STRATIGRAPHY AND TERRESTRIAL PALYNOLOGY OF LATE CRETACEOUS ECLIPSE GROUP STRATA, BYLOT ISLAND, NORTHWEST TERRITORIES, CANADA

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by

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ABSTRACT

Upper Cretaceous " Kanguk " strata on Bylot Island have been informally divided into three new, lithologically distinct formations: the Byam Martin Formation (mid to late Campanian), the Sermilik Formation (late Campanian to early late Maastrichtian) and the Bylot Island Formation (late Campanian to late Maastrichtian). These formations and Tertiary formations (not studied herein), comprise the Eclipse Group.

The Byam Martin Formation consists of mudstone, sandy mudstone and minor sandstone, and originated as basin plain and turbidite deposits followed by regressive marginal marine deposits of deltaic? origin. The Byam Martin Formation is conformably overlain by the Sermilik Formation in the south and the Bylot Island Formation in the north. The Sermilik Formation represents a major late Cretaceous regressive event, and is comprised of coarse-grained sandstones that were shed from the adjacent Byam Martin Mountains. These sandstones are preserved as braid delta and submarine fan deposits. The Bylot Island Formation conformably overlies the Sermilik Formation, and is in part a lateral equivalent to the Sermilik Formation. The Bylot Island Formation is comprised of mudstone and minor sandstone, representing slope, basin plain and turbidite deposits. Uppermost Bylot Island Formation strata conformably overlie the Sermilik Formation and represent a

late Maastrichtian transgression within Eclipse Trough.

Three informal palynomorph assemblage zones are recognized in these rocks: Gleicheniidites sp. cf. G. circinidites - Antulsporites distaverrucosus (GA) zone, the Porosipollis porosus - Aquilapollenites scabridus (PA) zone and the Singularia aculeata - Pesavis parva (SP) zone. These zones support lithostratigraphic correlations between south coast and Twosnout Creek sections. The GA zone of mid to late Campanian age is characterized by the occurrence of late Cretaceous palynomorphs Carpinipites ancipites, Hazaria sheopiarii, and Polyatriopollenites stellatus. Its age is in part based on the overlying PA zone. The PA zone, of late Campanian to mid Maastrichtian age is characterized by the first occurrence of several biostratigraphically important late Cretaceous palynomorphs. Diagnostic species include Ceratiopsis diebelii, Palaeoperidinium kozlowskii, Momipites wyomingensis, Wodehouseia gracile and Porosipollis porosus. The SP zone of late Maastrichtian age is characterized by the first occurrence of Pesavis parva and Paraalnipollenites alterniporus.

These pollen floras are similar to other late Campanian to Maastrichtian assemblages from Banks Island, Horton River and Police Island, N.W.T..

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CHAPTER 1 INTRODUCTION

1.1 Purpose and Objectives

Exposures of Cretaceous and Tertiary strata are rare in the eastern Canadian Arctic (Miall et al., 1980). Thus, a thick sequence of Cretaceous and Tertiary strata preserved in Eclipse Trough, Bylot Island (Figure 1.1) contains important evidence for interpreting the geologic history of the eastern Canadian Arctic. This study focuses on late Cretaceous "Kanguk Formation" strata of Bylot Island. The research involves the identification of stratigraphic units, an interpretation of their depositional environments, and the use of palynological data to correlate and date these units.

1.2 Location and Access

Bylot Island is situated at the northeastern tip of Baffin Island in the Northwest Territories (Figure 1.1), and encompasses an area of approximately 14,400 sq. km. The study area lies on southwest Bylot Island, where Cretaceous and Tertiary strata are exposed within the Eclipse Trough (Figure 1.1).

Canadian Airlines provided transportation north from Montreal to Pond Inlet, on nearby Baffin Island. Bylot Island is uninhabited; thus plans had to be finalized and sufficient supplies acquired prior to departure from Pond Inlet. The 4 man field party, including equipment, was

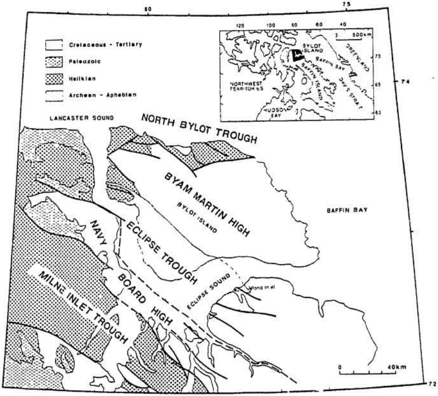

Figure 1.1 Regional Setting of Eclipse Trough (after Miall <u>et al.</u>, 1980). Inset shows location of Bylot Island in the southeastern Canadian Arctic.

transported across the sea ice on Eclipse Sound with a komatik and skidoo (Figure 1.2). Ice conditions were favourable for the trip, although breakup occurred rapidly in the days following. Helicopter support throughout the field season (July 6th - August 6th, 1987) provided food, supplies, camp moves, support during traverses and final transport back to Pond Inlet.

1.3 Weather Conditions

Weather conditions were monitored on a daily basis with a comprehensive report being submitted to Polar Continental Shelf Project (PCSP) at the culmination of the field season.

Temperatures varied between -1° C and 6° C, with high winds gusting continuously for days. Few sunny days were recorded; overcast conditions prevailed, with precipitation being predominantly in the form of fog and drizzle. Early August saw colder conditions and light snowfall.

1.4 Field Methods

Four stratigraphic sections along the southern shore of Bylot Island and on western Bylot Island at Twosnout Creek were measured for palynology and sedimentology (Figure 1.3). Sections were generally well exposed, with lateral facies changes being unobscured by post depositional features such as faulting or slumping. Weathering of the exposures and cryoturbation was responsible for the distortion of some

Figure 1.2 Traditional transportation methods used by local Inuit provided initial access to the field area.

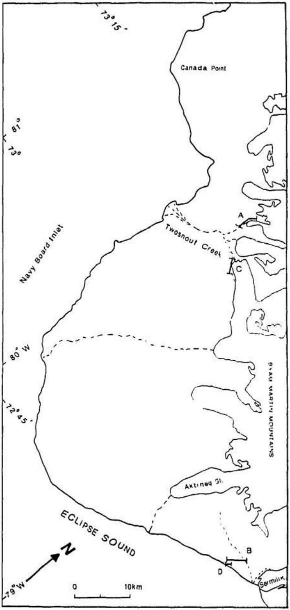

Figure 1.3 Location map of stratigraphic sections.

structures.

Sedimentology was carried out noting lithology, bed thickness, cyclicity, color, grain size, bed contacts, sedimentary structures and fossil content. Seventeen sandstones were collected and thin sectioned for petrography.

One hundred fifty palynomorph samples were collected and forty were processed. Samples were normally collected at 15 metre intervals; where tighter control was warranted, samples were collected at 5 metre spacings.

No systematic search was conducted for vertebrate or invertebrate remains. Discoveries of vertebrates during routine measuring and collecting were recorded for proper collection and preservation at some later date. Only small isolated bones, bone fragments, and teeth, in danger of destruction were collected for preservation. A small suite of invertebrates was also collected for identification and preservation.

1.5 Previous Studies

The earliest documented record of the geological history of Bylot Island was submitted in a report to the Department of Marine and Fisheries, Ottawa, by A.P. Low (1906), a geologist with D.G.S. Neptune. He reported that the northern and eastern coasts of Bylot Island appeared to be wholly formed of crystalline rocks.

The first extensive geological study of the coast of Bylot Island was administered and recorded by Captain J.E. Bernier (1910) of the D.G.S. Arctic. During routine prospecting at Canada Point on Bylot Island (Figure 1.3), Bernier's second officer, R.S. Janes, noted a similarity between these rock formations and those observed at the Salmon River coal deposit, near Pond Inlet (North Baffin Island). Further investigations at this locality uncovered fossilized trees and buds. An extensive coal seam was also discovered, thus confirming the relationship with the Salmon River coal beds.

The first systematic geological investigation of the entire island was carried out by the Geological Survey of Canada in 1968 (Jackson, 1969). The project resulted in the publication of two reports, each with a geological map at a 1:250,000 scale. The first was by Jackson and Davidson (1975) for the area north of 73° latitude, the other, by Jackson et al., (1975), described the southern half of Bylot Island and northern Baffin Island.

Jackson and Davidson (1975) introduced the epithet Eclipse Group for at least 1067 metres of Cretaceous - Tertiary sediments on Bylot Island. Sediments within the group were divided into four map units (Table 1.1). Palynology by W.S. Hopkins and D.C. McGregor (Jackson and Davidson, 1975) indicated an early Cretaceous to Eocene age.

TABLE 1.1

Map units of Jackson and Davidson (1975)

GROUP	MAP UNIT	LITHOLOGY
ECLIPSE GROUP	T	Fissile shale, mudstone, siltstone
	KT_2	Arkosic sandstone, siltstone, rare coal
	KT_1	Subgreywacke, quartzwacke, mudstone, siltstone
	K	Orthoquartzite, arkosic sandstone, coal

These strata were examined by B. Clarke of Shell Oil Company in 1973. Clarke (*in* Jackson *et al.*, 1975) indicated the Eclipse Group may be much thicker than originally thought, possibly 1830 metres thick, and that the section may thin westward. A suite of samples from the Eclipse Group submitted to Aquitaine Company of Canada Ltd. for hydrocarbon studies (Jackson *et al.*, 1975), showed that the organic matter was incapable of sourcing viable quantities of hydrocarbons.

Cretaceous - Tertiary strata were investigated by Miall *et al.*, (1980). From sedimentology and palynology, Miall *et al.*, (1980) revised the map units established by Jackson and Davidson (1975) and Jackson *et al.*, (1975). Miall *et al.*, (1980) recognized three formations: Hassel - Early Cretaceous; Kanguk - Late Cretaceous; Eureka Sound - Tertiary (Table 1.2), (Figure 1.4). These formations are widespread throughout the Arctic Islands (Miall *et al.*, 1980). In reclassifying the Cretaceous - Tertiary stratigraphy, Miall *et al.*, (1980) dropped the term Eclipse Group. Miall (1986) redefined the Eureka Sound Formation as a group, combining the Te^1 and Te^2 members into the Mount Lawson Formation, and the Te^3 and Te^4 members into the Mokka Fiord Formation.

Ioannides (1986) used dinoflagellate cysts to provide a more concise age assignment, (late Campanian to Maastrichtian) for the Kanguk Formation and (late

Table 1.2

Map units of Bylot Island

(units mapped by Miall *et al.*, 1980)

Map Unit	Formation	Thickness (m)	Lithology
Te^4	Eureka Sound	200+	mudstone, minor sandstone
Te^3		1370+	immature sandstone, minor siltstone, mudstone
Te^2		80-500+	mudstone, jarosite, minor sandstone
Te^1		0-200+	glauconitic sandstone
Kk^2	Kanguk	0-540	immature sandstone, minor siltstone, mudstone
Kk^1		560-590	mudstone
Kh	Hassel	10-120	sandstone, minor mudstone

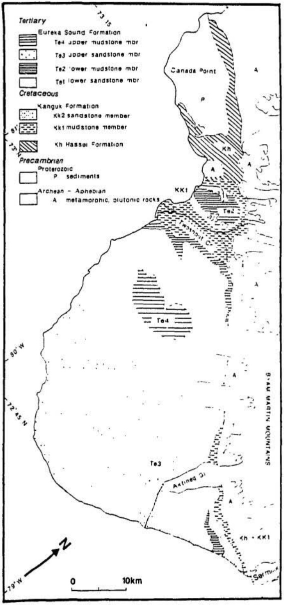

Figure 1.4 Cretaceous - Tertiary geology of southwest Bylot Island (after Miall et al., 1980).

Maastrichtian to Paleocene) for the Eureka Sound Group. The study suggested that revisions to the current stratigraphy are necessary.

1.6 Geologic Setting

Eclipse Trough is one of a series of fault-controlled basins in the North Baffin Rift Zone (Miall et al., 1980) (Figure 1.5). Extensional deformation propagated northwestward along pre-existing structural trends inherited from the Precambrian crystalline basement (Kerr, 1980). Approximately 1200 metres of Upper Cretaceous strata were deposited in response to faulting and extensional deformation during the Eurekan Rifting Episode (Kerr, 1980).

The Eurekan Rifting Episode occurred with the compressional deformation event (Eurekan Orogeny), which affected the Sverdrup Basin several hundred kilometres to the northwest (Thorsteinsson and Tozer, 1970). Both events, collectively known as the Eurekan Deformation, affected the Canadian Arctic in the late Cretaceous (Kerr, 1980). Structural and stratigraphic evidence also indicates that a physical barrier (Arctic Platform) separated the Sverdrup Basin and Eclipse Trough (Meneley et al., 1975; Balkwill, 1978; Kerr, 1980 and Miall, 1986), (Figure 1.6).

Prior to and during the onset of the Eurekan Deformation, marine sediments were thought to be accumulating in a widespread shallow sea that covered much

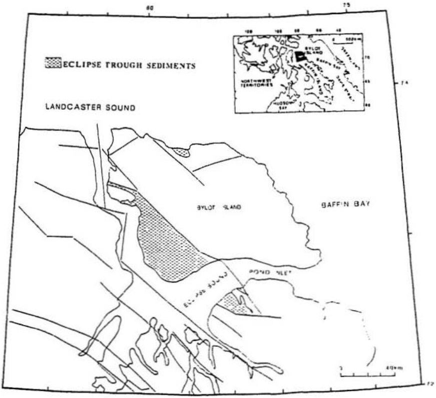

Figure 1.5 Dominant structural trends of Northern Baffin Island and Bylot Island, inherited from northwest trending structures in Precambrian crystalline basement (after Jackson and Iannelli, 1981).

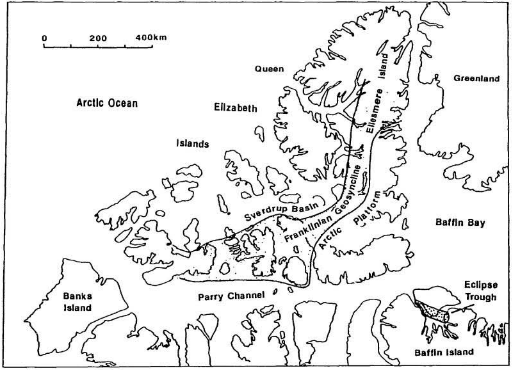

Figure 1.6 Map showing location of Arctic Platform relative to Eclipse Trough (after Kerr, 1980).

of the Arctic during the late Cretaceous (Kerr, 1980; Miall et al., 1980). The resultant sedimentary package has come to be known as the Kanguk Formation (Souther, 1963; Kerr, 1980; Miall et al., 1980).

The Kanguk Formation (Souther, 1963) was initially named for a 364 m thick marine succession of grey shale, in part silty, with minor amounts of sandstone, bentonitic shale and tuffaceous beds. Souther (1963) designated the type locality within the Sverdrup Basin as the Kanguk Peninsula, Axel Heiberg Island. Kanguk equivalent strata have been recognized elsewhere within the Sverdrup Basin on Ellef Ringnes Island (Grenier, 1963; Stott, 1969), Lougheed Island (Balkwill et al., 1982), Amund Ringnes Island (Balkwill, 1983), within the Banks Basin on Banks Island (Jutard and Plauchut, 1973; Miall, 1975; Miall, 1979) and within the Eclipse Trough on Bylot Island (Miall et al., 1980).

On Lougheed Island, Balkwill et al., (1982) assigned 200 metres of intercalated black, coaly, pyritic shale and fine-grained buff carbonaceous sandstone to the Kanguk Formation. Balkwill et al., (1982) noted that strata of Lougheed Island differed lithologically when compared to Kanguk strata in the type locality and its immediate vicinity (i.e. Amund Ringnes Island and Ellef Ringnes Island). Nevertheless, due to underlying and overlying relationships with assumed Hassel and Eureka Sound Formation strata, the rocks were assigned to the Kanguk Formation.

On Banks Island, 1000 km southwest of the type section, beds assigned to the Kanguk Formation have been divided into two members (Jutard and Plauchut, 1973): (1) a lower bituminous member, consisting of black bituminous shale, coal and carbonaceous shale; (2) and an upper shale member, consisting mainly of light grey shale, minor sandstone and rare jarosite layers. Miall (1979) further subdivided the Kanguk Formation on Banks Island into five members: a lower bituminous member; a lower silty shale; a lower sand; a silty shale; and an upper sand member.

The structural setting of the Banks Basin is similar to that for Eclipse Trough. The area underwent extensional deformation, contrasting in structural style with that of the Sverdrup Basin (Eurekan Orogeny). The Banks Basin was similarly separated from the Sverdrup Basin by part of the Sverdrup Rim (Storkerson Uplift) (Meneley et al., 1975) and part of the Prince Patrick Uplift (Cape Crozier Anticline) (Miall, 1979). Petrographic evidence indicates that sandstones within the Banks Basin were derived locally from the nearby Storkerson Uplift and the Cape Crozier Anticline, with the shale being derived from adjacent low-lying land areas (Miall, 1979).

Upper Cretaceous rocks on Bylot Island are very distinctive. They consist of up to 100 metres of grey lithified mudstone and muddy sandstone, 450 metres of black unconsolidated silty mudstone with randomly distributed sandstone beds and a 540 metre package of very coarse-grained marine sandstone. Petrographic evidence (Chapter 3) strongly suggests a local sediment source. The rocks are clearly distinct from strata identified as Kanguk Formation elsewhere in the arctic.

From comparisons in the literature, it is evident that several lithofacies variations exist between "Kanguk formation" strata of the Sverdrup Basin, Banks Basin and Eclipse Trough. As required by the North American Stratigraphic Code, a formation should be based strictly on description. Therefore, from descriptions, Upper Cretaceous "Kanguk formation" strata within the Eclipse Trough, the Sverdrup Basin and the Banks Basin comprise several distinct lithological and mappable formation rank units.

In addition to the lithostratigraphic evidence, structural and stratigraphic evidence suggests that "Kanguk" strata in the Eclipse Trough were affected by different tectonic regimes and are from different provenance than that for rocks of the Sverdrup Basin (Meneley et al., 1975; Balkwill, 1978; Kerr, 1980; and Miall et al., 1980).

To assign late Cretaceous strata of Bylot Island to the "Kanguk formation" of the Sverdrup basin would clearly be in violation of the North American Stratigraphic Code (Article 22a). In keeping with this code, late Cretaceous "Kanguk formation" strata on Bylot Island will be revised.

CHAPTER 2 STRATIGRAPHY

2.1 Introduction

From arguments presented in the preceding section, and in keeping with the North American Code on Stratigraphic Nomenclature, late Cretaceous strata on Bylot Island have been informally divided into three new and lithologically distinct formations. The epithet "Eclipse Group" of Jackson et al. (1975) is herein reinstated. It is comprised of three Cretaceous formations, herein named: the Byam Martin Formation, the Sermilik Formation, the Bylot Island Formation and Tertiary formations named and discussed by Waterfield (personal communication, 1989).

2.2 Byam Martin Formation

Definition, Distribution and Thickness

The Byam Martin Formation (named after the adjacent Byam Martin Mountains) is the lowest stratigraphic unit examined in this study. It consists of grey, well lithified mudstone; thin sandstone beds comprise less than 1% of the formation. The thickness at its type section at Twosnout Creek is 105 metres (Section A, Appendix A_1; Figures 2.1, 2.2), no other complete sections were measured. Talus and frost heave indicate that the formation extends south along the front of the Byam Martin Mountains to the Sermilik Glacier, one poorly exposed section in an outcrop near the Sermilik Glacier is 12 metres thick (Section B,

Figure 2.1 Type Section of the Byam Martin Formation.

Figure 2.2 Byam Martin Formation at Twosnout Creek. Close up of Type Section (largest interval of staff is 0.5 metres).

Appendix A_2).

Synonyms

The Byam Martin Formation includes the lower 100 metres of the Kanguk Formation (KK^1 mudstone member) of Miall et al., (1980) at Twosnout Creek. It is also equivalent to the entire Kanguk Formation (KK^1 mudstone member) exposed on the south coast of Bylot Island.

Contacts

At the type locality, the Byam Martin Formation unconformably overlies 14.5 metres of a basal sandstone, identified (in Miall et al., 1980) as Hassel Formation strata. Contact with the overlying Bylot Island Formation is gradational over several metres; the contact between these formations is placed on the upper contact of the last occurrence of lithified grey mudstone.

Poorly exposed strata of interbedded sandstone and muddy sandstone along the south coast suggest a transitional and probable conformable relationship with the overlying Sermilik Formation. The basal contact is not exposed in this area.

Lithology

The formation consists of well lithified grey (occasionally grey-black to red) mudstone with rare, centimetre to decimetre thick beds of medium-grained, white, weakly lithified subarkosic sandstone. Sandstone beds are laterally continuous for several tens of metres and frequently contain mudstone rip-up-clasts. Other sedimentary features include sandstone dykes and flame structures. Bioturbation is sporadic (1-5% - based on classification by Reineck and Singh, 1973). Burrows are horizontal and very small (1-2mm wide); they resemble Chondrites (Plate 1, Figure 1).

Immediately west of the Sermilik glacier, a 12 metre section outcrops adjacent to the Byam Martin Mountains. The sediments, where exposed in section, consist of poorly lithified, interbedded, very fine- to fine-grained white sandstone and brown muddy sandstone, and lesser coarser sands. Abundant, grey, lithified mudstone fragments are scattered about this hillside as frost heave, but nowhere are they exposed in section. Sedimentary structures are exclusively burrows; these vertical shafts (Plate 1, Figure 2) are confined to the muddier brown substrate. The section is only weakly bioturbated (5-30%), with burrows being infilled by coarser sand.

