 cm in upper part

11.0 - 39.4 m (28. 4 m)
Pebble and conglomerate, phenoclasts mainly 5 - 20 cm

39.4 - 45.4 m (6.0 m)
Pebble and cobble conglomerate, phenoclasts mainly 5 - 10 cm but with some coarser material

45.4 - 180 ± m
Inaccessible; appears to be upward-fining succession of peble conglomerate and sandstone (thickness obtained by subtraction of measured section from photogrammetrically obtained total thickness of formation)

Top of section: base of Zebra Cliffs Formation; contact presumed to be conformable

## CRASH POINT SECTION (CP)

Location: M'Clintock Inlet map-area (340F), northeast of Crash Point, east side of central M'Clintock Inlet;
UTM Zone 18X, 483700E, 9183600N.

Measured by H.P. Trettin, 1966, 1981.

Base of section: abrupt, probably conformable contact with map-unit Sp; mostly covered or difficult of access.

### TONGUE OF UPPER MARVIN FORMATION

unit 1, 0 - 39 m (39 m)
Limestone, medium light grey; analyzed specimens are pelletal and peloidal packstones, in part texturally transitional to grainstone or lime wackestone with scarce to abundant, generally common skeletal fragments derived from brachiopods, echinoderms, trilobites, ostracodes, corals, gastropods, pelecypods, algae, and (?) bryozoans; fragments commonly have cryptocrystalline coatings (coated grains); some have laminar algal envelopes (oncoids).

0 - 31 m (31 m)
Parting thickness 1 - 2 m; profile very steep.

31 - 39 m (8 m)
Parting thickness 0.5 - 1 and 5 - 10 cm; profile steps back.
Fossil collection 75421 from basal strata: late Wenlock - early Pridoli (based on brachiopod);
C-54969 from 0 - 1 m: probably Silurian, Ludlovian (?) (conodonts).

unit 2, 39 - 104± m (65± m)
Limestone a.b. (mainly pelletal packstone with common skeletal matter); some beds rich in macrofossils (brachiopods, large cephalopods, corals, bryozoans, stromatoporoids, etc.); massive or thick-bedded, resistant units alternate with recessive units that have more closely spaced parting surfaces.
Fossil collection C-54976 at 45 m: probably Silurian (pelecypod);
75422 (position not dermined): late Wenlock - early Pridoli (brachiopod).

unit 3, 104± - 154± m (50 m)
Limestone (about two thirds) interbedded with sandstone (one third).
Limestone: analyzed specimens represent skeletal lime wackestone, and oncolite with silty and sandy matrix; ledge-forming units 3 - 6 m thick, beds 2 - 15 cm thick; some beds rich in fossils (corals, brachiopods, echinoderms, gastropods, stromatoporoids, bryozoans).

Crash Point

Sandstone: quartzose, variably calcareous, micaceous, fine grained, flat-laminated.

Fossil collection 69208 (position not determined): late Wenlock - early Pridoli.

Top of section: conformable contact with Crash Point beds.

## SECTION ON SOUTHERN MARVIN PENINSULA SECTION (SMP)

Location: M'Clintock Inlet map-area (340F), syncline on central southern Marvin Peninsula;
UTM Zone 18X, 52300E, 9189000N.

Measured by H.P. Trettin, 1979.

Base of section: top of M'Clintock Formation; rubble of volcanic rocks. Note that conglomerate is present at base of Taconite River Formation on south flank of syncline; absence here could be due to faulting although this is not obvious.

### TACONITE RIVER FORMATION

unit 1, 0 - 5.7 m (5.7 m)
Covered with talus of sandstone from unit 2.

unit 2, 5.7 - 53.5 m (47.8 m)
Mainly sandstone with minor interlaminated mudrock.
Sandstone: fine and very fine grained; vague to distinct flat or undulating lamination; some intraclasts of mudrock; light brownish grey or pale red.
Mudrock: fine and coarse, in part sandy; flat lamination; light brownish grey.

unit 3, 53.5 - 66.3 m (12.8 m)
Sandstone, very fine and fine grained; flat lamination and small-scale cross-lamination; light brownish grey; in lower 2 m rubble of mudrock, coarse, highly calcareous, light olive grey.

unit 4, 66.3 - 68.2 m (1.9 m)
Mainly sandstone with minor interlaminated mudrock; at base intraformational conglomerate with fragments up to 1.2 cm long in sandy matrix.
Sandstone: fine to medium grained; flat lamination and small-scale cross-lamination; sets of cross-laminae 10 - 30 cm thick; light brownish grey.

unit 5, 68.2 - 70.5 m (2.3 m)
Sandstone, mudrock, and minor intraformational conglomerate.
Sandstone: very fine and fine grained; flat and undulating lamination; some vague, bedding-parallel trace fossils; light brownish grey.
Mudrock: fine and coarse; pale red; flat and unulating lamination.

unit 6, 70.5 - 71.4 m (0.9 m)
Sandstone, very fine to fine grained; flat lamination, minor small-scale cross-lamination; medium light grey.

unit 7, 71.4 - 75.4 m (4.0 m)
Rubble and some outcrop of lime mudstone, variably silty and sandy, grading to mudrock, calcareous; vague flat lamination; trace fossils cf. **Chondrites**; light grey to yellowish grey.

unit 8, 75.4 - 77.9 m (2.5 m)
Mudrock, calcareous, sandy, and partly pebbly (poorly exposed); medium light grey.

unit 9, 77.9 - 85.6 m (7.7 m)
Mudrock and limewackestone present as rubble
Mudrock: highly dolomitic and calcareous, sandy, medium light grey.
Lime wackestone (rudstone): highly fossiliferous, muddy and sandy, medium light grey.

unit 10, 85.6 - 88.6 m (3.0 m)
Sandstone with minor interlaminated mudrock.
Sandstone: very fine and fine grained; flat lamination and small-scale cross-lamination; sets of cross-laminae about 10 cm thick, beds up to 30 cm thick; light brownish grey.
Mudrock: coarse, sandy; flat and undulating lamination; light brownish grey.

unit 11, 88.6 - 90.3 m (1.7 m)
Mudrock, coarse, highly calcareous, flat and undulating lamination; small trace fossils on bedding planes; light grey.

unit 12, 90.3 - 93.2 m (2.9 m)
Sandstone, very fine to fine grained; mainly flat-laminated; medium light grey, light greenish grey weathering, ledge-forming.

unit 13, 93.2 - 94.7 m (1.5 m)
Mudrock, highly calcareous, very fine and fine sandy; flat lamination; light olive grey.

unit 14, 94.7 - 95.9 m (1.2 m)
Mudrock, coarse, very fine sandy, highly calcareous; flat lamination and some undulating and small-scale cross-lamination; light brownish grey.

unit 15, 95.9 - 103.6 m (7.7 m)
Sandstone, fine to medium grained, highly calcareous; flat lamination and small-scale cross-lamination; medium light grey.

unit 16, 103.6 - 104.7 m (1.1 m)
Sandstone with interlaminated mudrock and small amounts of flat-pebble conglomerate.
Sandstone: very fine to fine grained, silty, pale red to greyish red.
Mudrock: coarse, sandy, highly calcareous, light brown.

unit 17, 104.7 - 107.0 m (2.3 m)

Sandstone, very fine grained, silty, dolomitic and calcareous, flat-laminated, medium light grey.

unit 18, 107.0 - 107.7 m (0.7 m)
Mudrock, coarse, very fine and fine sandy, highly calcareous; flat and undulating lamination; light olive grey to medium light grey.

unit 19, 107.7 - 108.7 m (1.0 m)
Sandstone, medium to coarse grained, flat-laminated, pale red, resistant.

unit 20, 108.7 - 110.4 m (1.7 m)
Sandstone, fine grained, medium light grey, beds to 30 cm thick; interbedded with mudrock, highly calcareous, sandy, transitional to lime mudstone, silty, sandy; flat and undulating lamination; light olive grey to medium light grey.

unit 21, 110.4 - 112.0 m (1.6 m)
Deeply weathered rubble of pebble conglomerate with matrix of calcareous sandstone; phenoclasts include fossiliferous limestone, lime mudstone, metaquartzite with small amounts of muscovite, and shell fragments -- mainly corals and stromatoporoids, also ostracodes.

Fossil collection C-54938 at 111.5 m (transported), late Middle or Late Ordovician

unit 22, 112.0 - 112.6 m (0.6 m)
Lime mudstone and sandstone; some flat and undulating lamination and intraformational brecciation.
Lime mudstone: rich in silt and very fine grained sand, medium light grey.
Sandstone: highly silty, calcareous, medium light grey.

unit 23, 112.6 - 114.4 m (1.8 m)
Mainly lime wackestone, minor lime mudstone.
Lime wackestone: silty, slightly sandy, richly fossiliferous (corals, echinoderms, dasycladacean algae, gastropods, etc.); medium light grey.
Lime mudstone: silty, sandy, medium light grey.

Fossil collection C-54939 at 114 m: probably Late Ordovician to Middle Devonian.

unit 24, 114.4 - 117.1 m (2.7 m)
Mainly mudrock with two units of sandstone, 10 - 20 cm thick, in lower part.
Mudrock: calcareous (lime mud) and very fine and fine grained sandy with some brachiopod fragments; mainly flat-laminated with some small-scale cross-lamination (set 10 cm thick), bioturbation, and intraformational brecciation; light grey.
Sandstone: very fine grained, very silty, flat-laminated, medium light grey.

unit 25, 117.1 - 126.8 m, (9.7 m)
Lime wackestone, silty, slightly sandy, richly fossiliferous (echinoderms, brachiopods, corals, trilobites, dasycladacean algae ?), especially in lower 50 cm, medium light grey.
Fossil collection C-54940 at 117.5 m: Late Ordovician.

unit 26, 126.8 - 141.8 m (15.0 m)
Mainly mudrock with 6 units of lime wackestone and some breccia of limestone in pelitic matrix.
Mudrock: highly calcareous (lime mud); some vague lat lamination; light olive grey to medium light grey.
Lime wackestone: very silty, richly fossiliferous (dasycladacean algae, brachiopods, trilobites, cephalopods, corals), medium grey and greenish grey.

unit 27, 141.8 - 144.8 m (3.0 m)
Lime wackestone, silty, richly fossiliferous (brachiopods, cephalopods, corals, etc.).
Fossil collection C-54941 at 141.8 - 144.8 m: late Middle Ordovician to Silurian.

unit 28, 144.8 - 202.6 m (57.8 m)
Sandstone, minor mudrock.
Sandstone: very fine grained, argillaceous; beds 2 - 20 cm thick; some flat lamination; some ripup clasts of mudrock; medium light grey to greenish grey.
Mudrock: greenish grey.

unit 29, 202.6 - 203.6 m (1.0 m)
Limestone, fractured and contorted.

Top of section: present erosion surface (centre of syncline).

## SECTIONS NORTH OF THORES RIVER

Section NTR1 represents a short interval within the Lorimer Ridge Formation, measured in detail to establish the lithological character of this rather monotonous formation. Section NTR2 represents the relatively thin limestone unit that overlies the Lorimer Ridge Formation in this area. It either is a fault slice or a tongue of the lower Marvin Formation.

### SECTION NTR1

Location: M'Clintock Inlet map-area (340E), about 1.2 km north of mouth of Thores River;
UTM Zone 18X, 533000E, 9173600N.

Measured by H.P. Trettin, 1981.

Base of section: level within Lorimer Ridge Formation.

### LORIMER RIDGE FORMATION

unit 1, 0 - 1.5 m (1.5 m)
Mudrock, slightly sandy, very calcareous, bioturbated, greenish grey.

unit 2, 1.5 - 6.0 m (4.5 m)
Covered, recessive.

unit 3, 6.0 - 6.4 m (0.4 m)
Mudrock, coarse, sandy, and sandstone, very fine grained, argillaceous, both calcareous, greenish grey; some flat and undulating lamination.

unit 4, 6.4 - 8.0 m (1.6 m)
Mudrock, coarse, sandy, and sandstone, very fine grained, argillaceous, both calcareous, bioturbated, greyish red.

unit 5, 8.0 - 10. 5 m (2.5 m)
Sandstone, very fine grained, with intraclasts of lime mudstone; and mudrock; both calcareous, bioturbated, and greenish grey.

unit 6, 10.5 - 10.9 m (0.4 m)
Mudrock, coarse, sandy, and sandstone, very fine grained, argillaceous; both calcareous, bioturbated, medium light grey.

unit 7, 10.9 - 13.0 m (2.1 m)
Mudrock, coarse, sandy, and sandstone, very fine grained, argillaceous; both calcareous, bioturbated, greenish grey.

unit 8, 13.0 - 14.5 m (1.5 m)
Lime mudstone, very silty, with some skeletal matter (trilobites,

molluscs), bioturbated, medium light grey; beds 2 - 10 cm thick.

unit 9, 14.5 - 15.0 m (0.5 m)
Mudrock, slightly sandy, calcareous, bioturbated, greenish grey; parting surfaces at 1 - 2 mm.

unit 10, 15.0 - 20.5 m (5.5 m)
Mudrock, coarse, and minor amounts of sandstone, very fine grained; both calcareous, bioturbated, greyish red, poorly exposed.

unit 11, 20.5 - 26.5 m (6.0 m)
Mudrock, coarse, sandy, bioturbated, greenish grey; beds in lower part 1 - 5 cm thick, in upper part 1 - 2 m.

unit 12, 26.5 - 28.5 m (2.0 m)
Covered, recessive.

unit 13, 28.5 - 30.5 m (2.0 m)
Lime mudstone, light grey, and mudrock, greenish grey, with very minor amounts of sandstone, very fine grained, argillaceous; fragments of limestone in lower 0.3 m.

unit 14, 30.5 - 32.8 m (1.3 m)
Mudrock, coarse, and sandstone, very fine grained, argillaceous, both calcareous, bioturbated, greyish red; also sandstone, very fine and fine grained, flat-laminated, light brownish grey.

unit 15, 32.8 - 35.0 m (2.2 m)
Partly covered; some outcrop of mudrock, greenish grey, a.b.

unit 16, 35.0 - 36.0 m (1.0 m)
Lime mudstone, silty, medium to medium dark grey; macrofossils include favositic corals and gastropods; skeletal fragments of trilobites, ostracodes, etc.

