PRELIMINARY GEOLOGICAL MAP AND NOTES, CLEMENTS MARKHAM INLET AND ROBESON CHANNEL MAP-AREAS, DISTRICT OF FRANKLIN

(NTS 120 E, F, G)

by

U. Mayr, H.P. Trettin and A.F. Embry

April, 1982

CONTENTS

CONTENTS cont'd.

CONTENTS cont'd.

INTRODUCTION

The first geological reconnaissance work in parts of the Clements Markham-Robeson Channel map-areas was carried out by H.W. Feilden and other members of a British naval expedition led by Sir George Nares in 1875-76 (Feilden and de Rance, 1878). Exploration on foot was resumed by R.G. Blackadar in 1953 (1954) and R.L. Christie in 1954 (1957) and 1957-58 (1964). Aircraft-supported studies, using Piper Super Cub and piston-engine helicopter, began in 1965 with a reconnaissance project organized by R.L. Christie in 1965 and 1966 and continued by H.P. Trettin and T.O. Frisch in 1967. T.O. Frisch studied metamorphic terranes of the north coast region (1974; Sinha and Frisch, 1976), H.P. Trettin lower Paleozoic and (?) older strata (1971), R.L. Christie upper Paleozoic and Tertiary strata and W.W. Nassichuk upper Paleozoic rocks. Christie continued mapping of Tertiary strata during part of the 1973 field season (Christie and Rouse, 1976). A field party of Pacific Petroleums and Phillips Petroleum investigated the Lake Hazen area in 1973 (Acheson, 1974).

A program to complete the reconnaissance of nine map-areas in northern Ellesmere Island was begun by the Geological Survey in 1975 and is scheduled to terminate with the 1982 field season. In the course of this program, work was carried out in the Clements Markham and Robeson Channel map-areas during parts of the 1977, 1979 and 1980 seasons. It was done partly on foot from fly camps and partly by means of a Bell 206 jet-engine helicopter. Base camp was located at Lake Hazen and Clements Markham Inlet in 1977 and at the head of Tanquary Fiord during the following seasons.

This Open File presents a preliminary geological map resulting from the work along with brief notes on stratigraphy. Embry is responsible for Mesozoic stratigraphy, Mayr for Devonian to Permian stratigraphy and the mapping of Devonian to Tertiary rocks, and Trettin for stratigraphy and the mapping of lower Paleozoic and older rocks.

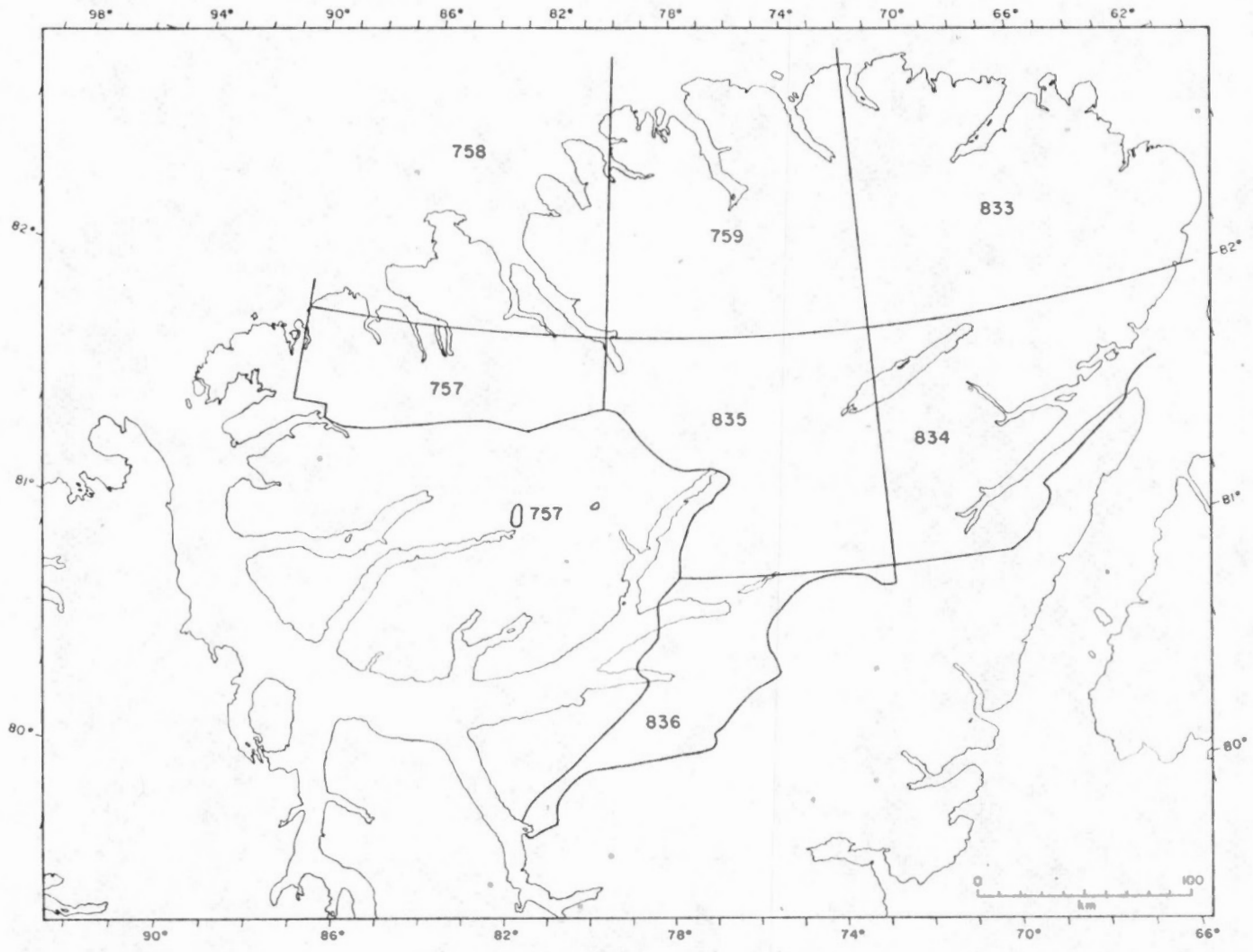

Figure 1: Index of Open Files, Project 730051

Open File 757	Preliminary geological map and notes, parts of Otto Fiord and Cape Stallworthy areas, District of Franklin (NTS 340C, 560D), by H.P.Trettin and U.Mayr, 1981
758	Preliminary geological map and notes, Yelverton Inlet map-area, District of Franklin (NTS 340F, 540G), by H.P.Trettin and T.O.Frisch, 1981
759	Geology of Precambrian to Devonian rocks, M'Clintock Inlet area, District of Franklin (NTS 340E,H) --preliminary geological map and notes, by H.P.Trettin, 1981*
833	Preliminary geological map and notes, Clements Markham Inlet and Robeson Channel map-areas, District of Franklin (NTS 120E,F,G), by U.Mayr, H.P.Trettin, A.F.Embry and R.L.Christie, 1982
834	Preliminary geological map and notes, part of Lady Franklin Bay map-area, District of Franklin (NTS 120C), by H.P.Trettin, U.Mayr and A.F.Embry, 1982
835	Preliminary geological map and notes, part of Tanquary Fiord map-area (NTS 340D), by U.Mayr, H.P.Trettin and A.F.Embry, 1982
836	Lower Paleozoic geology in parts of Greely Fiord East, Greely Fiord West and Cañon Fiord map-areas, District of Franklin (NTS 340A,B, 49H), by H.P.Trettin, 1982

* a revised version of map and notes, based on brief field work in 1981, age determinations, etc. has been placed with the Library, Institute of Sedimentary and Petroleum Geology, Calgary

The notes on Trold Fiord and Eureka Sound formations have been abstracted mainly from Miall (1978, 1979) who participated in the work in 1977. Also incorporated is some unpublished information obtained by R.L. Christie, W.W. Nassichuk and K.G. Osadetz (Osadetz, in prep.).

We are indebted to the Director and officers of the Continental Polar Shelf Project for fixed-wing aircraft support, management of the helicopter and numerous courtesies. The fossil identifications were made by the following paleontologists (scientists whose affiliation is not mentioned are members of the Geological Survey of Canada).

E.W. Bamber	upper Paleozoic corals
J. Dolby	Triassic palynomorphs
W.S. Hopkins, Jr.	Tertiary palynomorphs
B. Mamet (Université de Montréal)	upper Paleozoic foraminifera
J.A. Jeletzky	Cretaceous pelecypods
G. Merril (College of Charleston, South Carolina)	upper Paleozoic conodont
B.S. Norford	Ordovician and Silurian macrofossils
G. Nowlan	upper Paleozoic conodont
C.A. Ross (University of Western Washington, Bellingham)	upper Paleozoic fusulinids
E.T. Tozer	Triassic pelecypods
T.T. Uyeno	Silurian conodonts
P. von Bitter	upper Paleozoic conodont
J.H. Wall	Cretaceous foraminifera
B.R. Wardlaw (U.S. Geological Survey, Denver, Colorado)	upper Paleozoic brachiopods

Age determinations were made by D. Loveridge (zircon) and R.K. Stevens (K/Ar; hornblende).

PROTEROZOIC

Cape Columbia Complex (map-unit Pn; n = gneiss)

Nomenclature: originally named Cape Columbia Group by Blackadar (1954); redefined as Cape Columbia Complex by Trettin (1969a); restricted to type area in Clements Markham Inlet area and adjacent part of M'Clintock Inlet area by Frisch (1974).