Petrology

Sandstones from the Byam Martin Formation straddle the boundary between the subarkose and quartzarenite fields (Figure 2.3; Appendix B_1, B_2, B_3). Orthoclase and andesine are the dominant feldspar types. Most feldspars are clear

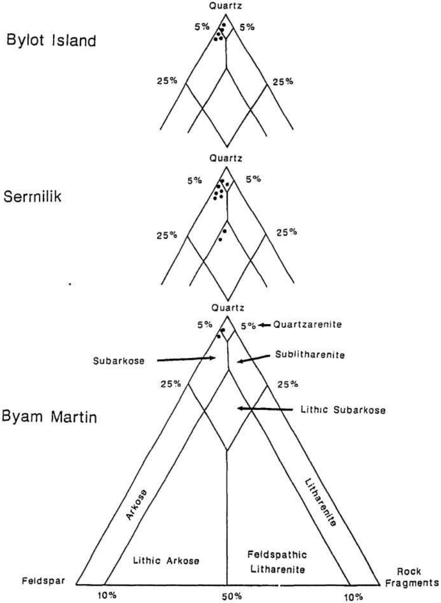

Figure 2.3 Detrital plots for sandstones.

and unaltered. However, two specific alteration types are recognized in the altered feldspars. An alteration assemblage of calcite and epidote is recognized as replacing some plagioclase grains, while sericite is noted as replacing the alkali grains. Heavy minerals identified in thin section include epidote and rutile. The adjacent Byam Martin Mountains provide an obvious source of detritus.

Clay matrix composes less than 5% of the total rock volume. Grains are rounded to well rounded, and moderately to well sorted.

Age

Palynomorph analysis (see Chapter 3) suggests a middle to late Campanian age for the Byam Martin Formation. This age assignment is based primarily on the absence of characteristic early Maastrichtian assemblages of Ceratiopsis, and Palaeoperidinium, and the conformable nature of the formation with the overlying early Maastrichtian strata.

Angiosperms recovered from the Byam Martin Formation included such genera as Carpinipites, Pseudoplicapollis, and Polyatriopollenites.

2.3 Sermilik Formation

Definition, Distribution and Thickness

The Sermilik Formation (named after the adjacent

Sermilik Glacier) conformably overlies the Byam Martin Formation. It is named after the Sermilik glacier, where the type section occurs (Section B, Appendix A_2), and is exceptionally well exposed (Figure 2.4). It is comprised of three lithotypes: a unit of weakly lithified, calcareous, buff colored, very coarse-grained sandstone; a green to buff unconsolidated, coarse-grained sandstone unit; and a grey, coarse-grained to conglomeratic unit. The thickness of the Sermilik Formation at its type section is 472 metres.

It also outcrops at Twosnout Creek; lenticular sandstone tongues of the Sermilik Formation (Lithotype 3) measuring between 17 and 40 metres in thickness, occur within the Bylot Island Formation (Figure 2.5). A reference section is herein included to demonstrate Lithotype 3 characteristics (Section C, Appendix A_3).

Synonyms

At its type section, the Sermilik Formation is equivalent to the KK^2 sandstone member of the Kanguk Formation of Miall et al., (1980). At Twosnout Creek, the Sermilik Formation is a series of tongues in the Bylot Island Formation. These sandstone tongues were not mentioned in Miall et al., (1980). They were recognized by Jackson and Davidson (1975), and incorporated into their Unit K of the Eclipse Group.

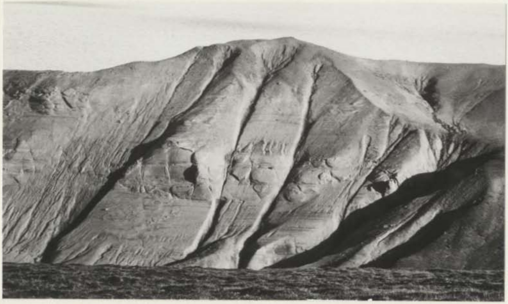

Figure 2.4 Type Section of the Sermilik Formation. Note the stacked channels at the center of the photo. Each channel is approximately 10 metres thick.

Figure 2.5 Sermilik Formation: Lithotype 3. Note the interfingering with Bylot Island Formation strata.

Contacts

The contact of the Sermilik Formation with the underlying Byam Martin Formation is not exposed. A river valley separates Byam Martin strata from the Sermilik Formation strata; nevertheless, a conformable contact is inferred within the stratigraphic succession. The basal contact is placed at the point where the first coarse-grained sandstone bed is observed. The upper contact with the overlying Bylot Island Formation is conformable and gradational over 10 metres, where coarse-grained sandstones of the Sermilik Formation become finer grained and interbedded with mudstones of the Bylot Island Formation. The contact is arbitrarily placed at the point where the average thickness of mudstone beds exceeds the thickness of sandstone beds.

At Twosnout Creek, lenticular sandstone pods are enveloped by Bylot Island Formation mudstone. These tongues suggest the Sermilik Formation is in part laterally equivalent with the Bylot Island Formation.

Lithology

The basal unit (Lithotype 1) is composed of 316 metres of well-sorted, buff to less commonly grey, medium- to very coarse-grained pebbly, subarkosic sandstone.

Beds are lenticular, with a maximum width of 200 metres. Thickness varies from decimetre to metre-thick units, with some individual beds reaching a maximum of ten metres (Figure 2.4). Contacts are always scoured. Some are incised up to 3 metres into underlying strata. The channeled bases contain rip-up-clasts, woody debris and well rounded pebbles or cobbles (Figure 2.6). Sediment grain size almost always decreases upwards to a medium-grained, occasionally bioturbated sandstone. Channels commonly erode previously deposited channel-fill to produce a series of stacked or multi-story sands which preserve only the coarse portion of the channel sequence.

Poor to well-defined planar-tabular and planar-tangential cross-stratification is preserved in channel sandstone bodies. Sets average 10 centimetres in thickness, the maximum set thickness is 30 centimetres. Cosets average one metre. However, one coset measured in the south coast (Section B, Figure 2.7) is 16 metres thick. Cross-bedding is unimodal; Miall et al., (1980) found a paleocurrent azimuth of 292°.

Other sedimentary structures in channel deposits include poorly defined trough cross-stratification averaging 15 centimetres in thickness and 50 centimetres in length. Packages of channelized beds exhibit fining and coarsening cycles over several metres. Diagenetic features evident include discontinuous centimetre to decimetre beds of round to platy calcite cemented concretions. Inter-channel strata consist of fining-upwards, decimetre thick beds of medium-

Figure 2.6 Channel cut-and-fill in Lithotype 1.

Figure 2.7 Sermilik Formation: Lithotype 1. Planar crossbedding with unimodal orientation.

grained argillaceous sandstones. Lateral tracing indicates beds thin and fine outwards from the channel margin. Some groups of stacked sandstone beds exhibit reactivation surfaces. Overall coarsening upward sequences are a common feature. Locally, ripple cross-stratification is preserved, but is rare.

Marine macrofossil debris is uncommon, only scattered pelecypod fragments were recovered, although, palynological evidence indicates an abundance of well preserved, late Cretaceous dinoflagellates.

A 156 metre thick unit (Lithotype 2) of green to buff, weakly consolidated, subarkosic sandstone directly overlies the lower buff unit. Beds from Lithotype 1 are gradational with beds of Lithotype 2.

Beds of Lithotype 2 are dominantly lenticular, with widths averaging between 10 and 20 metres. Decimetre thick units within beds are usual, though metre size beds are also present. Channelized bases frequently contain rip-up clasts with well rounded pebbles, cobbles, or boulders, and fine-upwards to a coarse-grained and muddy top. Channels are commonly stacked, and exhibit coarsening- and fining-cycles as in Lithotype 1.

Beds transitional with the Bylot Island Formation are finer-grained, and are lithified. Here, channelized sandstones exhibit a variety of sedimentary structures such as angular rip-up-clasts, poorly defined trough crossbedding, climbing ripple cross-laminations, parallel-laminations and large, round, metre size, carbonate cemented concretions (Figure 2.8).

Centimetre to decimetre beds of fine- to medium-grained, parallel bedded, muddy sandstone represent inter-channel areas. A variety of trace fossils, which include Diplocraterion, Skolithos, and Thalassinoides, have been identified (Plate 1, Figure 3). Marine macrofossil debris is abundant and diverse; fossils include bivalves, gastropods, marine reptile vertebrae (Plate 1, Figure 4), and shark teeth (Plate 1, Figure 5).

Lithotype 3 sediments are comprised of lentils of grey, coarse-grained pebbly and conglomeratic, lithic subarkose; and occur within the Bylot Island Formation at Twosnout Creek. These lentils are offshore extensions of the Sermilik Formation. Beds are lenticular; averaging between 5 and 20 metres in width and are preserved as decimetre to metre thick units.

Lithotype 3 is characterized by a polymodal, matrix supported, pebble to boulder conglomerate which fines upwards. Clasts are sub-angular to rounded. The average size is 40 centimetres and the maximum size is 80 centimetres. The clasts are composed of granitic, metamorphic and intraformational rock fragments. Coarsely crystalline bivalve debris is preserved in some intraformational clasts. Sedimentary structures include

Figure 2.6 Channel cut-and-fill in Lithotype 1.

Figure 2.7 Sermilik Formation: Lithotype 1. Planar crossbedding with unimodal orientation.

normal to reverse grading, trough cross-stratification, parallel laminations, flame structures and contorted beds. fossil invertebrates also occur as scattered debris and coquina of abraded bivalves, gastropods, echinoids, and scaphopods in sandstone beds.

Petrology

Sandstones from Lithotypes 1 and 2 of the Sermilik Formation fall clearly within the subarkose field (Figure 2.3), while sandstones from Lithotype 3 at Twosnout Creek fall within the lithic subarkose field. Feldspars are unaltered; the dominant types are orthoclase and andesine. Quartz grains are dominantly unstrained and monocrystalline. The dominant rock fragment recognized is a quartz rich plutonic rock. Other recognizable rock fragments include non-foliated metamorphic clasts and sedimentary clasts. Heavy minerals include biotite, garnet, tourmaline and pyroxene.

During routine measuring and sampling, pebbles and cobbles were visually examined for gross composition. Plutonic pebbles are the most common. These are followed by metamorphic pebbles or cobbles of mylonitic and gneissic origin. Sedimentary and volcanic pebbles were rarely observed.

Porosity in lithified samples (Appendix B_1) is consistently less than 5%. Some sandstone beds are cemented with calcite, which may comprise up to 30% of the total rock volume. Clay matrix accounts for less than 1% of the total rock volume. Both sorting and roundness are highly variable; grains range from poor to well-sorted and subangular to well-rounded.

The angularity and freshness of the plutonic rock fragments clearly suggests a first-cycle origin. Unnamed and undivided Archean-Aphebian plutonic rocks of the Byam Martin High are an obvious localized detrital source. The presence of sedimentary pebbles, volcanic pebbles, and accessory minerals (pyroxene) suggests that the sandstones were in part derived from rocks of the Mary River Group, adjacent the Sermilik Glacier.

Age

The age of the Sermilik Formation is designated by both macrofossil and microfossil evidence. The recovery of a dinosaur toe bone (Hadrosaur) (Plate 1, Figure 6) near the base of the formation (Lithotype 1) constrains the age, as Hadrosaurs lived between 65 and 75 million years ago (Russell, personal communication, 1987). One bivalve recovered from Lithotype 3 at Twosnout Creek was identified as Nemdon sp. by J. Haggart of the Geological Survey of Canada. This particular bivalve is restricted to the late Cretaceous (Cenomanian to Maastrichtian) of North America, Japan, and Madagascar (Cox et al., 1969). From palynology, the age of the Sermilik Formation is late Campanian to early late Maastrichtian. Characteristic palynomorphs include Wodehouseia, Momipites, Ceratiopsis and Palaeoperidinium.

2.4 Bylot Island Formation

Definition, Distribution and Thickness

The Bylot Island Formation is a sequence of black, friable silty mudstone, with subordinate medium-grained, subarkose and quartzarenite. At its type section at Twosnout Creek (Section A, Appendix A_1; Figure 2.9) the Bylot Island Formation is 420 metres thick. An additional section (Section C, Appendix A_3), incorporating Lithotype 3 strata of the Sermilik Formation, measured 80 metres in thickness. Along the south coast, a tongue of Bylot Island Formation extends into Sermilik Formation (Section D, Appendix A_4, Figure 2.10).

Synonyms

The Bylot Island Formation has been called the KK^1 mudstone member of the Kanguk Formation of Miall et al., (1980). In south coast sections, a tongue of Bylot Island strata was previously recognized as part of the KK^2 sandstone member of the Kanguk Formation. Waterfield (personal communication, 1989) has also shown that the Bylot Island Formation along the south coast is equivalent to the Te^2 mudstone member of Miall et al., (1980).

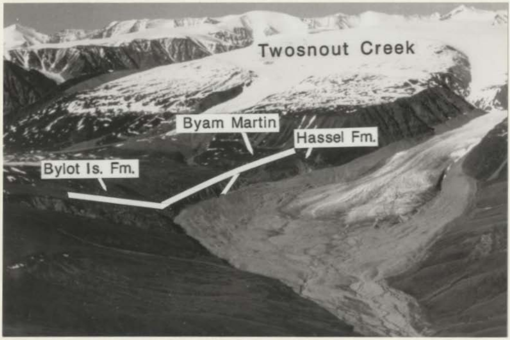

Figure 2.9 Type Section of the Bylot Island Formation.

Figure 2.10 Tongue of Bylot Island Formation strata interfingering with Sermilik Formation (Lithotype 1 and Lithotype 2).

Contacts

The contact with the underlying Byam Martin Formation is gradational. Lithified grey mudstones of the Byam Martin Formation become interbedded with black, friable silty mudstones of the Bylot Island Formation. The contact between these formations is placed directly on the upper contact of the last occurrence of lithified grey mudstone.

Overlying the Bylot Island Formation is the Pond Inlet Formation (Waterfield, personal communication, 1989). Although the lateral transition from the Pond Inlet Formation to the Bylot Island Formation is considered gradational (Waterfield, personal communication, 1989), the contact is locally sharp and erosional. Locally, the Pond Inlet Formation is thought to be a submarine fan. Lensoid deposits contain erosional disconformities in a regionally conformable sequence (Waterfield, personal communication, 1989). The contact is placed at the base of the first white sandstone bed more than 1 metre thick (Figure 2.11).

Along the south coast, tongues of Bylot Island Formation strata interfinger laterally with Sermilik Formation sandstones. Here, contacts consist of interbedded sandstones and siltstones (Figures 2.12).

Lithology

The Bylot Island Formation is composed of black, friable silty mudstone. Locally, the mudstone contains

Figure 2.11 Bylot Island Formation / Pond Inlet Formation contact.

Figure 2.12 Interbedded sandstones (Sermilik Formation) and mudstones (Bylot Island Formation) indicating the gradational contact between these formations.

siderite concretions which are up to a metre in diameter. Bioturbation consisting of Chondrites? is sporadic at Twosnout Creek, in contrast, the tongue of Bylot Island Formation mudstone along the south coast is completely bioturbated by Thalassinoides (Section D, Appendix A_4, Figure 2.13). These burrows are silt filled and/contrast little with material adjacent to the burrow.

Sandstone beds of the Bylot Island Formation are similar to sandstone beds of the Byam Martin Formation. Beds are tabular in appearance and average 50 centimetres in thickness (Figure 2.14); they display normal grading and frequently contain small (<1 cm thick) rip-up-clasts. Sedimentary structures consist of contorted beds and flame structures.

Petrology

Sandstones of the Bylot Island Formation are similar in composition to those of the Byam Martin Formation. All samples straddle the boundary between the subarkose and quartzarenite fields (Figure 2.3). Feldspars are unaltered, with the major types being orthoclase and andesine. Rock fragments consist of plutonic and metamorphic fragments. Heavy minerals include biotite, garnet, sphene, tourmaline and muscovite. Unnamed and undivided Archean-Aphebian Plutonic rocks of the Byam Martin High represent a local detrital source.

Figure 2.13 Close-up of Bylot Island Formation strata in Figure 2.10. Note the extensive bioturbation in the mudstone (staff is marked in 0.1 metre intervals).

Figure 2.14 Subordinate, tabular sandstones occurring within the Bylot Island Formation.

Clay matrix was consistently less than 6% of the total rock volume. Where present, calcite cement was less than 10%. All samples contain moderately to well-sorted, and subrounded to well-rounded grains.

Age

From palynology, this marine unit is very late Campanian to early late Maastrichtian in age (Chapter 3). Characteristic genera include Aquilapollenites, Porosipollis, Pesavis and Ceratiopsis.

CHAPTER 3 PALYNOLOGY

3.1 Introduction

Terrestrial palynology has been utilized to develop the first detailed palynomorph biostratigraphy for late Cretaceous strata on Bylot Island. Reconnaissance biostratigraphic studies (Jackson and Davidson, 1975, Miall et al., 1980, Ioannides, 1986) were inconclusive; stated problems include reworking, corrosion of palynomorphs, an abundance of long-ranging species and a lack of distinctive taxa such as those recorded by Felix and Burbridge (1973); McIntyre (1974); and Doerenkamp et al., (1976) for other Arctic localities.

3.2 Methods

3.2.1 Processing

One hundred twenty samples were collected from strata on Bylot Island. To limit contamination, unconsolidated sediment was freshly exposed before sampling. Forty of these samples have been processed and examined for palynology (Appendix C_1).

Labelled samples were placed in a clear plastic container, and covered with a lint-free tissue (for 24hrs) to air dry. The samples were then weighed (15-20 grams for siltstone and shale; 30-35 grams for sandstones) and placed in labelled 250 ml beakers. To each sample, 12,100 ± 400 Lycopodium grains were added to provide an estimate of palynomorph concentrations, and to identify possible processing errors (Stockmarr, 1971).

To remove carbonate, 150 ml of 20% Hydrochloric acid (HCl) was added to each sample. Methanol was used to control any excessive effervescence. The sample was periodically stirred and left for 12 hours. The samples were then centrifuged and the acid decanted. Distilled water was added, centrifuged, and decanted to remove all remaining acid.

Hydrofluoric (HF) acid was used to remove silicates. Samples were immersed in (HF) for 12 hours. Periodic stirring was necessary. The acid was then decanted and the sample washed with distilled water, and centrifuged until neutral. At this stage, the first of 5 slides was prepared from the unoxidized, unsieved portion.

The unoxidized, unsieved portion was then sieved through a 10μm screen using a technique described by Cwynar et al., (1979). Prior to oxidation, slides 2 and 3 were prepared from the sieved sample. In addition, approximately 15 mls of residue was placed in a labelled vial for storage. The preparation of slides at various increments and the storage of residue allows for mistakes to be found and corrected without the entire preparation having to be restarted.

For oxidation, 20 ml of schultz solution was added to the sample. Samples were stirred thoroughly, and left for

4-5 minutes. The sample was then washed and centrifuged three times. Prior to staining, the sample was sieved once again.

Three drops of Safranin O, were added to the sample, mixed, and left for five minutes. The sample was then centrifuged and decanted until the liquid was clear. Slides 4 and 5 of the oxidized, sieved, stained material were prepared.

To mount the slides, one or two drops of the sample were placed on a cover slip with two drops of polyvinal alcohol, and spread evenly with a toothpick. Samples were dried with a heat lamp to avoid prolonged exposure to possible contaminants. Once dry, two drops of Elvacite (Dupont) were placed on the residue on the cover slip. The coverslip was then mounted on a glass slide. The slide was left to dry overnight (8-12 hrs). The remaining residue was placed in a labelled vial and stored.

3.2.2 Identification

Two microscopes were used for palynology. Taxonomy and counts were completed with a Reichert Zetopan microscope, serial number 341717. Photographs were taken with a Zeiss Photomicroscope III, using Kodak, T-Max 100 E.I., with the optics set for interference contrast.

Slides were scanned at 0.5 mm intervals at 400X. Excluding the Lycopodium spike, 200 grains were counted per slide. In all samples a minimum of two slides were needed to achieve this number.

3.3 Systematics

For presentation purposes, proper classification of fossil palynomorph data is of utmost importance. Two of the more widely used systems are: the "Turma" system (Potonié and Kremp, 1954; Potonié, 1956; 1958; 1960; and Dettmann, 1963); and the "Natural" classification system used by Couper (1958), Filatoff (1975) and Singh (1964; 1971).

The "Turma" system is a morphological classification system; phyletic relationships are not implied. In "Natural" classification, genera are assigned to higher rank according to their morphologic similarities (Burden, 1982).

The classification system used in this study is a morphological one, based in part on that of Burden (1982). Palynomorphs are divided into the following groups and subgroups:

TERRESTRIAL PALYNOMORPHS

- Trilete Spores
- Monolete Spores
- Bisaccate Pollen
- Monosulcate Pollen
- Tricolpate Pollen
- Tricolporate Pollen
- Triporate Pollen

Stephanoporate Pollen

Binigeminate Pollen

Triprojectate Pollen

Syncolpate Pollen

Unknown Specimens

FUNGAL REMAINS

MARINE MICROPLANKTON

Proximate Dinoflagellates

The entry for each taxon includes a photograph, selected synonymy, a short description (where appropriate) and data on the relative abundance and occurrence in this study. Age and distribution data from the literature are included for those species which are biostratigraphically significant.

TERRESTRIAL PALYNOMORPHS

Trilete Spores

Genus Annulispora de Jersey, 1959

Type Species: Annulispora folliculosa (Rogalska) de Jersey, 1959.

Annulispora sp. 1

Pl. 2, Fig. 1

Description: Trilete; amb convexly subtriangular with a 4μm wide cingulum and a 4μm wide circum polar thickening.

Size Range: Equatorial diameter of two measured specimens is 34μm and 36μm.

Remarks: The two identified specimens were restricted to the Bylot Island Formation and the Byam Martin Formation.

Genus _Cingutriletes_ Pierce emend. Dettmann, 1963

Type Species: _Cingutriletes_ _congruens_ Pierce, 1961.

Cingutriletes _pocockii_ (Burger) Burden, 1982

Pl. 2, Fig. 2

Synonymy:

1980 _Stereisporites_ _pocockii_ Burger, p. 58, pl. 12, figs. 14-17.

1982 _Cingutriletes_ _pocockii_ (Burger) Burden, p. 191, pl. 10, figs. 1, 2.

Remarks: Burden (unpublished Ph.D thesis, 1982) recognized that grains described by Burger (1980) as _Stereisporites_ _pocockii_ were clearly cingulate, whereas the genus _Stereisporites_ Pflug, 1953 is acingulate. Species observed in this study have a well developed cingulum. Sporadic occurrences were recorded in the Bylot Island and Sermilik formations, however, this species occurs consistently within the Byam Martin Formation along the south coast.