Fossil collection C-54959: Late Ordovician (Ashgill) to Silurian (coral).

unit 17, 36.0 - 38.0 m (2.0 m)
Covered.

unit 18, 38.0 - 40.0 m (2.0 m)
Mudrock, partly coarse, sandy; calcareous, bioturbated, medium grey and greenish grey; some vague undulating and flat lamination.

unit 19, 40.0 - 42.0 m (2.0 m)
Interbedded mudrock, coarse, sandy, and sandstone, very fine grained, argillaceous; both calcareous, greyish red; bioturbation and some flat lamination.

unit 20, 42.0 - 44.4 m (2.4 m)
Mudrock, in part sandy; calcareous, bioturbated, greenish grey.

unit 21, 44.4 - 45.7 m (1.3 m)
Lime wackestone, argillaceous, and very fine grained sandy; fragments of trilobites, bryozoans, corals, etc.; medium grey; vague bedding surfaces at 5 - 20 cm.

unit 22, 45.7 - 48.0 m (2.3 m)
Mudrock, coarse, sandy, and sandstone, very fine grained, argillaceous; both calcareous and greenish grey; flat, undulating, and some lenticular lamination.

Top of section: level within Lorimer Ridge Formation (exposure continues).

SECTION NTR2

Location: M'Clintock Inlet map-area (340E), about 2 km north of Thores River;
UTM Zone 18X, 532700E, 9174400N.

Measured by H.P. Trettin, 1981.

Base of section: covered contact with Lorimer Ridge Formation.

**MARVIN FORMATION**

unit 1, 0 - 8 m (8 m)
Rubble of limestone, medium to medium dark grey, variably dolomitic; analyzed specimens represent lime mudstone with skeletal content and skeletal lime wackestone, both slightly silty, with varying proportions of dolomite, microcrystalline; skeletal matter includes gastropods, brachiopods, and trilobites.
Conodont collection C-54985 at 1.5 - 2.0 m: mid-Ordovician to Late Silurian;
C-54986 at 3.0 - 5.0 m: Late Ordovician.

unit 2, 8 - 90 m (82 m)
Outcrop and rubble of limestone, medium to medium dark grey; beds 10 - 50 cm thick; some burrow-controlled dolomitic mottling in lower part; large brachiopods common from 33 - 53 m; analyzed specimens represent pelletal packstone and lime mudstone with skeletal content, and skeletal lime wackestone; skeletal matter derived mainly from brachiopods and to a lesser extent from echinoderms, ostracodes and (?) trilobites.
Conodont collection C-54987 at 30 - 33 m: Late Ordovician.

Top of section: upper limit of Marvin Formation; concealed contact with adjacent Cranstone Formation may be faulted.

## SECTIONS SOUTH OF DISRAELI FIORD

Location: M'Clintock Inlet map-area (340F), south of west side of Disraeli Fiord;
UTM Zone 18X; approx. 533250E, 9182800N, to 533750E, 9180000N.

Section consists of two parts, labelled SDF1 and SDF2, that are separated by concealed strata and faults.

Measured by H.P.Trettin, 1981, 1982.

### SECTION SDF1

Base of section: level in uppermost part of Taconite River Formation.

**TACONITE RIVER FORMATION**

unit 1, 0 - 9.0 m (9.0 m)
Mudrock, commonly coarse and partly sandy, and sandstone, very fine grained and commonly argillaceous; both calcareous and dolomitic, laminated or bioturbated, medium light grey and greenish grey with faint reddish hue in lower 0.7 m.

- conformable contact -

**ZEBRA CLIFFS FORMATION**

unit 1, 0 - 47.0 m (47.0 m)
Lime wackestone, skeletal, medium to medium dark grey; well stratified; beds 5 - 20 cm thick; bedding surfaces wavy, amplitude 1 - 2 cm, half-wave length about 5 cm; macrofossils include colonial and solitary corals, bryozoans, gastropods, cephalopods; skeletal fragments also from brachiopods.
Fossil collection C-54957: Late Ordovician, Ashgill.

unit 2, 47.0 - 56.0 m (9m)
Limestone as before with interbedded, less abundant mudrock, coarse, and sandstone, very fine grained, argillaceous, both medium grey or greenish grey, bioturbated; mudrocks have parting thickness of 1 - 2 cm; trace fossils include **Chondreitis**.

unit 3, 56.0 - 95.0 m (39 m)
Interbedded mudrock, coarse, in part sandy, and sandstone, very fine and fine grained, in part argillaceous, both calcareous and dolomitic; beds 0.5 - 1 m thick, commonly bioturbated but with some flat and undulating lamination preserved; mainly pale red or greyish red with some medium light grey strata.

unit 4, 95.0 - 143.0 m (48 m)
Roughly two thirds limestone and one third mudrock and minor

sandstone.
Limestone: skeletal lime wackestone and lime mudstone with corals and fragments of gastropods, ostracodes, trilobites, etc.; commonly bioturbated; medium to medium dark grey.
Mudrock: coarse, in part very fine grained sandy.
Sandstone: very fine grained, argillaceous, calcareous, dolomitic, bioturbated, medium light grey; unit occurs mainly as rubble in place.

Fossil collection C-54958 at 137 m: probably Late Ordovician, Ashgill, possibly Silurian (corals).

Top of section: level within lower Zebra Cliffs Formation. Section is overlain by thick succession of predominantly limestone, present as rubble; measurement discontinued because of lack of attitude control.

SECTION SDF2

Base of section: level in uppermost part of Zebra Cliffs Formation.

**ZEBRA CLIFFS FORMATION**

unit 1, 0 - 23.0 m (23.0 m)
Limestone, medium to medium dark grey; vague, undulating parting surfaces at 5 - 20 cm; unit forms ledges 2 - 10 m thick; some chain corals (**Catenipora** sp.) in talus; analyzed samples are classified as lime mudstone and skeletal lime wackestone; skeletal fragments from calcareous sponges, dasycladacean algae, trilobites, echinoderms, pelecypods, etc.

- conformable contact -

**DISRAELI GLACIER BEDS**

unit 1, 0 - 34.0 m (34.0 m)
Limestone, medium dark grey, medium grey weathering; beds of moderately argillaceous and sandy lime wackestone, rich in calcareous sponge spicules with lesser amounts of trilobite debris, 2 - 10 cm, commonly 5 cm thick, with internal flat lamination, separated by laminae of highly argillaceous limestone and/or calcareous mudrock, also rich in calcareous spicules.

unit 2, 34.0 -39.5 m (5.5 m)
Lime packstone, recystallized, composed mainly of lime mudstone clasts with lesser amounts of skeletal material, derived from dasycladacean algae and trilobites; massive; parting thickness 10 - 50 cm; medium grey.

Fossil collection C-96701 at 35.5 - 36.5 m: mixed fauna, Middle and Late Ordovician; C-96700 at 38.0 m: Late Ordovician; C-96699 at 39.0 m: late Middle to latest Ordovician (undifferentiated).

unit 3, 39.5 - 41.8 m (2.3 m)
As unit 1.

unit 4, 41.8 - 44.6 m (2.8 m)
As unit 1 but beds 5 - 20 cm thick.

unit 5, 44.6 - 50.8 m (6.2 m)
As unit 1; beds 2 - 20 cm thick.

unit 6, 50.8 - 51.6 m (0.8 m)
Lime mudstone, highly argillaceous, medium dark grey; flat lamination.
unit 7, 51.6 - 55.1 m (3.5 m)
Covered.

- abrupt contact, conformable or submarine disconformity -

**CRANSTONE FORMATION**
**Member A**
Subdivision A1

unit 1, 0 - 40.5 m (40.5 m)
Interbedded sandstone, mudrock, and pebble conglomerate

0 - 2.0 m (2.0 m)
Sandstone, very fine grained, argillaceous, with pebbles and minor cobbles of quartzite, etc. up to 10 cm in diameter; mostly structureless but with some discontinuous, irregular lamination; medium grey and medium dark grey, olive grey weathering.

2 - 18.5 m (16.5 m)
Mudrock, sandy mudrock, and minor sandstone, very fine grained, argillaceous, medium dark grey, olive grey weathering, massive; dispersed pebbles up to about 5 cm in diameter, at 6.5 - 7.0 m.

18.5 - 23.0 m (4.5 m)
Mudrock, highly calcareous, more resistant than before, medium dark grey, olive grey weathering.

23.0 - 23.5 m (0.5 m)
Pebble congomerate with sandy matrix; flat upper and lower contacts.

23.5 - 23.8 m (0.3 m)
Sandstone.

23.8 - 25.3 m (1.5 m)

Pebble conglomerate, cobbly, phenoclasts up to 9 cm in diameter, fining upwards to sandstone, pebbly.

25.3 - 28.0 m (2.7 m)
Sandstone, coarse grained, with dispersed pebbles up to 5 cm in diameter.

28.0 - 31.0 m (3.0 m)
Mudrock, massive, with scattered pebbles of chert etc. in upper 1 m.

31.0 - 32.2 m (1.2 m)
Pebbble conglomerate, cobbly, with sandy matrix; phenoclasts up to 15 cm in diameter.

32.2 - 33.7 m (1.5 m)
Mudrock, sandy, with dispersed granules and pebbles up to 5 cm in diameter.

33.7 - 35.2 m (1.5 m)
Sandstone, medium grained, quartzose, dolomitic, beds 20 - 30 cm thick.

35.2 - 38.0 m (2.8 m)
Pebble conglomerate, cobbly; phenoclasts up to 12 cm in diameter; lenses of pebbly sandstone, about 10 cm thick, 1 - 2 m long, in upper part.

38.0 - 38.4 m (0.4 m)
Sandstone with interlaminated mudrock; flat lamination.

38.4 - 39.4 m (1.0 m)
Sandstone with dispersed pebbles up to a few cm in diameter.

39.4 - 40. 4 m (1.0 m)
Sandstone.

40.4 - 40.5 m (0.1 m)
Mudrock, sandy.

unit 2, 40.5 -61.5 m (21.0 m)
Intermittent outcrop of sandstone, mudrock, and conglomerate (complex structure).

unit 3, 61.5 - 180.0 m (118.5 m)
Mainly sandstone and mudrock, minor pebble conglomerate. Bouma sequences composedd of divisions A and B or of division A alone common; see detailed partial section at 61.5 m:

0 - 8.0 cm (8.0 cm)
Mudrock, coarse.

8.0 - 38.0 cm (30.0 cm)

Sandstone, upward-fining, medium-grained at base (max. coarse - very coarse), fine grained at top (max. medium); mostly structureless with flat lamination at 29.0 - 38.0 cm.

38.0 - 49.0 cm (11.0 cm)
Sandstone, very fine grained, argillaceous; slight upward decrease in grain size; flat lamination; abrupt upper contact with poorly developed, small flute marks.

49.0 - 58.3 cm (9.3 cm)
Sandstone, medium grained at base (max. very coarse), fining upwards to very fine grained with 3 mm of mudrock at top; abrupt upper contact with small mud diapir.

58.3 - 60.0 cm (1.7 cm)
Two layers of sandstone, very fine grained, separated and overlain my two layers of mudrock; flat lamination.
60.0 - 62.3 cm (2.3 cm)
Sandstone, fining upward to mudrock; abrupt upper contact with small mud diapir.

62.3 - 64.5 cm (2.2 cm)
Sandstone, fining upwards to mudrock.

64.5 - 72.0 cm (7.5 cm)
Interlaminated sandstone and mudrock; lamination flat.

72.0 - 73.5 cm (1.5 cm)
Sandstone, fining upwards to mudrock (through sandy mudrock); flat lamination; abrupt upper contact with small grooves and ridges.

73.5 - 79.5 cm (6.0 cm)
Sandstone, relatively calcareous, upward-fining; fine grained at base, very fine grained at top.

79.5 cm - 119.0 cm (39.5 cm)
mudrock with minor interlaminated sandstone; flat lamination; abrupt upper contact with load casts.

119.0 - 167.0 cm (48.0 cm)
Sandstone, coarse grained, poorly sorted, with granules and pebbles in lower 17 cm (119.0 - 136.0 cm), and with contorted mudrock clasts at 124.0 - 126.0 cm; vague flat lamination at 154.0 -160.0 cm; good flat lamination at 160.0 - 167.0 cm; fine and medium grained in upper few cm.

Top of detailed section at 63.17 cm.

At 112.5 m: upward from this level a few conglomerate beds, 30 - 50 cm thick.

At 151.5 - 154.0 m: ledge of cobbly pebble conglomerate;

phenoclasts up to 15 cm in diameter.

At 154.0 - 173.0 m:interbedded sandstone and mudrock with no more than a few percent of pebble conglomerate.

At 173.0 - 179.5 m: ledge-forming pebble conglomerate, cobbly, with mudrock matrix.

unit 4, 180.0 - 218.5 m (38.5 m)
Mudrock and sandstone a.b. with very minor amounts of pebbly mudrock; proportion of sandstone decreases upwards.

Subdivision A2

unit 5, 218.5 - 298.0± m (79.5± m)
Mainly mudrock with small amounts of sandstone and very small amounts of pebble conglomerate, pebbly mudrock, and sandstone (thickness somewhat uncertain because of complex structure, incomplete exposure and rain and fog conditions during measurement).

At 218.5 - 219.0 m: sandstone, filling channel.

At 223.5 m: sandstone bed.

At 235.0 - 240.0 m: sandstone.