Lithology (after Frisch, 1974): mainly gneiss with lesser amounts of amphibolite, granitic and pegmatite dykes and meta-gabbro and small amounts of marble and quartzite. Gneiss commonly is banded and comprises: leucocratic gneiss (mainly quartz and feldspar); garnet-biotite gneiss, commonly with feldspar porphyroblasts part of which are abraided (augen gneiss); and hornblende gneiss. Metamorphism is of amphibolite grade with superimposed retrograde features such as development of chlorite, muscovite, and epidote, granulation of garnet and straining of quartz and feldspar.

Distribution: northwestern extremity of Clements Markham Inlet area.

Contact relationships: locally unconformably overlain by Upper Carboniferous strata (map-unit (CPc); contact with adjacent map-unit Ps possibly faulted.

Age determinations (after Sinha and Frisch, 1976):

- $^{207}Pb/^{206}Pb$ (zircon): 980, 926 Ma
- Rb/Sr isochrons (based on 14 whole-rock samples):
  - (1) 1060 ± 18 Ma (9 analyses)
  - (2) 501 ± 88 Ma (6 analyses) or 522 ± 45 Ma (5 analyses)
    (recalculated from values published by Sinha and Frisch on the basis of presently used constant $1.42 \times 10^{-11}\ a^{-1}$)

Map-unit Ps (s = schist)

Nomenclature: informal lithological unit.

Lithology (after Frisch, 1974): schist, muscovite-rich, commonly with porphyroblasts of garnet, feldspar and/or quartz, crenulation cleavage.

Distribution: Clements Markham Inlet map-area; northern part of unnamed peninsula between Markham Fiord and Parr Bay.

Contact relationships: in fault contact with map-unit cpxq; contact with map-unit Pn possibly faulted.

Age: age of metamorphism probably the same as that of Cape Columbia Complex (about 1 Ga); accordingly original sediments are probably Helikian or older.

EARLY PALEOZOIC AND (?) OLDER

Map-unit cpxq (c = carbonate rocks, p = pelite, x = diamictite, q = quartzite)

Nomenclature: originally named Mount Disraeli group by Blackadar (1954) but proper stratigraphic treatment impossible at present because of excessive deformation, lack of fossils or age determinations and lack of detailed studies. Rocks of uncertain Proterozoic-early Paleozoic age in other areas have been designated in a similar manner, i.e. by italicized lower case letters indicating lithology.

Lithology

Suite 1: - limestone, dolomitic limestone, dolostone or marble

- quartzite, fine to coarse grained, in part pebbly; grey, red, green; green quartzite is rich in chlorite partly pseudomorphous after glauconite (?)

Suite 2: - mudrock, in part sandy or sandy and conglomeratic

- greywacke or compositionally immature sandstone (contains quartz, carbonate, chert, schist, volcanics, feldspar, mica, etc.)

- minor andesite (seen only at Gypsum River, loc. 77T305D)

Clastic sediments metamorphosed to schist (lower greenschist facies) on north coast.

Distribution: northwestern part of Clements Markham Inlet area.

Contact relationships: locally unconformably overlain by upper Paleozoic strata (map-unit CPc); in fault contact with various lower and upper Paleozoic units.

Age and regional relationships: sponge spicules in chert fragments of sandstone from loc. 77MSARG19 indicate that at least part of succession is Phanerozoic; all other inferences are indirect and speculative. Structural complexity and apparent absence of fossils from carbonates suggest a pre-late Middle Ordovician age. In northern Ellesmere Island, metamorphosed glauconite (?) is common in Ellesmere Group (Lower Cambrian) and in upper parts of Grant Land Formation (Cambrian and (?) Lower Ordovician); generally glauconite is known to be associated with Cambrian transgressions in many parts of the world. Suite 2 is comparable to map-units px and xp of Yelverton Inlet map-area (Trettin and Frisch, 1981). Volcanic materials are reminiscent of Ordovician and (?) older volcanics in M'Clintock Inlet area (Trettin, 1981).

Mode of origin:

Suite 1: - deposited in shelf environments under relatively stable tectonic conditions.

Suite 2: - deposited by sediment gravity flows under unstable tectonic conditions.

Map-unit vs (v = volcanics, s = sediments)

Nomenclature: provisional lithological designation.

Lithology: crenulated schist composed of chlorite, carbonate, quartz and minor muscovite and opaque minerals.

Distribution: 8-18 km SE of head of Markham Fiord.

Contact relationships: in fault contact with Markham Fiord pluton and Upper Carboniferous strata.

Age: early Paleozoic and/or older; perhaps related to map-unit cpxq.

Mode of origin: marine tuffaceous(?) sediments metamorphosed to greenschist facies.

Map-unit cpssm

Nomenclature: provisional lithological designation.

Lithology: carbonate rocks, slate, quartzose, cherty sandstone, abundant mafic sills.

Distribution and thickness: W of Markham Fiord; thickness unknown.

Contact relationships: in fault contact with upper Paleozoic strata in Clements Markham inlet map-area, with M'Clintock Formation in adjacent M'Clintock Inlet map-areas.

Age: no fossils; lithology, metamorphism, and setting suggest early Paleozoic, perhaps pre-late Middle Ordovician age.

Map-unit cp

Nomenclature: provisional lithological designation.

Lithology: recrystallized limestone, slate.

Distribution and thickness: W of Markham Fiord; thickness unknown.

Contact relationships: in fault contact with upper Paleozoic strata and map-unit cpssm in present area, with M'Clintock Formation in adjacent M'Clintock Inlet area.

Age: no fossils; lithology, metamorphism, and setting suggest early Paleozoic, perhaps pre-late Middle Ordovician age.

Map-unit d (d = dolostone)

Nomenclature: provisional lithological designation.

Lithology: dolostone, brecciated, vuggy.

Distribution: 10 km SW of head of Markham Fiord.

Contact relationships: unconformably overlain by map-unit Ccgrb.

Age and correlation: uncertain; tentatively considered as early Paleozoic; if so map-unit d may be part of map-units cpxq or Sm3? or may represent a dolomitic facies of the Zebra Cliffs Formation. However, the possibility that it is Carboniferous in age cannot be ruled out.

EARLY PALEOZOIC

Grant Land Formation (map-unit €g)

Nomenclature: defined by Trettin (1971) with type section at Hare Fiord, NW Ellesmere Island.

Lithology: mainly sandstone and mudrock, minor pebble conglomerate and intraformational conglomerate (rip-up clasts of mudrock in sandstone matrix). Mean and maximum grain size decrease upwards in section; upper few tens of metres consist of mudrock only. Metamorphosed to lower greenschist facies in northern Piper Pass.

Sandstone: quartzose with up to 30 per cent of feldspar and variable proportions of secondary chlorite and muscovite; feldspar content decreases upwards in section. Primary structures: structureless flat beds, one to several m thick, most common; flat lamination and small-scale crosslamination fairly common; medium-scale trough crossbedding rare. Upward-fining sequences are common but generally not of Bouma-type.

Mudrocks: flat lamination, small-scale crosslamination; slaty cleavage; contain chlorite and muscovite pellets pseudomorphous after glauconite in upper part of formation; carbonate alteration common in upper part.

Conglomerate: pebbles and granules are of vein quartz and feldspar; occur mostly in structureless flat beds, commonly as part of upward-fining sequences.

Distribution and thickness: central parts of map-area; thickness unknown here; N of Hare Fiord maximum thickness is 1.6 km+.

Contact relationships: base not exposed; overlain by Hazen Formation with abrupt but apparently conformable contact.

Age: unfossiliferous unit; top is possibly Early Ordovician on basis of conodonts and pelecypod from base of Hazen Formation east of head of Tanquary Fiord (Trettin et al., 1979, loc. 10 and unpub. identification of pelecypod by J. Pojeta, Jr.).

Mode of origin: derived from metamorphic-plutonic terranes, possibly to the north. Structureless flat beds with common intraclasts probably deposited by sediment gravity flows in slope or basinal environments; other sediments probably in marine deltaic settings.

Ordovician and Silurian deep-water deposits of Hazen Trough

Hazen Formation (map-units €Oh1, OSh2, €-Sh)

Nomenclature: defined by Trettin (1971) with type section at St. Patrick Bay, Archer Fiord and subsequently divided into lower carbonate and upper chert member.

Distribution and thickness: Patterson River, vicinity of Gilman Glacier, foothills of United States Range; thickness unknown in present area but less than 540 m (thickness at Ella Bay, Archer Fiord, where formation has longer age range).

Lithology:

Carbonate Member (map-unit €Oh1): mainly redeposited, impure carbonate sediments (calcilutite, calcarenite, minor pebble conglomerate) and calcareous and dolomitic mudrock with variable proportions of calcareous sandstone and radiolarian and replacement chert. Noteworthy is occurrence of carbonate pebble conglomerate and very coarse grained sandstone with ooids in northeastern Patterson River Graben (Robeson Channel map-area).

Chert Member: mainly dark grey radiolarian chert with interlaminated dark grey claystone and minor resedimented carbonates.

Age: base of formation appears to be diachronous, being as old as late Early Cambrian at Archer Fiord and probably as young as Early Ordovician W of head of Tanquary Fiord (Trettin et al., 1979); no fossil evidence from present map-area.

Lower part of chert member contains graptolites of latest Early Ordovician (late Arenigian) age at Mount Pullen (loc. 67T17A; Jackson, 1975). Graptolites of Early Silurian (early or middle Llandoverian) age occur near top of formation at Wood River (loc. 77T110A; Trettin et al., 1979, loc. IX).

Mode of origin: carbonate and clastic sediments probably derived mainly from shelf areas to the southeast but carbonate conglomerate and coarse grained sandstone in Patterson River Graben probably had northerly or northeasterly sources. Formation accumulated very slowly in deeper-water settings.