Genus Densoisporites Weyland and Kreiger

emend. Dettmann, 1963

Type Species: Densoisporites velatus Weyland and Kreiger, emend. Krasnova, 1961

Densoisporites velatus Weyland and Kreiger,

emend. Krasnova, 1961

Pl. 2, Fig. 3

Synonymy:

1963 Densoisporites velatus (Weyland and Kreiger) Krasnova; Dettmann, p. 84, pl. 19, figs. 4-8.

1971 Densoisporites velatus (Weyland and Kreiger) Krasnova; Singh, p. 46, pl. 3, figs. 9, 10.

1980 Densoisporites velatus (Weyland and Kreiger) Krasnova; Wingate, p. 12, pl. 2, fig. 10.

1981 Densoisporites velatus Weyland and Kreiger; Herngreen and Chlonova, p. 447, pl. 1, fig. 6.

1982 Densoisporites velatus (Weyland and Kreiger) Krasnova; Burden, p. 305, pl. 24, figs. 5-10.

1986 Densoisporites velatus (Weyland and Kreiger) Krasnova; Ricketts and Sweet, p. 19, pl. 1, fig. 14.

Remarks: This species is restricted to the Sermilik Formation (Lithotype 1) along the south coast and to the Bylot Island Formation at Twosnout Creek.

Genus Antulsporites Archangelsky and Gamerro, 1966

Type Species: Antulsporites baculatus (Archangelsky and Gamerro) Archangelsky and Gamerro, 1966.

Antulsporites distaverrucosus (Brenner) Archangelsky and Gamerro, 1966

Pl. 2, Fig. 4

Synonymy:

1963 Cingulatisporites distaverrucosus Brenner, p. 58, pl. 13, figs. 6, 7; pl. 14, fig. 1.

1971 Antulsporites distaverrucosus (Brenner) Archangelsky and Gamerro; Singh, p. 109, pl. 15, figs. 6, 7.

1980 Antulsporites distaverrucosus (Brenner) Archangelsky and Gamerro; Wingate, p. 23, pl. 9, figs. 7, 8.

Remarks: This species is restricted to rocks of the Byam Martin Formation on the south coast.

Genus Cirratriradites Wilson and Coe, 1940

Type Species: Cirratriradites saturni (Ibrahim) Schopf, Wilson and Bentall, 1944.

Cirratriradites teter Norris, 1967

Pl. 2, Fig. 5

Synonymy:

1967 Cirratriradites teter Norris, p. 98, pl. 14, figs. 6-10.

1971 Cirratriradites teter Norris; Singh, p. 118, pl. 15, figs. 14, 15.

1975 Cirratriradites teter Norris; Brideaux and McIntyre, p. 56, pl. 2, fig. 36.

1975 Cirratriradites teter Norris; Norris et al., p. 338, pl. 1, fig. 15.

Age and Distribution: The range of this species is Aptian-Albian (Brideaux and McIntyre, 1975), middle to late Albian (Singh, 1971), and Albian ? to Cenomanian (Norris, 1967).

Remarks: This species is restricted to the Sermilik Formation (Lithotype 1) along the south coast. The presence of Cirratriradites teter in late Cretaceous strata of Bylot Island may be a result of reworking. Specimens of this species were, however, very well preserved; alternatively, this may indicate a range extension of the species into the Maastrichtian of Bylot Island.

Genus Appendicisporites Weyland and Krieger, 1953

Type Species: Appendicisporites tricuspidatus Weyland and Greifeld, 1953.

Appendicisporites bifurcatus Singh, 1964

Pl. 2, Fig. 6

Synonymy:

1964 Appendicisporites bifurcatus Singh, p. 54, pl. 5, figs. 1-5.

1971 Appendicisporites bifurcatus Singh; Singh, p. 56, pl. 4, figs. 3-5.

1971 Appendicisporites bifurcatus Singh; Playford, p. 544, pl. 104, fig. 10.

1975 Appendicisporites bifurcatus Singh; Brideaux and McIntyre, p. 15, pl. 2, fig. 10.

1975 Appendicisporites bifurcatus Singh; Srivastava, p. 12, pl. 3, figs. 8-10; pl. 4, figs. 1-8; pl. 5, figs. 1-3.

1987 Appendicisporites bifurcatus Singh; Langille, p. 60-61, pl. 2, fig. 5.

Remarks: This species is very rare, a total of three specimens were observed; one specimen from the Sermilik Formation (Lithotype 2) and one each from the Byam Martin and Bylot Island formations.

Appendicisporites erdtmanii Pocock, 1964

Pl. 2, Fig. 7

Synonymy:

1964 Appendicisporites erdtmanii Pocock; Singh, p. 48, pl. 2, figs. 5-7.

1971 Appendicisporites erdtmanii Pocock; Singh, p. 58, pl. 4, fig. 11.

1975 Appendicisporites erdtmanii Pocock; Brideaux and McIntyre, p. 2, pl. 2, fig. 17.

1980 <u>Appendicisporites erdtmanii</u> Pocock; Wingate, p. 15, pl. 3, figs. 13, 14.

1982 <u>Appendicisporites erdtmanii</u> Pocock; Burden, p. 204, pl. 11, figs. 5, 6.

1988 <u>Appendicisporites erdtmanii</u> Pocock; Sweet and McIntyre, p. 503, fig. 5, No. 5, 8.

Remarks: This species is characterized by 4 to 6 distal ribs in each interradial region. Ribs are parallel to one another and to the side of the spore where they form a triangular area centered on the distal pole (Singh, 1971). This species is restricted to the Bylot Island Formation.

Genus <u>Camarozonosporites</u> Pant ex Potonié emend. Klaus 1960

Type Species: <u>Camarozonosporites cretaceous</u> (Weyland and Krieger) Potonié 1956.

<u>Camarozonosporites ambigens</u> (Fradkina) Playford, 1971

Pl. 2, Fig. 8

Synonymy:

1967 <u>Camarozonosporites insignis</u> Norris, p. 96-97, pl. 13, figs. 12-16.

1971 <u>Camarozonosporites insignis</u> Norris; Singh, p. 111, pl. 15, figs. 8-13.

1971 <u>Camarozonosporites ambigens</u> (Fradkina) Playford, p. 546, pl. 104, figs. 22, 23

1975 Camarozonosporites ambigens (Fradkina) Playford; Brideaux and McIntyre, p. 15, pl. 2, fig. 25.

1980 Camarozonosporites ambigens (Fradkina) Playford; Wingate, p. 10, pl. 1, fig. 10.

Remarks: This genus has interradial crassitudes and is readily distinguished from the genus Hamulatisporis which lacks interradial crassitudes (Farabee and Canright, 1986).

Genus Hamulatisporis Krutzsch emend. Srivastava, 1972

Type Species: Hamulatisporis hamulatis Krutzsch, 1959.

Hamulatisporis amplus Stanley, 1965

Pl. 2, Fig. 9

Synonymy:

1965 Hamulatisporis amplus Stanley, p. 242, pl. 29, figs. 1-6.

1969 Hamulatisporis amplus Stanley, Oltz, p. 119, pl. 39, fig. 18.

1974 Hamulatisporis amplus Stanley; McIntyre, pl. 14, figs. 24, 25.

1986 Hamulatisporis amplus Stanley; Farabee and Canright, p. 19, pl. 4, figs, 1, 2.

Age and Distribution: This species has been reported from the Maastrichtian of the Hell Creek Formation, South Dakota, U.S.A. (Stanley, 1965); early to mid Maastrichtian of the

Horton River Section (McIntyre, 1974); Maastrichtian of the Lance Formation, Wyoming, U.S.A. (Farabee and Canright, 1986); and Maastrichtian of the Bearpaw Shale, east-central Montana, (Oltz, 1969).

Remarks: This species is distinguished from H. hamulatis by its distinctly larger size; (52μm to 83μm) as opposed to (24μm to 36μm) for Hamulatisporis hamulatis (Farabee and Canright, 1986). Hamulatisporis amplus is restricted to the Sermilik Formation and the Bylot Island Formation.

Hamulatisporis sp. cf. H. loeblichii Srivastava, 1972

Pl. 2, Fig. 10

Remarks: A single specimen found in the Bylot Island Formation at Twosnout Creek, is cluttered with organic debris; thus a positive identification is not possible. The finely punctate proximal face is not visible; the distal surface which is visible lacks the characteristic punctae. The specimen has an equatorial diameter of 101μm, thus, fitting the specified size range of Hamulatisporis loeblichii. Hamulatisporis loeblichii is the largest species of the genus Hamulatisporis. The largest known equatorial diameter of Hamulatisporis amplus (83μm) was recorded by Farabee and Canright (1986). Hamulatisporis loeblichii has been reported from the Edmonton Formation

(Maastrichtian) of Alberta (Srivastava, 1972).

Genus Gleicheniidites Ross 1949 ex Delcourt and Sprumont emend. Dettmann, 1963

Type Species: Gleicheniidites senonicus Ross, 1949

Gleicheniidites senonicus Ross, 1949

Pl. 2, Fig. 11

Synonymy:

1958 Gleicheniidites senonicus Ross; Couper, p. 138, pl. 19, figs. 13-15.

1964 Gleicheniidites senonicus Ross; Singh, p. 69, pl. 8, figs. 10, 11.

1965 Gleicheniidites senonicus Ross; McGregor, pl. 10, fig. 6.

1971 Gleicheniidites senonicus Ross; Rouse et al., p. 218, pl. 1, figs. 1, 2.

1971 Gleicheniidites senonicus Ross; Singh, p. 97, pl. 14, fig. 1.

1973 Gleicheniidites senonicus Ross; Hopkins and Balkwill, p. 14, pl. 1, fig. 23.

1974 Gleicheniidites senonicus Ross; McIntyre, pl. 14, figs. 4, 5.

1986 Gleicheniidites senonicus Ross; Farabee and Canright, p. 19, pl. 3, figs. 5-7.

1986 Gleicheniidites senonicus Ross; Ricketts and Sweet, p. 20, pl. 1, fig. 21.

Remarks: This species occurs (2-30 specimens/sample) in every sample.

Gleicheniidites sp. cf. *G. circinidites* (Cookson) Dettmann, 1963

Pl. 2, Fig. 12

Synonymy:

1964 *Gleicheniidites* sp. cf. *G. circinidites* (Cookson) Dettmann; Singh, p. 39, pl.8, figs. 10, 11.

1971 *Gleicheniidites* sp. cf. *G. circinidites* (Cookson) Dettmann; Singh, p. 97, pl. 14, figs. 2, 3.

1982 *Gleicheniidites* sp. cf. *G. circinidites* (Cookson) Dettmann; Burden, p. 224, pl. 13, fig. 21.

Remarks: *Gleicheniidites* sp. cf. *G. circinidites* can be distinguished from *Gleicheniidites senonicus* by its more pointed apices and thicker interradial crassitudes (Singh, 1964; 1971). The species is restricted to the Byam Martin Formation, with the exception of one occurrence in the Bylot Island Formation at Twosnout Creek.

Genus *Asbeckiasporites* von der Brelie, 1964

Type Species: *Asbeckiasporites wirthi* von der Brelie, 1964.

Asbeckiasporites wirthi von der Brelie, 1964

Pl. 2, Fig. 13

Synonymy:

1963 Cingulatisporites sp. B; Davis, p. 78, pl. 5, fig. 4.

1964 Asbeckiasporites wirthi von der Brelie, p. 142, pl. 8, figs. 7, 8; p. 142, pl. 9, figs. 1-6.

1971 Murospora truncata Singh, p. 128, pl. 18, figs. 1, 2.

1971 Asbeckiasporites wirthi von der Brelie; Playford, p. 545, pl. 105, figs. 11, 12.

Remarks: This species is rare, a total of three specimens were observed from the Sermilik Formation (Lithotype 2) and the Bylot Island Formation at Twosnout Creek.

Genus Ornamentifera Bolkhovitina, 1966

Type Species: Ornamentifera echinata (Bolkhovitina) Bolkhovitina, 1966.

Ornamentifera baculata Singh, 1971

Pl. 2, Fig. 14

Synonymy:

1971 Ornamentifera baculata Singh, p. 100, pl. 14, figs. 4, 5.

1975 Ornamentifera baculata Singh; Brideaux and McIntyre, p. 15, pl. 2, fig. 29.

Remarks: This species is restricted to the Byam Martin Formation. Only two specimens were observed.

Genus Tappanispora Srivastava, 1972

Type Species: Tappanispora loeblichii Srivastava, 1972

Tappanispora reticulata (Singh) Srivastava, 1975

Pl. 2, Fig. 15

Synonymy:

1971 Tigrisporites reticulatus Singh, p. 139, pl. 18, figs. 17, 18.

1975 Tappanispora reticulata (Singh) Srivastava, p. 64, pl. 29, figs. 7-9.

1981 Tappanispora reticulata (Singh) Srivastava; Srivastava, pl. 8, figs. 9, 10.

1982 Tigrisporites reticulatus Singh; Burden, p. 230, pl. 14, figs. 1-3.

1987 Tappanispora reticulata (Singh) Srivastava; Langille, p. 72, pl. 3, fig. 8.

Remarks: Tappanispora reticulata is restricted to the Bylot Island Formation, except for one isolated occurrence within the Byam Martin Formation.

Genus Lycopodiacidites Couper emend. Potonié, 1956

Type Species: Lycopodiacidites bullerensis Couper, 1953

Lycopodiacidites canaliculatus Singh, 1971

Pl. 2, Fig. 16

Synonymy:

1971 Lycopodiacidites canaliculatus Singh, p. 38, pl. 1,

fig. 15.

1987 Lycopodiacidites canaliculatus Singh; Langille, p. 66, pl. 2, fig. 13.

Remarks: This species is characteristic of the Byam Martin Formation. It is absent from the Sermilik Formation (Lithotype 1 and 2), and occurs very rarely (3 isolated occurrences) in the Bylot Island Formation.

Lycopodiacidites sp. 1

Pl. 2, Fig. 17

Description: Trilete; amb rounded to convexly triangular; proximal and distal surface ornamented by long narrow rugulae or ridges, separated by narrow grooves. The sculpture is composed of 0.5 to 1μm wide rugulae of uneven width and 0.5 to 1μm wide grooves. The exine has a smoothly crenulated surface and is 2μm thick.

Size Range: Equatorial diameter (12 specimens) 24 (28) 32μm.

Remarks: This species can be distinguished from Hamulatisporis hamulatis Krutzsch, by the presence of well developed sculpture on the proximal surface and the absence of tortuous muri. Lycopodiacidites canaliculatus and

Lycopodiacidites caperatus Singh are distinct from this species, by their larger size; 36μm to 55μm for Lycopodiacidites canaliculatus and 48μm to 63μm for Lycopodiacidites caperatus.

Genus Cicatricosisporites Pflug and Thomson, 1953

Type Species: Cicatricosisporites dorogensis Potonié and Gelletich, 1933.

Cicatricosisporites australiensis (Cookson) Potonié, 1956

Pl. 2, Fig. 18

Synonymy:

1963 Cicatricosisporites australiensis (Cookson) Potonié; Dettmann, p. 53, pl. 9, figs. 10-16.

1967 Cicatricosisporites australiensis (Cookson) Potonié; Norris, p. 92, pl. 11, fig. 14.

1971 Cicatricosisporites australiensis (Cookson) Potonié; Singh, p. 69, pl. 7, figs. 12-15.

1974 Cicatricosisporites australiensis (Cookson) Potonié; Hopkins, p. 15, pl. 3, fig. 32.

1975 Cicatricosisporites australiensis (Cookson) Potonié; Brideaux and McIntyre, p. 15, pl. 1, fig. 37.

1981 Cicatricosisporites australiensis (Cookson) Potonié; Herngreen and Khlonova, p. 483, pl. 9, fig. 2.

1982 Cicatricosisporites australiensis (Cookson) Potonié; Burden, p. 239, pl. 14, figs. 21, 22.

1986 Cicatricosisporites australiensis (Cookson) Potonié;

Ricketts and Sweet, p. 18, pl. 1, figs. 5, 6.

1987 Cicatricosisporites australiensis (Cookson) Potonié; Langille, pl. 3, fig. 1.

Remarks: Cicatricosisporites australiensis occurs sporadically in all sections. Nevertheless, there appears to be a conspicuous absence of this species from (Lithotype 1) of the Sermilik Formation and lowermost strata of the Bylot Island Formation; a total of 5 specimens were recorded. In contrast, the frequency of this species in the Byam Martin Formation, (Lithotype 2) of the Sermilik Formation and uppermost strata of the Bylot Island Formation is higher (1 to 9 specimens/sample) for most samples.

Cicatricosisporites sp. 1

Pl. 3, Fig. 1

Description: This species is characterized by its exceptionally large size (approximately 65-70 μm in equatorial diameter) and large ribs (3.5 to 4 μm wide) separated by (2 to 3 μm wide) canals. Each interradial region on the proximal surface has between 6 and 8 ribs, which are parallel to the side and oblique to the laesurae. Ribs appear to terminate at the laesurae, however, the specimen is poorly preserved, and it is not possible to indicate whether the ribs continue around the apices. The distal surface has 12 to 13 subparallel ribs.

Remarks: The 3 specimens described here, resemble in part those described by Singh (1971) as Cicatricosisporites sp. cf. C. potomacensis. The species described by Singh (1971) differs, in possessing a greater number (17) of narrow (2μm wide) distal ribs, with narrow canals (.5μm wide).

This species was restricted to the Sermilik Formation (Lithotype 2) and the Bylot Island Formation at Twosnout Creek.

Genus Radialisporis Krutzsch, 1967

Type Species: Radialisporis radiatus (Krutzsch) Krutzsch, 1967

Radialisporis radiatus (Krutzsch) Krutzsch, 1967

Pl. 3, Fig. 2

Synonymy:

1965 Anemia radiatus (Krutzsch) Stanley, p. 258, pl. 33, figs. 6, 7.

1972 Radialisporis radiatus (Krutzsch) Krutzsch; Rouse and Srivastava, p. 1177, pl.5, figs. 54, 55.

1972 Radialisporis radiatus (Krutzsch) Krutzsch; Srivastava, p. 29, pl. 24, figs. 8-13, pl. 25, figs. 1, 2.

1974 Radialisporis radiatus (Krutzsch) Krutzsch; McIntyre, p. 36, pl. 14, figs. 15, 16.

Age and Distribution: This species has been reported from the Edmonton Formation (Maastrichtian) of Alberta (Srivastava, 1972); the Bonnet Plume Formation (Paleocene) of the Yukon Territory (Rouse and Srivastava, 1972); the Horton River Section (late Campanian to mid Maastrichtian) of the North West Territories, Canada, (McIntyre, 1974).

Remarks: This species is found in the Sermilik Formation and the Bylot Island Formation.

Genus Retitriletes (van der Hammen, 1956 ex Pierce, 1961) emend. Doring, Krutzsch, Mai and Schultz, 1963

Type Species: Retitriletes globosus Pierce, 1961.

Retitriletes austroclavatides (Cookson) Doring, Krutzsch, Mai, and Schultz, 1963

Pl. 3, Fig. 3

Synonymy:

1965 Lycopodiumsporites austroclavatides (Cookson) Potonié; McGregor, p. 24, pl. 7, fig. 11.

1966 Lycopodiumsporites austroclavatides Cookson; Burger, p. 247, pl. 15, fig. 2.

1971 Lycopodiumsporites austroclavatides (Cookson) Potonié; Singh, p. 40, pl. 2, fig. 1.

1971 Lycopodiumsporites austroclavatides (Cookson) Potonié; Playford, p. 537, pl. 103, fig. 2.

1972 Retitriletes austroclavatides (Cookson) Krutzsch;

Srivastava, p. 30, pl. 25, figs. 5-9, pl. 26, figs. 1-3.

1974 Lycopodiumsporites austroclavatides (Cookson) Potonié; Hopkins, p. 30, pl. 2, fig. 14.

1975 Lycopodiumsporites austroclavatides (Cookson) Potonié; Brideaux and McIntyre, p. 56, pl. 1, fig. 21.

1981 Retitriletes austroclavatides (Cookson) Krutzsch; Srivastava, p. 19, pl. 7, figs. 10, 11.

Remarks: Only one specimen of Retitriletes austroclavatides was observed in the study area. This specimen appears to be reworked due to its consistantly poor preservation.

Genus Foveotriletes Potonié, 1956

Type Species: Foveotriletes scrobiculatus (Ross) Potonié, 1956.

Foveotrilites subtriangularis Brenner, 1963

Pl. 3, Fig. 4

Synonymy:

1966 Foveotriletes subtriangularis Brenner; Burger, p. 246-247, pl. 14, fig. 1.

1971 Foveotriletes subtriangularis Brenner; Singh, p. 122, pl. 17, figs. 4, 5.

1980 Foveotriletes subtriangularis Brenner; Wingate, p. 25, pl. 10, fig. 1.

1982 Foveotriletes subtriangularis Brenner; Burden, p. 258, pl. 17, figs. 13, 14.

Description: Specimens are convexly triangular, having an equatorial diameter of 42μm–45μm (5 specimens observed). The grains have a foveolate exine with evenly distributed round lumina.

Remarks: All grains are pitted and corroded, indicating that they are possibly reworked. This species was restricted to the Bylot Island Formation and the Sermilik Formation.

Genus Stereisporites Pflug, 1953

Type Species: Stereisporites stereoides (Potonié and Venitz) Pflug, 1953.

Stereisporites antiquasporites (Wilson and Webster) Dettmann, 1963

Pl. 3, Fig. 5

Synonymy:

1963 Stereisporites antiquasporites (Wilson and Webster) Dettmann, p. 25, pl. 1, figs. 20, 21.

1965 Sphagnum antiquasporites (Wilson and Webster) Stanley, p. 236, pl. 27, figs. 1-5.

1971 Stereisporites antiquasporites (Wilson and Webster) Dettmann; Singh, p. 33-34, pl. 1, figs. 4-5.

1974 Stereisporites antiquasporites (Wilson and Webster)

Dettmann; McIntyre, pl. 14, fig. 1.

1975 Stereisporites antiquasporites (Wilson and Webster) Dettmann; Brideaux and McIntyre, p. 14, pl. 1, fig. 6.

1982 Stereisporites antiquasporites (Wilson and Webster) Dettmann; Jarzen, pl. 1, fig. 2.

1983 Stereisporites antiquasporites (Wilson and Webster) Dettmann; Truswell, p. 142, pl. 1, figs. 1, 2.

1987 Stereisporites antiquasporites (Wilson and Webster) Dettmann; Langille, p. 75, pl. 3, fig. 15.

Remarks: This species was observed in all samples, in quantities greater than (5-9 specimens/sample) for most samples. Stereisporites antiquasporites was the most abundant trilete spore.