At 258.0 - 261.0 m: sandstone beds up to 50 cm thick, interbedded with mudrock.

At 261.0 - 263.5 m: sandstone and pebble conglomerate; pebbles up to 5 cm in diameter.

At 263.5 - 264.0 m: pebbly mudrock.

unit 6, 298.0 - 377.0 m, (79.0 m)
Mainly mudrock, medium dark grey, olive grey weathering; flat lamination partly destroyed by bioturbation.

At 361.0 - 362.0 m: sandstone, very fine grained, argillaceous in beds, 5 - 10 cm thick, with minor interlaminated mudrock.

unit 7, 377.0 - 395.0 m (18.0 m)
Covered, recessive

unit 8, 395.0 - 402.0 m (7.0 m)
Mudrock and argillaceous limestone, rich in calcareous sponge spicules (lime wackestone); flat lamination; laminae, 0.12 - 3 mm thick, differ in grain size and concentration of argillaceous and carbonaceous impurities; rare graptolites.

Fossil collections C-94373, C-94374: middle or earliest late

Llandovery.

unit 9, 402.0 - 416.0 m (14.0 m)
Mudrock, medium and medium dark grey, olive grey weathering; flat lamination; partings at 1 - 5 cm.

- abrupt contact, probably conformable -

**Member B**
Subdivision B1

unit 10, 416.0 - 434.0 m (18.0 m)
Conglomerate and minor amounts of sandstone; bluff-forming unit.

416.0 - 419.0 m (3.0 m)
Pebble conglomerate, cobbly, est. 60 %, sandstone 40 %, both medium grey, olive grey and brownish weathering.
Conglomerate: phenoclasts mainly 1 - 2 cm but up to 10 cm in diameter; closely packed but with sandy matrix; beds 10 - 50 cm thick, flat at outcrop scale.
Sandstone: units are lenticular, totally exposed lenses a few m long with some low-angle, concave foreset cross-bedding.
Paleocurrent indicators: phenoclast imbrication and some foresets suggest transport to SW.

419.0 - 431.0 m (12.0 m)
Mainly pebble conglomerate, cobbly; phenoclasts mainly 1 - 5 cm but up to 10 cm long; flat bed of sandstone at 426.8 - 426.9 m.

431.0 - 434.0 m (13.0 m)
Pebble conglomerate, cobbly, with beds and lenses of sandstone, 10 - 70 cm thick.

unit 11, 434.0 - 449.5 m (15.5 m)
Partly covered, recessive; some outcrop of sandstone and mudrock

434.0 - 439.0 m (5.0 m)
Covered, recessive.

439.0 - 441.0 m (2.0 m)
Some outcrop of sandstone, very fine grained, argillaceous, medium grey, olive grey and brown weathering; some flat lamination; outcrop disturbed by frost action.

441.0 - 447.5 m (6.5 m)
Some outcrop of interbedded sandstone and mudrock; partly covered.

447.5 - 448.2 m (0.7 m)
Sandstone, very fine grained, argillaceous, interlaminated

with mudrock a.b.

448.2 - 448.7 m (0.5 m)
Sandstone, medium grained at top; upper contact abrupt.

448.7 - 449.5 m (0.8 m)
Sandstone and mudrock a.b.

unit 12, 449.5 -549.0 m (99.5 m)
Pebble conglomerate, cobbly with perhaps 10 % sandstone and pebbly sandstone.

Conglomerate: massive; mainly pebbles, rare cobbles of carbonate rocks up to 17.5 cm in diameter; cobbles, 8 - 17 cm in diameter common at 525.0 - 526.0 m.

Sandstone and pebbly sandstone: flat beds, 1 - 15 cm thick, with some low-angle concave foresets.

unit 13, 549.0 - 565.5 m (16.5 m)
Partly covered, recessive; some outcrop of mudrock and sandstone.

549.0 - 550.0 m (1.0 m)
Mainly mudrock, variably sandy, flat-laminated; less sandstone, very fine to medium grained, partly flat-laminated; both medium grey, olive grey weathering.

550.0 - 555.5 m (5.5 m)
Mostly covered; some rubble and frost-heaved outcrop of mudrock.

555.5 - 565.5 m (10.0 m)
Covered, recessive.

unit 14, 565.5 - 566.8 m (1.3 m)
Mainly pebble conglomerate with phenoclasts 1 - 5 cm in diameter; 10 cm sandstone at top.

unit 15, 566.8 - 578.5 m (11.7 m)
Covered, recessive.

unit 16, 578.5 - 593.5 m (15.0 m)
Mainly pebble conglomerate, cobbly, with sandy matrix; phenoclasts 2 - 5 cm but up to 10 cm in diameter; some upward-fining units, e.g. at 171.5 - 172.4 m:

0 - 10 cm (10 cm)
Sandstone, pebbly and cobbly, phenoclasts up to 10 cm in diameter.

10 - 30 cm (20 cm)
Sandstone, pebbly.

30 - 90 cm (60 cm)
Sandstone.

unit 17, 593.5 - 598.0 m (4.5 m)
Covered, recessive (creek).

unit 18, 598.0 - 607.2 m (9.2 m)
Pebble conglomerate, cobbly, bouldery, massive, matrix-supported; terrigenous phenoclasts up to 10 cm, intraclasts of sandstone up to 40 cm in diameter.

unit 19, 607.2 - 636.5 m (29.3 m)
Mainly sandstone, very fine to medium grained or coarser (est. 60 %); less mudrock; some lenses of pebble conglomerate, 5 cm thick; sandstone and mudrock medium grey, weathering olive grey - brownish grey a.b.; pyrite common; flat to slightly undulating lamination; upward fining sandstone-mudrock bed (50 cm mudrock) at base.

unit 20, 636.5 - 663.0 m (26.5 m)
Mudrock, in part sandy, medium grey, olive grey and brownish weathering; some flat lamination.

unit 21, 663.0 - 701.0 m (38.0 m)
Mainly pebble conglomerate, sandy and cobbly, massive, with lenses of mudrock, medium grey, olive grey weathering, perhaps a few tens of metres in strike length; cobbles up to 17 cm in diameter at 669.0 - 670.0 m, the larger ones of limestone and dolostone, in part laminated; boulders up to 30 cm at 695.5 - 696.0 m.

unit 22, 701.0 - 705.5 m (4.5 m)
Covered, recessive, with rubble of mudrock in upper 1 m; changes facies to pebble conglomerate about 30 m to the south.

unit 23, 705.5 - 735.5 m (30.0 m)
Pebble conglomerate with cobbles up to 10 cm in diameter; sandstone, medium to coarse grained, flat-bedded, massive at 705.9 - 706.0 m.

unit 24, 735.5 - 772.5 m (37 m)
Pebble conglomerate, cobbly (about 51 %), mudrock (23 %), sandstone (11 %), and covered intervals (15 %).

> 735.5 m -737.0 m (1.5 m)
> Mudrock, medium grey, olive grey weathering.
>
> 737.0 - 739.0 m (2.0 m)
> Pebble conglomerate with cobbles up to 19 cm in diameter; cobble of carbonate rocks contains favositid coral.
>
> 739.0 - 740.5 m
> Mostly covered, with 30 cm of mudrock, medium grey, olive grey weathering, at top.

740.5 - 742.0 m (1.5 m)
Pebble conglomerate with cobbles up to 15 cm in diameter; sandy matrix.

742.0 - 745.0 m (3.0 m)
Covered.

745.0 - 746.5 m (1.5 m)
Pebble conglomerate with cobbles up to 10 cm in diameter.

746.5 - 751.5 m (5.0 m)
Mostly covered, recessive; some rubble of mudrock a.b. and of sandstone, medium grey, pebbly.

751.5 - 753.5 m (2.0 m)
Pebble conglomerate with 0.5 m of sandstone in middle.

753.5 - 759.0 m (5.5 m)
Covered, recessive.

759.0 - 768.0 m (9.0 m)
Pebble conglomerate, cobbly; poorly exposed.

768.0 - 772.5 m (4.5 m)
Pebble conglomerate with about 30 % of sandstone, pebbly, mainly in upper part.

unit 25, 772.5 - 796.0 m (23.5 m)
Mainly pebble conglomerate, cobbly, mostly flat-bedded, units commonly 1 - 2 cm thick; minor sandstone (est. 10 %) and mudrock at 789.0 - 789.3 m.

unit 26, 796.0 - 800.0 m (4.0 m)
Recessive, partly covered; some outcrop of sandstone and mudrock.

796.0 - 797.0 m (1.0 m)
Covered, recessive.

797.0 - 800.0 m (3.0 m)
Interbedded mudrock and sandstone with 50 cm of pebble conglomerate; upper part mudrock.

unit 27, 800.0 - 819.5 m (19.5 m)
Pebble conglomerate with cobbles up to 25 cm in diameter.

Subdivision B2

unit 28, 819.5 - 856.5 m (37.0 m)
Rubble and intermittent outcrop of mudrock, medium dark grey, olive grey weathering; some flat lamination; rare graptolites.
Fossil collection C-75496: middle Llandovery.

Subdivision B3

unit 29, 856.5 - 899.6 m (43.1 m)
Mostly pebble conglomerate, cobbly, with a few lenses of sandstone and mudrock.

856.5 - 861.0 m (4.5 m)
Pebble conglomerate, cobbly, in argillaceous and sandy matrix; phenoclasts up to 8 cm in diameter.

861.0 -861.3 m (0.3 m)
Mudrock lens, a few m in strike length.

861.3 - 897.3 m (36.0 m)
Mainly pebble conglomerate, cobbly; poorly defined beds about 0.5 - 2 m thick; phenoclasts up to 22 cm in diameter (e.g. at 864.5 m); some small lenses of sandstone, in part pebbly.

897.3-898.6 m (1.3 m)
Mudrock.

898.6 -899.6 m (1.0 m)
Pebble conglomerate.

Subdivision B4

unit 30, 899.6 - 920.1 m (20.5m)
Mudrock, medium dark grey, olive grey weathering; 899.6-905.6 outcrop, 905.6 - 920.1 m rubble.

unit 31, 920.1 -936.1 m (16.0 m)
Mudrock and sandstone interbedded.

920.1 - 921.1 m (1.0 m)
Sandstone, partly medium grained; mostly present as rubble.

921.1 - 936.1 m (15.0 m)
Mainly mudrock a.b. present mostly as rubble; some outcrop.

Top of section: limit of outcrop; rubble continues to a stratigraphic height of perhaps 1050 m; no overlying beds preserved.

## SECTION SOUTHEAST OF DISRAELI FIORD (SEDF)

Location: M'Clintock Inlet map-area (340F), about 6.5 km southeast of head of Disraeli Fiord;
UTM Zone 18X, 540100E, 9179600N.

Measured by H.P. Trettin, 1981.

Base of section: base of outcrop near glacier; level in uppermost Lorimer Ridge Formation.

### Lorimer Ridge Formation

unit 1, 0 - 0.6 m (0.6 m)
Interbedded mudrock and sandstone.
Mudrock: coarse, calcareous and dolomitic, bioturbated; flat and undulating lamination; pale red to moderate red; units 2 - 15 cm thick.
Sandstone: fine grained, calcareous; flat lamination; pale red; units 2 - 10 cm thick.

unit 2, 0.6 -0.8 m (0.2 m)
Sandstone, very fine grained, very silty, calcareous, bioturbated, greenish grey.

unit 3, 0.8 - 1.5 m (0.7 m)
Mudrock, partly sandy, massive, rubbly weathering, probably bioturbated, brownish; upper contact gradational.

unit 4, 1.5 - 37.0 m (35.5 m)
Mudrock with lesser amounts of interbedded limestone and sandstone.
Mudrock: mostly coarse, sandy, calcareous, bioturbated but with some flat lamination preserved; mainly medium grey.
Limestone: skeletal lime wackestone, containing mainly gastropod fragments and lesser proportions of ostracode, trilobite, and echinoderm fragments; microcrystalline dolomite common in burrows; medium dark grey; occurrences at 16 m (parting 5 - 30 cm), 18 m (5- 30 cm), 27 m.
Sandstone: very fine grained, silty, calcareous; flat and wavy lamination; parting thickness 5 - 10 cm; medium grey, brownish grey weathering; occurrence mainly at 31.2 - 36.0 m.
Fossil collection C-54961 at 28 m: Late Ordovician (Ashgill) to Middle Devonian (coral).

unit 5, 37.0 - 41.3 m (4.3 m)
Limestone with common corals, medium grey; in lower 1 m undulating parting surfaces at 5 - 10 cm; massive at 1 - 1.5 m; above this parting surfaces at 5 - 10 cm.
Fossil collection C-54962 at 38 m: Late Ordovician (Ashgill) to Late Silurian (corals).

unit 6, 41.3 - 46.0 m (4.7 m)
Sandstone, very fine grained, silty, calcareous, light grey, with minor amounts of interlaminated mudrock; flat and undulating lamination, rare small-scale cross-lamination; parting thickness 5- 8 cm; some trace fossils on bedding planes.

unit 7, 46.0 -47.5 m (1.5 m)
Sandstone, very fine and fine grained, variably calcareous; medium light grey, yellowish grey weathering; some flat lamination, some brecciation.

unit 8, 47.5 - 48.0 m (0.5 m)
Covered, recessive.

- conformable contact -

**MARVIN FORMATION**

unit 1, 0- 36.0 m (36.0 m)
Limestone, mainly medium grey, massive, resistant; mainly pelletal packstone with scarce to abundant skeletal fragments (from trilobites, ostracodes, gastropods, echinoderms, corals); mud matrix variably recrystallized; some peloidal grainstone in upper part (e.g. at 30 m); irregular stringers of microcrystalline dolomite in upper part (in samples from 14 - 30 m).