Disraeli Glacier beds (map-units Sdg1, Sdg2)

Nomenclature: informal name introduced here; corresponds to map-unit Ocg in Trettin, 1981; type area is S of head of Disraeli Ford, M'Clintock Inlet map-area.

Internal stratigraphy and lithology: reconnaissance work in type area indicates five members (A-E) but only members A, B, C and lower part of D have been studied so far. Members A, C and probably also D are recessive and consist of medium grey calcareous mudrock, locally with pelitic limestone. Members B and D are resistant and consist of sandstone, conglomerate and minor mudrock. Only members A and B (map-units Sdg1, Sdg2) are exposed in the present area where they were briefly examined at localities 80T233B and 80T230H and 80T233A respectively.

Member B: about 400 m thick in type area. Conglomerate mainly of pebble grade but with cobbles and some boulders. Phenoclasts are mainly carbonate rocks, chert and quartzite. Occurs as flat beds or lenses. Sandstone occurs mainly as thin to very thick beds; medium-scale, concave foresets relatively rare. Diverse and immature in composition (quartz, chert, carbonates, feldspar, mica etc.).

Distribution and thickness: NW part of Clements Markham Inlet map-area; thickness there unknown; total thickness of unit may be 1 km or more.

Contact relationships: in Clements Markham Inlet area member A or, locally, member B seem to lie on Lorimer Ridge beds; contact remains to be examined.

Age: in M'Clintock Inlet area members A and C both contain graptolites of Early Silurian (mid-Llandoverian) age (B.S. Norford, pers. comm., 1981). Age may extend downward to latest Ordovician.

Mode of origin: probably deposited by sediment gravity flows and tractive currents in submarine canyon within carbonate shelf (represented by map-unit Sc) and adjacent to it. Proximal facies equivalent of lowermost parts of Imina Formation.

Imina Formation (map-unit Si)

Nomenclature: introduced as reconnaissance group by Christie (1957); redefined as formation by Trettin (1969a).

Lithology: mainly calcareous and dolomitic sandstone and mudrock with flysch-like primary structures (Bouma sequences, massive bedding, sole marks); granule and pebble conglomerate observed only in northern part of Clements Markham Inlet map-area (e.g. loc. 77T305B south of Gypsum River and loc. 79T227C south of lower Clements Markham Inlet). Rocks weather yellowish or brownish.

Distribution and thickness: S of Gypsum River, NW of Markham River, SE of Clements Markham Inlet; widely exposed on Hazen Plateau in SE parts of map-areas; thickness unknown in present area, probably in order of kilometres in southern parts but significantly smaller in vicinity of Clements Markham Inlet.

Contact relationships: overlies Hazen Formation with abrupt but probably conformable contact. Conformably overlain by Lands Lokk Formation in Otto Fiord map-area but contact is faulted in present area.

Age: no fossil collections from present map-areas. Regional stratigraphic relationships suggest that in northern part of Clements Markham Inlet map-area formation is restricted to Early and Middle Silurian. It could range to Upper Silurian or earliest Devonian in Hazen Plateau region but in that region upper part has generally been removed by erosion.

Mode of origin: derived from metamorphic and sedimentary source terranes to N and NE; deposited by sediment gravity flows in submarine fan and bottom environments of Hazen Trough. Paleocurrent transport in present area was transverse from NW to SE and longitudinal from NE to SW (Trettin, 1971).

Land Lokk Formation (map-unit S1)

Nomenclature: defined by Trettin (1969a) with type area at Emma Fiord, NW Ellesmere Island.

Lithology: (1) thinly interstratified sandstone and mudrock with minor intraformational and pebble conglomerate; thin flat bedding most common; thin Bouma sequences; some massive sandstones with intraclasts of mudrock; mudrocks mainly medium dark grey, resulting in overall dark grey appearance of unit; minor amounts of greenish grey and purple red mudrocks, mainly in region SE of Clements Markham Inlet. Sandstone and conglomerate typically composed of quartz and chert with only minor amounts of carbonate, muscovite and chlorite but some strata NW of Markham River have large content of detrital carbonates. (2) Mudrock medium grey and medium dark grey; flat lamination; considerable bioturbation in some areas.

Distribution and thickness: extensive NE-SW trending belt in central to northern part of map-area; thickness impossible to establish because of complex structure; information from type area suggests that it is in the order of kilometres.

Contact relationships: overlies Imina Formation in type area but in present area lower contact is faulted. Disconformably overlain by tongue of upper Marvin Formation(?) NW of Markham River; in fault contact with Marvin Formation at Piper Pass.

Age: Middle to early Late Silurian (Wenlockian to early Ludlovian) in type area on basis of graptolites. Strata NW of Markham River (loc. 79T236) contain poorly preserved palynomorphs of probable Late Silurian age (D.C. McGregor, pers. comm., 1980).

Mode of origin: probably deposited in submarine fan and prodelta environments. At Barrier Lake transport was strike-parallel, probably NE-SW.

Ordovician and Silurian volcanic, shallow marine and nonmarine deposits

Map-unit OSv (v = volcanics)

Nomenclature: informal lithological unit.

Lithology: volcanic rocks and less abundant carbonate rocks, minor chert. Volcanic rock samples from localities 77T310E and 310F are crystal and lithic tuff of rhyolitic to dacitic aspect that are altered by carbonates and sheared. Two chemically analyzed specimens of tuff were classified as "rhyolite, calcalkaline, average series" and "rhyolite, calcalkaline, K-poor" respectively according to Irvine and Baragar (1979). Carbonate rocks at these localities are schistose recrystallized limestone, probably original lime mudstone.

Distribution and thickness: NW part of Clements Markham Inlet map-area, vicinity of Mount Rawlinson and Mount Frere; thickness unknown because of complex structure.

Contact relationships: lower contact not exposed (thrust over Lands Lokk Formation). Air photos indicate that it is overlain with gently dipping contact by Imina Formation; it is uncertain whether this is a normal contact or a thrust fault.

Age: uncertain; may be equivalent to Bromley Assemblage of M'Clintock Inlet area (pre-late Middle Ordovician), M'Clintock Formation (late Middle to early Late Ordovician), map-unit OSv at Kulutingwak Fiord, Yelverton Inlet map-area (Early Silurian, early to middle Llandoverian; Barnes in Trettin et al., 1979, loc. XI; Trettin and Frisch, 1981) or to member B of Lands Lokk Formation at Emma Fiord (early Ludlovian; Trettin, 1969a). Probably correlative with Otv in M'Clintock area.

Mode of origin: volcanic arc, partly or entirely submerged.

M'Clintock Formation (map-unit Omc)

Nomenclature: erected as reconnaissance group by Christie (1957); redefined as formation by Trettin (1969b).

Lithology: mainly pyroclastic deposits and volcanic flows, locally with volcanic-derived clastic sediments and limestones, but carbonates probably are absent from Clements Markham Inlet area. Volcanic rocks are mainly basalt and andesite with less abundant dacite and rhyolite.

Distribution and thickness: NW part of Clements Markham Inlet area; thickness unknown here; 1300 m+ in M'Clintock Inlet area.

Contact relationships: contacts faulted in present area; in adjacent M'Clintock Inlet area it overlies Cape Discovery Formation with conformable contact and is disconformably overlain by Taconite River Formation.

Age: no fossils from present area, at M'Clintock Inlet coral of Late Ordovician age occurs in uppermost part; late Middle to early Late Ordovician on basis of regional stratigraphic relationships.

Mode of origin: volcanic arc.

Taconite River Formation (map-unit Otr)

Nomenclature: defined by Trettin (1969b) with type section W of M'Clintock Inlet.

Lithology: mainly compositionally immature sandstone and mudrock, both multi-coloured (hues of green, grey, brown, red), with lesser amounts of conglomerate and limestone; conglomerate and limestone have not yet been recorded in Clements Markham Inlet area.

Distribution and thickness: nunataks in NW part of Clements Markham Inlet area; thickness unknown.

Contact relationships: overlies Precambrian to Ordovician units with angular unconformity or disconformity in M'Clintock Inlet area; base not exposed in present area, conformably overlain by Zebra Cliffs Formation.

Age: Late Ordovician on basis of fossils from M'Clintock Inlet area.

Mode of origin: mainly shallow marine.

Zebra Cliffs Formation (map-unit Ozc)

Nomenclature: introduced by Trettin (1969b) for outcrops west of M'Clintock Inlet. Originally divided into three members (A-C). Member C subsequently reassigned to Hazen Formation and designated tongue of upper Hazen Formation (Trettin, 1981).

Lithology: not yet thoroughly examined in present map-area; in M'Clintock Inlet area formation consists mainly of limestone with variable proportions of dolostone, mudrock and sandstone.

Distribution and thickness: NW part of Clements Markham Inlet map-area; thickness unknown here; 430-570 m in M'Clintock Inlet area.

Contact relationships: overlies Taconite River Formation with conformable contact; overlain by Lorimer Ridge beds; contact either is conformable or represents minor disconformity.

Age: Late Ordovician (Ashgillian) on basis of fairly extensive collections from M'Clintock Inlet area; collection from 77M81 is of unspecified late Middle or Late Ordovician age.

Mode of origin: deposited on carbonate shelf, close to shore.

Lorimer Ridge beds (map-unit Olr)

Nomenclature: informal provisional name introduced by Trettin (1981); unit warrants formational rank.

Lithology: mainly sandstone and mudrock, less limestone, very small amounts of pebble conglomerate; clastic sediments are mainly red-brown and also greenish grey;

sandstones are calcareous and compositionally immature; flat and undulating lamination predominant with some small-scale crosslamination; limestones in part sandy and pelitic; fossils, mainly colonial corals, fairly common.

Distribution and thickness: NW part of Clements Markham Inlet area; thickness unknown here; about 770 m on Lorimer Ridge in adjacent part of M'Clintock Inlet map-area.