Stereisporites regium (Drozhastchich) Drugg, 1967

Pl. 3, Fig. 6

Synonymy:

1965 Sphagnum regium Drozhastchich; Stanley, p. 238, pl.27, figs. 12-17.

1967 Stereisporites regium (Drozhastchich) Drugg, p. 37, pl. 6, fig. 20.

1974 Stereisporites regium (Drozhastchich) Drugg; McIntyre, p. 36, pl. 14, figs. 2, 3.

1978 Stereisporites regium (Drozhastchich) Drugg; Wilson, p. 109, pl. 1, fig. 4.

Remarks: Specimens of Stereisporites regium are found in the Sermilik Formation and the Bylot Island Formation.

Genus Cingulatisporites Pflug emend. Potonié, 1956

Type Species: Cingulatisporites levispeciosus Pflug, 1953.

Cingulatisporites dakotaensis Stanley, 1965

Pl. 3, Fig. 7

Synonymy:

1965 Cingulatisporites dakotaensis Stanley, p. 243, pl. 30, figs. 1-8.

1969 Cingulatisporites dakotaensis Stanley; Norton and Hall, p. 15, pl. 2, fig. 6.

1969 Cingulatisporites dakotaensis Stanley; Oltz, p. 120, pl. 39, fig. 22.

1973 Cingulatisporites dakotaensis Stanley; Stone, p. 66, pl. 10, fig. 56.

1975 Cingulatisporites dakotaensis Stanley; Norris et al., p. 349, pl. 3, fig. 2.

1986 Cingulatisporites dakotaensis Stanley; Farabee and Canright, p. 15, pl. 2, fig. 1.

Age and Distribution: This species has been reported from the Fort Union Formation (Maastrichtian) of South Dakota, (Stanley, 1965); the Tullock Member of the Fort Union Group (Paleocene), Montana, (Oltz, 1969); the Almond Formation (late Campanian) of Wyoming (Stone, 1973); and the Lance

Formation (Maastrichtian) of Wyoming (Farabee and Canright, 1986).

Remarks: The characteristic " Y " - shaped polar thickening is preserved on the distal surface. This species is differentiated from C. radiatus which has a homogeneous and transparent cingulum that lacks radiating striations (Stanley, 1965). Three poorly preserved specimens were recovered; one from the Byam Martin Formation, one from the Bylot Island Formation at Twosnout Creek, and the other from Sermilik Formation (Lithotype 1).

Genus Deltoidospora Miner, 1935

Type Species: Deltoidospora hallii Miner, 1935.

Deltoidospora hallii Miner, 1935

Pl. 3, Fig. 8

Synonymy:

1964 Deltoidospora hallii Miner; Singh, p. 80, pl. 9, figs. 13, 14.

1971 Deltoidospora hallii Miner; Singh, p. 118, pl. 16, fig. 8.

1980 Deltoidospora hallii Miner; Wingate, p. 24, pl. 9, fig. 14.

1982 Deltoidospora hallii Miner; Burden, p. 261, pl. 17, fig. 23.

1986 Deltoidospora hallii Miner; Boland, p. 106, pl. 1,

fig. 11.

1987 Deltoidospora hallii Miner; Langille, p. 76, pl. 3, fig. 16.

Remarks: This species is sporadic in distribution and rare in abundance (1-3 specimens/sample).

Genus Cibotiumspora Chang, 1965

Type species: Cibotiumspora parodoxa (Malyavkina) Chang, 1965.

Cibotiumspora juncta (Kara-Murza) Singh, 1983

Pl. 3, Fig. 9

Synonymy:

1964 Concavisporites jurienensis Balme; Balme, p. 77, pl. 6, fig. 2.

1965 Deltoidospora juncta (Kara-Murza) Singh; McGregor, p. 22, pl. (fig. 4.

1966 Concavisporites jurienensis Balme; Burger, p. 237, pl. 4, fig. 6.

1971 Deltoidospora juncta (Kara-Murza) Singh; Singh, p. 119-120, pl. 16, figs. 10, 11.

1975 Cibotiumspora jurienensis (Balme) Filatoff, p. 61, pl. 10, figs. 8-13.

1980 Concavisporites jurienensis (Balme) Wingate, p. 25, pl. 9, fig. 12.

1982 Concavisporites jurienensis Balme; Burden, p. 267, pl. 18, figs. 7-10.

1983 Cibotiumspora sinuata (Couper) Fensome, p. 403-409, pl. 15, figs. 7-14, 16, 18.

Remarks: Fensome (1983) spent considerable time sorting out systematic problems and emending the genus Cibotiumspora. His unpublished study (Fensome, 1983), suggested that this taxon should be transferred to the species designation sinuata. The basis for this transfer was his recognition of a highly variable morphology that had lead to well over 30 distinct names or combinations to the genus and species level.

Genus Cyathidites Couper, 1953

Type Species: Cyathidites australis Couper, 1953.

Cyathidites minor Couper, 1953

Pl. 3, Fig. 10

Synonymy:

1958 Cyathidites minor Couper; Couper, p. 139, pl. 20, figs. 9, 10.

1963 Cyathidites minor Couper; Dettmann, p. 22, pl. 1, figs. 4, 5.

1963 Cyathidites minor Couper; Davis, p. 39, pl. 1, fig. 2.

1964 Cyathidites minor Couper; Singh, p. 71, pl. 8, fig. 13.

1965 Cyathidites minor Couper; McGregor, pl. 7, figs. 3, 4.

1967 Cyathidites minor Couper; Srivastava, pl. 1, fig. M.

1971 Cyathidites minor Couper; Singh, p. 101, pl. 14, fig. 9.

1973 Cyathidites minor Couper; B.D. Tschudy, p. 6, pl. 1, fig. 1.

1974 Cyathidites minor Couper; McIntyre, pl. 14, fig. 8.

1975 Cyathidites minor Couper; Brideaux and McIntyre, p. 14, pl. 1, fig. 3.

1987 Cyathidites minor Couper; Langille, p. 77, pl. 4, fig. 1.

Remarks: This species occurs in all sections.

Genus Gemmatriletes Pierce, 1961

Type Species: Gemmatriletes morulus Pierce, 1961.

Gemmatriletes clavatus Brenner, 1968

Pl. 3, Fig. 11

Synonymy:

1968 Gemmatriletes clavatus Brenner, p. 353, pl. 1, fig. 7.

1983 Gemmatriletes clavatus Brenner; Singh, p. 30, pl. 1, figs. 2, 3.

1988 Gemmatriletes clavatus Brenner; Sweet and McIntyre, fig. 6, No. 11.

Age and Distribution: This species is reported from Albian to Cenomanian strata of northeastern Peru (Brenner, 1968); Cenomanian strata of Alberta (Singh, 1983); and late

Turonian strata of the Alberta Foothills (Sweet and McIntyre, 1988).

Remarks: Gemmatriletes clavatus is distinguished from Gemmatriletes densegemmatus Brenner, by its smaller size (40 (46) 54 μm), and more widely spaced gemmae (Singh, 1983). A single specimen was recovered from the Bylot Island Formation.

Genus Osmundacidites Couper, 1953

Type Species: Osmundacidites wellmanii Couper, 1953

Osmundacidites wellmanii Couper, 1953

Pl. 3, Fig. 12

Synonymy:

1958 Osmundacidites wellmanii Couper; Couper, p. [illegible], pl. 16, figs. 4, 5.

1963 Osmundacidites wellmanii Couper; Dettmann, p. 32, pl. 3, figs. 19-21.

1963 Osmundacidites wellmanii Couper; Davis, p. 51, pl. 2, fig. 7.

1964 Osmundacidites wellmanii Couper; Singh, p. 44, pl. 1, fig. 20.

1965 Osmundacidites wellmanii Couper; McGregor, pl. 2, fig. 12.

1966 Osmundacidites wellmanii Couper; Burger, p. 251, pl. 20, fig. 3.

1967 Osmundacidites wellmanii Couper; Norris, p. 88, pl. 10, fig. 14.

1971 Osmundacidites wellmanii Couper; Singh, p. 251, pl. 20, fig. 3.

1972 Osmundacidites wellmanii Couper; Srivastava, p. 27, pl. 23, figs. 1-3.

1974 Osmundacidites wellmanii Couper; McIntyre, p. 36, pl. 14, figs. 10, 11.

1974 Osmundacidites wellmanii Couper; Hopkins, p. 13, pl. 2, fig. 24.

1982 Osmundacidites wellmanii Couper; Burden, p. 268, pl. 18, figs. 14, 15.

1987 Osmundacidites wellmanii Couper; Langille, p. 80, pl. 4, fig. 6.

Remarks: This species occurs in the Byam Martin Formation, the Bylot Island Formation and Lithotype 3 of the Sermilik Formation.

Genus Baculatisporites Thomson and Pflug, 1953

Type Species: Baculatisporites primarius (Wolff) Thomson and Pflug, 1953.

Baculatisporites comaumensis (Cookson) Potonié, 1956

Pl. 3, Fig. 13

Synonymy:

1963 Baculatisporites comaumensis (Cookson) Potonié;

Dettmann, p. 35, pl. 3, figs. 22, 23.

1965 Baculatisporites comaumensis (Cookson) Potonié; McGregor, pl. 7, fig. 10.

1971 Baculatisporites comaumensis (Cookson) Potonié; Hopkins, pl. 20, figs. 10, 11.

1971 Baculatisporites comaumensis (Cookson) Potonié; Singh, p. 48, pl. 3, fig. 14.

1974 Baculatisporites comaumensis (Cookson) Potonié; McIntyre, p. 36, pl. 14, fig. 9.

1975 Baculatisporites comaumensis (Cookson) Potonié; Brideaux and McIntyre, p. 56, pl. 1, fig. 12.

1983 Baculatisporites comaumensis (Cookson) Potonié; Truswell, p. 141, pl. 1, figs. 3, 4.

1987 Baculatisporites comaumensis (Cookson) Potonié; Langille, p. 80-81, pl. 4, fig. 7.

Remarks: This species is restricted to the Bylot Island and Byam Martin formations.

Monolete Spores

Genus Laevigatosporites Ibrahim emend. Schopf, Wilson and Bentall, 1944

Type Species: Laevigatosporites vulgaris (Ibrahim) Ibrahim, 1933.

Laevigatosporites haardti (Potonié and Venitz)

Thomson and Pflug, 1953

Pl. 3, Fig. 14

Synonymy:

1965 Laevigatosporites haardti (Potonié and Venitz) Thomson and Pflug; Stanley, p. 252, pl. 32, figs. 1-3.

1972 Laevigatosporites haardti (Potonié and Venitz) Thomson Pflug; Srivastava, p. 232, pl. 5, figs. 9, 10.

1978 Laevigatosporites haardti (Potonie and Venitz) Thomson and Pflug; Wilson, p. 117-118, pl. 4, figs. 7, 8.

1981 Laevigatosporites haardti (Potonié and Venitz) Thomson and Pflug; Srivastava, p. 8, pl. 7, fig. 4.

1986 Laevigatosporites haardti (Potonié and Venitz) Thomson and Pflug; Boland, p. 135, pl. 3, fig. 4.

Description: Grains assigned to this species are distinctly bean shaped, thick walled (1-2μm), psilate, and range from 30-70μm in diameter.

Remarks: Wilson (1978) indicated that any distinction between Laevigatosporites haardtii and Laevigatosporites ovatus Wilson and Webster was purely artificial. Srivastava (1972) also grouped these two species, stating that similar morphologies, shapes, and size ranges exist. Waterfield (personal communication, 1989) noted a morphological gradation, and both species were categorized as

Laevigatosporites haardti. This study has two distinct end members; no gradation was noted.

Laevigatosporites sp. cf. L. ovatus Wilson and Webster, 1946

Pl. 3, Fig. 15

Description: Specimens have a faint monolete mark preserved on the proximal surface. The exine is translucent, thin (<1μm), psilate; and the length of the polar axis ranges between 24-28μm.

Remarks: Differential diagnosis of Laevigatosporites sp. cf. ovatus from Laevigatosporites ovatus is based on a faint monolete mark and a slightly thinner exine. All other characteristics compare favourably.

Genus Hazaria Srivastava, 1971

Type Species: Hazaria sheopiarii Srivastava, 1971

Hazaria sheopiarii Srivastava, 1971

Pl. 3, Fig. 16

Synonymy:

1971 Hazaria sheopiarii Srivastava, p. 258, pl. 2, figs. 1-4.

1972 Hazaria sheopiarii Srivastava; Rouse and Srivastava, p. 1172, pl. 2, figs. 15, 16.

1974 Hazaria sheopiarii Srivastava; McIntyre, p. 37, pl. 14, figs. 26, 27.

1986 Hazaria sheopiarii Srivastava; Jerzykiewicz and Sweet, p. 1364, pl. 1, fig. 4.

Age and Distribution: This species is reported from the Edmonton Formation (Maastrichtian) of Alberta (Srivastava, 1971); the Bonnet Plume Formation (Maastrichtian) of the Yukon Territory (Rouse and Srivastava, 1972); the Horton River section (late Campanian to late Maastrichtian) of the Northwest Territories (McIntyre, 1974); the Coalspur Formation (Maastrichtian to Paleocene) of the Alberta Foothills (Jerzykiewicz and Sweet, 1986).

Remarks: The minimum size of this taxon, according to Srivastava (1971) is 40μm. Specimens in this study were seen to be as small as 37μm. This species is present in all sections. It is most frequently observed (1-3 specimens/sample) in Lithotype 3 of the Sermilik Formation.

Inaperturate Pollen

Genus Taxodiaceaepollenites Kremp, 1949 ex Potonié, 1958

Type Species: Taxodiaceaepollenites hiatus Potonié ex Potonié, 1958.

Taxodiaceaepollenites hiatus (Potonié) Kremp, 1949

Pl. 3, Fig. 17

Synonymy:

1965 Thuja ? hiatus (Potonié) Stanley, p. 273, pl. 38, figs. 1-3.

1967 Taxodiaceaepollenites hiatus (Potonié) Kremp; Srivastava, pl. 2, fig. C.

1971 Taxodiaceaepollenites hiatus (Potonié) Kremp; Singh, p. 158, pl. 22, fig. 7.

1975 Taxodiaceaepollenites hiatus (Potonié) Kremp; Brideaux and McIntyre, p. 17, pl. 4, fig. 19.

1980 Taxodiaceaepollenites hiatus (Potonié) Kremp; Wingate, p. 37, pl. 13, fig. 15.

1986 Taxodiaceaepollenites hiatus (Potonié) Kremp; Farabee and Canright, p. 35, pl. 10, fig. 2.

1987 Taxodiaceaepollenites hiatus (Potonié) Kremp; Langille, p. 85, pl. 4, fig. 14.

Remarks: Taxodiaceaepollenites hiatus is present (2-15 specimens/sample) in every sample.

Taxodiaceaepollenites vacuipites (Wodehouse) Wingate, 1980

Pl. 3, Fig. 18

Synonymy:

1980 Taxodiaceaepollenites vacuipites (Wodehouse) Wingate, p. 37, pl. 13, fig. 16.

Remarks: Taxodiaceaepollenites vacuipites is distinguished from Taxodiaceaepollenites hiatus by its larger size, fusiform shape, and exinal folds adjacent to the area of dehiscence (Wingate, 1980).

Bisaccate Pollen

Genus Podocarpidites Cookson, 1947, ex Couper 1953

Type Species: Podocarpidites ellipticus Cookson, 1947.

Podocarpidites multesimus (Bolkovitina) Pocock, 1962

Pl. 4, Fig. 1

Synonymy

1964 Podocarpidites multesimus (Bolkhovitina) Pocock; Singh, p. 116, pl. 15, figs. 12, 13.

1971 Podocarpidites multesimus (Bolkhovitina) Pocock; Singh, p. 166, pl. 24, fig. 2.

1973 Podocarpidites multesimus (Bolkhovitina) Pocock; B.D. Tschudy, p. 16, pl. 7, figs. 1, 2.

1975 Podocarpidites multesimus (Bolkhovitina) Pocock; Brideaux and McIntyre, p. 16, pl. 4, figs. 3, 4.

1980 Podocarpidites multesimus (Bolkhovitina) Pocock; Wingate, p. 38, pl. 14, figs. 7, 8.

1982 Podocarpidites multesimus (Bolkhovitina) Pocock; Burden, p. 314, pl. 25, fig. 16.

Remarks: This species was observed only rarely (2 to 4 specimens / sample) at Twosnout Creek and along the south coast.

Podocarpidites sp. 1

Pl. 4, Fig. 2

Description: Bisaccate; The central body is granulate; the bladders are coarsely reticulate (1μm to 2μm wide). The bladders have a length / breadth ratio of 1.85 / 1. The bladders appear to be distally pendant, however, the poor preservation of the grain makes this remark tenuous.

Size Range: Total breadth of the grain 140 μm
Breadth of the central body 60 μm
Breadth of the bladders 40 μm
Length of the bladders 74 μm

Remarks: This grain is noted for its exceptionally large size. The single grain observed is torn and distorted and was recovered from the top of the Sermilik Formation (Lithotype 2).

Genus Pityosporites Seward emend. Manum, 1960

Type Species: Pityosporites antarcticus Seward, 1914.

Pityosporites constrictus Singh, 1964

Pl. 4, Fig. 3

Synonymy:

1964 Pityosporites constrictus Singh, p. 122, pl. 16, figs. 8, 9.

1966 Pityosporites constrictus Singh; Srivastava, p. 524, pl. 6, fig. 2.

1967 Pityosporites constrictus Singh; Srivastava, p. 140, pl. 2, fig. M.

1971 Pityosporites constrictus Singh; Singh, p. 167, pl. 25, fig. 10.

1973 Pityosporites sp. cf P. constrictus Singh; B.D. Tschudy, p. 15, pl. 5, fig. 9.

1980 Pinuspollenites constrictus Singh; Wingate, p. 40, pl. 15, figs. 6, 7.

1982 Pityosporites constrictus Singh; Burden, p. 317, pl. 15, figs. 2, 3.

Remarks: Specimens of this species were exceptionally well preserved. The species occurred in Lithotype 1 of the Sermilik Formation and the Bylot Island Formation

Pityosporites alatipollenites (Rouse) Singh, 1964

Pl. 4, Fig. 4

Synonymy:

1964 Pityosporites alatipollenites (Rouse) Singh, p. 123, pl. 16, fig. 10.

1971 Pityosporites alatipollenites (Rouse) Singh; Singh, p. 173, pl. 25, fig. 9.

1973 Pityosporites alatipollenites (Rouse) Singh; B.D. Tschudy, p. 15, pl. 6, fig. 1.

1982 Pityosporites alatipollenites (Rouse) Singh; Burden, p. 315, pl. 26, fig. 1.

1987 Pityosporites alatipollenites (Rouse) Singh; Langille, p. 89, pl. 5. fig. 5.

Remarks: Specimens of Pityosporites alatipollenites were poorly preserved. They are restricted to the Bylot Island and Sermilik formations.

Pityosporites sp. 1

Pl. 4, Fig. 5

Description: Bisaccate; bladders distally pendant and moderately constricted towards the base. The bladders exhibit a fine to coarse reticulum (.5μm to 1μm wide). The central body is finely granulate with a 1-2μm thick granulose proximal cap.

Size Range: Proximal cap 1-2μm thick
Total breadth of the grain 50-90μm
Height of the central body 16-20μm
Breadth of the central body 32-50μm

Breadth of the bladders 24-40μm
Width of the distal furrow 10-14μm
(51 grains examined)

Remarks: A concise description was hampered by poor preservation and a lack of specimens in polar view. This species was frequently observed in south coast sections (1-5 specimens/sample) for most samples; it is less common (1-2 specimens/sample) at Twosnout Creek.

<u>Pityosporites</u> sp. 2

Pl. 4, Fig. 6

Description: Bisaccate; bladders are circular in outline, coarsely reticulate and widely separated from one another. The central body is sub-circular with a width greater than its length. The grain exhibits a wide distal furrow.

Size Range: Total breadth of the grain 64-67μm
Breadth of the central body 35-36μm
Length of the central body 28-30μm
Breadth of the bladders 23-25μm
Length of the bladders 26-31μm
Width of the distal furrow 16-18μm
(37 specimens examined)

Remarks: This species occurs in most samples along the south coast. The distribution at Twosnout Creek is sporad c.

Pityosporites sp. 3

Pl. 4, Fig. 7

Description: Bisaccate; bladders are distally pendant, much shorter than the central body and coarsely reticulate (2μm wide). In lateral view the bladders and the central body are in the same sweeping curve. The proximal cap is ≤ 1μm thick, and the central body is finely rugulate (<.5μm wide).

Size Range: Total breadth of the central body 66-72μm
Breadth of the central body 40-48μm
Height of the central body 30-40μm
Breadth of the bladders 14-20μm
Width of the distal furrow 5-6μm
(5 specimens examined)

Remarks: This species appears most like the Eocene bisaccate Pinus coloradensis Ting (pl. 2, figure 11). This species was restricted to the Sermilik Formation and the Bylot Island Formation.

Genus Alisporites Daugherty emend. Jansonius, 1971

Type Species: Alisporites opii Daugherty, 1941.

Alisporites bilateralis Rouse, 1959

Pl. 4, Fig. 8

Synonymy:

1962 Alisporites thomasii (Couper) Pocock, p. 62, pl. 14, fig. 143.

1964 Alisporites thomsaii (Couper) Pocock; Singh, p. 109, pl. 14, figs. 11, 12.

1965 Alisporites thomasii (Couper) Nilsson; McGregor, p. 24, pl. 7, fig. 39.

1966 Alisporites thomasii (Couper) Pocock; Burger, p. 259, pl. 35, fig. 2.

1971 Alisporites bilateralis Rouse; Singh, p. 169, pl. 24, fig. 9.

1975 Alisporites bilateralis Rouse; Brideaux and McIntyre, p. 16, pl. 3, fig. 32.

1976 Alisporites bilateralis Rouse; Scott, p. 592, pl. 9, fig. 5.

1987 Alisporites bilateralis Rouse; Langille, p. 91, pl. 5, fig. 8.

Remarks: This species was observed in all sections.