Conodont collections: C-54977 at 2 m: probably Late Ordovician; C54978 at 4-5 m: Middle Ordovician to Devonian.

unit 2, 36.0 - 44.0 m (8.0 m)
Dolostone, microcrystalline to very coarsely crystalline, light grey, weathering in hues of yellow, brown, and orange; parting thickness 20 - 50 cm with some lamination preserved; vuggy weathering.

unit 3, 44.0 - 55.0 m (11.0 m)
Limestone, medium dark grey, dolomitic; brachiopod shells very common.

unit 4, 55.0 - 58.5 m (3.5 m)
Dolostone; groundmass microcrystalline, medium grey to medium dark grey; blobs of light grey, very finely to very coarsely crystalline dolomite probably are "ghosts" of shells.

unit 5, 58.5 - 73. 0 m (14.5 m)
Limestone, medium grey to medium dark grey; brachiopods fairly common; parting thickness about 1 m; analyzed specimen is pelletal packstone transitional to grainstone, rich in skeletal fragments from ostracodes, molluscs, etc.

unit 6, 73.0 - 80.5 m (7.5 m)
Rubble and some outcrop of dolostone, microcrystalline to coarsely crystalline, medium grey, with ghosts of brachiopod (?)

shells.

unit 7, 80.5 - 122.0 m (41.5 m)
Limestone, medium grey to medium dark grey, massive with parting surfaces at 50 cm; some dolomite replacement, commonly in stringers.

80.5 - 83.0 m (2.5 m)
Brachiopods extremely common; analyzed specimen is pelletal packstone transitional to skeletal grainstone with fragments of brachiopods, ostracodes, gastropods.
Fossil collection C-54964 at 82.0 m: late Wenlock - early Pridoli (brachiopod).

83.0 - 84.5 m (1.5 m)
Brachiopods less abundant; favositid corals present.
Fossil collection C-54965 at 84.5 m:

84.5 - 89.0 m (4.5 m)
Brachiopods very common, some are large; analyzed specimen is pelletal packstone transitional to skeletal grainstone with fragments of brachiopods, gastropods, ostracodes; stringers of microcrystalline dolomite.

89.0 - 103.0 m (14.0 m)
Fossils present but less common than below; analyzed specimen is pelletal packstone with scarce brachiopod fragments; stringers of microcrystalline dolomite.

103.0 - 122.0 m (19.0 m)
Large brachiopods common in places (e.g. at 107 m and 113 - 116 m); large favositid at 110 m; analyzed specimens are pelletal packstone with scarce to rich skeletal matter (brachiopods, ostracodes, trilobites); some stringers of microcrystalline dolomite.
Fossil collections C-54966 at 107 m and C-54966 at 113 m: late Wenlock - early Pridoli (brachiopods); C-54967 at 110 m:

unit 8, 122.0 - 145.0 m (23.0 m)
Limestone, medium dark grey, parting surfaces at 5 - 20 cm; more recessive than underlying unit; upper 10 m represented by rubble; some brachiopods, corals; analyzed specimens are sparsely fossiliferous lime mudstone with fragments of brachiopods and ostracodes (at 126.5 m) and richly fossiliferous peloidal packstone with patches of grainstone, fragments mainly of brachiopods, also ostracodes, gastropods, echinoderms (at 144 m).
Fossil collection C-54969 at 128 m:

unit 9, 145.0 - 147.0 m (2.0 m)
Rubble of limestone, medium dark grey, recessive; analyzed specimen is lime wackestone rich in calcareous sponge spicules

with trilobites, ostracodes, gastropods; abundant stringers of microcrystalline dolomite.

unit 10, 147.0 - 155. 0 m (8.0 m)
Intermittent outcrop and rubble of dolostone, medium light grey, microcrystalline to medium crystalline; beds in the order of 10 cm thick.

unit 11, 155.0 - 211.5 m (56.5 m)
Mainly limestone, medium dark grey; small amounts of dolostone; rare chert lenses; analyzed limestone specimens are lime wackestones and pelletal packstones rich in sponge spicules (mostly calcareous) with fragments of ostracodes, brachiopods, gastropods, echinoderms, and trilobites; stringers of microcrystalline dolomite common.

155.0 - 156.5 m (1.5 m)
Limestone, parting thickness 5 cm, overlain by dolostone, parting thickness 30 cm; both recessive.

156.5 - 172.0 m (15.5 m)
Mainly limestone, parting thickness 5- 20 cm, with dolomitic stringers; minor dolostone, microcrystalline to medium crystalline, parting thickness 10 - 20 cm, medium dark grey; unit forms bluff.

172.0 - 174.0 m (2.0 m)
Limestone, a.b., bluff-forming, with lenses of chert.

174.0 - 187.0 m (13.0 m)
Limestone a.b., parting thickness 5- 10 cm; slightly more recessive than underlying strata.

187.0 - 211.5 m (24.5 m)
Limestone a.b., parting thickness 5 - 10 cm; small chert lenses in places; halysitid corals from 193 m to top.
Fossil collection C-54970 at 193 m: Middle Ordovician to Late Silurian (corals etc.);
C-54971 at 209 m:
C-54972 at 211 m:

unit 12, 211.5 - 230.0 m (18.5 m)
Mainly dolostone, microcrystalline to coarsely crystalline with "ghosts" of fossils (ostracodes etc.), medium grey; parting thickness 5 - 30 cm; minor amounts of dolomitic limestone and cherty lenses in lower 2 m (211.5 - 213.5 m); silicified corals common in lower 10 m (211.5 - 221.5 m); relatively recessive unit.

unit 13, 230.0 - 239.0 m (9.0 m)
Limestone, medium dark grey; parting thickness 5 - 20 cm; relatively recessive; analyzed specimen is pelletal packstone rich in skeletal matter, including calcareous sponges,

ostracodes, echinoderms, corals.

unit 14, 239.0 - 246.0 m (7.0 m)
Dolomitic limestone, calcareous dolostone, and dolostone; parting thickness 5 - 20 cm; silicified corals.
Fossil collection C-54973 at 241 m:

unit 15, 246.0 - 289.0 m (43.0 m)
Limestone, medium light grey to medium dark grey; massive or with vague parting surfaces at 10 - 20 cm; bluff-forming unit; large broken brachiopods common at 259.5 and 288-289 m; favositid corals at 254.5 and 287 m; analyzed specimens are transitional between pelletal packstone and grainstone, rich in skeletal material (mainly brachiopods, echinoderms, corals) and peloids; stringers of microcrystalline dolomite common.
Fossil collections C-54974 at 254.5 m:
C-54975 at 287 m:

unit 16, 289.0 - 292.0 m (3.0 m)
Dolostone, microcrystalline to very coarsely crystalline, light grey, weathering in hues of orange, yellow and brown; vuggy weathering; "ghosts" of brachiopods.

unit 17, 292.0 - 294.5 m (2.5 m)
Limestone, medium grey, thick-bedded; some large brachiopods; analyzed specimen is pelletal packstone, transitional to grainstone with common skeletal fragments (brachiopods, echinoderms).

unit 18, 294.5 - 316.0 m (21.5 m)
Dolostone, microcrystalline to coarsely crystalline, light grey, vuggy weathering.

unit 19, 316.0 - 325.0 m (9.0 m)
Limestone, medium grey, massive; present as rubble and outcrop; analyzed specimen is pelletal packstone rich in skeletal matter, mainly brachiopods, ostracodes, molluscs.

unit 20, 325.0 - 334.0 m (9.0 m)
Limestone a.b., replaced, in irregular fashion, by dolostone, microcrystalline to very coarsely crystalline, light grey; unit forms steep bluff.

unit 21, 334.0 - 365.0 m (31.0 m)
Mainly limestone, minor dolostone; limestone medium dark grey; large brachiopods common; analyzed specimens are pelletal packstone rich in skeletal material, mainly brachiopods; stringers of microcrystalline dolomite.

unit 22, 365.0 - 368.0 m (3.0 m)
Dolostone, microcrystalline to very coarsely crystalline; some relict lamination; medium grey matrix with light grey blobs of irregular but rounded shapes.

unit 23, 368.0 - 372.0 m (4.0 m)
Rubble of limestone; parting thickness about 10 cm, probably thin-bedded; analyzed specimen is lime wackestone and pelletal packstone rich in brachiopod fragments; stringers of microcrystalline dolomite.

unit 24, 372.0 - 390.0 m (18.0 m)
Dolostone, microcrystalline to coarsely crystalline, medium grey; relict brachiopods; blotchy texture in lower part; parting thickness 10 - 50 cm; cliff-forming unit.

unit 25, 390.0 - 402.0 m (12.0 m)
Recessive, partly covered unit; rubble of limestone, medium grey with brachiopods; specimen is pelletal packstone with fairly common brachiopod fragments; stringers of microcrystalline dolomite.

unit 26, 402.0 - 434.5 m (32.5 m)
Limestone, medium grey to medium dark grey; massive and bluff-forming to 421.5 m, then more recessive; parting thickness 5 - 10 cm from 426.5 - 434.5 m; analyzed specimens are lime mudstone (at 403 m) and recrystallized pelletal packstone (?) with indeterminable skeletal matter (at 426 m).

unit 27, 434.5 - 439.5 m (5.0 m)
Dolostone, microcrystalline to very coarsely crystalline; blotchy texture; medium grey; parting thickness 10 -20 cm; grades into limestone laterally.

unit 28, 439.5 - 442.5 m (3.0 m)
Limestone, medium grey to medium dark grey; parting thickness 10 - 20 cm;specimen is peloidal grainstone with rare ostracodes.

unit 29, 442.5 m - 451.5 m (9.0 m)
Dolostone a.b., parting thickness 10 - 20 cm.

unit 30, 451.5 - 460.5 m (9.0 m)
Rubble of limestone, thin-bedded.

unit 31, 460.5 - 461.5 m (1.0 m)
Limestone, medium grey to medium dark grey; parting thickness 2 - 10 cm; analyzed specimen is pelletal packstone with rare trilobite fragments; faint lamination; fenestrae; stringers of microcrystalline dolomite.

unit 32, 461.5 - 464.5 m, (3.0 m)
Dolostone, microcrystalline to very coarsely crystalline, light grey and medium grey; swirly texture; parting thicknesses 2 - 10 cm and 1 - 1.5 m; vuggy weathering.

unit 33, 464.5 - 468.0 m (3.5 m)
Rubble of limestone.

unit 34, 468.0 - 487.0 m (19.0 m)
Limestone, medium grey; parting thickness 5 - 15 cm; some thin flat lamination in lower 1.5 m; analyzed specimens are pelletal packstones with or without sparse trilobite fragments; fenestral structures, in part laminar; stringers of microcrystalline dolomite in lower 1 m or so.

unit 35, 487.0 - 491.0 m (4.0 m)
Covered.

unit 36, 491.0 - 493.0 m (2.0 m)
Limestone, medium dark grey; some dolomitic mottling; specimen is pelletal packstone with a few fragments of gastropods and (?) ostracodes.

unit 37, 493.0 - 499.4 m (6.4 m)
Covered.

unit 38, 499.4 - 501.1 m (0.7 m)
Limestone, medium dark grey, parting thickness 0.5 - 1 m; analyzed specimen is pelletal packstone rich in skeletal fragments (brachiopods, corals, ostracodes, trilobites).

unit 39, 501.1 - 504.0 m (2.9 m)
Limestone, medium dark grey; parting thickness 2 - 5 cm; partly present as rubble.

unit 40, 504.0 - 516.0 m (12.0 m)
Limestone, medium grey, in part dolomitic; some brachiopods; parting thickness 5 - 15 cm; bluff-forming unit; analyzed specimen is peloidal grainstone with rare trilobite fragments.

unit 41, 516.0 - 517.0 m (1.0 m)
Limestone, medium dark grey; parting thickness 3 - 5 cm; recessive; analyzed specimen is recrystallized pelletal packstone, rich in skeletal matter, mostly indeterminable but including ostracodes.

unit 42, 517.0 - 576.0 m (59.0 m)
Limestone, medium to medium dark grey; resistant, thick-bedded units alternate with recessive thin-bedded units; analyzed specimens are pelletal packstones with scarce skeletal material, mainly trilobite fragments; flat lamination rare; laminar and irregular fnestrae present in all specimens.

Conodont collections C-54981, C-54982, C-54983 at 573 - 574 m: Ludlow or Pridoli.

Top of section: top of preserved column at this locality; R. Gardner and D. Jones obtained a thickness of 741 m along a different line in the same area.

## LORIMER RIDGE SECTION (LR)

Location: M'Clintock Inlet map-area (340F), east side of Lorimer Ridge, southeast of Disraeli Fiord;
UTM Zone 18X, 539800E, 9175700N.

Measured by R. Gardner and D. Jones, 1977; rewritten from their log and samples by H.P. Trettin; samples listed because sample control insufficient.

Base of section: approximate base of Lorimer Ridge Formation; contact with Zebra Cliffs Formation covered.