Contact relationships: overlies Zebra Cliffs Formation; contact is low-angle unconformity at head of M'Clintock Inlet and probably disconformable or conformable elsewhere; overlain by Marvin Formation (map-unit OSm) at some localities and by Disraeli Glacier beds at others; contact with Marvin Formation may be minor disconformity; contact with Disraeli Glacier beds remains to be examined.

Age: no fossils from present area; fossils from adjacent M'Clintock Inlet area are of unspecified late Middle to Late Ordovician age; formation is Late Ordovician in age on basis of stratigraphic relationships.

Mode of origin: shallow marine.

Marvin Formation (map-units OSm, Sm3, Sm3c, Sm3p (c = carbonate rocks, p = pelite), Sm3?)

Nomenclature: defined by Trettin (1969b) for limestone with minor sandy limestone and calcareous sandstone at Crash Point, E of M'Clintock Inlet (M'Clintock Inlet map-area), underlain and overlain by predominantly clastic sediments. Macrofossils indicated an unspecified late Middle to early Late Silurian age. It now is recognized that the type section represents a tongue of the upper part of a longer ranging, thicker carbonate body exposed E and W of the head of Disraeli Fiord. The same applies to a fault slice extending from NE of Piper Pass to SW of Barrier Glacier

and probably also to strata NW of Clements Markham River that have not yet been dated precisely. A tongue of the lower Marvin Formation SW of Disraeli Fiord (M'Clintock Inlet map-area) will be designated OSm1, and the three tongues of the upper part mentioned will be designated Sm3 at Crash Point; Sm3, Sm3c and Sm3p at Piper Pass and Barrier Glacier, and Sm3? NW of Clements Markham River.

Lithology

OSm (E margin of Clements Markham Inlet area, based on section SE of head of Disraeli Fiord in immediately adjacent part of M'Clintock Inlet area): lime mudstone and lime wackestone, both in part dolomitic, with lesser amounts of dolostone, variably calcareous; rare chert lenses; corals, predominantly favositids, occur throughout; large pentamerids common in lower part.

Sm3 (Piper Pass-Barrier Glacier): lime mudstone and calcisiltite, calcarenitic, both medium dark grey, carbonaceous and variably pelitic (quartz, muscovite), commonly sheared and recrystallized, with some thin flat lamination preserved; (2) mudrock, medium dark grey to dark grey, carbonaceous, variably calcareous and dolomitic; (3) minor amounts of lime wackestone and packstone with abundant fossils (echinoderms, bryozoans, corals, brachiopods, trilobites, ostracodes, etc.) in matrix of variably dolomitic lime mudstone or calcisiltite. At Barrier Glacier predominantly pelitic units (Sm3p) and predominantly calcareous units (Sm3c) have been mapped separately (airphoto interpretation).

Sm3? (NW of Clements Markham River): dolostone, in part sandy, some beds with abundant oncolites; dolomitic sandstone; pebble conglomerate, sandy and dolomitic; locally regolith at base, overlain by a few m of conglomerate fining upwards from cobble to pebble grade and containing malachite.

Distribution and thickness

OSm: central part of W margin of Clements Markham Inlet map-area, 740 m+ (top not preserved).

Sm3: NE of Piper Bass to SW of Barrier Glacier; thickness unknown because of complex structure.

Sm3?: several small outcrop areas NW of Clements Markham River; thickness no more than a few hundred m; top not preserved.

Contact relationships

OSm: overlies Lorimer Ridge Ridge beds with abrupt contact that probably represents minor disconformity; top not preserved.

Sm3 (Piper Pass-Barrier Glacier); in fault contact with Grant Land and Lands Lokk formations; age relationships suggest that Marvin Formation overlies Lands Lokk Formation.

Sm3? (NW of Clements Markham River): overlies Lands Lokk Formation with marked disconformity; top not preserved.

Age

OSm: conodonts range in age from Late Ordovician(?) at base to Late Silurian or Devonian at top (T.T. Uyeno, pers. comm., 1982); stratigraphic relationships suggest age range from latest Ordovician to Late Silurian (late Ludlovian).

Sm3 (Piper Pass-Barrier Glacier): macrofossils are of unspecified Middle to Late Silurian (middle Wenlockian to early Pridolian) age (B.S. Norford, pers. comm., 1979); 5 conodont faunules from Piper Pass are all Late Silurian in age; one of these is younger than latest Ludlovian, another late Ludlovian, probably **latialata** Zone (T.T. Uyeno, pers. comm., 1980).

Sm3? (NW of Clements Markham River): underlying strata of Lands Lokk Formation probably are Late Silurian in age on basis of palynomorphs (D.C. McGregor, pers. comm., 1980); no fossils from Marvin Formation.

The only area where the upper age limit of the formation has been determined is the type section at Crash Point. There the Marvin Formation contains conodonts of probable Ludlovian age and the overlying clastic sediments conodonts of probable Ludlovian or Pridolian age (T.T. Uyeno, pers. comm., 1982). The macrofossils of the Marvin Formation are now assigned to the Ludlovian (B.S. Norford, pers. comm., 1982).

Mode of origin

OSm: carbonate buildup adjacent to submarine canyon represented by Disraeli Glacier beds.

Sm3 (Piper Pass-Barrier Glacier): shelf margin and adjacent slope.

Sm3? (NW of Clements Markham River): sandy shelf, probably close to shore.

Ordovician granitic intrusion

Markham Fiord pluton (map-unit Ogm)

Nomenclature: name informally introduced here.

Lithology: mainly granitic rocks including quartz monzodiorite and granodiorite; diabase common in eastern part; minor serpentinite.

Distribution: SE of head of Markham Fiord.

Contact relationships: bounded by fault contacts.

Age: zircon age of 462 ± 11 Ma (unpub. determination by D. Loveridge) probably gives time of crystallization (early Middle or late Early Ordovician according to time scale of Rundle, 1981); K/Ar (hornblende) age of 422 ± 37 Ma (unpub. determination by R.K. Stevens) time of uplift and cooling or later thermal event.

Mode of origin: probably marks peak of pre-late Middle Ordovician orogeny of northeasternmost Ellesmere Island.

DEVONIAN

Sail Harbour "Group" (map-unit Dsh)

Nomenclature: defined as (reconnaissance) group by Blackadar (1953); rates formational status.

Lithology: mainly interbedded dark grey mudstone, siltstone and sandstone with lesser amounts of impure carbonate rocks and shale; sandstone is fine grained and classified mainly as sublitharenite and lithic arenite; carbonate rocks include skeletal-peloidal packstone with large proportions of quartz and mica, laminated aphanocrystalline dolomite or detrital dololutite with one occurrence of oolite; rare ostracodes and pelecypods.

Distribution and thickness: Parker Bay, James Ross Bay and SE coast of Clements Markham Inlet; 600 m+.

Contact relationship: in fault contact with Lands Lokk Formation; contrast in structural style suggests high angular unconformity between Lands Lokk Formation and Sail Harbour Group; overlain by map-unit Cprb; contact is disconformity or possibly low angular unconformity.

Age and correlation: age is bracketed by early Late Silurian age of adjacent (and presumably underlying) Lands Lokk Formation and by Late(?) Carboniferous age of overlying redbeds. Ostracodes from Sail Harbour group are probably of undifferentiated Late Silurian to Middle Devonian age (M.J. Copeland, pers. comm., 1978). Possibly correlative with Lower Devonian Stallworthy Formation of northern Azel Heiberg Island.

Mode of origin: deposited in brackish water environments of delta.

CARBONIFEROUS AND PERMIAN

Emma Fiord Formation (map-unit Ce)

Nomenclature: defined by Thorsteinsson (1974) with type section on Kleybolte Peninsula, NW Ellesmere Island.

Lithology: interbedded coarse-grained sandstone and black shale; possibly upward fining sedimentation units; abundant plant fossils.

Distribution and thickness: large nunatak at 82°25'N, 71°00'W on W side of Crescent Glacier; 50 m ±.

Contact relationships: overlies Imina Formation with angular unconformity; disconformably overlain by map-unit Cprb.

Age: plant fossils from outcrop W of Crescent Glacier are Early Carboniferous in age (Christie, 1964); samples collected there during present investigation did not yield any palynomorphs. Type section of formation has been dated as late Early Carboniferous (Viséan) on basis of palynomorphs (Thorsteinsson, 1974).

Mode of origin: fluvial?

Map-unit Ccgrb (cg = conglomerate, rb = redbeds)

Nomenclature: informal map-unit introduced here for undifferentiated equivalents of Borup Fiord and Canyon Fiord Formations. From the published description (Thorsteinsson, 1974) there is no obvious lithological difference between them and fossil control is insufficient to distinguish them on the basis of age. The informal nomenclature used here is based on distinguishable lithologies (cf. map-unit Cprb).

Lithology: medium and coarse grained sandstone and conglomerate with minor shale and siltstone; upward fining sedimentation units present locally; unit weathers maroon.

Distribution and thickness: S of Markham Fiord and vicinity of Clements Markham Inlet; 500-600 m.

Contact relationships: overlies lower Paleozoic formations with high angular unconformity; overlain with gradational contact by map-unit Cc at Clements Markham River and with abrupt contact by map-unit Css S of Markham Fiord. Overlain by Belcher Channel Formation on Feilden Peninsula; contact is assumed to be disconformable on basis of regional stratigraphic relationships and uncertain fossil evidence.

Age and correlation: foraminifera of middle Late Carboniferous (Moscovian) age (GSC Cat. No. C-70202, C-70316), collected from lower part of overlying map-unit Cc in Clements Markham River area, indicate that map-unit Ccgrb is middle Late Carboniferous (Moscovian) and/or older. In this area, unit is comparable in age and lithology to Canyon Fiord Formation.