Alisporites grandis (Cookson) Dettmann, 1963

Pl. 4, Fig. 9

Synonymy:

1957 Alisporites rotundus Rouse, p. 371, pl. 1, figs. 15, 16.

1962 Alisporites rotundus Rouse; Pocock, p. 61-62, pl. 9, figs. 140, 141.

1964 Alisporites rotundus Rouse; Singh, pl. 14, figs. 13, 14; p. 110, pl. 15, figs. 1, 2.

1967 Alisporites grandis (Cookson) Dettmann; Srivastava, p. 140, fig. pl. 2, fig. K.

1971 Alisporites grandis (Cookson) Dettmann; Singh, p. 170, pl. 25, figs. 1,2.

1973 Alisporites grandis (Cookson) Dettmann; B.D. Tschudy, p. 14, pl. 5, figs. 2, 3.

1980 Alisporites grandis (Cookson) Dettmann; Wingate, p. 39, pl. 15, fig. 1.

1982 Alisporites grandis (Cookson) Dettmann; Burden, p. 318, pl. 26, fig. 7.

Remarks: Alisporites grandis was observed in all formations.

Genus Cedripites Wodehouse, 1933

Type Species: Cedripites eocenicus Wodehouse, 1933

Cedripites canadensis Pocock, 1962

Pl. 4, Fig. 10

Synonymy:

1964 Cedripites canadensis Pocock; Singh, p. 112, pl. 15, fig. 6.

1967 Cedripites canadensis Pocock; Norris, p. 102, pl. 15, figs. 149, 150.

1971 Cedripites canadensis Pocock; Singh, p. 171, pl. 25, figs. 4, 5.

1975 Cedripites canadensis Pocock; Brideaux and McIntyre, p. 16, pl. 3, fig. 37.

1982 Cedripites canadensis Pocock; Burden, p. 325, pl. 27, figs. 1, 2.

1987 Cedripites canadensis Pocock; Langille, p. 93, pl. 5, fig. 12.

Remarks: According to Singh (1964) the size for the " total breadth of the grain " ranges between 60 μm and 90 μm. Specimens in this study reach a maximum size of 100 μm. Cedripites canadensis can be distinguished from Cedripites cretaceous Pocock by a notable difference in the thickness of the proximal cap (Singh, 1964).

Cedripites canadensis is the most abundant bisaccate taxon at Twosnout Creek, with as many as 10-14 specimens/sample. In south coast sections Cedripites canadensis is as abundant, although other bisaccate grains frequently occur.

Genus Pristinuspollenites B.D. Tschudy, 1973

Type Species: Pristinuspollenites microsaccus (Couper) B.D. Tschudy, 1973.

Pristinuspollenites sp. cf. P. inchoatus (Pierce)
B.D. Tschudy, 1973
Pl. 4, Fig. 11

Remarks: Except for the shape of the bladders, this taxon resembles Pristinuspollenites inchoatus. Singh (1964) indicates that the bladders are elongate with a length to width ratio of 2:1. The one specimen recorded in this study has bladders that are crescent shaped, with a length to width ratio of 1:1.

Size Range: Total breadth of the grain 50μm
Length of the central body 43μm
Exine thickness 2μm
Breadth of the bladders 20μm
Length of the bladders 20μm

Monosulcate Pollen

Genus Liliipollis Krutzsch, 1970

Type Species: Liliipollis lilioides Krutzsch, 1970.

Liliipollis sp. 1 ?
Pl. 4, Fig. 12

Description: Monosulcate pollen with two-layered exine. Nexine is ≤ 1μm thick; sexine with baculae less than 1μm high. Baculae cover the entire surface and are arranged in a crotonid reticulate pattern. The sulcus extends the entire length of the grain.

Size Range: Length x Width: 38 (42) 44 x 22 (24) 25 μm, (five measured specimens)

Remarks: The morphological description of specimens in this study resemble in detail those of Farabee and Canright (1986). However, the described specimeens are on average 10μm larger than those described by Farabee and Canright (1986).

In south coast sections, this species is restricted to Lithotype 1 of the Sermilik Formation, and a tongue of Bylot Island Formation strata (Section D, Appendix A_4). At Twosnout Creek, this species is confined to samples occuring around the Byam Martin - Bylot Island Formation contact.

Genus Liliacidites Couper, 1953

Type Species: Liliacidites kaitangataensis Couper, 1953.

Liliacidites variegatus Couper, 1953

Pl. 4, Fig. 13

Synonymy:

1957 Liliacidites variegatus Couper; Rouse, p. 368, pl. II, figs. 29, 30.

1966 Liliacidites variegatus Couper; Srivastava, p. 25, pl. 4, figs. 15, 16.

1967 Liliacidites variegatus Couper; Drugg, p. 46-47, pl. 7, fig. 23.

1968 Liliacidites variegatus Couper; Elsik, p. 312, pl. 15, fig. 1.

1973 Liliacidites variegatus Couper; B.D. Tschudy, p. 20, pl. 8, fig. 12.

1980 Liliacidites variegatus Couper; Wingate, p. 43, pl. 16, fig. 11.

1986 Liliacidites variegatus Couper; Farabee and Canright, p. 53, pl. 19, fig. 5.

Description: Reticulate, monosulcate pollen. The sulcus extends almost the entire length of the grain, and is narrow. The reticulum is coarse (about 2μm wide), and the muri are simplibaculate.

Size Range: Length x breadth (39.6 x 24.2) μm
Length / breadth ratio 1.6
(3 specimens examined)

Age and Distribution: Early to middle Oligocene of New Zealand (Couper, 1953); late Campanian of North Central Montana (B.D. Tschudy, 1973); Albian of Oklahoma (Wingate, 1980); Maastrichtian of Wyoming (Farabee and Canright, 1986).

Remarks: This species is rare, a total of three specimens were observed from the Sermilik Formation (Lithotype 1), the Bylot Island Formation and the Byam Martin Formation.

Genus Cycadopites Wodehouse, 1933, ex Wilson and Webster, 1946

Type Species: Cycadopites follicularis Wilson and Webster, 1946.

Cycadopites fragilis Singh, 1964

Pl. 4, Fig. 14

Synonymy:

1962 Monosulcites minimus Cookson; Pocock, p. 77, pl. 13, figs. 206-208.

1964 Cycadopites fragilis Singh, p. 103, pl. 14, fig. 2.

1965 Cycadopites fragilis Singh; McGregor, p. 24, pl. 7, fig. 25.

1980 Cycadopites fragilis Singh; Wingate, p. 36, pl. 13, fig. 9.

Remarks: A single specimen was found in the Sermilik Formation (Lithotype 1).

Genus Monosulcites Cookson ex Couper, 1953

Type Species: Monosulcites minimus Couper, 1953.

Monosulcites sp. 1

Pl. 4, Fig. 15

Description: Monosulcate; sulcus running entire length of grain, and narrowing at the longitudinal ends. The exine is psilate and less than 1μm thick.

Size Range: Length 60μm

Width 18μm

Length to Breadth ratio 3 / 1

Remarks: Two specimens were recovered; one from the Sermilik Formation (Lithotype 1), and the other from Bylot Island Formation strata located along the south coast (Section D, Appendix A_4).

Genus Entylissa Naumova, 1939, ex Ishchenko, 1952

Type Species: Entylissa caperatus (Luber) Potonié and Kremp, 1954.

Entylissa nitidus Balme, 1957

Pl. 5, Fig. 1

Synonymy:

1962 Ginkgocycadophytus nitidus (Balme) de Jersey, p. 12, pl. 5, figs. 1-3.

1963 Ginkgocycadophytus nitidus (Balme) de Jersey; Dettmann, p. 104, pl. 26, figs. 8, 9.

1971 Ginkgocycadophytus nitidus (Balme) de Jersey; Singh, p. 155, pl. 22, fig. 3.

1980 Ginkgocycadophytus nitidus (Balme) de Jersey; Wingate, p. 36, pl. 13, fig. 12.

1982 Entylissa nitidus Balme; Burden, p. 340, pl. 30, figs. 4, 5.

Remarks: This species is sporadic in distribution, but occurs in all formations.

Tricolpate Pollen

Genus Tricolpites Cookson ex Couper 1953
emend. Potonié 1960

Type Species: Tricolpites reticulatus Cookson, 1947.

Tricolpites sp. 1
Pl. 5, Fig. 2

Description: Prolate tricolpate pollen; characterized by 4μm high club shaped pila. The body is granular, with a length / width ratio of 1.4 to 1.

Remarks: A single specimen was found in the Sermilik Formation (Lithotype 2).

Genus Rousea Srivastava, 1969

Type Species: Rousea subtillis Srivastava, 1969.

Rousea georgensis (Brenner) Dettmann, 1973

PL. 5, Fig. 3

Synonymy:

1968 Retitricolpites georgensis Brenner; Hedlund and Norris, p. 145, pl. 6, figs. 1, 3.

1971 Retitricolpites georgensis Brenner; Singh, p. 200, pl. 30, figs. 1-6.

1971 Retitricolpites georgensis Brenner; Playford, p. 561, pl. 107, figs. 11, 12.

1973 Retitricolpites georgensis (Brenner) Burger, p. 7, pl. 3, figs. 2-4.

1975 Retitricolpites georgensis Brenner; Brideaux and McIntyre; p. 17, pl. 4, figs. 31, 32.

1975 Rousea georgensis (Brenner) Dettmann; Srivastava, p. 92, pl. 43, figs. 10, 11.

1980 Tricolpites sp. cf. Retitricolpites georgensis Brenner; Wingate, p. 45, pl. 17, figs. 3, 4.

1981 Rousea georgensis (Brenner) Dettmann; Srivastava, p. 27, pl. 11, fig. 3.

1988 Rousea georgensis (Brenner) Dettmann; Sweet and McIntyre, p. 506, fig. 7, No. 15, 16.

Remarks: This species is characterized by the reduction in size of the lumina towards the poles and the pilate structure of the muri (Singh, 1971). This species occurs in the Sermilik and Bylot Island Formations.

Genus Cupuliferoidaepollenites Potonié, Thomson & Thiergart 1950 ex Potonié, 1960

Type Species: Cupuliferoidaepollenites liblarensis (Thomson) Potonié, 1960.

Cupuliferoidaepollenites parvulus (Groot and Penny) Dettmann, 1973

Pl. 5, Fig. 4

Synonymy:

1960 Tricolpopollenites parvulus Groot and Penny, p. 232, pl. 2, figs. 8, 9.

1961 Tricolpopollenites parvulus Groot and Penny; Groot et al., p. 132, pl. 26, figs. 3, 4.

1967 Psilatricolpites parvulus (Groot and Penny) Norris, p. 107, pl. 17, figs. 5-7.

1971 Psilatricolpites parvulus (Groot and Penny) Norris; Singh, p. 198, pl. 29, figs. 15, 16.

1973 Cupuliferoidaepollenites sp. cf. C. parvulus (Groot and Penny) Dettmann, p. 12, pl. 2, figs. 11-15.

1986 Cupuliferoidaepollenites parvulus (Groot and Penny) Dettmann; Farabee and Canright, p. 46, pl. 17, figs. 5, 6.

1988 Cupuliferoidaepollenites parvulus (Groot and Penny) Dettmann; Sweet and McIntyre, p. 508, fig. 7, No. 8, 9.

Remarks: This species is rare, a total of 7 specimens were observed throughout the Bylot Island, Sermilik and Byam Martin formations.

Genus Fraxinoipollenites Potonié ex Potonié, 1960

Type Species: Fraxinoipollenites pudicus (Potonié) Potonié, 1960.

Fraxinoipollenites variabilis Stanley, 1965

Pl. 5, Fig. 5

Synonymy:

1965 Fraxinoipollenites variabilis Stanley, p. 306, pl. 45, figs. 29-35.

1971 Fraxinoipollenites variabilis Stanley; Leffingwell, p. 45, pl. 8, figs. 8-10.

1972 Fraxinoipollenites variabilis Stanley; Rouse and Srivastava, p. 1178, figs. 71-73.

1973 Fraxinoipollenites variabilis Stanley; Stone, p. 88, pl. 18, figs. 116, 117.

1975 Fraxinoipollenites variabilis Stanley; Srivastava, p. 88, pl. 42, figs. 3-5.

1981 Fraxinoipollenites variabilis Stanley; Srivastava, pl. 10, figs. 9, 10.

1986 Fraxinoipollenites variabilis Stanley; Farabee and Canright, p. 49, pl. 18, fig. 1.

Age and Distribution: Fraxinoipollenites variabilis is found in the Almond Formation (late Campanian) of Wyoming (Stone, 1973); the Lance Formation (Maastrichtian) of Wyoming (Farabee and Canright, 1986; the Fort Union Formation (Paleocene) of South Dakota (Stanley, 1965); and the Fort Union Formation (Paleocene) of Wyoming (Leffingwell, 1971).

Remarks: This species is restricted to the Byam Martin Formation and lowermost strata of the Bylot Island Formation.

Genus Tubifloridites Cookson ex Potonié, 1960

Type species: Tubifloridites antipodica (Cookson) Potonié, 1960.

Tubifloridites lilliei (Couper) Farabee and Canright, 1986

Pl. 5, Fig. 6

Synonymy:

1953 Tricolpites lilliei Couper, p. 43, pl. 8, figs. 116, 117.

1973 Tricolporites lilliei (Couper) Stover and Evans, p. 65, pl. 1, fig. 8.

1973 Tricolpites lilliei Couper; Stone, p. 86, pl. 18, fig. 111.

1969 Tricolpites lilliei Couper; Norton and Hall, p. 46, pl. 7, fig. 6.

1986 Tubifloridites lilliei (Couper) Farabee and Canright,

p. 70, pl. 24, fig. 15.

Age and Distribution: This species was reported from the Almond Formation (Campanian) of Wyoming (Stone, 1973); the Lebo Formation (Paleocene) of Montana (Norton and Hall, 1969); the Lance Formation (Maastrichtian) of Wyoming (Farabee and Canright, 1986)

Remarks: The species lilliei was placed in the genus Tubiflorides because it possessed an echinate to granulate sexine with conspicuous colpi (Farabee and Canright, 1986). A single specimen was recovered from the Sermilik Formation (Lithotype 1).

Syncolpate Pollen

Genus Porosipollis Krutzsch, 1969

Type Species: Porosipollis porosus Krutzsch (Mchedlishvili 1969).

Porosipollis porosus Krutzsch (Mchedlishvili) 1969

Pl. 5, Fig. 7

Synonymy:

1969 Porosipollis porosus Krutzsch, p. 407, pl. 1, figs. 10-14.

1974 Syncolpites porosus Mchedlishvili; McIntyre, p. 51, pl. 21, figs. 4, 5.

1976 Syncolpites porosus Mchedlishvili; Doerenkamp et al., p. 407, pl. 2, figs. 1, 2.

1989 Porosipollis porosus Krutzsch; Sweet et al., p. 94, pl. 1, fig. 29.

Age and Distribution: This species was reported from Paleocene strata of Siberia (Krutzsch, 1969); late Campanian to mid Maastrichtian strata of Horton River (McIntyre, 1974); Kanguk Formation strata (early to mid Maastrichtian) of Banks Island and Adjacent Areas (Doerenkamp et al., 1976); and mid or late Maastrichtian strata of Police Island, N.W.T. (Sweet et al., 1989).

Remarks: In their Police Island Section, Sweet et al., (1989), informally defined a Porosipollis porosus zone of mid or late Maastrichtian age. Specimens of this species were restricted to south coast sections. Only two specimens were recovered; one from the Bylot Island Formation (Section D, Appendix A_4), and the other from the Sermilik Formation (Lithotype 1).

Tricolporate Pollen

Genus Caprifoliipites Wodehouse, 1933

Type Species: Caprifoliipites viridifluminis Wodehouse, 1933.

Caprifoliipites longus Stanley, 1965

Pl. 5, Fig. 8

Synonymy:

1965 Caprifoliipites longus Stanley, p. 295, pl. 44, figs. 10-14.

Age and Distribution: This species is reported from the Fort Union Formation (Paleocene) of South Dakota (Stanley, 1965).

Remarks: This species is characterized by meridionally elongated pores, having a length of 8 to 10μm (Stanley, 1965). A single specimen was recovered from the Sermilik Formation (Lithotype 1).

Genus Cranwellia Srivastava emend. Srivastava, 1969

Type Species: Cranwellia striata (Couper) Srivastava, 1966.

Cranwellia sp. cf. C. striata Srivastava, 1966

Pl. 5, Fig. 9

Remarks: The specimen in this study is slightly different from Cranwellia striata, in having a less pronounced finely granulate sculpture. The equatorial view shown in the photo is a poor orientation for an exact species designation. A single specimen was observed from the Bylot Island Formation along the south coast.

Triporate Pollen

Genus Pseudoplicapollis Krutzsch ex Goczan et al., 1967
emend. Christopher 1979

Type Species: Pseudoplicapollis palaeocaenicus Krutzsch, 1967.

Pseudoplicapollis longiannulata Christopher, 1979
Pl. 5, Fig. 10

Synonymy:

1979 Pseudoplicapollis longiannulata Christopher, p. 114-115, pl. 5, figs. 3,4; pl. 9, figs. 1-9.

Age and Distribution: Late Turonian to Santonian of the Magothy Formation, New Jersey (Christopher, 1979).
Remarks: Christopher emended the genus Pseudoplicapollis to include species that have protruding annuli and/or endannuli. Three specimens were recovered from the Byam Martin Formation on the south coast; a single specimen was recovered from the Sermilik Formation (Lithotype 2).

Pseudoplicapollis sp. G of Christopher, 1979
Pl. 5, Figs. 11, 12

Synonymy:

1979 Pseudoplicapollis sp. G Christopher, pl. 7, figs. 4, 5.

Description: Grains in polar view were convex-triangular. Endoplicae are Y-shaped structures centered over the poles, and terminate as points within the germinals. The exogerminals are very weakly annulate. The surface sculpture is scabrate.

Size Range: Equatorial diameter 19μm (2 specimens examined)

Age and Distribution: Santonian of the Magothy Formation, New Jersey (Christopher, 1979).

Remarks: Two specimens were recovered; one from the Byam Martin Formation and one from the Sermilik Formation (Lithotype 2).

Genus Carpinipites Srivastava, 1966

Type Species: Carpinipites ancipites (Wodehouse) Srivastava, 1966.

Carpinipites ancipites (Wodehouse) Srivastava, 1966

Pl. 5, Fig. 13

Synonymy:

1933 Carpinus ancipites Wodehouse, p. 510, fig. 42.

1966 Carpinus ancipites Wodehouse; Martin and Rouse, p. 197, pl. 8, figs. 74-76.

1967 Carpinites ancipites (Wodehouse) Srivastava; Srivastava, p. 141, pl. 2, fig. R.

1971 Carpinus ancipites Wodehouse; Rouse et al., p. 236, pl. 8, figs. 12, 15.

1978 Carpinites ancipites (Wodehouse) Srivastava; Wilson, p. 142, pl. 10, fig. 2.

Age and Distribution: This species has been reported from the Lebo Formation (late Campanian to Maastrichtian) of the Yukon Territory (Wilson, 1978); and the Burrard Formation (Eocene) of British Columbia (Rouse et al., 1971.

Remarks: The genus Carpinipites is differentiated from other similar genera by the lack of a thickened region in the pore area, and having pores that are slightly or not at all protruding (Wodehouse, 1959). This species is very rare; one or two specimens were recovered from the Sermilik, Byam Martin and Bylot Island formations.

Genus Paraalnipollenites Hills and Wallace, 1969

Type Species: Paraalnipollenites alterniporus (Simpsom) Srivastava, 1975.

Paraalnipollenites alterniporus (Simpson)
Srivastava, 1975
Pl. 4, Fig. 14

Synonymy:

1967 Triatriopollenites confusus Zaklinskaia; Bratzeva, p. 123, pl. 1, fig. F.

1969 Paraalnipollenites confusus (Zaklinskaia) Hills and Wallace, p. 141, pl. 17, figs. 1-8.

1972 Paraalnipollenites confusus (Zaklinskaia) Hills and Wallace; Rouse and Srivastava, p. 1177, fig. 59.

1974 Paraalnipollenites confusus (Zaklinskaia) Hills and Wallace; McIntyre, p. 53, pl. 22, fig. 14.

1977 Paraalnipollenites confusus (Zalinskaia) Hills and Wallace; Rouse, p. 51, pl. 1, fig. 2.

1978 Paraalnipollenites confusus (Zaklinskaia) Hills and Wallace; Wilson, p. 144, pl. 10, fig. 25.

1983 Paraalnipollenites confusus (Zaklinskaia) Hills and Wallace; Wingate, p. 118, pl. 5, fig. 18.

1986 Paraalnipollenites alterniporus (Simpson) Srivastava; Jerzykiewicz and Sweet, p. 1371, pl. 4, fig. 1.

1988 Paraalnipollenites confusus (Zaklinskaia) Hills and Wallace; Frederiksen et al., p. 521, pl. 1, figs. 8, 9.

1989 Paraalnipollenites alterniporus (Simpson) Srivastava; Sweet et al., p. 98, pl. 2, fig. 10.

1989 Paraalnipollenites alterniporus (Simpson) Srivastava; McIntyre, p. 195, pl. 2, fig. 5.

Age and Distribution: This species has been reported from the Eureka Sound Formation (Maastrichtian to Paleocene) of Bathurst Island, N.W.T., Canada (Hills and Wallace, 1969); the Bonnet Plume Formation (early Paleocene) of northeastern Yukon (Rouse and Srivastava, 1972); late Maastrichtian strata of Horton River (McIntyre, 1974); the Eureka Sound Formation (Paleocene) of Ellesmere Island (Rouse, 1977); Maastrichtian strata of the Yukon Territory (Wilson, 1978); the Elko Formation (Eocene) of Nevada (Wingate, 1983); the Coalspur Formation (late Maastrichtian to Paleocene) of central Alberta (Jerzykiewicz and Sweet, 1986); mid Maastrichtian strata of north Alaska (Frederiksen et al., 1988); late Maastrichtian to Paleocene strata of Police Island, N.W.T. (Sweet et al., 1989) and the Eureka Sound Group (Paleocene) of Somerset Island, N.W.T. (McIntyre).

Remarks: Paraalnipollenites alterniporus is distinguished from other triporates by the presence of false pores, the arci extending between the true pores arc out as if to form a pore (Wilson, 1978). This species is restricted to the Bylot Island Formation and the Sermilik Formation (Lithotypes 1 and 2).

Genus Momipites (Wodehouse) Frederiksen and Christopher, 1978

Type Species: Momipites coryloides Wodehouse, 1933.