### LORIMER RIDGE FORMATION

Unit 1, 0 - 28.5 m (28.5 m)
Described as "mudrock" calcareous, fossiliferous; 0 - 13.5 m thin-bedded, 13.5 - 28.5 m slightly coarser and massive; however, specimen from 1.5 m is skeletal lime wackestone, containing mainly brachiopods with some ostracodes; therefore, either the entire unit or its lower part (0 - 13.5 m ?) consists of limestone.
Fossil collection C-70082 from 1.5 m: Ordovician or Silurian (brachiopod).

unit 2, 28.5 - 33.0 m (4.5 m)
Sandstone, fine and medium grained, calcareous, medium grey, brownish weathering, very thick-bedded (C070083).

unit 3, 33.0 - 34.5 m (1.5 m)
"Mudrock" calcareous, coarse, fining upward.

unit 4, 34.5 - 39.0 m (4.5 m)
Sandstone as in unit 2, but massive.

unit 5, 39.0 -43.5 m (4.5 m)
"Mudrock" olive brown, green-brown weathering.

unit 6, 43.5 - 51.0 m (7.5 m)
Sandstone as in unit 2.

unit 7, 51.0 - 60.5 m (9.5 m)
"Mudrock" as in units 3 and 5, fining upward.

unit 8, 60.5 -61.5 m (1.0 m)
"Mudrock", relatively fine, reddish, red-brown weathering.

unit 9, 61.5 - 66.0 m (4.5 m)
Sandstone as in unit 2.

unit 10, 66.0 - 69.0 m (3.0 m)
"Mudrock" red, as in unit 8.

unit 11, 69.0 - 73. 0 m (4.0 m)
Sandstone, fine grained, calcareous, medium grey, grey-brown weathering,massive (C070086).

unit 12, 73.0 - 82.5 m (9.5 m)
"Mudrock", relatively coarse, reddish, fissile.

unit 13, 82.5 - 87.0 m (4.5 m)
Sandstone, fine and medium grained, calcareous, light brownish grey (C070087).

unit 14, 87.0 - 90.0 m (3.0 m)
"Mudrock", red; contains coarser intraclasts from underlying unit.

unit 15, 90.0 - 109.5 m (19.5 m)
Sandstone, medium grained.

unit 16, 109.5 - 112.5 m (3.0 m)
Pebble conglomerate with sandy matrix, poorly sorted; pebbles 2 - 10 mm in diameter; mottled green and red, brownish weathering; beds about 30 cm thick and lenticular; foresets dip southwest (C070088).

unit 17, 112.5 - 132.0 m (19.5 m)
Sandstone, calcareous, light grey, with interbedded mudrock, red.

unit 18, 132.0 - 136.5 m (4.5 m)
Sandstone, calcareous, light grey, with red and green tinge, with interbedded mudrock, red.

unit 19, 136.5 - 144.0 m (7.5 m)
Sandstone, fine grained, reddish.

unit 20, 144.0 - 148.5 m, (4.5 m)
Sandstone, medium grained, light grey with green and red tinge, with interbedded "mudrock", reddish.

unit 21, 148.5 - 156.0 m (7.5 m)
Sandstone, reddish, fine grained and very fine grained, argillaceous.

unit 22, 156.0 - 199.5 m (43.5 m)
Sandstone, fine grained, light grey, greyish brown weathering; mostly massive with some lamination marked by phyllosilicates.

unit 23, 199.5 - 291.0 m (91.5 m)
"Mudrock", calcareous, brownish red.

unit 24, 291.0 - 294.0 m (3.0 m)
Limestone, argillaceous, green and red.

unit 25, 294.0 - 331.5 m (37.5 m)

"Mudrock", reddish, as in unit 23.

unit 26, 331.5 - 372.0 m (40.5 m)
"Mudrock", reddish, interbedded with sandstone, calcareous, light grey.

unit 27, 372.0 -492.0 m (120.0 m)
Sandstone, very fine grained, calcareous, reddish brown, massive.

unit 28, 492.0 - 499.5 m (7.5 m)
"Mudrock", greenish, calcareous, brownish weathering.

unit 29, 499.5 - 508.5 m (9.0 m)
Lime wackestone, medium to medium dark grey, containing brachiopods, stromatoporoids, echinoderm fragments; also sandstone, medium grey, very fine grained, very calcareous, containing brachiopod fragments; unit preserved as rubble (C070091).

Fossil collection C-70091: Ordovician to Permian.

unit 30, 508.5 - 511.5 m, (3.0 m)
"Mudrock", calcareous, greenish brown.

unit 31, 511.5 -529.5 m (18.0 m)
"Mudrock", reddish, as in unit 25 (unit may include sandstone).

unit 32, 529.5 - 531.0 m (1.5 m)
Sandstone, calcareous, fine grained, light grey, medium bedded, grey to orange brown weathering.

unit 33, 531.0 - 565.5 m (34.5 m)
"Mudrock", green weathering, with interbedded sandstone, fine grained, greenish grey.

unit 34, 565.5 - 646.5 m (81.0 m)
Upward-fining sequences, 25 - 50 cm thick, composed of sandstone, fine grained, nonbedded, overlain by "mudrock" with thin flat lamination, dusky red.

unit 35, 646.5 - 657.0 m (10.5 m)
"Mudrock", calcareous, mainly greenish grey; some red beds in upper (but not uppermost) part of unit (C070092).

unit 36, 657.0 - 715.5 m (58.5 m)
Sandstone, fine grained, greenish.

unit 37, 715.5 - 768.0 m (52.5 m)
Mainly mudrock, calcareous, greenish grey; limestone, highly argillaceous, with abundant fossils (colonial corals, stromatoporoids, bryozoans, etc.) at 737 m; limestone, greenish, probably highly argillaceous, with colonial corals at 767 m.

Fossil collections C-70106 from 737 m: Middle or Late Ordovician (coral);
C-70093 from 767 m: probably Middle or Late Ordovician (corals).

Top of section: conformable contact with Marvin Formation.

# APPENDIX 5

## FOSSIL IDENTIFICATIONS

by

B.S. Norford, T.T. Uyeno, G.S. Nowlan, R.S. Tipnis,

G.W. Sinclair, A.E.H. Pedder, and M.J. Copeland

## INTRODUCTION

This appendix lists all all fossil collections from lower Paleozoic (Ordovician and Silurian) strata obtained by July, 1987. Responsibilities for different fossil groups were divided as follows:

macrofossils in general: B.S. Norford

selected Silurian corals: A.E.H. Pedder

Ordovician macrofossils collected by R.L. Christie in 1964: G.W. Sinclair

Ordovician conodonts: G.S. Nowlan, R.S. Tipnis

Silurian and some Upper Ordovician conodonts: T.T. Uyeno

Ordovician ostracodes: M.J. Copeland

It is important to note that the Gamachian, introduced as a "series" by Twenhofel (1928) on the basis of macrofossils, was generally not recognized until 1981 when it was re-introduced as a Stage by McCracken and Barnes on the basis of a distinct conodont fauna (Fauna 13). The Gamachian and Richmondian stages can neither be distinguished in the present conodont collections nor in the macrofossil collections. Thus, in all identifications made prior to 1981 or 1982, the term "Richmondian" is equivalent to the term "undifferentiated Gamachian and Richmondian" of present usage. In the more recent macrofossil identifications the British Series name, Ashgill, generally is used for macrofossils of this age range.

## CAPE DISCOVERY FORMATION
### Member A

GSC locality 75417: M'Clintock Inlet map-area (NTS 340E), Bromley Island, about 6 km north-northeast of south tip of island;
UTM Zone 17X, 539000E, 9209600N;
Section NEBI, 42 - 44 m above base of formation and member.

Identification by B.S. Norford (from Trettin, 1969b, loc. 9).

trimerellid brachiopod

Middle Ordovician (probably Wildernessian or Blackriveran) to Late Silurian (Ludlow).

GSC locality 75416: M'Clintock Inlet map-area (NTS 340E), Bromley Island, about 3.9 km north of south tip of island;
UTM Zone 17X, 536500E, 9207700N.

Identification by B.S. Norford (from Trettin, 1969b, loc. 10).

rhynchonellid brachiopod

Probably Ordovician to Permian.

GSC locality 75418: M'Clintock Inlet map-area (NTS 340E), section north of Bethel Peak, northwest side of unnamed cape;
UTM Zone 17X, 530900E, 9209800N;
62 - 132 m above base of formation and member.

Identification by B.S. Norford (from Trettin, 1969b, loc. 8).

bifoliate bryozoan
straight cephalopod
colonial coral
undetermined trilobite

Middle Ordovician to Middle Devonian.

GSC locality 24720: same locality; stratigraphic position not stated but probably from same interval as 75418.

Collected by R.L. Christie in 1954.
Identification by G.W. Sinclair (from Christie, 1964, p. 21).

crinoid fragments

Anthozoa, genus indeterminate
**Sowerbyella** sp.
**Liospira** sp.
**Illaenus** sp.
**Gonioceras** sp.
**Richardsonoceras** sp.
**Lophospira** sp.

Middle Ordovician, Wildernessian (Blackriveran-Rocklandian).

## Member B

GSC locality 75419; M'Clintock Inlet map-area (NTS 340E), Bromley Island, about 6 km north-northeast of south tip of island;
UTM Zone 17X, 538800E, 9210200N;
Section NEBI, stratigraphic position within member B not determined.

Identification by B.S. Norford (from Trettin, 1969b, loc. 9)

echinoderm fragments
straight cephalopod
gastropod
undetermined corals

Middle Ordovician to Permian.

GSC locality 69206: M'Clintock Inlet map-area (NTS 340E), east side of unnamed peninsula west of Bromley Island; partly from outcrop and partly from a continuous stream of talus extending from this locality for about 2 km to the north;
UTM Zone 17X, 534400E, 9203900N.

Identification by B.S. Norford (from Trettin, 1969b, loc. 13).

**Maclurites** sp.
**Palaeophyllum** sp.
bryozoan
stromatoporoids
straight cephalopods
echinoderm debris

Ordovician, probably Barneveldian or Wildernessian (Trentonian) or Blackriveran.

GSC locality C-74987: M'Clintock Inlet map-area (NTS 340E), east side of unnamed peninsula west of Bromley Island, south of GSC loc. 69206;

UTM Zone 17X, 9202600N, 534600E.
(77TM304d1)

Identification by R.S. Tipnis (May 16, 1978).

**Acodus mutatus** (Branson and Mehl)
**Drepanoistodus suberectus** (Branson and Mehl)
**Panderodus gracilis** (Branson and Mehl)
**Oistodus venustus** Stauffer s.f.
**Periodon aculeatus** Hadding
aff. **Sagittodontus**? sp.
aff. **Coelocerodontus digonius** Sweet and Bergström, s.f.

The most diagnostic taxon in this collection is **Periodon aculeatus** Hadding. Other taxa generally indicate a late Middle Ordovician to even Late Ordovician age. **P. aculeatus** extends from early Llanvirn to early Caradoc; higher in the stratigraphic column it is replaced by **P. grandis** (Ethington). Although these two multi-element species are somewhat difficult to separate, based on the features of the oistodiform element, the present taxon appears to be closer to **P. aculeatus**. With this in mind, I would suggest that the sample is probably Llandeilo to Caradoc in age.

## M'CLINTOCK FORMATION

GSC locality 69207: M'Clintock Inlet map-area (NTS 340E), 4.9 km west-northwest of Egingwah Bay;
UTM Zone 18X, 468300E, 9191200N;
0 - 4.9 m below top of formation.

Identification by B.S. Norford (from Trettin, 1969b, loc. 15).

**Paleofavosites**? sp.
stromatoporoids

Late Ordovician (Richmondian) to Silurian.

## AYLES FORMATION

GSC locality 69204: M'Clintock Inlet map-area (NTS 340E), about 6.6 km west of Egingwah Bay;
UTM Zone 18X, 466400E, 9190300N.

Identification by B.S. Norford (from Trettin, 1969b, loc. 20).

**Tollina** sp.
bryozoan

Ordovician, probably Barneveldian (Trentonian) to Richmondian.

GSC locality 69212: M'Clintock Inlet map-area (NTS 340E), about 6 km west of Egingwah Bay;
UTM Zone 18X, 467100E, 9189700N.

Identification by B.S. Norford (from Trettin, 1969b, loc. 21).

**Calapoecia** 2 spp.
**Catenipora** sp.
**Favosites** sp.
**Paleofavosites** sp.
**Palaeophyllum** sp.
gastropod
stromatoporoid

Ordovician, Richmondian.

GSC locality 69213: M'Clintock Inlet map-area (NTS 340E), about 4.5 km west of Egingwah Bay;
UTM Zone 18X, 468500E, 9190250N.

Identification by B.S. Norford (from Trettin, 1969b, loc. 22).

**Catenipora** sp.
solitary coral

Ordovician, Barneveldian (Trentonian) to Richmondian.

## TACONITE RIVER FORMATION

GSC locality 69205: M'Clintock Inlet map-area (NTS 340E), about 7.1 km west of Egingwah Bay;
UTM Zone 18X, 466000E, 9180300N.

Identification by B.S. Norford (from Trettin, 1969b, loc. 24).

**Calapoecia** sp.
**Catenipora** sp.
gastropod
cephalopod

Middle Ordovician to Early Silurian, probably Barneveldian (Trentonian) to Richmondian.

GSC locality C-54938: M'Clintock Inlet map-area (NTS 340E), section on southern Marvin Peninsula (SMP);
Zone 18X, 9189000N, 501300E;
111.5 m above base of formation; fossils occur in (transported) pebbles.

Identification by B.S. Norford (November 7, 1979).

**Palaeophyllum** sp.
**Protrochiscolithus**? sp.
indeterminate brachiopods

Probably Late Ordovician to Middle Devonian.

GSC locality C-54939: same locality as C-54938;
114 m above base of formation.

Identification by B.S. Norford (November 7, 1979).

**Favosites**? sp.

Probably Late Ordovician to Middle Devonian.

GSC locality C-54940: same locality as C-54938;
117.5 m above base of formation.

Identification by B.S. Norford (November 7, 1979).

**Favosites**? sp.
**Palaeophyllum**? sp.
**Tollina** sp.

streptelasmid coral
straight cephalopod

Late Ordovician.

GSC locality C-54941; same location as C-54938;
141.8 - 144.8 m above base of formation.

Identification by B.S. Norford (November 7, 1979).

**Paleofavosites** sp.
straight cephalopod
undetermined brachiopod

Late Middle Ordovician to Silurian.

GSC locality C-75459: M'Clintock Inlet map-area (NTS 340E), northernmost Marvin Peninsula,
UTM Zone 18X, 9216800N, 488000E.
(80TM205d4)

Identification by B.S. Norford (September 11, 1980).

**Calapoecia** sp.
favositid coral

Late Middle or Late Ordovician, probably Ashgill.