Age of map-unit Ccgrb S of Markham Fiord is unknown.

Mode of origin: nonmarine, fluvial.

Map-unit Cprb (p = pelite, rb = redbeds)

Nomenclature: informal map-unit introduced here; should become new formation.

Lithology: maroon calcareous siltstone and argillaceous limestone with minor sandstone; W of Clements Markham Inlet red and green slaty mudstone.

Distribution and thickness: Parker Bay, Clements Markham River, Crescent Glacier; 500 m+.

Contact relationships: overlies Sail Harbour "Group" and Emma Fiord Formation with disconformity and folded lower Paleozoic units with high angular unconformity; overlain with gradational contact by Otto Fiord Formation.

Age and correlation: no fossils; presumed to be basinward equivalent of map-unit Ccgrb and therefore to be middle Late Carboniferous (Moscovian) and/or older.

Mode of origin: deltaic.

Map-unit Css (ss = sandstone)

Nomenclature: informal lithological unit.

Lithology: Calcareous sandstone with minor interbedded limestone and siltstone; unit weathers yellow.

Distribution and thickness: S of Markham Fiord; 400 m (estim.).

Contact relationships: overlies map-unit Ccgrb with abrupt, perhaps disconformable contact; overlain by map-unit CPpe; contact not examined, appears sharp on air photographs and is interpreted as disconformity.

Age and correlation: no fossils; tentatively considered to form part of the basal terrigenous complex of the upper Paleozoic sequence.

Mode of origin: shallow marine.

Map-unit Cc (c = carbonate rocks)

Nomenclature: informal lithological unit.

Lithology: dolomite, finely crystalline, medium to thick-bedded, sparsely fossiliferous, with chert nodules; conglomerate and sandstone present at base in those areas where unit overlies lower Paleozoic rocks.

Distribution and thickness: NW side of Clements Markham Inlet; vicinity of Clements Markham River; 200-300 m+.

Contact relationships: overlies lower Paleozoic folded strata with angular unconformity and map-unit Ccgrb with gradational contact; overlain with abrupt contact by breccia facies of Otto Fiord Formation; contact with overlying map-units CPbe and CPc have not been observed and seem to be faulted everywhere.

Age and correlation: middle Late Pennsylvanian (Moscovian) on basis of foraminifera (GSC Cat. Nos. C-70052, C-70060, C-70066, C-70316; C.A. Ross, pers. comm., 1977); unit is coeval with lower part of Nansen Formation.

Mode of origin: deposited on shallow, subtidal platform.

Map-unit CPbe (b = breccia; e = evaporites)

Nomenclature: informal lithological designation.

Lithology: brecciated dolomite, interfingers locally with anhydrite.

Distribution and thickness: W of Clements Markham Inlet; thickness unknown, probably no more than a few hundred m.

Contact relationships: upper and lower contacts faulted; seems to form lenses within map-unit CPc.

Age and correlation: appears to be facies of CPc and hence late Late Carboniferous and Early Permian in age; may be correlative with Mount Bayley Formation and map-unit CPpe.

Mode of origin: deposited in restricted basin; brecciation of dolomite is attributed to removal (by solution) of originally interstratified evaporites.

Otto Fiord Formation (map-units Co and Co(be); b = breccia, e = evaporites)

Nomenclature: defined by Thorsteinsson (1974) with type section at Otto Fiord, NW Ellesmere Island.

Lithology: two distinct lithofacies; (1) anhydrite with some sandstone and black dolomite in lower part (typical development; map-unit Co); (2) massive breccia with interbedded dolosiltite; breccia clasts composed entirely of dolomite; texture varies from fractured without much dislocation to chaotic (mosaic and rubble breccias of Morrow and Meijer-Drees, 1981).

Distribution and thickness: head of Clements Markham Inlet; Co 400 m+, Co(be) 700 m.

Contact relationships: Co overlies map-unit Cprb with gradational contact; Co(be) overlies map-unit Cc with abrupt contact; Co(be) disconformably overlain by map-unit Cqp, upper contact of Co with CPpe appears to be abrupt.

Age and correlation: no fossils from evaporites; blocks of bioclastic rock in breccia contain foraminifera that are still under study. Age of underlying map-unit Cc indicates that Otto Fiord Formation is middle Late Carboniferous (Moscovian) and/or younger. Evaporites are assumed to be correlative with part of map-unit Ccgrb and with map-unit Cc along southeastern margin of evaporite basin.

Mode of origin: Nassichuk and Davies (1980) interpreted Otto Fiord Formation as subaqueous evaporite deposit; brecciation of dolomite is attributed to removal (by solution) of originally interstratified evaporites.

Map-unit Cqp (q = quartzite, p = pelite)

Nomenclature: informal lithological designation; unit probably warrants formational status.

Lithology: massive units of sandstone and orthoquartzite interbedded with thick units of purple or green, slaty mudstone.

Distribution: E side of Clements Markham River; 0-400 m (estim.).

Contact relationships: overlies Otto Fiord Formation; contact not examined, presumed to be disconformable; disconformably overlain by map-unit CPpe.

Age and correlation: no fossils; assumed to be Late Carboniferous in age on basis of age of underlying and overlying units; no correlative units known.

Mode of origin: nonmarine.

Belcher Channel Formation (map-unit CPbc)

Nomenclature: defined by Harker and Thorsteinsson (1960) with type section Grinnell Peninsula, Devon Island; revised by Nassichuk (1965).

Lithology: thick-bedded limestone.

Distribution and thickness: SE of Clements Markham Inlet, Feilden Peninsula; 325 m+.

Contact relationships: overlies map-unit Ccgrb; contact not examined in present area but known to be disconformable elsewhere; overlain by Assistance Formation with abrupt, disconformable contact.

Age and correlation: fossils from present area have not yet been identified; elsewhere the formation is known to be Late Carboniferous and Early Permian in age (Thorsteinsson, 1974; Nassichuk and Wilde, 1977; Mayr et al., 1982). Belcher Channel Formation interfingers with map-unit CPpe and probably correlates with map-units CPc, CPbe and Pc.

Mode of origin: shallow subtidal platform.

Map-unit CPpe (p = pelite, e = evaporites)

Nomenclature: informal lithological designation.

Lithology: grey, soft, papery weathering shale with interbeds of sandstone and siltstone, especially in lower part; gypsum-anhydrite occurs as lenses in vicinity of Clements Markham Inlet and predominates S of Markham Fiord.

Contact relationships: overlies map-units Co(be), Cqp, and possibly Cprb with disconformable contact; contact with overlying map-unit CPbe has not yet been examined.

Age and correlation: no fossils; interfingering facies relationship with Belcher Channel Formation suggests a Late Carboniferous and Early Permian age; may be local, restricted facies of Hare Fiord Formation.

Mode of origin: deposited in restricted, evaporitic basin.

Map-unit CPc (c = carbonate rocks)

Nomenclature: informal lithological designation.

Lithology: at Clements Markham Inlet poorly exposed carbonate rocks, probably mainly limestone, in part bioclastic; limestone and sandy limestone at Cape Nares (Christie, 1964); basal redbeds are included where unit overlies lower Paleozoic and older rocks.

Distribution and thickness: W of Clements Markham Inlet and Cape Nares; 400-500 m (estim.).

Contact relationships: lower contact not observed, may overlie map-unit Cc with disconformity; grades laterally into map-unit CPbe; overlain by Assistance Formation with abrupt, disconformable contact.

Age and correlation: no datable fossils; unit is presumed to be Late Carboniferous-Early Permian in age because it is overlain by Assistance Formation; probably correlative with Belcher Channel Formation.

Mode of origin shallow carbonate platform?

Map-unit Pc (c = carbonate rocks)

Nomenclature: informal lithological unit.

Lithology: medium to thick-bedded limestone (interbedded lime mudstone and skeletal packstone and grainstone) with chert nodules.

Distribution and thickness: S of Markham Fiord; 500 m (estim.).

Contact relationships: conformably overlies evaporites of map-unit CPpe; overlain by van Hauen Formation with abrupt, probably disconformable contact.

Age and correlation: **Kleopatrina (Porfirievella)** sp. indicates that at least part of unit is Early Permian in age (E.W. Bamber, pers. comm., 1978); probably correlative with Tanquary Formation.

Mode of origin: shallow subtidal platform.

van Hauen Formation (included with Degerböls Formation in map-unit Pv, d)

Nomenclature: defined by Thorsteinsson (1974) with type section at van Hauen Pass, NW Ellesmere Island.

Lithology: thin-bedded, light coloured, spicular chert.

Distribution and thickness: S of Markham Fiord; 75 m.

Contact relationships: overlies map-unit Pc with abrupt, probably disconformable contact; overlain by Degerböls Formation; contact not exposed here, disconformable elsewhere (Thorsteinsson, 1974).

Age and correlation: no fossils from this area; age bracketed by Early Permian age of underlying map-unit Pc and Late Permian age of overlying Degerböls Formation; elsewhere the formation is assumed to be late Early Permian (Artinskian) in age (Thorsteinsson, 1974). Chert beds at top of Belcher Channel Formation E of James Ross Bay and a unit of black shale and siliceous siltstone at base of Assistance Formation S of Parker Bay are both probably correlative with parts of van Hauen Formation.

Mode of origin: deposited in subtidal starved (?) basin.

Degerböls Formation (included with van Hauen Formation in map-unit Pv, d)

Nomenclature: defined by Thorsteinsson (1974) with type section near van Hauen Pass, NW Ellesmere Island.

Lithology: brachiopod coquina overlain by interbedded chert and argillaceous limestone.

Distribution and thickness: S of Markham Fiord; 160 m+.