Momipites wyomingensis Nichols and Ott, 1978

Pl. 5, Fig. 15

Synonymy:

1978 Momipites wyomingensis Nicholls and Ott, p. 100, pl. 1, figs. 1-4.

1986 Momipites wyomingensis Nicholls and Ott; Farabee and Canright, p. 55, pl. 19, fig. 15.

1989 Momipites wyomingensis Nicholls and Ott; McIntyre, p. 195, pl. 1, fig. 3.

Age and Distribution: This species has been reported from the Fort Union Formation (Paleocene) in the Wind River Basin, Wyoming (Nicholls and Ott, 1978); the Lance Formation (Maastrichtian) of Wyoming (Farabee and Canright, 1986); and the Eureka Sound Group (late Paleocene) of Somerset Island, N.W.T..

Remarks: This species is restricted to the Sermilik Formation and the Bylot Island Formation. Momipites wyomingensis is most abundant (5 to 9 specimens/sample) in Lithotype 3 of the Sermilik Formation.

Genus Triatriopollenites Pflug, 1953

Type Species: Triatriopollenites rurensis Pflug and Thomson, 1953.

Triatriopollenites rurensis Pflug and Thomson, 1953

Pl. 5, Fig. 16

Synonymy:

1978 Triatriopollenites rurensis Pflug and Thomson; Schumaker-Lambry, pl. 13, figs. 4, 8.

Age and Distribution: Paleocene of Belgium (Schumacker-Lambry, 1978).

Remarks: This species first occurred in the Sermilik Formation (Lithotype 2) in the south coast sections. At Twosnout Creek, the species was by and large restricted to upper strata of the Bylot Island Formation. Isolated occurrences were recorded in lower strata of the Bylot Island Formation and the Byam Martin Formation.

Genus Trudopollis Pflug emend. Krutzsch, 1967

Type Species: Trudopollis pertrudens (Pflug) Pflug, 1953.

Trudopollis variabilis R.H. Tschudy, 1975

Pl. 5, Fig. 17

Synonymy:

1975 Trudopollis variabilis R.H. Tschudy, p. 25, pl. 16, figs. 13-22.

1976 Trudopollis variabilis R.H. Tschudy; Wolfe, p. 13, pl. 1, fig. 28.

Age and Distribution: This species has been reported from the Ripley Formation (mid Campanian to early Maastrichtian) of the Mississippi Embayment (R.H. Tschudy, 1975); and the Englishtown Formation (mid Campanian) of the middle Atlantic States (Wolfe, 1976).

Remarks: This taxon is characterized by a verrucate ektexine, a greatly thickened and angular annulus and the absence of an interloculum (R.H. Tschudy, 1975). Trudopollis conrector Pflug differs from Trudopollis variabilis by the presence of a prominent vestibulum and a scabrate exine.

Trudopollis conrector Pflug, 1953

Pl. 5, Fig. 18

Synonymy:

1961 Trudopollis conrector Pflug; Groot et. al., p. 137, pl. 26, fig. 52.

1981 Trudopollis conrector Pflug; Pacltová, p. 205, pl. 17, figs. 2, 2b, 2c.

1981 Trudopollis conrector Pflug; Mikhelis, p. 229, pl. 13, figs. 5-10.

Age and Distribution: This species has been reported from the Magothy Formation (Santonian) of the Eastern United States (Groot et al., 1961); Campanian to Paleocene strata of the Sea of Azov (Mikhelis, 1981); Santonian strata of the Bohemian Massif, Eastern Europe (Pacltová, 1981).

Remarks: Only 5 specimens of this species were recovered. Four of the specimens were from the Bylot Island Formation at Twosnout Creek and a single specimen from the Byam Martin

Formation at Twosnout Creek.

Genus Megatriopollis Goczan and Krutzsch, 1967

Type Species: Megatriopollis santonius Goczan and Krutzsch, 1967.

Megatriopollis sp. 1

Pl. 6, Fig. 1

Synonymy:

1974 Extratriporopollenites sp. 2 McIntyre (pars) p. 52, pl. 22, fig. 2 only.

1976 Extratriporopollenites sp. 2 McIntyre; Doerenkamp et al., p. 405, pl. 1, fig. 16.

Description: Pollen grains have a triangular to convex triangular shape. Wall is two layered (1μm thick), with a slightly thickened exine (1.5μm thick) bordering the germinal. Surface sculpture is finely reticulate (lumina ≤ 0.5μm wide). The commonly observed internal structured layer is absent.

Size Range: Polar diameter 28-30μm (2 specimens measured)

Remarks: The generic diagnosis by Goczan and Krutzsch, (1967; in Jansonius and Hills, 1976) indicates that the internal structured layer may or may not be present. A specimen labelled Extratriporopollenites sp. 2 by McIntyre

(1974) from Horton River appears identical to specimens found in the Sermilik Formation (Lithotype 1). As well, the specimen labelled Extratriporopollenites sp. 2 McIntyre by Doerenkamp et al., (1976) also appears identical to those observed in this study.

Age and Distribution: Specimens labelled Extratriporopollenites sp. 2 McIntyre have been reported from early to mid Maastrichtian strata of Horton River (McIntyre, 1974) and from late Campanian to Paleocene strata of Banks Island (Doerenkamp et al., (1976).

Genus Neotriangulipollis Goczan and Krutzsch, 1967
Type Species: Neotriangulipollis piolencensis Krutzsch, 1967.

Neotriangulipollis sp. 1 of Azema, 1981

Pl. 6, Fig. 2

Synonymy:

1980 Vacuopollis microconcavus Pacltova; Medus et al., p. 144, pl. 11, figs. 11-13, 26.

1981 Neotriangulipollis sp. 1 Azema; p. 263, pl. 5, fig. 13.

Description: This species is similar to Neotriangulipollis sp. 1 of Azema (1981), however, there is a slight variation in the pore area. With the latter species, the ectexine is thickened around the pore to form a 2.5μm annulus. The single specimen recovered from this study exhibited a thickened region (approximately 1.5μm wide) around the pore. The specimen measured 24 μm in polar diameter.

Age and Distribution: Santonian strata of France (Azema *et al.*, 1981); and late Turonian strata of Portugal (Medus *et al.* 1980).

Remarks: Azema (1981) indicates that *Vacuopollis microconcavus* by Medus *et al.*, (1980) from the Turonian of Portugal is identical. A single specimen was recovered from the Sermilik Formation (Lithotype 1).

Genus *Extratriporopollenites* Pflug emend. Skarby, 1968

Type Species: *Extratriporopollenites fractus* Pflug, 1953.

Extratriporopollenites sp. 2 of McIntyre, 1974

Pl. 6, Fig. 3

Synonymy:

1974 *Extratriporopollenites* sp. 2 McIntyre (pars) p. 52, pl. 22, figs. 3 and 4 only.

Description: Triporate; triangular to convex triangular; surface finely reticulate (lumina ≤ 0.5μm wide); ektexine uniformly thin (0.5μm thick) and unthickened in the aperatural region.

Size Range: Polar diameter 21-24µm (5 specimens measured)

Remarks: This species is identical in all respects to that of McIntyre (1974). Specimens were restricted to the Sermilik Formation (Lithotype 2) and the Bylot Island Formation (Section C).

Age and Distribution: Early to mid Maastrichtian strata of Horton River (McIntyre, 1974).

Stephanoporate Pollen

Genus Polyvestibulopollenites Pflug, 1953

Type Species: Polyvestibulopollenites verus (Potonie) Thomson and Pflug, 1953.

Polyvestibulopollenites trinus (Stanley) Norris, 1986

Pl. 6, Fig. 4

Synonymy:

1965 Alnus trina Stanley, p.289, pl. 43, figs. 4-6.

1969 Alnipollenites trina Stanley; Norton and Hall, p. 42, pl. 5, fig. 20.

1978 Alnipollenites versus Potonie; Wilson, p. 145, pl. 11, figs. 9, 10.

1980 Jarzenipollenites trinus Stanley; Kedves, p. 172, pl. II, figs. 4-6.

1986 Alnus trina Stanley; Jerzykiewicz and Sweet, pl. 1,

fig. 19.

1986 Alnipollenites trina (Stanley) Norton; Farabee and Canright, p. 36, pl. 10, figs. 11-13.

1986 Polyvestibulopollenites trinus (Stanley) Norris, p. 41, pl. 10, figs. 46, 53.

Age and Distribution: This species has been reported from the Fort Union Formation (early Paleocene) of South Dakota (Stanley, 1965); the Tullock Formation (Paleocene) of Montana (Norton and Hall, 1969); the Lance Formation (Maastrichtian) of Wyoming (Farabee and Canright, 1986); the Paskapoo Formation (Paleocene) of the Alberta Foothills (Jerzykiewicz and Sweet, 1986); and the Mackenzie Bay and Kugmallit Formations (Paleocene to Miocene) (Norris, 1986).

Remarks: Polyvestibulopollenites trinus is readily distinguished from other polyporate grains by the presence of curved arci joining the pores (Wilson, 1978). This species is also characterized by a thickened exine in the pore region, forming an annulus and a slight labrum (Stanley, 1965).

Specimens of this species were recovered from the Bylot Island Formation at Twosnout Creek.

Genus Polyatriopollenites Pflug, 1953

Type Species: Polyatriopollenites stellatus (Potonié) Pflug, 1953.

Polyatriopollenites stellatus (Potonié) Pflug, 1953

Pl. 6, Fig. 5

Synonymy:

1966 Pterocarya stellatus (Potonié); Martin and Rouse, p. 196, pl. 8, figs. 79, 80.

1969 Pterocarya stellatus (Potonié) Martin and Rouse; Hopkins, p. 1121, pl. 9, figs. 122-124.

1969 Pterocaryapollenites stellatus (Potonié) Thiergart; Norton and Hall, p. 42, pl. 5, fig. 23.

1971 Pterocarya stellatus (Potonié) Martin and Rouse; Piel, p. 1910, pl. 13, figs. 113, 114.

1978 Pterocaryapollenites stellatus (Potonié) Raatz; Wilson, p. 146, pl. 9, fig. 7; pl. 10, figs. 13, 17.

1986 Polyatriopollenites stellatus (Potonié) Pflug; Norris, p. 42, pl. 11, figs. 5-7.

1987 Polyatriopollenites stellatus (Potonié) Pflug; Langille, p. 101, pl. 6, fig. 12.

Age and Distribution: Mid Maastrichtian of the Hell Creek Formation, Montana (Norton and Hall, 1969); Maastrichtian to Paleocene of the Bonnet Plume Formation, Northeastern Yukon (Rouse and Srivastava, 1972); Maastrichtian strata of the Mackenzie Delta (Wilson, 1978); Eocene to Pliocene of the

Kugmallit and Richards Formations, Mackenzie Delta (Norris, 1986); Paleocene strata of Baffin Island (Langille, 1987).

Remarks: Specimens in this study have slightly raised labra. Four, five and six pored pollen were observed. This species was very rare; one or two specimens were recovered from all three formations (Byam Martin, Sermilik, and the Bylot Island Formation).

Genus Tetraporites Samoliovich, 1965

Type Species: Tetraporites pravus Samoliovich, 1965.

Tetraporites sp. 1 of McIntyre, 1974

Pl. 6, Fig. 6

Synonymy:

1974 Tetraporites sp. 1 McIntyre, pl. 22, fig. 9, 10.

Description: Only two specimens were observed. The grains are granulate and measured 26 and 30 μm in diameter. The exine is thin (< 1μm thick) and slightly thickened (1.5μm thick) in the pore region.

Age and Description: Very late Campanian to mid Maastrichtian strata of Horton River (McIntyre, 1974).

Remarks: Tetraporites sp. 1, is identical in nearly all respects to Tetraporites sp. 1 of McIntyre (1974).

Tetraporites sp. 2 differs in being 8μm to 9μm smaller in diameter, and possessing a psilate exine. This species was very rare; a single specimen was recovered from the Bylot Island Formation along the south coast (Section D, Appendix A_4) and the other from the Sermilik Formation (Lithotype 1).

Tetraporites sp. 2

Pl. 6, Fig. 7

Description: The exine is psilate, thin (< 1μm thick) and slightly thickened (1.5μm thick) in the pore region.

Size Range: Equatorial diameter 18-21μm (6 specimens measured)

Remarks: This species is restricted to the Sermilik Formation (Lithotype 2) and uppermost strata of the Bylot Island Formation at Twosnout Creek.

Binigeminate Pollen

Genus Wodehouseia Stanley, 1961

Type Species: Wodehouseia spinata Stanley, 1961.

Wodehouseia gracile (Samoilovitch) Pokrovaskaya, 1966

Pl. 6, Fig. 8

Synonymy:

1967 *Wodehouseia gracile* (Samoilovitch) Samoilovitch, p. 132, pl. 2, fig. 6.

1974 *Wodehousiea gracile* (Samoilovitch) Pokrovaskaya; McIntyre, pl. 15, figs. 15, 16.

1976 *Wodehouseia gracile* (Samoilovitch) Pokrovaskaya; Doerenkamp *et al.*, pl. 3, figs. 18, 19.

1976 *Wodehouseia gracile* (Samoilovitch) Pokrovaskaya; Wiggins, p. 65, pl. 3, figs. 3, 4.

1989 *Wodehouseia gracile* (Samoilovitch) Pokrovaskaya; Sweet *et. al.*, p. 95, pl. 1, fig. 20.

Age and Distribution: Very late Campanian to mid Maastrichtian strata of Horton River (McIntyre, 1974); Maastrichtian of the Kanguk Formation, Banks Island and adjacent areas (Doerenkamp *et al.* 1976); late Maastrichtian strata of Alaska (Wiggins, 1976); and mid(?) Maastrichtian strata of Police Island, N.W.T. (Sweet *et al.*, 1989).

Remarks: Wiggins (1976) indicated that the size range for specimens in his Alaskan study was (28-31 μm in length) and (39-41 μm in transverse equatorial projection). Specimens in this study were as small as 20μm in length and ranged between 26-34 μm in transverse equatorial projection.

In south coast sections, *Wodehouseia gracile* is restricted to the Sermilik Formation (Lithotype 1) and a tongue of Bylot Island Formation strata (Section D, Appendix

A_4). At Twosnout Creek, this species is restricted to (Section C, Appendix A_3), which incorporates both Bylot Island Formation strata and Lithotype 3 of the Sermilik Formation.

Wodehouseia sp. 1

Pl. 6, Fig. 9

Description: Isopolar fossil pollen with bilateral symmetry. Equatorial pollen profile, circumscribing the longest pollen axis, suboblate to oblate. Apertures binigeminate, large, elliptical colpi, approximately 10μm long and 4μm wide. The colpi are at right angles to the longest pollen axis. The wall is double layered, composed of a smooth endexine which forms a central pollen body, and a slightly punctate flange with external spines. The spines are restricted to the flange meridian. The flange is 1μm wide at the termini of the longest equatorial axis.

Size Range: Polar Length (2 specimens) 34-38 μm
Transverse equatorial projection 50-52 μm
Central body length 13-15 μm
Flange length 9-10 μm
Length of spines 1.5-2 μm

Remarks: This species is differentiated from Wodehousia

<u>spinata</u> Stanley and <u>Wodehousia</u> <u>octospina</u> Wiggins by the absence of spines on the central body. It differs from <u>Wodehousia</u> <u>edmontonicola</u> Wiggins by its distinctly larger size, and smooth central body. This species is restricted to the Sermilik Formation (Lithotype 2) and the Bylot Island Formation.

Genus <u>Singularia</u> Samoilovitch, 1961

Type Species: <u>Singularia</u> <u>aculeata</u> Samoilovitch, 1961.

<u>Singularia</u> <u>aculeata</u>, Samoilovitch, 1961

Pl. 6, Fig. 10

Synonymy:

1974 <u>Singularia</u> <u>aculeata</u> Samoilovitch; McIntyre, p. 39, pl. 15, fig. 17.

1976 <u>Singularia</u> <u>aculeata</u> Samoilovitch; Wiggins, p. 68.

Description: The equatorial profile is oblate. The flange is very poorly developed with the ektexine and endexine being closely appressed. The central body is characterized by numerous short spines. The spines are developed along the meridian as well. The flange or meridian is $\leq 1\mu m$.

Size Range: (1 Specimen measured)

Transverse equatorial projection 30μm

Polar length 16μm

Age and Distribution: Maastrichtian-Paleocene? strata of the Western Siberian Lowland (Chlonova, 1961); late Maastrichtian strata of Alaska (Wiggins, 1976); and very late Campanian to mid Maastrichtian strata of Horton River, (McIntyre, 1974).

Remarks: This species is very rare; two specimens were recovered from the Sermilik Formation (Lithotype 2). Wiggins (1976) encountered too few specimens to make a precise morphologic evaluation of the genus, but indicated that its stratigraphic value could be important.

Triprojectate Pollen

Genus Mancicorpus Mtchedlishvili emend.

Srivastava, 1968

Type Species: Mancicorpus anchoriforme Mtchedlishvili, 1961.

Mancicorpus trapeziforme Mtchedlishvili, 1961

Pl. 6, Fig. 11

Synonymy:

1974 Mancicorpus trapeziforme Mtchedlishvili; McIntyre, p. 49, pl. 20, figs. 5, 6.

1976 Mancicorpus trapeziforme Mtchedlishvili; Doerenkamp et al., p. 409, pl. 3, fig. 2.

Age and Distribution: Very late Campanian to mid

Maastrichtian of Horton River (McIntyre, 1974); Maastrichtian of Banks Island and adjacent areas (Doerenkamp et al., 1976).

Remarks: B.D. Tschudy (1969) indicates that Mancicorpus trapeziforme resembles Aquilapollenites senonicus Mtchedlishvili; the two species are only differentiated by a variation in the size of the angle formed at the contact of the equatorial projections. For Mancicorpus trapeziforme the equatorial projection joins the body nearly at right angles, for Aquilapollenites senonicus the equatorial projection joins the body at an acute angle. A single specimen was recovered from the Sermilik Formation (Lithotype 2).

Genus Aquilapollenites (Rouse) Funkhouser, 1961

Type Species: Aquilapollenites quadrilobus Rouse, 1957.

Aquilapollenites scabridus B.D. Tschudy, 1969

Pl. 6, Fig. 12

Synonymy:

1969 Aquilapollenites scabridus B.D. Tschudy, p. A11, pl. 13, figs. 1-11, pl. 14, figs. 1, 2.

Age and Distribution: Aquilapollenites scabridus B.D. Tschudy, was recovered with other mid Campanian to Maastrichtian species of Aquilapollenites at Nation River, Alaska. Only one sample was collected at that locality, hence a more precise age was not possible.

Remarks: This species is diagnostic for its rough surface sculpture (B.D. Tschudy, 1969). A single specimen was recovered from the Bylot Island Formation along the south coast.

Aquilapollenites sp. 1

Pl. 6, Fig. 13

Remarks and Description: A single poorly preserved specimen was recovered from the Sermilik Formation (Lithotype 2). The surface is ornamented with numerous short spines (< 1μm high); the grain has an equatorial diameter of 30μm.

Unknown Specimens

Specimen 1

Pl. 6, Fig. 14

Description: Spore or pollen of unknown affinity. Grains circular; surface ornament psilate to finely granulate. Diameter of 25 measured specimens 26 (30) 33 μm.

Remarks: Specimens were observed in the Sermilik Formation

(Lithotype 1) and lowermost strata of the Bylot Island Formation at Twosnout Creek.

Specimen 2

Pl. 6, Fig. 15

Description: Monosulcate pollen ? of unknown affinity. Grain circular; surface ornament rugulate (<1μm wide). Ektexine consists of 2μm high simple, slender spines. The dimensions of the only recorded specimen are; Length - 49.5 μm, Breadth - 44 μm.

Remarks: A single specimen was recovered from uppermost strata of the Bylot Island Formation at Twosnout Creek.

FUNGAL REMAINS

Genus Pesavis Elsik and Jansonius, 1974

Type Species: Pesavis tagluensis Elsik and Jansonius, 1974.

Pesavis parva Kalgutkar and Sweet, 1988

Pl. 6, Fig. 16

Synonymy:

1974 Pesavis tagluensis Elsik and Jansonius (pars), p. 955, pl. 1, fig. 10 only.

1976 "Pesavis parva" Jansonius, p. 133, pl. 1, fig. 2.

1978 Pesavis sp. Sweet, p. 36, pl. 6.2, fig. 15.

1980 Pesavis sp. in Jerzykiewicz and Sweet, p. 1365, pl. 1, fig. 7.

1988 Pesavis parva Kalgutkar and Sweet, p. 123, pl. 6.1, figs. 6-12.

Description: The overall diameter is 26 μm; there are 6 lateral arm cells; and a central cavity is absent (one specimen measured).

Age and Distribution: Late Maastrichtian to Lower Paleocene strata of the Yukon Coastal Plain (Kalgutkar and Sweet, 1988); late Maastrichtian strata of the Bonnet Plume Basin (Kalgutkar and Sweet, 1988).

Remarks: Pesavis parva is a biostratigraphically important fungal spore described by Kalgutkar and Sweet (1988). Two specimens of Pesavis parva were recorded in this study, both from uppermost strata of the Bylot Island Formation at Twosnout Creek.

MARINE MICROPLANKTON

Introduction

This project is a stratigraphic and terrestrial palynomorph study; however, selected biostratigraphically significant dinoflagellates were incorporated to help establish age relationships. The dinoflagellates were not counted, thus, the range chart (Appendix C_2) represents only the presence or absence of a taxon.

Proximate Dinoflagellates

Genus Ceratiopsis Vozzhenikova emend. Bujak, Downie, Eaton and Williams, 1980

Type Species: Ceratiopsis leptoderma Vozzhennikova, 1963

Ceratiopsis diebelii (Alberti) Vozzhennikova, 1967.