GSC locality 69214: M'Clintock Inlet map-area (NTS 340E), Marvin Peninsula, about 9.3 km northeast of Crash Point;
UTM Zone 18X, 9185900N, 491500E;
original member B.

Identification by B.S. Norford and M.J. Copeland (from Trettin, 1969b, loc. 30; re-assigned from Zebra Cliffs Fm. to Taconite River Fm.).

**Bollia** sp.
**Hallatia** sp.
**Diplograptus**? sp.
bryozoan
gastropod
orthid brachiopod

Ordovician, probably Wildernessian (Blackriveran) to Richmondian.

## ZEBRA CLIFFS FORMATION

GSC locality 24721: M'Clintock Inlet map-area (NTS 340E), Zebra Cliffs (see Christie, 1964 GSC Map 1148A, loc. 7; precise location in terms of UTM coordinates not obtainable).

Identification by G.W. Sinclair (from Christie, 1964, p. 22).

**Plasmopora lambei** Schuchert
**Columnaria** n. sp. aff. **C. halysitoides** Troedsson
**Paleofavosites** sp.
**Calapoecia canadensis** Billings
**Halysites** sp. aff. **H. feildeni** Etheridge
**Syringopora** n. sp.
**Batostoma** n. sp.
**Rhinidictya** sp.
**Cyclospira** cf. **C. vokesi** Roy
**Hormotoma gracilis** (Hall)
**Lophospira** spp.
**Umbospira** sp.
**Holopea** sp.
trilobite fragments
**Leperditia** sp.
**Aparchites** sp.
**Krausella** sp.
**Conchoprimites** sp.
scolecodonts

Upper Ordovician, Richmondian.

GSC locality 69203: M'Clintock Inlet map-area (NTS 340E), about 2.5 km southwest of Zebra Cliffs;
UTM Zone 18X, 9186500N, 473700E;
original member A, less than 22 m above base of formation.

Identification by B.S. Norford (from Trettin, 1969b, loc. 25).

**Troedssonites conspiratus** Troedsson

Ordovician, Richmondian.

GSC locality 69211: M'Clintock Inlet map-area (NTS 340E), Marvin Peninsula, about 8.5 km east-northeast of Crash Point;
UTM Zone 18X, 9183750N, 491600E;
original member A, probably less than 25 m above base of formation.

Identification by B.S. Norford (from Trettin, 1969b, loc. 29).

**Catenipora** sp.
**Calapoecia** sp.
**Paleofavosites** sp.

Ordovician, Richmondian.

GSC locality 69215: M'Clintock Inlet map-area (NTS 340E), about 2 km southeast of Egingwah Bay;
UTM Zone 18X, 9188300N, 474250E;
original member B.

Identification by B.S. Norford (from Trettin, 1969b, loc. 31).

**Catenipora** sp.
**Receptaculites** sp.

Ordovician, Barneveldian (Trentonian) to Richmondian.

GSC locality 69217: M'Clintock Inlet map-area (NTS 340E), top of Zebra Cliffs;
UTM Zone 18X, 9188000 N, 475000E; original member B.

Identification by B.S. Norford (from Trettin, 1969b, loc. 32)

**Favosites** sp.
straight cephalopod
bryozoans

Richmondian to Middle Devonian.

GSC locality 69210: M'Clintock Inlet map-area (NTS 340E), 2.4 km south-southeast of Egingwah Bay;
UTM Zone 18X, 9187750N, 473800E;
original member B.

Identification by B.S. Norford (from Trettin, 1969b, loc. 33).

**Calapoecia** sp.
**Catenipora** sp.

Middle Ordovician to Early Silurian, probably Barneveldian (Trentonian) to Richmondian.

GSC locality 69202: M'Clintock Inlet map-area (NTS 340E), 1.9 km south-southeast of Egingwah Bay;

UTM Zone 18X, 9188200N, 473400E;
original member B.

Identification by B.S. Norford (from Trettin, 1969b, loc. 34, and Norford, 1971).

**Sibiriolites sibiricus** Sokolov
**Rhynchotrema** sp.

Ordovician, Richmondian.

GSC locality C-69; M'Clintock Inlet map-area (NTS 340E), west side of Harley Ridge, about 3.2 km southeast of south tip of small island;
UTM Zone 18X, 486200E, 9165700N;
from lowermost part of formation.

Identification by B.S. Norford (from Trettin, 1969b, loc. 42).

**Cystihalysites**? sp.
**Receptaculites**? sp.
heliolitid coral
orthid brachiopod
gastropod
ostracodes

Probably Silurian.
(Note by H.P. Trettin, 1987: This age assignment conflicts with geological mapping and other fossil collections from Harley Ridge. It has not been possible to restudy the sample because its present location is unknown.)

GSC locality C-6: M'Clintock Inlet map-area (NTS 340E), west side of Harley Ridge;
UTM Zone 18X, 9160800N, 489400E.
(NF66-2-41)

Identification by B.S. Norford (collected by W.W. Nassichuk, 1966; from Trettin, 1969b, loc. 37).

**Rafinesquina** sp.
**Calapoecia** sp.
**Catenipora** 2 spp.
**Liostrophia**? sp.
echinoderm fragments
undetermined trilobite
straight cephalopods
undetermined brachiopods

Ordovician, Edenian to Richmondian.

GSC locality C-7: M'Clintock Inlet map-area (NTS 340E), west side of Harley Ridge;
UTM Zone 18X, 9159800N, 489200N.
(NF66-2-41a)

Identification by B.S. Norford (collected by W.W. Nassichuk, 1966; from Trettin, 1969b, loc. 37).

**Rafinesquina** sp.
**Calapoecia** sp.
**Catenipora** sp.
**Austinella**? sp.
**Hesperorthis**? sp.
echinoderm fragments
undetermined trilobite
straight cephalopod
gastropod
ostracode
undetermined brachiopods, 6 spp.

Ordovician, Edenian to Richmondian

GSC locality C-8: M'Clintock Inlet map-area (NTS 340E), west side of Harley Ridge;
UTM Zone 18X, 9159400N, 489500E;
(NF66-2-42)

Identification by B.S. Norford (collected by W.W. Nassichuk, 1966).

**Rostricellula** sp.
clam
bryozoan
solitary coral
undetermined brachiopods, 2 spp.

Probably Ordovician, Wildernessian (Blackriveran) to Richmondian.

GSC locality C-9: same locality as C-8 but about 50 m higher.

Identification by B.S. Norford (collected by W.W. Nassichuk, 1966; from Trettin, 1969b, loc. 37.
(NF66-2-42a)

**Rostricellula** sp.

clam
bryozoan
? straight cephalopod

Probably Wildernessian (Blackriveran) to Richmondian; same assemblage as C-8.

GSC locality C-74849: M'Clintock Inlet map-area (NTS 340E), west side of Harley Ridge;
UTM Zone 18X, 9160700N, 486700E;
lower part of formation.
(77TM235a)

Identification by R.S.Tipnis (May 16, 1978).

**Phragmodus undatus** Branson and Mehl
**Belodina compressa** (Branson and Mehl)
**Panderodus gracilis** (Branson and Mehl)
aff. **Pravognathus idiones** (Stauffer) s.f.
**Acodus mutatus** (Branson and Mehl)
**Drepanoistodus suberectus** (Branson and Mehl)

The presence of **P. undatus** restricts the lower age limit of this sample to Rocklandian or Fauna 8 (Sweet et al., 1971). The upper limit extends to the top of the Ordovician. No other stratigraphically significant taxon being present, the only clue may be the recent comment by Barnes (1977) that elements of **Panderodus gracilis** during the Late Ordovician are strongly recurved towards the tip. Based on this criterion (which is not very definitive) a Late Ordovician age is suggested. All significant elements from this sample show a Midcontinent affinity. The depositional regime for a **Phragmodus** dominant fauna is a deep shelf (Barnes et al., 1973). It may be of some interest to note that the composition of this fauna is identical with some of my collections from a section near the western margin of the Mackenzie Platform, close to Selwyn Basin.

GSC locality C-54957: M'Clintock Inlet map-area (NTS 340E), section south of Disraeli Fiord (SDF1);
UTM Zone 18X, 9182800N, 533250E;
0 - 47 m above base of formation.

Identification by B.S. Norford (April 16, 1982).

**Beatricia** sp.
**Calapoecia** sp.
**Catenipora** sp.
**Grewingkia** sp. (of Bolton, 1967)
**Palaeophyllum raduguini** Nelson, v. of Bolton, 1979

**Armenoceras michaudae** Bolton
bryozoans
ostracode
algae, several species
gastropod, brachiopod, and trilobite debris

Late Ordovician, Ashgill. This faunule is remarkably similar to that described by Bolton (Bolton and Nowlan, 1979) from an Ordovician outlier near Aberdeen Lake, southwest of Boothia Peninsula. Bolton correlated his fauna with the Upper Ordovician Churchill River Group, with a late Maysvillian to Richmondian age, corroborated by associated conodonts (Fauna 12) studied by Nowlan. Of palaeontological interest is the single large specimen of **Armenoceras michaudae** that reveals the external ornament of the species to consist of fine longitudinal ribs. Polished longitudinal sections show cameral deposits and long septal necks that are not normal characteristics of **Armenoceras**.

GSC locality C-94164: same location as C-54957;
3 - 113 m above base of formation.

Identification by B.S. Norford (June 26, 1984).

**Rhabdotetradium** sp.

Middle or Late Ordovician.

GSC locality C-75105: M'Clintock Inlet map-area (NTS 340E), 4.2 km southwest of central Disraeli Fiord;
UTM Zone 18X, 9189500N, 521200E.
(77TM314b1)

Identification by B.S. Norford (October 20, 1977).

**Catenipora** sp.
**Favosites** sp.
**Palaeophyllum** cf. **P. halysitoides** (Wilson)

Late Ordovician, Ashgill or possibly Early Silurian.

GSC locality C-75393: M'Clintock Inlet map-area (NTS 340E), 1.1 km southwest of Thores River;
UTM zone 18X, 9174400N, 520250E.
(80TM312e)

Identification by B.S. Norford (July 28, 1981).

**Catenipora** sp.

Late Middle Ordovician to Late Silurian.

GSC locality C-75394: M'Clintock Inlet map-area (NTS 340E), 1.5 km northeast of Thores River;
UTM Zone 18X, 9175300N, 524000E.
(80TM313a)

Identification by B.S. Norford (July 28, 1981).

**Catenipora** sp.

Middle Ordovician to Late Silurian.

GSC locality C-75395: M'Clintock Inlet map-area (NTS 340E), 1.2 km northeast of Thores River; UTM Zone 18X, 9175100N, 524000E.
(80TM313b)

Identification by B.S. Norford (July 28, 1981).

**Palaeophyllum** sp.
**Dicoelosia** sp.
**Austinella**? sp.
**Lepidocyclus**? sp.
aff. **Rhynobolus** sp.
echinoderm debris
solitary coral
gastropods
bryozoan
pelecypods
strophomenid, sowerbyellid, and orthid brachiopods
unidentified brachiopods

Probably Late Ordovician.

GSC locality C-73596: M'Clintock Inlet map-area (NTS 340E), 0.6 km northeast of Thores River;
UTM Zone 18X, 9174400N, 523700E.
(80TM313c)

Identification by B.S. Norford (July, 28, 1981).

**Maclurites**? sp.

Probably Middle or Late Ordovician.

GSC locality C-70043: M'Clintock Inlet map-area (NTS 340E),
central Marvin Peninsula;
UTM Zone 18X, 9186700N, 505900E.
(77MSA103)

Identification by B.S. Norford (November 21, 1977; collected by U. Mayr, 1977).

**Catenipora** sp.
**Parafavosites**? sp.

Late Ordovician (Ashgill) to Late Silurian.

GSC locality C-70045: M'Clintock Inlet map-area (NTS 340E),
central Marvin Peninsula;
UTM Zone 18X, 9186300N, 506600E.
(77MSA104)

Identification by B.S. Norford (November 21, 1977; collected by U. Mayr, 1977).

**Paleofavosites** sp.
**Palaeophyllum** sp.
undetermined solitary coral

Late Ordovician, Ashgill.

GSC locality C-70081: M'Clintock Inlet map-area (NTS 340E),
northeast side of Lorimer Ridge;
UTM Zone 18X, 9175000N, 540700E;
talus, probably from uppermost Zebra Cliffs Formation, but possibly from lowermost Lorimer Ridge Formation.
(77MSA-RG-32)

Identification by B.S. Norford (November 21, 1977; collected by R. Gardner and D. Jones, 1977).

**Sibiriolites sibiricus** Sokolov
**Catenipora** sp.
indeterminate cephalopod
stromatoporoid
streptelasmid coral

Late Ordovician, Richmondian.

## LORIMER RIDGE FORMATION

GSC locality C-75494: M'Clintock Inlet map-area (NTS 340E), west side of Harley Ridge;
UTM Zone 18X, 9165800N, 491400E;
lowermost part of formation.
(80TM201d7)

Identification by B.S. Norford (April 16, 1982).

**Sibiriolites sibiricus** Sokolov
bryozoan

Late Ordovician, Ashgill.

GSC locality C-10: M'Clintock Inlet map-area (NTS 340E), west side of Harley Ridge;
UTM Zone 18X, 9159700N, 490400E;
from lower part of formation.
(66NF2-42b)

Identification by B.S. Norford (collected by W.W. Nassichuk, 1966; Norford, 1971).

**Sibiriolites sibiricus** Sokolov
ostracode
brachiopod fragment

Late Ordovician, Ashgill.

GSC locality C-70082: M'Clintock Inlet map-area (NTS 340E) Lorimer Ridge section, east side of Lorimer Ridge;
UTM Zone 18X, 9175500N, 539900E;
1.5 m above base of formation.

Identification by B.S. Norford (May 20, 1980; collected by R. Gardner and D. Jones, 1977).

undetermined orthid brachiopod
pelecypod

Probably Ordovician or Silurian.