Contact relationships: lower contact, with van Hauen Formation, not exposed; disconformable elsewhere (Thorsteinsson, 1974); upper contact not preserved (faulted against Ordovician M'Clintock Formation).

Age and correlation: brachiopods from lower part are early Late Permian (early Wordian, early Guadalupian) in age (B.R. Wardlaw, pers. comm., 1980) and coeval with brachiopods from Trold Fiord Formation S of Piper Pass.

Mode of origin: deposited on carbonate platform(?).

Assistance Formation (map-unit Pa)

Nomenclature: defined by Harker and Thorsteinsson (1960) with type section on Grinnell Peninsula, Devon Island.

Lithology: black shale and dark grey, siliceous siltstone in lower part overlain with gradational contact by richly fossiliferous limestone.

Distribution and thickness: NW side of Clements Markham Inlet, S of James Ross Bay, Feilden Peninsula; 178 m+.

Contact relationships: overlies Belcher Channel Formation and map-unit CPc with abrupt, probably disconformable contacts; upper contact not preserved.

Age and correlation: fossils from present map-areas have not yet been identified; brachiopods from Henrietta Nesmith Glacier in the Tanquary Fiord map-area, adjacent on the SW, are late Early Permian (Artinskian) in age (B.R. Wardlaw, pers. comm., 1980; Mayr et al., 1982). The lower unit of dark grey siltstone and shale probably correlates with part of the van Hauen Formation.

Mode of origin: deposited on shallow marine carbonate platform.

Trold Fiord Formation (map-unit Ptf)

Nomenclature: defined by Thorsteinsson (1974) with type section near Cañon Fiord, central Ellesmere Island.

Lithology: light grey to white, fine to medium grained sandstone, in part pebbly or calcareous; minor sandy limestone and shale; herringbone ripple marks and low-angle crossbedding; **Spirophyton** common, some vertical burrows, brachiopods and plant remains (Miall, 1978).

Distribution and thickness: southern entrance to Piper Pass; 480 m+.

Contact relationships: overlies Grant Land and Hazen Formations with high angular unconformity; contact with adjacent Triassic rocks is faulted.

Age and correlation: brachiopods collected by Miall (Miall, 1978) indicate an early Late Permian (Wordian, Guadalupian) age (B.R. Wardlaw, pers. comm., 1978).

Mode of origin: coastal sand deposited in intertidal to shallow subtidal settings including foreshore or shoreface (Miall, 1978).

UNDIVIDED UPPER PALEOZOIC AND MESOZOIC

Map-unit PR

Nomenclature: informal map-unit.

Lithology: white, quartzose sandstone, siltstone, shale.

Distribution: S of entrance to Piper Pass, S of Divide Glacier to E of Turnabout Glacier.

Contact relationships: bounded by thrust faults.

Age and correlation: Permian and Triassic, includes mainly Trold Fiord Formation (Late Permian) and Blind Fiord Formation (Early Triassic).

Map-unit CPM

Nomenclature: informal map-unit, includes stratigraphic units listed below.

Distribution: SW of Turnabout Glacier to Gilman River.

Age, stratigraphic unit, lithology, thickness: (based on stratigraphic sections along Gilman River and in adjacent Lady Franklin Bay map-area).

Upper Carboniferous (?) and Lower Permian	Belcher Channel Fm.	limestone	
Upper Permian	Trold Fiord Fm.	sandstone	250 m
Lower Triassic	Blind Fiord Fm.	siltstone, shale	113 m
Upper Triassic	Hoyle Bay Fm.	siltstone, shale	24 m
Upper Triassic	Pat Bay Fm.	sandstone	13 m
Upper Triassic	Barrow Fm.	shale	20 m
Upper Triassic	Heiberg Fm.	sandstone	20 m
Lower Jurassic	Sandy Point Fm.	sandstone	50 m
Middle Jurassic	Hiccles Cove Fm.	sandstone	60 m
Upper Jurassic	Ringnes Fm.	shale	100 m
Upper Jurassic	Awingak Fm.	sandstone	120 m
Lower Cretaceous	Deer Bay Fm.	shale	40 m
Lower Cretaceous	Isachsen Fm.	sandstone	30 m

Contact relationships: basal contact is thrust fault; conformably overlain by Christopher Formation.

MESOZOIC

Christopher Formation (map-unit Kc)

Nomenclature: defined by Heywood (1957) with type section on NW Ellef Ringnes Island.

Lithology: medium to dark grey, silty shale with siltstone interbeds and a variety of concretion types.

Distribution and thickness: (1) core of syncline, SW of Turnabout Glacier to Gilman River; only basal part (about 200 m) preserved; (2) S of entrance of Piper Pass beneath thrust fault; only upper part (about 100 m) exposed.

Contact relationships: overlies Isachsen Formation and underlies Hassel Formation, both contacts conformable.

Age: late Early Cretaceous (Albian) on basis of foraminifera.

Mode of origin: deposited below wave base in outer marine shelf environment.

Hassel Formation (map-unit Kh)

Nomenclature: defined by Heywood (1957) with type section on central Ellef Ringnes Island.

Lithology: fine to medium grained sandstone with interbeds of carbonaceous siltstone and shale, and coal; upward fining sequences present; two flows of tholeiitic basalt with high Fe, Ti (for outcrop area, petrography and chemical composition see Osadetz, in prep.).

Distribution and thickness: S of entrance of Piper Pass in footwall of thrust; about 200 m (estim.); basalt flows up to 20 m thick.

Age: late Early Cretaceous (late Albian) on basis of pelecypods (J.A. Jeletzky, pers. comm., 1981).

Mode of origin: deposited in delta front and delta plain environments.

Mafic sills (map-unit Km; m= mafic intrusion)

Numerous basic dykes and sills are present but only two outcrops of a major sill NE of Eugene Glacier are shown. A thin section of one of these consists of olivine diabase. This intrusion is tentatively correlated with the volcanics in the Lower Cretaceous Hassel Formation.

TERTIARY

Eureka Sound Formation, sandstone-mudstone member (map-unit Te)

Nomenclature: Eureka Sound defined as group by Troelsen (1950), redefined as formation by Tozer (1963); informal sandstone-mudstone member in present area named by Miall (1979).

Lithology

Clements Markham Inlet map-area (after Miall, 1979): sandstone, siltstone, mudstone, coal with rare pebble to cobble conglomerate; units are lenticular; upward fining sequences common.

Sandstone: very fine to very coarse grained, weakly cemented; planar and trough crossbeding, horizontal lamination, ripple marks; carbonaceous debris (incl. logs), ironstone intraclasts, rare pelecypods shells.

Coal: mostly thin and lenticular but more extensive seams up to 3 m thick also present; abundant amber.

Conglomerate: phenoclasts are of sandstone, conglomerate, limestone, diabase, ironstone.

Robeson Channel map-area, outcrop S of Lincoln Bay; reconnaissance section, measured (by means of altimeter) by R.L. Christie (unpubl. field notes, 1965) contact with Imina Formation not exposed.

1	Coal, shaly, crumbly weathering	8' (2.4 m)
2	Sandstone, feldspathic, micaceous with carbonaceous markings and partings, fine to medium grained at base, thin-bedded	162' (49 m)
3	Shale, sandy, weakly indurated, brown	250' (76 m)
4	Sandstone, minor shale, intraformational conglomerate, conglomerate	
	sandstone: medium grained; thick horizontal bedding, lenticular bedding, crossbedding; coaly fragments up up to 5 mm and stem impressions	
	shale: thick-bedded, brown, with brown concretions	
	intraformational conglomerate: shale balls and flakes up to 2 cm long in sandy matrix,	
	conglomerate: quartz pebbles to 5 mm and rock fragments, mainly shale and hard, green and grey mudstone	150' (46 m)

Distribution and thickness: (1) SW part of Clements Markham Inlet area; est. 150-450 m, thickening to the S (Miall, 1979); (2) Robeson Channel map-area, S of Lincoln Bay; 174 m+ (Christie, unpub., 1965).

Contact relationships: overlies Imina Formation with high angular unconformity and Hassel Formation with disconformity; conformably overlain by conglomerate member of Eureka Sound Formation.

Age: palynomorphs from various localities in the Clements Markham Inlet area and adjacent Lady Franklin Bay map-area indicate that most of the strata are Eocene (and possibly Oligocene) in age (Christie and Rouse, 1976; Miall, 1979). However, a pine cone of Miocene (or younger) age was found by Blackadar (1954) immediately E of Eugene Glacier (see fossil locality). This suggests that equivalents of Beaufort Formation are present locally.

Mode of origin: deposited mainly by meandering rivers, to a lesser extent by braided rivers; sediments derived from lower Paleozoic strata to S (Miall, 1979).

Eureka Sound Formation, conglomerate member (map-unit Tecg)

Nomenclature: informal member, named by Miall (1979).

Lithology: (after Miall, 1979) conglomerate with lesser amounts of interbedded sandstone; both weakly indurated and generally poorly exposed. Conglomerate ranges up to boulder grade, maximum clast size 1.3 m; clast types include sandstone, limestone, conglomerate, diabase and dark mudstone. Sandstone shows planar and trough crossbedding.

Distribution and thickness (after Miall, 1979): Boulder Hills and butte S of Turnabout Glacier; 450 m+ (top not preserved).

Contact relationships: conformably overlies sandstone-mudstone member (Miall, 1979).

Age: no fossils; Eocene, Oligocene or Miocene; Miall (1979) favours Oligocene on basis of stratigraphic relationships with sandstone-mudstone member.

Mode of origin: deposited on alluvial fans bordering Lake Hazen Fault Zone; sediments derived from lower Paleozoic and Mesozoic sediments and sills NW of fault zone (Miall, 1979).