Pl. 6, Fig. 17

Synonymy:

1967 Deflandrea diebelii sp. cf. D. Diebelii Alberti; Drugg, p. 16, pl. 2, fig. 6.

1974 Deflandrea diebelii Alberti; McIntyre, p. 17, pl. 4, figs. 4, 5.

1975 Deflandrea diebelii Alberti; McIntyre, p. 67, pl. 4, figs. 1, 2.

1976 Deflandrea diebelii Alberti; Doerenkamp et al., pl. 4, fig. 7.

1977 Deflandrea diebelii Alberti; Williams and Bujak, p. 46, pl. 5, fig. 1.

1978 Deflandrea diebelii Alberti; Wilson, p. 151, pl. 11, fig. 15.

1980 Deflandrea diebelii Alberti; May, p. 75, pl. 8, fig. 16.

1980 Deflandrea diebelii Alberti; Croxton, p. 25, pl. 4, fig. 6; p. 27, pl. 5, fig. 6.

1985 Ceratiopsis diebelii (Alberti) Vozzhennikova; Williams and Bujak, p. 870, fig. 23, No. 17.

1986 Deflandrea diebelii Alberti; Ioannides, p. 19, pl. 11, figs. 6, 7, 10, 11.

1988 Ceratiopsis diebelii (Alberti) Vozzhennikova; Shaozhi and Norris, p. 78, pl. 9, fig. 6.

Age and Distribution: This species has been reported from Maastrichtian strata of Horton River (McIntyre, 1974; 1975); Maastrichtian of Banks Island and Adjacent Areas (Doerenkamp et al., 1976); Maastrichtian of offshore southeastern Canada, (Bujak and Williams, 1978); Maastrichtian of the Atlantic Highlands, New Jersey (May, 1980); Maastrichtian and Danian of Escarpado Canyon, California (Drugg, 1967); Maastrichtian - Paleocene ?, of West Central Greenland (Croxton, 1980).

Remarks: Lentin and Williams (1975, p. 2153); considered this genus to be a junior synonym of Deflandrea. This view was later rejected by Lentin and Williams (1977, p. 20); because of the nature of the hexa 2a archeopyle.

Ceratiopsis diebelii is the most significant marine palynomorph marking the Maastrichtian worldwide. Extensive compilations by Wilson (1971), Bujak and Williams (1978), McIntyre (1974; 1975), May (1980) and Williams and Bujak

(1985) indicate that the presence of Ceratiopsis diebelii marks the first occurrence of Maastrichtian strata. The first occurrence of Ceratiopsis diebelii is subsequently used to indicate the presence of Maastrichtian rocks on Bylot Island. This species was recovered from the Sermilik Formation and the Bylot Island Formation.

Genus Palaeoperidinium Deflandre emend. Sarjeant, 1967
Type Species: Palaeoperidinium pyrophorum (Ehrenberg) Sarjeant, 1967.

Palaeoperidinium kozlowskii (Gorka) Davey, 1970

Pl. 6, Fig. 18

Synonymy:

1974 Lejeunia kozlowskii Gorka; McIntyre, p. 17, pl. 4, figs. 2, 3.

1975 Lejeunia kozlowskii Gorka; McIntyre, p. 68, pl. 4, figs. 3, 4.

1976 Lejeunia kozlowskii Gorka; Doerenkamp et al., p. 411, pl. 4, fig. 8.

Age and Distribution: This species has been reported from the late Campanian to early Maastrichtian strata of Horton River (McIntyre, 1974; 1975); and late Campanian to early Maastrichtian strata of Banks Island and adjacent areas (Doerenkamp et al., (1976).

Remarks: McIntyre (1974; 1975), Doerenkamp et al., (1976), and Bujak and Williams (1978) suggest that the coexistance of Ceratopsis diebelii and Palaeoperidinium kozlowskii are excellent indicators for Maastrichtian strata. A single specimen of Palaeoperidinium kozlowskii was recovered from the Sermilik Formation (Lithotype 1).

CHAPTER 4 DISCUSSION

4.1 Biostratigraphy

Palynological analyses of Cretaceous strata from Eclipse Trough are divided into three palynological assemblage zones, herein called the Gleicheniidites sp. cf. G. circiniidites - Antulsporites distaverrucosus (GA) zone, the Porosipollis porosus - Aquilapollenites scabridus (PA) zone and the Singularia aculeata - Pesavis parva (SP) zone. These units are informally established in accordance with guidelines in the North American Stratigraphic Code (NACSN, 1983) and the International Stratigraphic Guide (Hedberg, 1976).

Zones are characterized by the occurrence of selected index species. It is not necessary for every index species to be present in a sample, nor is it necessary for a species to be restricted to a particular zone (Hedberg, 1976). The boundary between two zones is placed at the median between the uppermost sample of the lower zone and the lowermost sample of the overlying zone. Those long ranging taxa that are in abundance and characterize no particular zone are recorded on the range chart only (Appendix C_2). Figure 4.1 indicates the known ranges of the significant taxa within these zones.

For each assemblage zone, those species which define or characterize the zone are identified under the following subheadings: species which are restricted to the biozone

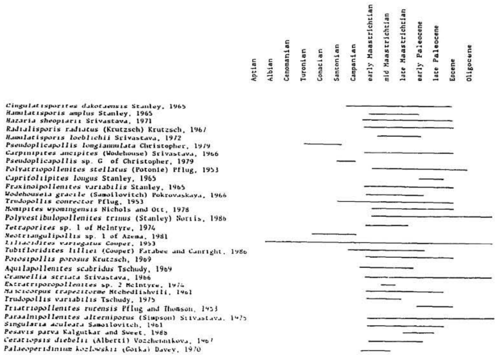

Figure 4.1 Range chart indicating the known ranges of significant taxa identified in this study (based on available literature).

(both biostratigraphic and long ranging taxa), species which characterize the zone, but overlap with other zones (both biostratigraphic and long ranging taxa), those species which are considered to be new species or unknown taxa, and those species which are common in all zones, but are biostratigraphically significant for late Cretaceous and younger strata.

4.1.1 Gleicheniidites sp. cf. G. circinidites, Antulsporites distaverrucosus (GA) zone

Species which are restricted to the biozone include: Gleicheniidites sp. cf. G. circinidites (Cookson) Dettmann, Ornamentifera baculata Singh, Antulsporites distaverrucosus (Brenner) Archangelsky and Gamerro and Gemmatriletes clavatus Brenner. Those species which are most common in the GA zone but overlap with other zones include: Lycopodiacidites canaliculatus Singh, Pseudoplicapollis longiannulata Christopher and Fraxinoipollenites variabilis Stanley. New species which first occur in this assemblage zone and are locally restricted to strata of Eclipse Trough are: Lycopodiacidites sp. 1, Pityosporites sp. 1, Pityosporites sp. 2, Annulispora sp. 1 and Liliipollis sp. 1.

Species that are biostratigraphically important, but not definitive of the GA zone include: Cingulatisporites dakotaensis Stanley, Hazaria sheopiarii Srivastava, Carpinipites ancipites (Wodehouse) Srivastava, Pseudoplicapollis sp. G of Christopher, Polyatriopollenites stellatus (Potonié) Pflug, Trudopollis conrector Pflug and Triatriopollenites rurensis Pflug.

Distribution

The stratotype for the GA biozone is the interval which spans 01-SC-22 to 02-SC-23, 0 to 12 metres, of the Byam Martin Formation on the south coast (Section B, Appendix A_2). At Twosnout Creek, the GA zone is equivalent with the interval which spans 01-TC-85 to 04-TC-98, 14.5 to 220 metres, (Section A, Appendix A_1). This corresponds with the Byam Martin Formation and the lower 100 metres of the Bylot Island Formation, and is herein designated as a parastratotype for the biozone.

Age

The age of the GA zone is not certain. Terrestrial palynomorph diversity is relatively low and age is in part inferred from associations with conformably overlying zones. Species occurring in this zone which indicate a general late Cretaceous age include: Pseudoplicapollis longiannulata Christopher (late Turonian to Santonian ?), Pseudoplicapollis sp. G of Christopher (Santonian ?), and Trudopollis conrector Pflug (Santonian to Paleocene). Those species which are biostratigraphically restricted include:

Cingulatisporites dakotaensis Stanley (late Campanian to Paleocene), Hazaria sheopiarii Srivastava (late Campanian to Paleocene), Carpinipites ancipites (Wodehouse) Srivastava (late Campanian to Eocene), Polyatriopollenites stellatus (Potonié) Pflug (Maastrichtian to Paleocene) and Triatriopollenites rurensis Pflug and Thomson (Paleocene).

The presence of characteristic late Campanian to Maastrichtian taxa in the overlying PA biozone, and in particular, Ceratiopsis diebelii (Alberti) Vozzhennikova and Palaeoperidinium kozlowskii (Ehrenberg) Davey, coupled with the conformable relationship of the two zones, suggests a mid to late Campanian age for the GA biozone.

The paucity of diverse late Cretaceous terrestrial palynomorphs within the GA biozone makes correlations with other Arctic (Campanian age) palynofloral zones difficult.

4.1.2 Porosipollis porosus - Aquilapollenites scabridus (PA) zone

Species restricted to the biozone include: Densoisporites velatus (Weyland and Kreiger) Krasnova, Cirratriradites teter Norris, Pityosporites constrictus Singh, Cycadopites fragilis Singh, Pityosporites alatipollenites (Rouse) Singh, Caprifoliipites longus Stanley, Rousea georgensis (Brenner) Dettmann, Neotriangulipollis sp. 1 of Azema, Tubifloridites lilliei (Couper) Farabee and Canright, Porosipollis porosus

Mchedlishvili, Aquilapollenites scabridus Tschudy and Palaeoperidinium kozlowskii (Ehrenberg) Davey.

Those species that characterize the PA biozone, but which overlap with other zones include: Wodehouseia gracile (Samoilovitch) Pokrovaskaya, Tetraporites sp. 1 of McIntyre, Cibotiumspora juncta (Kara-Murza) Singh and Foveotriletes subtriangularis Brenner. New species and unknown taxa occurring within the PA zone are: Lycopodiacidites sp. 1, Pityosporites sp. 1, 2, and 3, Cicatricosisporites sp. 1, Cycadopites sp. 1, Liliipollis sp. 1, Megatropollis sp. 1, and Unknown Specimen 1. Of the aforementioned species, Liliipollis sp. 1, Megatropollis sp. 1, and Unknown Specimen 1 are locally important for biostratigraphy. Species that are biostratigraphically important, but not definitive of the PA zone include: Hamulatisporis amplus Stanley, Radialisporis radiatus (Krutzsch) Krutzsch, Cingulatisporites dakotaensis Stanley, Carpinipites ancipites (Wodehouse) Srivastava, Polyatriopollenites stellatus (Potonié) Pflug, Trudopollis conrector Pflug, Momipites wyomingensis Nichols and Ott, Polyvestibulopollenites trinus (Stanley) Norris, Triatriopollenites rurensis Pflug and Thomson, and Ceratiopsis diebelii (Alberti) Vozzhennikova.

Distribution

The stratotype for the PA biozone incorporates the interval 03-SC-24 to 09-SC-36, 30 to 370 metres, of the Sermilik Formation (Section B, Appendix A_2). The PA zone is also found in a 70 metre thick section of Bylot Island Formation strata and basal Lithotype 2 strata (Section D, Appendix A_4), which occurs directly adjacent to and overlying the stratotype.

At Twosnout Creek, the PA zone is the interval which spans 05-TC-720 to 09-TC-109, 220 to 420 metres (Section A, Appendix A_1) of the Bylot Island Formation. This portion of strata is designated the parastratotype for the PA biozone.

Age

Several biostratigraphically important Late Cretaceous and younger palynomorphs first occur in the PA zone. These include: Radialisporis radiatus (Krutzsch) Krutzsch (late Campanian to Paleocene), Hamulatisporis amplus Stanley (Maastrichtian), Wodehouseia gracile (late Campanian to late Maastrichtian), Momipites wyomingensis (Maastrichtian to Paleocene), Polyvestibulopollenites trinus (Stanley) Norris (Maastrichtian to Miocene), Porosipollis porosus (Mchedlishvili) Krutzsch (late Campanian to late Maastrichtian), Palaeoperidinium kozlowskii (Ehrenberg) Davey (late Campanian to mid Maastrichtian) and Ceratiopsis diebelii (Alberti) Vozzhennikova (Maastrichtian to Danian).

Of these species, Porosipollis porosus (Mchedlishvili) Krutzsch is not known to range above the mid Maastrichtian of the Horton River Section (McIntyre, 1974), and mid Maastrichtian strata of Banks Island (Doerenkamp et al., 1976). In the western Canadian Arctic, this species is reported from mid or late Maastrichtian strata of Police Island (Sweet et al., 1989).

Palaeoperidinium kozlowskii (Ehrenberg) Davey first appears in the late Campanian of Horton River (McIntyre, 1974) and Banks Island (Doerenkamp et al., 1976), and ranges no higher than early to mid Maastrichtian in either of these areas. Extensive compilations by Wilson (1971), Bujak and Williams (1978), McIntyre (1974; 1975), May (1980) and Williams and Bujak (1985) indicate that Ceratiopsis diebelii marks the base of the Maastrichtian. The first occurrence of Ceratiopsis diebelii is subsequently used to indicate Maastrichtian rocks on Bylot Island.

The ranges of taxa in the PA zone suggest a very late Campanian to mid Maastrichtian age. The PA biozone correlates with microfloral division H3 of the CR 16B N-68 Section (late Campanian to Maastrichtian) at Horton River (McIntyre, 1974), the (CVIc) subzone of the Expressipollis, Orbiculapollis, Deflandrea biapertura (CVI) zone (late Campanian to mid Maastrichtian) at Banks Island (Doerenkamp et al., 1976), the Wodehouseia gracile / Aquilapollenites parallelus (mid Maastrichtian) and the Porosipollis porosus zones (mid or late Maastrichtian) at Police Island (Sweet *et al.*, 1989).

4.1.3 *Singularia aculeata* - *Pesavis parva* (SP) zone

Species restricted to this biozone include: *Appendicisporites erdtmanii* Pocock, *Asbeckiasporites wirthi* von der Brelie, *Extratriporopollenites* sp. 2 of McIntyre, *Singularia aculeata* Samoilovitch, *Mancicorpus trapeziforme* Mchedlishvili, *Paraalnipollenites alterniporus* (Simpson) Srivastava, *Pesavis parva* Kalgutkar and Sweet and *Trudopollis variabilis* Tschudy. Species characterizing the SP zone but overlapping with other zones, include: *Hamulatisporis amplus* Stanley, *Radialisporis radiatus* (Krutzsch) Krutzsch, *Hazaria sheopiarii* Srivastava, *Momipites wyomingensis* Nicholls and Ott, *Triatriopollenites rurensis* Pflug and Thomson, *Carpinipites ancipites* (Wodehouse) Srivastava and *Ceratiopsis diebelii* (Alberti) Vozzhennikova.

New species and unknown taxa which occur in this assemblage zone and are locally restricted to strata of Eclipse Trough are: *Lycopodiacidites* sp. 1, *Pityosporites* sp. 1, 2 and 3, *Annulispora* sp. 1, *Cicatricosisporites* sp. 1, *Cycadopites* sp. 1, *Podocarpidites* sp. 1, *Aquilapollenites* sp. 1, *Wodehouseia* sp. 1, *Tricolpites* sp. 1, and Unknown Specimen 2. Of these palynomorphs, *Podocarpidites* sp. 1, *Aquilapollenites* sp. 1, *Wodehouseia* sp. 1, *Tricolpites* sp.

1, Pristinuspollenites sp. cf. P. inchoatus, Hamulatisporis sp. cf. H. loeblichii, Cranwellia sp. cf. C. striata and Unknown Specimen 2 are restricted to the zone. Species that are biostratigraphically important, but not definitive of the SP zone include: Cingulatisporites dakotaensis Stanley, Pseudoplicapollis longiannulata Christopher, Polyatriopollenites stellatus (Potonie) Pflug, Polyvestibulopollenites trinus (Stanley) Norris, Tetraporites sp. 1 of McIntyre and Trudopollis conrector Pflug.

Distribution

The stratotype for the SP biozone incorporates the interval which spans 11-SC-201 to 14-SC-209, 370 to 500 metres of the Sermilik Formation (Section B, Appendix A_2). At Twosnout Creek, the SP zone is equivalent to the interval which spans 10-TC-116 to 13-TC-114, 420 to 540 metres (Section A, Appendix A_1) of the Bylot Island Formation, and 01-TC-142 to 03-TC-156, 0 to 82 metres, (Section C, Appendix A_3) of the Bylot Island Formation and Lithotype 3 of the Sermilik Formation. The former (Section A, Appendix A_1) is designated as a parastratotype for the SP biozone.

Age

Biostratigraphically important palynomorphs making their first appearance in the SP zone include:

Extratriporopollenites sp. 2 of McIntyre (early to mid Maastrichtian), Singularia aculeata Samoilovitch (late Campanian to Paleocene), Mancicorpus trapeziforme Mchedlishvili (late Campanian to Maastrichtian), Paraalnipollenites alterniporus (Simpson) Srivastava (late Maastrichtian to Eocene), Pesavis parva Kalgutkar and Sweet (late Maastrichtian to early Paleocene) and Trudopollis variabilis Tschudy (late Campanian to mid Maastrichtian).

Of these species, Pesavis parva Kalgutkar and Sweet is not known to range below the late Maastrichtian in Arctic Canada (Kalgutkar and Sweet, 1988). Similarly, Paraalnipollenites alterniporus (Simpson) Srivastava is not known to range below the late Maastrichtian of northwestern Canada (McIntyre, 1974). This species is also not known to range below late Maastrichtian strata of Police Island (Sweet et al., 1989). Late Cretaceous taxa that are not known to range into the Paleocene, include: Wodehouseia gracile (late Campanian to late Maastrichtian), Hamulatisporis amplus (Maastrichtian), Mancicorpus trapeziforme Mchedlishvili (late Campanian to Maastrichtian) and Trudopollis variabilis Tschudy (late Campanian to mid Maastrichtian). The continued presence of Ceratiopsis diebelii (Alberti) Vozzhennikova also supports a Maastrichtian age for the SP biozone.

The ranges of the taxa within the SP zone strongly suggest an early late Maastrichtian age for the strata. The

SP zone approximately correlates with microfloral division H3 of Section CR 17A N-68 (mid to late Maastrichtian), of Horton River (McIntyre, 1974), and the "Deflandrea" diebelii, Palaeoperidinium pyrophorum (CVII) zone (late Maastrichtian) of Banks Island (Doerenkamp et al., 1976).

4.2 Environmental Interpretation

Byam Martin Formation

Based on sedimentological characteristics and abundant marine palynomorphs, the depositional environment is a basin plain setting, with medium-grained sandstones representing distal turbidites.

Criteria which characterize a basin plain setting have only been formulated since the dual model of turbidite fan and basin plain was introduced (Mutti and Ricci-Lucchi, 1972 in Reading, 1978). A number of features observed in this study are consistent with criteria outlined by Walker (1967), Mutti and Ricci-Lucchi (1972), Walker and Mutti (1973), and Reading (1978) for a basin plain environment. These features include: (a) well developed mudstone layers with a low sand/mud ratio; (b) a lack of abrupt lateral and vertical facies changes; (c) regular bedding with alternating sandstone and mudstone beds; (d) no distinct vertical thickening or thinning sequences; (e) good lateral continuity; (f) a dominantly thin bed size for sandstones, as noted by the preponderance of centimetre to decimetre scale bedding; and (g) sharp based sandstones with few scours and no channels. Sandstones which display these characteristics in association with thick successions of mudstone have been termed basin plain turbidites (Nelson and Nilson, 1974). Flame structures and sandstone dykes are all evidence of rapid deposition associated with distal turbidites (Ayres, 1986; Allen, 1984).

Near the Sermilik glacier, the depositional environment of the Byam Martin Formation is more problematic. The relative isolation from the overlying Sermilik Formation, the absence of other intrastratal facies and its generally poor exposure, hinders a confident assessment. The mixed bioturbated and coarser non-bioturbated beds of one small section indicate intermittent and rapid sedimentation, as might occur seaward of a delta distributary mouth (Young et al., 1983). Its stratigraphic position (approximately 16 metres below the base of the Sermilik Formation), suggests a transitional environment between typical Byam Martin strata and the marginal marine conditions of the Sermilik Formation. This coarsening of the strata may represent the initial stage of a regressive cycle, as suggested by Miall et al. (1980).

Sermilik Formation

Lithotypes 1 and 2

Lenticular beds with scoured bases, rip-up-clasts, coarse pebbly lag, planar tabular and trough cross-beds and normal to reverse grading indicate a subaqueous origin in channels. Large stacked sets of planar tabular cross-beds are commonly formed in high energy channel-bar complexes (Williams and Rust, 1969; Miall, 1977). Coarsening upward strata proximal to channel margins represent crevasse splay and associated overbank deposits (Harms and Fahnestock, 1965).

Channelized deposits and their inter-channel strata have been examined in many sedimentary environments (eg: Mutti and Ricci Lucchi, 1972; Ricci Lucchi, 1975; Miall, 1978; Putnam and Oliver, 1980; Walker and Cant, 1984; Swift et al., 1987; McPherson et al., 1987; and Shanmugan and Moiola, 1988). The combination of sedimentologic characteristics displayed by Lithotypes 1 and 2 suggest deposition in a high energy braided distributary system, such as that described by McPherson et al., (1987) for a braid delta deposit.

The braid delta model is a relatively new model. It was introduced by McPherson et al., (1987) to encompass all coarse-grained deltas formed by the progradation of a braided fluvial system into a standing body of water. Coarse-grained deltas are distinguished from normal fine-grained deltas by the presence of coarser sand sizes and few facies changes (McPherson et al., 1987). Another type of coarse-grained delta is a fan-delta. Fan-deltas are formed by the progradation of an alluvial fan into a standing body of water (Holmes, 1965). Hence, the most diagnostic feature distinguishing braid deltas from fan-deltas is the presence of their respective subaerial components. In the absence of these components other diagnostic characteristics are used to distinguish between both types of coarse-grained deltas

(Table 4.1). Based on the lithological characteristics outlined in Chapter 2, and the data presented in Table 4.1, characteristics of the braid delta model are more appropriate in defining the environment for Sermilik strata (Figure 4.2).

Within the study area, it is not clear if a subaerial component is present. Lithotype 1 displays all of the characteristics necessary to define a high energy braided river system. Scattered and abraded dinosaur bones are suggestive of a nearby terrestrial source. However, pelecypod fragments and abundant dinoflagellates suggest a marine depositional setting. Typical shoreline strata (i.e. beaches) are not present in these deposits. McPherson et al., (1987) indicates that beaches are highly modified by the high rates of coarse sediment input into braid deltas. By channel switching and migration, beach deposits are subject to constant erosion, and may therefore be erased from the record.

Lithologic evidence suggests that Lithotype 1 represents a marginal marine environment within the braid delta system, whereas Lithotype 2 is the offshore equivalent to Lithotype 1. Evidence supporting a subaerial component is not exposed.