GSC locality C-70091: same location as C-70082;
talus, 499.5 - 507.0 m above base of formation.

Identification by B.S. Norford (April 7, 1978; collected by R.

Gardner and D. Jones, 1977).

indeterminate brachiopod
stromatoporoid
echinoderm fragments

Ordovician to Permian.

GSC locality C-70106: same location as C-70082;
732 m above base of formation.

Identification of coral by B.S. Norford (May 20, 1980; collected by R. Gardner and D. Jones, 1977).

**Paratetradium** sp.
stromatoporoid
bryozoan
gastropod

Middle or Late Ordovician, probably Caradoc, possibly Ashgill.

Identification of conodonts by R.S. Tipnis (May 17, 1978).

**Panderodus gracilis** (Branson and Mehl)
cf. **Panderodus panderi** sensu Sweet et al., 1975
**Plectodina furcata tenuis** Sweet et al., 1975
**Oulodus**? sp.
**Eobelodina**? sp. s.f.

Latest Middle or Late Ordovician, faunas 9 - 12 of Sweet et al., 1971. Both **P. furcata tenuis** and **P. panderi** range from Fauna 9 to Fauna 12. The elements of **Oulodus**? sp., though broken, show some similarity with the Late Ordovician oulodid **O. oregonia oregonia** (Branson, Mehl, and Branson). If this is true, then the sample would be of Late Ordovician age (faunas 11 and 12 of Sweet et al., 1971). Biogeographic affinity lies with the Midcontinent Province. A shallow shelf environment is suggested.
CAI approximately 3 (deep brownish to black).

GSC locality C-70093; same location as C-70082;
767 m above base of formation.

Identification by B.S. Norford (April 7, 1978; collected by R. Gardner and D. Jones, 1977).

**Calapoecia** sp.
tabulate coral

Lorimer Ridge Fm.

Probably Middle or Late Ordovician. **Calapoecia**, **Paratetradium**, and **Rhabdotetradium** occur together in the lower part of formation B on Judge Daly Promontory (Norford, 1967).

GSC locality C-54959; M'Clintock Inlet map-area (NTS 340E), section NTR1 north of Thores River;
UTM Zone 18X, 9173700N, 532900E;
middle part of formation, 35 - 36 m above base of section.

Identification by B.S. Norford (April 16, 1982).

**Paleofavosites** sp.
gastropod and other fossil fragments

Late Ordovician (Ashgill) to Silurian.

GSC locality C-54960: same location as C-54959;
72.5 m above base of section NTR1.

Identification by B.S. Norford (April 16, 1982).

**Favosites**? sp.
indeterminate bryozoan, gastropod, pelecypod (?)

Late Ordovician (Ashgill) to Middle Devonian.

GSC locality C-54961: M'Clintock Inlet map-area (NTS 340E), section southeast of Disraeli Fiord; UTM Zone 18X, 9179300N, 540400E;
28 m above base of section, 20 m below top of formation.

Identification by B.S. Norford (April, 16, 1982).

**Favosites** sp.
indeterminate solitary coral
gastropod

Late Ordovician (Ashgill) to Middle Devonian.

GSC locality C-54962: same location as C-54961;
38 m above base of section, 10 m below top of formation.

Identification by B.S. Norford (April 16, 1982).

**Catenipora** sp.

Lorimer Ridge Fm.

**Favosites**? sp.

Late Ordovician (Ashgill) to Late Silurian.

late Middle Ordovician to latest Ordovician.
CAI 3.5

## Western facies

GSC locality C-59; M'Clintock Inlet map-area (NTS 340E), 5.6 km south-southeast of Egingwah Bay at section ZC2;
UTM Zone 18X, 476200E, 9185300N.

Identification by B.S. Norford (re-identification of Trettin, 1969b, loc. 28; October 4, 1983).

**Climacograptus latus** Elles and Wood
**Glyptograptus** cf. **G. tenuissimus** Ross and Berry
**Orthograptus amplexicaulis abbreviatus** Elles and Wood

Late Ordovician, Ashgill; **complanatus ornatus** Zone or **pacificus** Zone.

GSC locality C-60: M'Clintock Inlet map-area (NTS 340E), 3.1 km south-southwest of Egingwah Bay;
UTM Zone 18X, 472300E, 9187000N.

Identification by B.S. Norford (re-identification of Trettin, 1969b, loc. 36; October 4, 1983).

**Climacograptus** sp.
**Orthograptus amplexicaulis abbreviatus** Elles and Wood

Late Ordovician, Ashgill.

GSC locality C-61: M'Clintock Inlet map-area (NTS 340E), 3.6 km south of Egingwah Bay;
UTM Zone 18X, 473400E, 9186400N;
probably from lower part of Disraeli Glacier beds.

Identification by B.S. Norford and R. Thorsteinsson (from Trettin, 1969b, loc. 35).

**Climacograptus latus** Elles and Wood
**Orthograptus** spp.

Late Ordovician, Ashgill.

GSC locality C-75499; M'Clintock Inlet map-area (NTS 340E), east

side of M'Clintock Inlet, 3.2 km north of Crash Point;
UTM Zone 18X, 483400E, 9184800N.
(81TM131d)

Identification by B.S. Norford (July, 28, 1981).

**Climacograptus**? sp.
**Diplograptus**? sp.

Late Middle Ordovician to Early Silurian.

# CRANSTONE FORMATION

## Eastern Facies

### Member A

GSC locality C-94374; M'Clintock Inlet map-area (NTS 340E),
section south of Disraeli Fiord (SDF2);
UTM Zone 18X, 9182100N, 533800E;
395 - 402 m above base of formation and member.
(82TM5-F1)

Identification by B.S. Norford (October 4, 1982).

**Glyptograptus** sp.
**Monograptus**? sp.
sponge spicules
trilobite fragment

Probably Early Silurian.

GSC locality C-94373; same location as C-94374; talus either from same beds or from strata 0 - 20 m below them.
(82TM119A)

Identification by B.S. Norford (October 4, 1982).

**Glyptograptus** sp.
**Monograptus** sp.
**Rastrites** sp.
sponge spicules

Silurian, Middle or earliest Late Llandovery.

GSC locality C-75497: M'Clintock Inlet map-area (NTS 340E), 2.5 km north of Thores River;
UTM Zone 18X, 9174500N, 532300E.
member A, stratigraphic position unknown.
(81TM117a)

Identification by B.S. Norford (July 28, 1981).

**Monograptus** aff. **M. convolutus** (Hisinger)

Silurian, Middle Llandovery.

GSC locality C-75498: same locality as C-75497 but different

strata.
(81TM117b)

Identification by B.S. Norford (July 28, 1981).

**Monograptus** 2 spp., one with spiral curvature

Silurian, probably Middle or Late Llandovery.

Member B

GSC locality C-75496: M'Clintock Inlet map-area (NTS 340E), near section south of Disraeli Fiord;
UTM Zone 18X, 9181500N, 534200E;
member B, subdivision B2, 820 - 856.5 m above base of formation.
(81TM101b)

Identification by B.S. Norford (July, 28, 1981).

**Monograptus** aff. **M. argenteus cygneus** Törnquist
**M.** aff. **M. convolutus** (Hisinger)

Silurian, Middle Llandovery.

**Western facies**

GSC locality C-68: M'Clintock Inlet map-area (NTS 340E), west side of M'Clintock Inlet, south of Zebra Cliffs, section ZC3;
UTM Zone 18X, 9184800N, 476200E.

Identification by B.S. Norford and R. Thorsteinsson (from Trettin, 1969b, loc. 38).

**Mongraptus** aff. **M. priodon** (Bronn)

Silurian, Late Llandovery to Wenlock.

## MARVIN FORMATION

GSC locality C-54977: M'Clintock Inlet map-area (NTS 340E), section southeast of Disraeli Fiord;
UTM Zone 18X 9179700N, 540000E;
2 - 3 m above base of formation.

Identification by T.T. Uyeno (April 6, 1982).

**Panderodus gracilis** (Branson and Mehl)

**Drepanoistodus**? sp. (suberectiform, possibly of **D. suberectus** (Branson and Mehl))

**Plegagnathus**? sp. (proclined element)

Age not precisely determinable but overall the faunule appears to be of probable Late Ordovician age.

GSC locality C-54978: same location;
4 - 5 m above base of formation.

Identification by T.T. Uyeno (April 6, 1982).

**Panderodus gracilis** (Branson and Mehl)

Middle Ordovician to Late Silurian

GSC locality C-54964: same location;
82 m above base of formation.

Identification by B.S. Norford (April 16, 1982).

**Kirkidium** sp.

Late Wenlock to early Pridoli, most common in the Ludlow.

GSC locality C-54966: same location;
107 m above base of formation.

Identification by B.S. Norford (April 16, 1982).

**Kirkidium**? sp.

See C-54964.

GSC locality C-54968: same location;
113 m above base of formation.

Identification by B.S. Norford (April 16, 1982).

**Kirkidium**? sp.

See C-54964.

GSC locality C-54970: same location;
193 m above base of formation.

Identification by B.S. Norford (April 16, 1982).

**Catenipora** 2 spp.

indeterminate straight cephalopods, gastropods, brachiopods, and chiton

algae

Middle Ordovician to Late Silurian.

GSC locality C-54981: same location;
573 m above base of formation.

Identification by T.T. Uyeno (April 6, 1982).

**Panderodus** sp.
**Ozarkodina** cf. **O. excavata** (Branson and Mehl)

Probably Late Silurian or Early Devonian.

GSC locality C-54982: same location;
573 - 574 m above base of formation.

Identification by T.T. Uyeno (April 6, 1982).

**Ozarkodina** cf. **O. confluens** (Branson and Mehl), possibly gamma morphotype of Klapper and Murphy, 1975

**O.** cf. **O. excavata** (Branson and Mehl)
**Panderodus** sp.

Silurian, probably Late Silurian.

GSC locality C-54983: same location;
574 m above base of formation.

Identification by T.T. Uyeno (April 6, 1982).

**Ozarkodina confluens** (Branson and Mehl), form approaching epsilon morphotype of Klapper and Murphy, 1975

O. cf. **O. excavata** (Branson and Mehl)
**Panderodus** sp.

Late Silurian, Ludlow-Pridoli.

GSC locality C-70120: approximately same location;
collected by R. Gardner and D. Jones, 1977;
321 m above base of formation, according to their measurement.

Identification by B.S. Norford (April 7, 1978).

**Favosites** sp.

Latest Ordovician to Middle Devonian.

GSC locality C-70135: same location as C-70120;
collected by R. Gardner and D. Jones, 1977;
713.5 m above base of formation according to their measurement.

Identification by B.S. Norford (April 7, 1978).

**Zelophyllum**? sp.
stromatoporoid

Late (?) Silurian to Devonian.

GSC locality C-70022; same location as C-70120;
collected by R. Gardner and D. Jones, 1977;
talus.

Identification by A.E.H. Pedder (April 7, 1978).

**Spinolasma**? sp. nov.
stromatoporoid

Silurian.

GSC locality C-54985: M'Clintock Inlet map-area (NTS 340E), section north of Thores River (NTR2);
UTM Zone 18X, 9174400N, 533000E;
1.5 - 2.0 m above base of formation.

Identification by T.T. Uyeno (November 2, 1982).

**Panderodus gracilis** (Branson and Mehl) (graciliform element)

Mid-Ordovician to Late Silurian.

GSC locality C-54986: same location as C-54985;
3 - 5 m above base of formation.

Identification by T.T. Uyeno (November 2, 1982).

**Belodina** cf. **B. stonei** Sweet (belodiniform element)
**Panderodus gracilis** (Branson and Mehl)
P. sp. undet.

Late Ordovician, probably Fauna 12 of Sweet et al., 1971.

GSC locality C-54987: same location as C-54985;
30 - 33 m above base of formation.

Identification by T.T. Uyeno (November 2, 1987).

**Panderodus gracilis** (Branson and Mehl)

**Plegagnathus** cf. **P. nelsoni** Ethington and Furnish (plegagnathiform element)

Late Ordovician, Faunas 11 to 13 (of Sweet et al., 1971; Sweet, 1979; McCracken and Barnes, 1981).

Locality C-54984: M'Clintock Inlet map-area (NTS 340E), a short distance west of section NTR2;
UTM Zone 18X, 9174200N, 532400E.
(81TM112b)

Identification of brachiopod by B.S. Norford (October 4, 1983).

**Kirkidium (Kirkidium)** sp.

Silurian, late Wenlock to early Pridoli, most common in the Ludlow.

Identification of conodonts by T.T. Uyeno (November 2, 1982).

**Panderodus gracilis** (Branson and Mehl) (compressiform element)

Mid-Ordovician to Late Silurian.

GSC locality C-75386: M'Clintock Inlet map-area (NTS 340E), east-central Marvin Peninsula;
UTM Zone 18X, 9182600N, 512700E.
(80TM312a1)

Identification by T.T. Uyeno (April 6, 1982).

**Aulacognathus bullatus** (Nicoll and Rexroad)
**Oulodus? fluegeli** n. subspec. A of Uyeno and Barnes (1983)
**Panderodus** sp.

Silurian, late Llandovery, upper **staurognathoides** Zone to **inconstans** Zone.

GSC locality C-75387: same location as C-75386 but different strata.
(80TM312a2)

Identification by T.T. Uyeno (April 6, 1982)

**Ozarkodina polinclinata** (Nicoll and Rexroad)
**Oulodus fluegeli** n. subspec. A of Uyeno and Barnes (1983)
**Panderodus** sp.
**Walliserodus sancticlairi** Cooper

Silurian, late Llandovery, **inconstans** Zone.

GSC locality C-75388: same location as C-75386 but different strata.
(80TM312a3)

Identification by T.T. Uyeno (April 6, 1982).

**Walliserodus sancticlairi** Cooper
**Panderodus** sp.

Silurian, probably late Llandovery.