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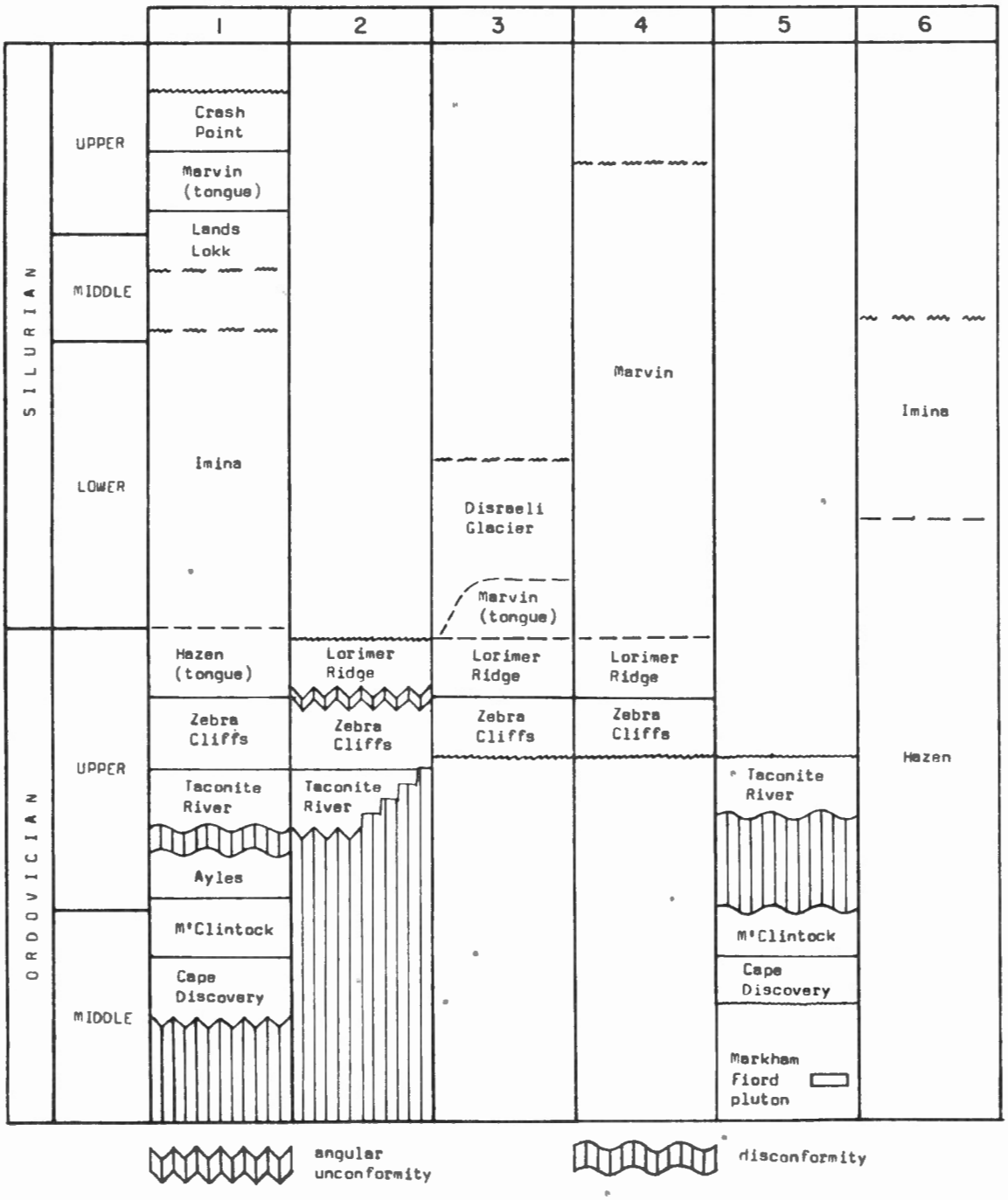

Figure 2b: Tentative correlation, Middle Ordovician to Upper Silurian units, northeasternmost Ellesmere Island