GSC locality C-75389: same location as C-75386 but different strata.
(80TM312a4)

Identification by T.T. Uyeno (April 6, 1982).

**Oulodus**? cf. **O.**? **fluegeli** Walliser
**Panderodus** sp.
**Ozarkodina** sp.
**Walliserodus** sp.

Probably Early Silurian.

GSC locality C-70049: M'Clintock Inlet map-area (NTS 340E), central Marvin Peninsula;
UTM Zone 18X, 9184200N, 507600E.
(77MSA109)

Identification by B.S. Norford (November 21, 1977).

**Catenipora** sp.
**Parafavosites** sp.

Late Ordovician (Ashgill) to Late Silurian.

GSC locality C-54988: M'Clintock Inlet map-area (NTS 340E), section northeast of Crash Point;
UTM Zone 18X, 9183600N, 483700E;
0 - 1 m above base of formation.

Identification by T.T. Uyeno (April 6, 1982).

"**Neoprioniodus**" cf. "**N.**" **multiformis** Walliser
**Panderodus** sp.

Probably Silurian (Ludlovian?).

GSC locality 75421: same locality as C-54988;
basal strata.

Identification by B.S. Norford (from Trettin, 1969b, loc. 40; age assignment modified)

**Atrypella**? sp.
**Kirkidium**? sp.
**Howellella**? sp.

rhynchonellid and undetermined brachiopods
undetermined trilobite
echinoderm fragments

Late Wenlock to early Pridoli on the basis of **Kirkidium**; the latter is most common in the Ludlow.

GSC locality 75422: same location as C-54988; 39 - 104 m above base of formation.

Identification by B.S. Norford (from Trettin, 1969b, p. 40)

**Kirkidium** sp.

See C-75421.

GSC locality C-54976: same location as C-54988; 45.5 m above base of formation.

Identification by B.S. Norford (April 16, 1982).

megalomoid pelecypod

Probably Silurian.

GSC locality C-74917: same location as C-54988; about 48 m above base of formation.

Identification by T.T. Uyeno (April 5, 1983).

**Ozarkodina excavata excavata** (Branson and Mehl)
**Panderodus** sp.

Late Silurian to Early Devonian, early Ludlow to Emsian; the lowest occurrence of **O. excavata excavata** is in the **crassa** Zone.
CAI 2 - 2.5

GSC locality 69208: same location, 104 - 154 m above base of formation.

Identification by B.S. Norford (from Trettin, 1969b, p. 40).

**Kirkidium** sp.
**Cystihalysites** sp.
**Halysites** sp.

**Fossopora** sp.
**Syringopora** sp.
**Tryplasma**? sp.
solitary coral

fossil debris, including echinoderms, gastropods, and bryozoans

See 75421.

GSC locality C-74916: same locality;
uppermost strata of formation.

Identification by T.T. Uyeno (April 5, 1983).

**Panderodus** sp.

Middle Ordovician to Middle Devonian.
CAI 2 - 2.5

## CRASH POINT BEDS

GSC locality C-54996: M'Clintock Inlet map-area (NTS 340E), fault block on south side of Crash Point Syncline;
UTM Zone 18X, 9183200N, 483600E.
(80TM130a3)

Identification by T.T. Uyeno (April 6, 1982).

Sa element (highly fragmented, possibly referable to **Ozarkodina excavata** (Branson and Mehl))

Possibly Silurian-Devonian.

GSC locality C-54997: same locality, different strata.
(80TM130a4)

Identification by T.T. Uyeno (April 6, 1982).

**Ozarkodina confluens** (Branson and Mehl) (beta morphotype of Klapper and Murphy, 1975)

**Oulodus** sp.

Silurian, Wenlock to Pridoli.

PRECARBONIFEROUS GEOLOGY, M'CLINTOCK INLET MAP-AREA

(340E, 340H)

Geology by R.L. Christie (1954), T. Frisch (1965 - 67), W.W. Nassichuk (1966), U. Mayr (1977, 1979, 1982), and H.P. Trettin (1965 - 67, 1977, 1979, 1980, 1982, 1984). Compiled by H.P. Trettin (July, 1987).

## LEGEND

### POST-ELLESMERIAN COVER

**QUATERNARY**

| | |
|---|---|
| Q | unconsolidated sediments (bedrock geology obscured) |

**TERTIARY**

| | |
|---|---|
| T | breccia, conglomerate, minor mudrock (in part poorly consolidated) |

**CARBONIFEROUS AND/OR PERMIAN**

| | |
|---|---|
| uP2 | clastic and carbonate sediments |

## SEDIMENTARY AND METAMORPHIC ROCKS OF PEARYA TERRANE

### SILURIAN

Carbonate and clastic shelf facies near Crash Point

| | |
|---|---|
| Scp | **Crash Point beds** (Upper Silurian)<br>sandstone, mudrock, limestone |
| SM | **Marvin Formation** (probably Ludlow)<br>limestone, minor sandstone |
| Sp | mudrock (Wenlock ?) |

### SILURIAN AND UPPER ORDOVICIAN

Carbonate shelf facies

| | |
|---|---|
| OSM | **Marvin Formation** (Ashgill to Ludlow or Pridoli)<br>limestone, dolostone |

Deep-water facies south of Disraeli Fiord

| | | | |
|---|---|---|---|
| Sc2 | **Cranstone Formation** (Llandovery)<br>**member B**<br>conglomerate, mudrock,<br>minor sandstone | Sc | undiff. |
| Sc1 | **member A** (Llandovery and ? older)<br>mudrock, sandstone,<br>minor conglomerate | | |
| ODG | **Disraeli Glacier beds** (Ashgill and ? younger)<br>resedimented carbonates and minor mudrock | | |

Deep-water facies at Crash Point and Zebra Cliffs

| | |
|---|---|
| Sc | **Cranstone Formation** (Ashgill ?, Llandovery and ? Wenlock)<br>sandstone, mudrock; very rare pebble conglomerate |

| | |
|---|---|
| $O_{DG}$ | **Disraeli Glacier beds** (Ashgill and ? younger)<br>resedimented carbonates and mudrock |

ORDOVICIAN

Ashgill shelf facies

| | | |
|---|---|---|
| | **Harley Ridge Group** | |
| $O_{LR}$ | **Lorimer Ridge Formation**<br>mudrock, sandstone, minor limestone (red beds very common) | |
| $O_{ZC}$ | **Zebra Cliffs Formation**<br>limestone, minor dolostone, mudrock, sandstone; rare conglomerate | $O_{HR}$ undiff. |
| $O_{TR}$ | **Taconite River Formation**<br>sandstone, limestone, mudrock conglomerate (red beds very common) | |

| | |
|---|---|
| $O_{A}$ | **Ayles Formation**<br>dolostone, minor limestone |

Ashgill and Caradoc

| | |
|---|---|
| $O_{MC}$ | **M'Clintock Formation**<br>volcanic flows and tuff (predominantly andesite, minor basalt and siliceous rocks); minor limestone |
| $O_{MCc}$ | limestone<br>(stratigraphic position unknown) |

Caradoc

| | |
|---|---|
| $O_{CD1-4}$ | **Cape Discovery Formation**<br>clastic and carbonate sediments, minor volcanics; numbers, or combination of numbers, indicate members, or combination of members, as follows: |

4: **member D**
volcanic-derived sandstone (red); minor dolostone, dacite

3: **member C**
interlaminated argillaceous limestone and calcareous mudrock, flat-pebble conglomerate (all red)

2: **member B**
dolostone, limestone

1: **member A**
sandstone, mudrock, conglomerate; minor tuff and volcanic flows (trachyandesite, comendite-pantellerite, etc.)

## ORDOVICIAN OR OLDER

Llandeilo and/or older

**Maskell Inlet assemblage**

OMI — tuff and volcanic flows (mainly andesite and basalt), limestone (in part argillaceous and sandy), mudrock, chert; metamorphism ranges from subgreenschist to amphibolite facies)

OMIc — limestone, dolostone, marble (stratigraphic position unknown)

## CAMBRIAN AND/OR LOWER ORDOVICIAN

**Milne Fiord assemblage**

OM3 — **division 1** (Lower Ordovician ?)
quartzite and very rare mudrock

€OM2 — **division 2** (Lower Ordovician and/or Cambrian)
phyllite, minor marble (dolostone, limestone), tuff (including rhyolite)

€OM1 — **division 1** (Lower Ordovician and/or Cambrian)
marble (limestone, minor dolostone)

## HADRYNIAN AND/OR CAMBRIAN

Age and stratigraphic order mostly unknown.

**Lithological designations**

c= carbonate rocks (limestone, dolostone, marble)

p= (pelite) slate, phyllite (p*= green and red)

q= quartzite

s= schist

t= chert

v= volcanics

w= (wacke) sandy mudrock, argillaceous sandstone

x= diamictite

Suggested scheme for combination of Hadrynian-Cambrian map-units (recurrent, not related to tentative age assignments)

| | |
|---|---|
| [ ] | predominantly carbonate rocks (map-unit c) |
| [ ] | pelitic and mixed assemblages, low-grade metamorphic (map-units p*, psvqc, pvc, qpcv, cpq, cp) |
| [ ] | pelitic and mixed assemblages, greenschist or amphibolite facies (map-units s, sc, scq) |
| [ ] | dimictite or wacke-bearing assemblages (map-units pxqc, pcqw, pqwv, pw) |
| [ ] | volcanics |
| [ ] | quartzite |

Tentative age assignments (not part of map-unit designations; shown in brackets, detached from lithological letter symbols):

Ꞓ= Cambrian

H 3 = Ediacaran

H 2 = Varangian (Early Vendian)

H 1 = post-Helikian, pre-Varangian

H Ꞓ= Hadrynian and/or Cambrian

**NEOHELIKIAN** (age of metamorphism and plutonism)
Upper Neohelikian

| | |
|---|---|
| hHn | gneiss, minor amphibolite, schist with rare marble and quartzite in Cape Columbia Belt |

CLEMENTS MARKHAM FOLD BELT

SILURIAN
Llandovery or Wenlock to lower Ludlow

| | |
|---|---|
| $S_L$ | **Lands Lokk Formation**<br>sandstone, mudrock |

Llandovery

| | |
|---|---|
| $S_I$ | **Imina Formation**<br>sandstone, mudrock (calcareous and dolomitic) |

ORDOVICIAN

Landeilo-Caradoc (isotopic age; may include younger and older strata)

| | |
|---|---|
| $O_{MR}$ | **Mount Rawlinson assemblage**<br>radiolarian chert, tuff |

HADRYNIAN AND/OR LOWER PALEOZOIC

| | |
|---|---|
| $H\|lP_2Y$ | Yelverton assemblage<br>marble, schist |

HAZEN FOLD BELT

CAMBRIAN
Lower Cambrian

| | |
|---|---|
| $Є_G$ | **Grant Land Formation**<br>quartzite, slate, phyllite; minor pebble conglomerate |

## INTRUSIONS

### CRETACEOUS

Upper Cretaceous

[Kqm] quartz monzodiorite, quartz monzonite, granodiorite

### LOWER DEVONIAN OR OLDER (ORDOVICIAN ?)

[O?b] **Cape Fanshawe Martin Intrusion**
gabbro, peridotite

### ORDOVICIAN

Llandeilo or Llanvirn

[Oqm] **Cape Richards intrusive complex**
quartz monzonite, granodiorite, hornblende syenite

Middle Ordovician (?)

[mO?gd] granodiorite

Arenig

[Ovb | g] **Thores Suite**
ultramafic rocks (serpentinite, wehrlite, clinopyroxenite), gabbro, minor granitic rocks;
g: larger granitic bodies (diorite, quartz diorite, tonalite, etc.)

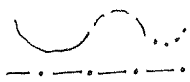
### AGE UNKNON

[qm] quartz monzonite

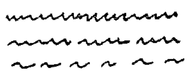
[sy] syenite (metamorphosed)

b mafic dykes and sills of different ages (in part metamorphosed)

lamp lamprophyre

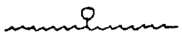


geological boundary (defined, approximate, assumed; projected through ice, overburden or water)

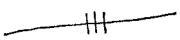


fault (defined, approximate, assumed; projected through ice, overburden or water)

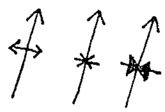
thrust fault



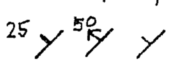
normal fault



lineament (from air photographs)



anticline, syncline (arrow indicates plunge), synform




strike and dip of bedding, tops known (field determination; photogrammetric determination; dip unknown)

strike and dip of bedding, tops unknown; dip estimates from air photographs

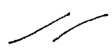
g: gentle (about $3^{\circ}$ - $10^{\circ}$)

m: medium (about $10^{\circ}$ - $25^{\circ}$)

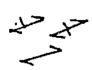
s: steep (about $25^{\circ}$ - $45^{\circ}$)

vs: very steep (about $45^{\circ}$ - $89^{\circ}$)

vertical



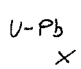
trend of bedding



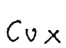
schistosity, gneissosity (inclined, vertical, dip unknown; dip estimates as for bedding)

primary flow structures in igneous rocks (vertical)


fossil locality




age determination




metallic minerals (copper)


stratigraphic section (ground, photogrammetric)

Pre-Carboniferous geology, M'Clintock Inlet map-area, northern Ellesmere Island, interim report and map (340 E, H).

This revised interpretation is based on field work up to 1984. The report is supplemented by appendices containing: 37 chemical analyses of volcanic rocks (by G.R. Lachance et al.); 326 X-ray diffraction and thin-section analyses; verbal logs of 12 stratigraphic sections; and a compilation of published and unpublished fossil identifications (71 lots of macrofossils by B.S. Norford, G.W. Sinclair, A.E.H. Pedder, and M.J. Copeland; 24 lots of conodonts by T.T. Uyeno, G.S. Nowlan, and R.S. Tipnis).