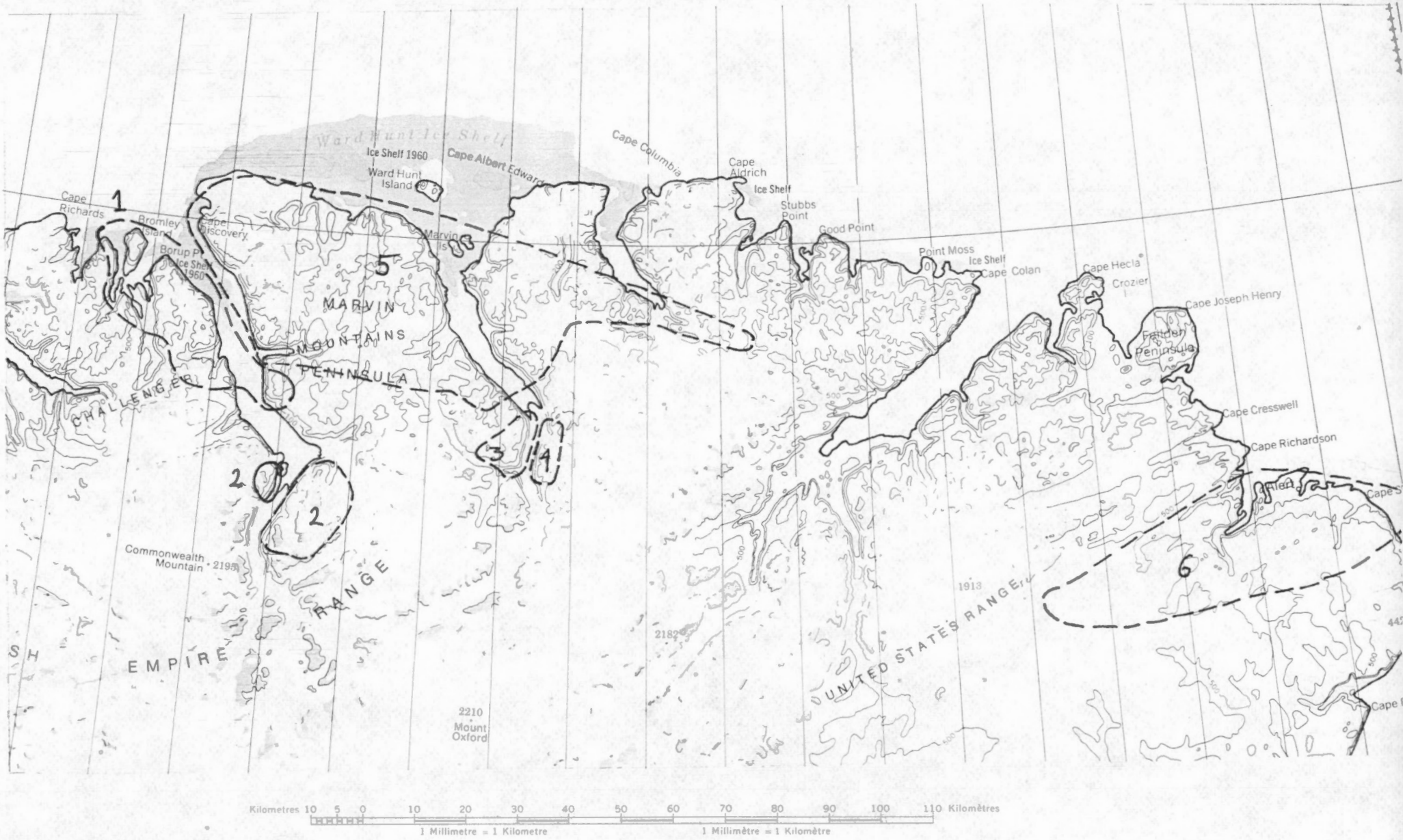

Figure 2a: Index for correlation chart, Fig. 2b

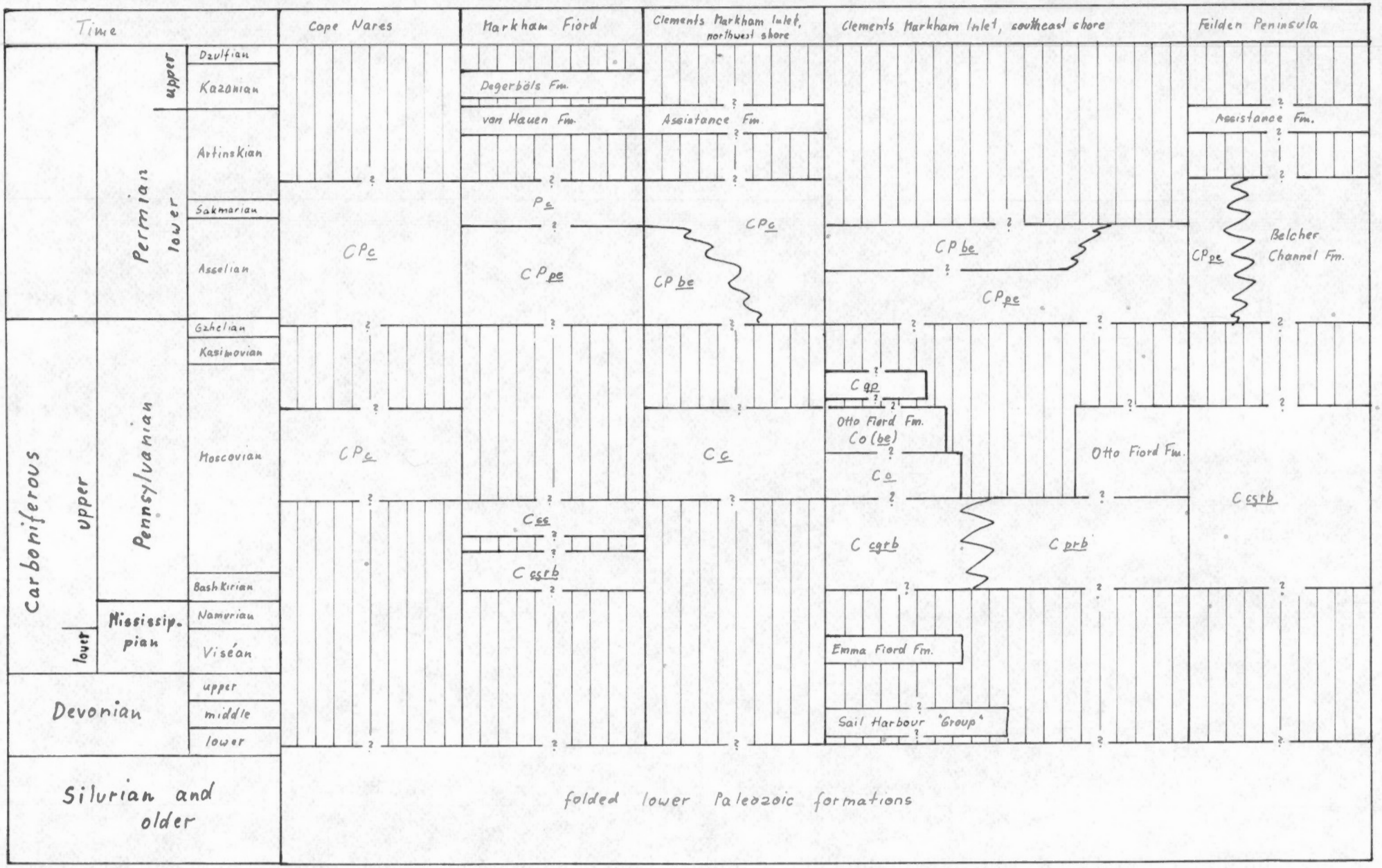

Figure 3: Tentative correlation, Devonian to Permian rocks, northern part of Clements Markham Inlet and Robeson Channel map-areas

QUATERNARY

Q — unconsolidated sediments

TERTIARY

mainly early Tertiary (Eocene and ? Oligocene); may include some Miocene

Eureka Sound Formation

conglomerate member

Tecg — pebble to boulder conglomerate, sandstone

sandstone-mudstone member

Te — sandstone, mudrock; minor coal, conglomerate

CRETACEOUS

Lower Cretaceous

Hassel Formation

Kh — sandstone, siltstone, shale, coal, basalt

Christopher Formation

Kc — silty shale, siltstone

CRETACEOUS

Lower Cretaceous

Km — mafic sills

CARBONIFEROUS (?), PERMIAN AND MESOZOIC

Upper Carboniferous or Lower Permian to Lower Cretaceous

CPM — sandstone, shale, siltstone; minor limestone

PERMIAN AND TRIASSIC

mainly Upper Permian and Lower Triassic

PTr — sandstone, siltstone, shale

CARBONIFEROUS AND (?) PERMIAN

Upper Carboniferous and (?) Permian (undifferentiated)

CP — dolostone, in part brecciated; sandstone mudrock, conglomerate, limestone; minor anhydrite

(Cl. Markham Inl.-Robeson Ch. legend, p.1)

PERMIAN

Lower and Upper Permian

van Hauen and Degerböls formations

$P_{v,d}$ — chert, brachiopod coquina, argillaceous limestone

Lower Permian

P_c — limestone, chert nodules

PERMIAN

Upper Permian

Trold Fiord Formation

P_{tf} — sandstone, in part pebbly or calcareous; minor sandy limestone, shale

Lower Permian

Assistance Formation

P_a — shale, siltstone, limestone

CARBONIFEROUS AND PERMIAN

Upper Carboniferous and Lower Permian

CP_{be} | CP_{pe}

CP_{be}: dolomitic solution collapse breccia, anhydrite

CP_{pe}: shale, minor sandstone, siltstone; anhydrite

CARBONIFEROUS AND PERMIAN

Upper Carboniferous and Lower Permian

CP_c — limestone, sandy limestone; locally with redbeds at base

CARBONIFEROUS AND PERMIAN

Upper Carboniferous and Lower Permian

Belcher Channel Formation

CP_{bc} — limestone

CARBONIFEROUS

Upper Carboniferous

C_{qp} — sandstone, orthoquartzite, slaty mudrock

Otto Fiord Formation

Co | Co(be)

Co: anhydrite; minor sandstone, dolomite

Co(be): dolomitic breccia

C_{ss} — calcareous sandstone; minor limestone, siltstone

C_{cgrb} — sandstone, conglomerate; minor shale, siltstone

CARBONIFEROUS

Upper Carboniferous

C_c — dolomite; locally with conglomerate and sandstone at base

CP_{rb} — maroon calcareous siltstone, argillaceous limestone; locally red and green slaty mudrock; minor sandstone

(Cl. Markham Inl.- Robeson Ch. legend, p. 2)

CARBONIFEROUS

Lower Carboniferous

Ce — Emma Fiord Formation
sandstone, shale

DEVONIAN

Lower Devonian (?)

D sh — Sail Harbour "Group"
mudstone, siltstone, sandstone; minor impure limestone, dolomite

SILURIAN

Middle and Upper Silurian

Se — Lands Lokk Formation
sandstone, mudrock; minor intraformational and pebble conglomerate

Lower and Middle Silurian

Si — Imina Formation
calcareous and dolomitic sandstone and mudrock; minor granule and pebble conglomerate

Lower Silurian

Sdg 2 — Disraeli Glacier beds
Member B
sandstone, conglomerate; minor mudrock

Sdg 1 — Member A
calcareous mudrock; minor argillaceous limestone

ORDOVICIAN AND SILURIAN

Upper Ordovician to Upper Silurian

Sm — Marvin Formation
limestone, dolostone
Sm3: tongue of upper Marvin Formation (Upper Silurian); limestone, mudrock
Sm3p: mainly mudrock and argillaceous limestone
Sm3c: mainly limestone
Sm3?; dolostone, sandy dolostone, dolomitic sandstone; minor conglomerate
(could be younger than Marvin Fm.)

(Cl. Markham Inl.-Robeson Channel legend, p. 3)

CAMBRIAN (?), ORDOVICIAN AND SILURIAN

Lower Ordovician (or older) to
Lower Silurian

ϵ-Sh — Hazen Formation
resedimented limestones (lime mudstone,calcisiltite,calcarenite; minor pebble conglomerate),variably pelitic, sandy,dolomitic; radiolarian chert with interlaminated claystone;secondary chert; mudrock and sandstone,both variably calcareous and dolomitic
OSh1: carbonate member --mainly resedimented limestone,mudrock and sandstone,minor chert (Ordovician and ? Cambrian)
OSh2: chert member --mainly radiolarian chert with interlaminated claystone,minor resedimented limestone

CAMBRIAN AND (?) ORDOVICIAN

Cambrian and (?) Lower Ordovician

ϵ_g — Grant Land Formation
quartzite,variably feldspathic; mudrock,slaty,phyllitic;minor pebble conglomerate; locally schist

ORDOVICIAN AND/OR SILURIAN

OSv — volcanic rocks, mainly pyroclastics of siliceous composition;minor limestone, chert (stratigraphic position unknown)

ORDOVICIAN

Upper Ordovician

Oe — Lorimer Ridge beds
sandstone,mudrock;minor limestone, conglomerate

Ozc — Zebra Cliffs Formation
mainly limestone;locally dolostone,sandstone, mudrock, conglomerate

Otr — Taconite River Formation
sandstone,mudrock;minor limestone, conglomerate

Middle and Upper Ordovician

Omc — M'Clintock Formation
basalt,andesite,dacite,rhyolite (flows and pyroclastics);minor volcanic-derived sediments

Early or Middle Ordovician

Oqm — Markham Fiord pluton
quartz monzodiorite,granodiorite and related granitic rocks;minor diabase,serpentinite

EARLY PALEOZOIC AND (?) OLDER
(stratigraphic order uncertain)

d — dolostone

vs — quartz-carbonate-chlorite schist

(Cl. Markham Inl.-Robeson Ch. legend, p. 4)

CPssm	carbonate rocks,slate,sandstone; abundant mafic sills
Cp	recrystallized limestone,slate
Cpxq	dolostone,limestone,marble;mudrock,slaty phyllitic,in part sandy or sandy and conglomeratic; greywacke,conglomerate,quartzite,schist; minor andesite

PROTEROZOIC

Helikian (?)

P s	schist
P h	Cape Columbia Complex gneiss,amphibolite,pegmatite,meta-gabbro; minor quartzite,marble

(Cl. Markham Inl.-Robeson Ch. legend, p. 5)

geological boundary (defined, approximate, assumed; projected through ice or overburden)

fault (defined, approximate, assumed or projected through ice or overburden; solid circle indicates downthrow side)

thrust fault, assumed or projected through ice or overburden; overturned thrust (teeth on upthrust side)

lineament visible on air photographs

anticline (arrow indicates plunge)

syncline

synform

strike and dipp of bedding, tops known

strike and dip of bedding , tops unknown; dip estimate from air photographs

- g: gentle (about 3^{o}-10^{o})
- m: medium (about 10^{o}- 25^{o})
- s: steep (about 25^{o}- 45^{o})
- vs: very steep (about 45^{o}- 89^{o})

vertical

trend of bedding

helicopter landing, outcrop observation or sample locality

fossil locality

isotopic age determination

stratigraphic section (longer, short)

<u>Note</u>: only some sample or fosssil localities and stratigraphic sections are shown