Lithotype 3

Channel deposits in the lentils at Twosnout Creek

Table 4.1
Generalized characteristics of Fan-deltas and Braid deltas (after McPherson et al., 1987), compared with Bylot Island strata

Characteristics	*Fan-delta*	*Braid delta*	*Sermilik Formation*
Subaerial component	Alluvial fan	Braided river	Braided River ?
Paleocurrents	Semi-radial and complex	Unimodal and simple	Unimodal (Miall et al., 1980)
Maximum grain size	Boulders and cobbles very common	Boulders and cobbles uncommon	Boulders and cobbles uncommon
Sorting	Poor, grading uncommon	Moderate-good, grading common	Moderate-good, grading common
Clast shape	Angular-subrounded	Subrounded-rounded	Sub-angular to well rounded
Lateral continuity	Low	Moderate-high	Moderate
Facies changes (vertical and lateral)	Complex, numerous, sharp	Simple, few, gradational	Simple, few, both gradational and sharp
Soils and oxidation	Common	Uncommon	Not present

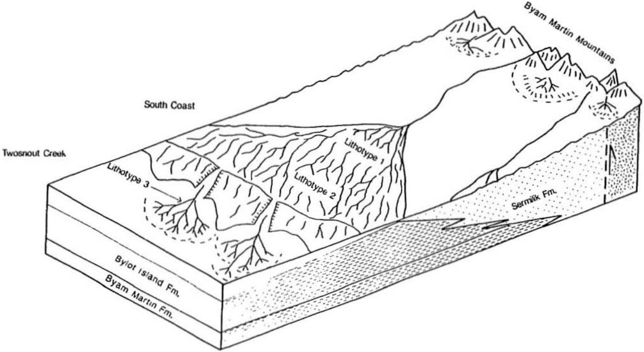

Figure 4.2 Schematic paleogeographic reconstruction of late Cretaceous Eclipse Trough strata, illustrating the depositional setting.

(Lithotype 3) suggest deposition in a submarine fan complex, within the upper- to mid-fan region (Shanmugam and Moiola, 1988). The lack of large-scale slumps or deep canyons argues against the interpretation that these are innermost fan channels (Watts, 1987). Inverse to normally graded conglomeratic units, like beds observed in this study, suggest deposition within the main feeder channels of the upper fan (Walker, 1975; 1977). Comparative marine macrofossils, shark teeth, and petrological data suggest that Lithotype 3, is in part, laterally equivalent with Lithotype 2.

Bylot Island Formation

The characteristics of this unit at Twosnout Creek (Section A, Appendix A_1) indicate deposition within a basin plain environment similar to that inferred for the Byam Martin Formation. The fine grain size shows deposition was predominantly by suspension (Arndorfer, 1973; and Reineck and Singh, 1973). Subordinate, medium-grained sandstones preserverd within the Bylot island Formation, are typical of distal turbidites.

Bylot Island Formation strata on the south coast are strongly bioturbated where they interfinger with the Sermilik Formation. Bioturbated mudstone suggests that sediments were rich in nutrients (Young et al., 1983) and oxygenated (Ekdale et al., (1984). Bioturbation is known to occur where intrastratal sediment feeders can thoroughly rework the sediment before it is too deeply buried. In the Sacramento Basin (California), bioturbated shales interfingering with and occurring seaward of deltaic distributaries are recognized as lower slope shales (Cherven, 1983). The extent of bioturbation and the proximity to Lithotype 2, suggests that Bylot Island Formation mudstones along the south coast are lower slope sediments that have formed under similar conditions to those of the Sacramento Basin.

4.3 Summary and Conclusions

Upper Cretaceous strata on Bylot Island are lithologically distinct from formations of the Sverdrup Basin. Additional structural and petrographic evidence suggests that strata in Eclipse Trough were affected by different tectonic regimes and are of different provenance than rocks of the Sverdrup basin. To assign Upper Cretaceous strata of Eclipse Trough to units of the Sverdrup Basin would clearly be a violation of the North American Stratigraphic Code (Article 22a). As a result, strata within Eclipse Trough have been divided into three new, lithologically distinct formations: the Byam Martin Formation, the Sermilik Formation and the Bylot Island Formation. Three informal palynomorph assemblage zones of mid Campanian to late Maastrichtian age provide important intrabasinal correlations and constrains the timing for the initiation of basin fill within Eclipse Trough.

As a result, a revised stratigraphic reconstruction for Eclipse Trough is proposed (Figure 4.3). During the late Campanian to early Maastrichtian, a local sediment source (undivided Archean - Aphebian rocks and the Mary River Group) gave rise to the Sermilik Formation through a major regressive event. Several phases of coarsening-upward cycles within the Sermilik Formation imply a complex history of basin fill, with both sea level fall and source terrane uplift intricately related. Palynomorph assemblages suggest that this regressive event was terminated by a late Maastrichtian transgression, represented by the Bylot Island Formation.

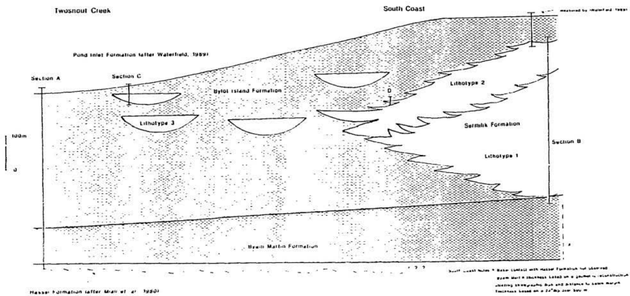

Figure 4.3 Reconstructed stratigraphic cross-section across southwest Bylot Island. Diagram is a schematic with no horizontal scale implied.

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PLATES

All specimens, except those in plate 1, are illustrated in interference contrast unless otherwise stated. In the explanation of figures, the species name is followed by a palynology processing number, field sample number, microscope coordinates, magnification and view. Plate 1 specimens (Figures 4, 5 and 6) were identified by D.A. Russell of the National Museum of Natural Science. The aforementioned specimens are housed in collections of the Paleobiology Division, National Museum of Natural Science, Ottawa, and have been assigned the acronym (NMC).

Plate 1

Figure 1. Trace fossils, Chondrites ?; Byam Martin Formation, Twosnout Creek.

Figure 2. Burrows; Byam Martin Formation, South Coast. *Note: Knife is 20cm in length.

Figure 3. Trace fossils, Thalassinoides; Sermilik Formation, Lithotype 2.

Figure 4. Marine lizard vertebrae, Mosasauridae, (NMC - 40769); Sermilik Formation, Lithotype 2.

Figure 5. Shark Teeth, cf. Scapanorhynchus sp., (NMC - 40758); Sermilik Formation, Lithotype 2.

Figure 6. Dinosaur bone (3rd left metatarsal), Hadrosauridae, (NMC - 40757); Sermilik Formation, Lithotype 1.

1

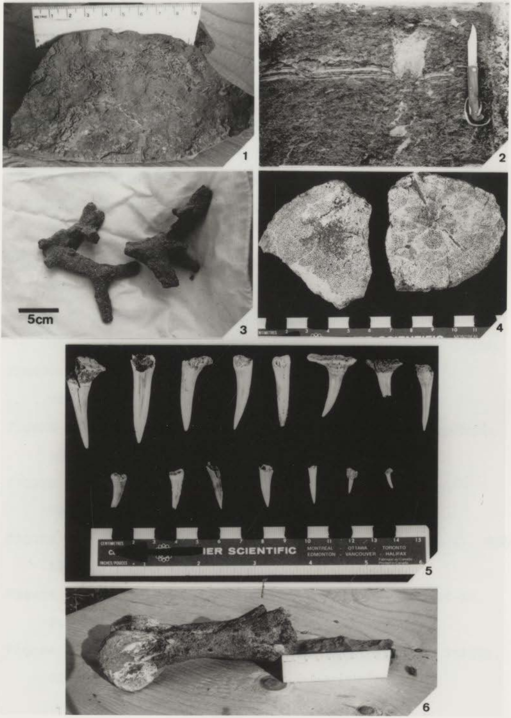
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Plate 2

Figure 1. Annulispora sp. 1; 420(2), TCG-151, 98.9 19.6, 650X, Mid-focus.

Figure 2. Cingutriletes pocockii (Burger) Burden; 399(3), SC-22, 89.9 10.2, 650X, Proximal.

Figure 3. Densoisporites velatus (Weyland and Kreiger) Krasnova; 394(1), SC-33, 105 21, 650X, Proximal.

Figure 4. Antulsporites distaverrucosus (Brenner) Archangelsky and Gamerro; 401(1), SC-23, 103.1 15.7, 650X, Distal.

Figure 5. Cirratriradites teter Norris; 394(4), SC-33, 96.1 12.6, 520X, Proximal.

Figure 6. Appendicisporites bifurcatus Singh; 399(3), SC-22, 85 14, 650X, Equatorial, Plane polarized light.

Figure 7. Appendicisporites erdtmanii Pocock; 420(2), TCG-151, 87.3 15.7, 520X, Distal.

Figure 8. Camarozonosporites ambigens (Fradkina) Playford; 382(2), SC-30, 89.2 8.4, 650X, Proximal.

Figure 9. Hamulatisporis amplus Stanley; 396(2), TC-105, 102.2 8.7, 650X, Distal.

Figure 10. Hamulatisporis sp. cf. H. loeblichii; 3'5(1), TCG-156, 92 12.1, 416X, Distal.

Figure 11. Gleicheniidites senonicus Ross; 399(1), SC-22, 94.5 13, 650X, Proximal.

Figure 12. Gleicheniidites sp. cf. G. circinidites; 399(1), SC-22, 77 4, 650X, Proximal.

Figure 13. Asbeckiasporites wirthi von der Brelie; 420(1), TCG-151, 101 12.3, 650X, Proximal.

Figure 14. Ornamentifera baculata Singh 421(1), TC-92, 81.8 15.2, 650X, Mid-focus.

Figure 15. Tappanispora reticulata (Singh) Srivastava; 374(2), TC-85, 84.1 14, 650X, Distal.

Figure 16. Lycopodiacidites canaliculatus Singh; 374(1), TC-85, 86.9 15.5, 650X, Distal.

Figure 17. Lycopodiacidites sp. 1; 371(2), SC-31, 87 19.2, 650X, Proximal.

Figure 18. Cicatricosisporites australiensis (Cookson) Potonié, 382(1), SC-30, 111.3 11.1, 650X, Equatorial.

2

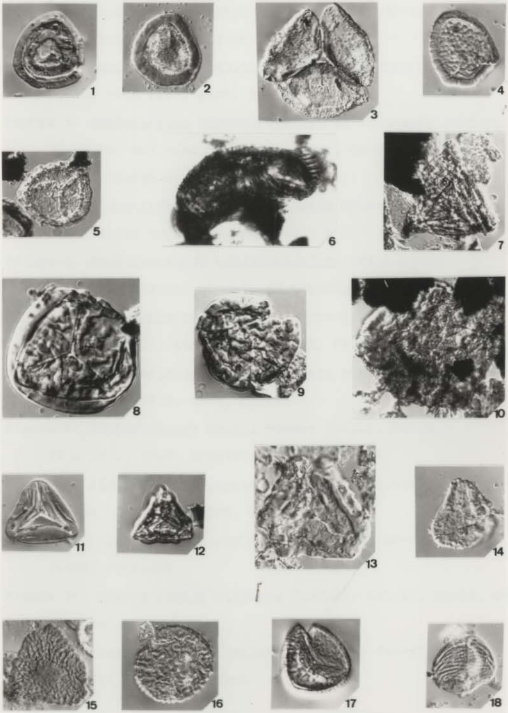


Plate 3

Figure 1. Cicatricosisporites sp. 1; 415(1), SC-207, 99.2 12.5, 520X, Oblique.

Figure 2. Radialisporis radiatus (Krutzsch) Krutzsch; 373(2), TC-98, 99.8 13.1, 650X, Distal.

Figure 3. Retitriletes austroclavatidites (Cookson) Doring, Krutzsch, Mai, and Schultz; 416(2), TC-114, 92.1 8, 1040X, Distal.

Figure 4. Foveotriletes subtriangularis Brenner; 420(1), TCG-151, 82 19, 650X, Proximal.

Figure 5. Stereisporites antiquasporites (Wilson and Webster); 415(1), SC-207, 83.5 13.2, 1040X, Proximal.

Figure 6. Stereisporites regium (Drozhastchich) Drugg; 371(1), SC-31, 110.9 18.2, 1638X, Proximal.

Figure 7. Cingulatisporites dakotaensis Stanley; 408(2) SC-115, 89 20.5, 650X, Distal.

Figure 8. Deltoidospora hallii Miner; 381(4), SC-26, 79.1 13.2, 650X, Proximal.

Figure 9. Cibotiumspora juncta (Kara-Murza) Singh; 414(2), SC-301, 88.1 14, 1300X, Proximal.

Figure 10. Cyathidites minor Couper; 370(1), SC-24, 106 10, 1040X, Proximal.

Figure 11. Gemmatriletes clavatus Brenner; 373(1), TC-98, 101 12, 650X, Oblique.

Figure 12. Osmundacidites wellmanii Couper; 415(4), SC-207, 96.2 9.1, 650X, Proximal.

Figure 13. Baculatisporites comaumensis (Cookson) Potonié; 401(3), SC-23, 71 16.9, 650X, Distal.

Figure 14. Laevigatosporites haardti (Potonié and Venitz) Thomson and Pflug; 394(1), SC-33, 90 8.2, 650X, Equatorial.

Figure 15. Laevigatosporites sp. cf. L. ovatus; 415(1), SC-207, 102.1 4.1, 1040X, Polar.

Figure 16. Hazaria sheoparii Srivastava; 408(2), TC-115, 98.1 15.5, 650X, Equatorial.

Figure 17. Taxodiaceaepollenites hiatus (Potonié) Kremp; 399(3), SC-22, 68.5 18.3, 650X, Mid-focus.

Figure 18. Taxodiaceaepollenites vacuipites (Wodehouse) Wingate; 374(1), TC-85, 75.5 15, 650X, Mid-focus.

3

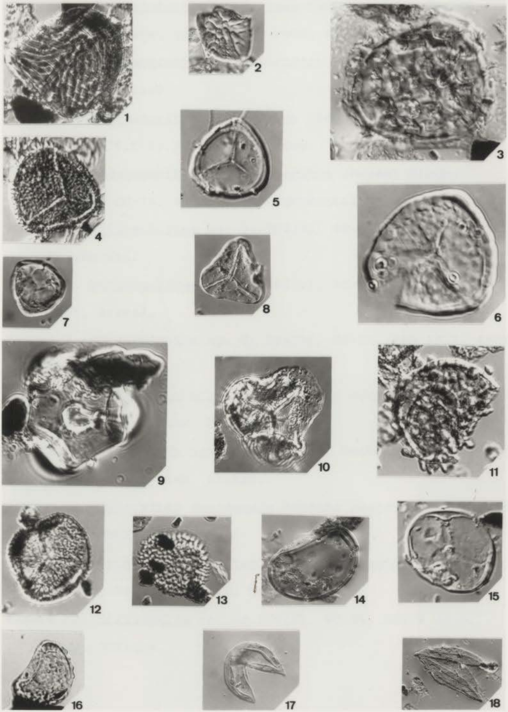


Plate 4

Figure 1. Podocarpidites multesimus (Bolkovitina) Pocock; 370(2), SC-24, 104.6 10.8, 650X, Proximal.

Figure 2. Podocarpidites sp. 1; 415(2), SC-207, 83.5 9.2, 416X, Proximal.

Figure 3. Pityosporites constrictus Singh; 381(4), SC-26, 79.5 12.2, 650X, Oblique.

Figure 4. Pityosporites alatipollenites (Rouse) Singh; 372(2), SC-36, 98 7, 650X, Equatorial.

Figure 5. Pityosporites sp. 1; 382(1), SC-30, 83.9 13, 650X, Equatorial.

Figure 6. Pityosporites sp. 2; 381(2), SC-26, 103.5 5.2, 650X, Distal.

Figure 7. Pityosporites sp. 3; 394(1), SC-33, 100 10.2, 650X, Equatorial.

Figure 8. Alisporites bilateralis Rouse; 415(3), SC-207, 108.4 16.2, 1040X, Distal.

Figure 9. Alisporites grandis (Cookson) Dettmann; 402(1), SC-201, 78.3 7, 416X, Distal.

Figure 10. Cedripites canadensis Pocock; 382(2), SC-30, 77.8 18.2, 650X, Equatorial.

Figure 11. Pristinuspollenites sp. cf. P. inchoatus; 415(1), SC-207, 94.2 4.1, 416X, Oblique.

Figure 12. Liliipollis sp. 1; 370(2), SC-24, 105.9 19.5, 650X, Oblique.

Figure 13. <u>Liliacidites</u> <u>variegatus</u> Couper; 371(1), SC-31, 105.9 21.3, 1300X, Equatorial.

Figure 14. <u>Cycadopites</u> <u>fragilis</u> Singh; 371(1), SC-31, 102.2 19.8, 650X, Proximal.

Figure 15. <u>Monosulcites</u> sp. 1; 414(2), SC-301, 87 7.8, 650X, Proximal.

4

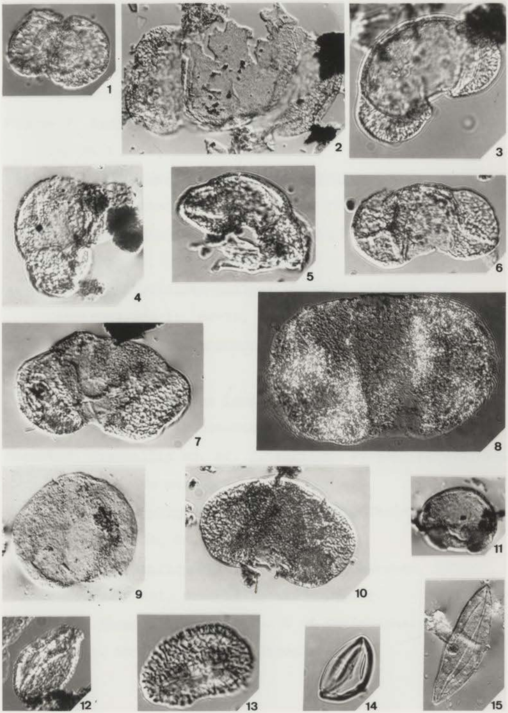


Plate 5

Figure 1. Entylissa nitidus Balme; 399(2), SC-22, 98.6 16.6, 650X, Oblique.

Figure 2. Tricolpites sp. 1; 407(2), SC-209, 81.9 12.1, 650X, Equatorial.

Figure 3. Rousea georgensis (Brenner) Dettmann; 394(3), SC-33, 81.1 13.5, 1040X, Polar.

Figure 4. Cupuliferoidaepollenites parvulus (Groot and Penney) Dettmann; 374(2), TC-85, 74.3 9.7, 650X, Polar.

Figure 5. Fraxinoipollenites variabilis Stanley; 401(3), SC-23, 91 12, 1040X, Equatorial.

Figure 6. Tubifloridites lilliei (Couper) Farabee and Canright; 394(3), SC-33, 83.7 6.8, 1040X, Polar.

Figure 7. Porosipollis porosus Krutzsch; 372 (1), SC-36, 89 7.9, 1040X, Polar.

Figure 8. Caprifoliipites longus Stanley; 382(1), SC-30, 88.5 15.5, 1300X, Equatorial.

Figure 9. Cranwellia sp. cf. C. striata; 402(2), SC-201, 98.6 16, 1300X, Equatorial.

Figure 10. Pseudoplicapollis longiannulata Christopher; 401(3), SC-23, 80.9 5.1, 1300X, Polar.

Figure 11. Pseudoplicapollis sp. G of Christopher, 1979; 402(1), SC-201, 89.9 17.3, 1300X, Polar.

Figure 12. Pseudoplicapollis sp. G of Christopher, 1979; 401(2), SC-23, 82.9 8.1, 1300X, Polar.

Figure 13. Carpinipites ancipites (Wodehouse) Srivastava; 416(2), TC-114, 94.2 10, 1300X, Polar.

Figure 14. Paraalnipollenites alterniporus (Simpson) Srivastava; 408(2), TC-115, 111.1 19, 1638X, Polar.

Figure 15. Momipites wyomingensis Nichols and Ott; 415(2), SC-207, 98.2 12.4, 1040X, Polar.

Figure 16. Triatriopollenites rurensis Pflug and Thomson; 404(2), TC-113, 78.3 7.1, 650X, Polar.

Figure 17. Trudopollis variabilis Tschudy; 408(2), TC-115, 93 10.2, 1638X, Polar.

Figure 18. Trudopollis conrector Pflug; 412(1), TC-107, 94 13.2, 1300X, Polar.

5

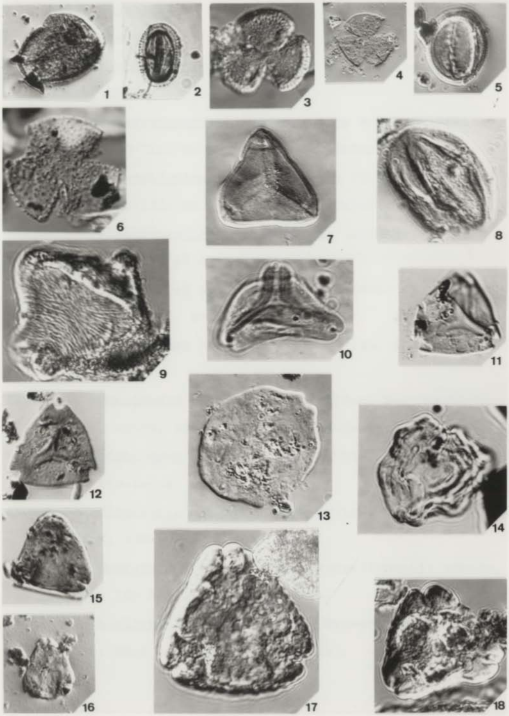


Plate 6

Figure 1. Megatropollis sp. 1; 394(1), SC-33, 76.9 19.6, 1300X, Polar.

Figure 2. Neotriangulipollis sp. 1 of Azema 1981; 371(11), SC-31, 104 10.3, 1300X, Polar.

Figure 3. Extratriporopollenites sp. 2 of McIntyre 1974; 402(1), SC-201, 86.9 12.6, 1040X, Polar.

Figure 4. Polyvestibulopollenites trinus (Stanley) Norris; 408(1), TC-115, 82.8 14.9, 1040X, Polar.

Figure 5. Polyatriopollenites stellatus (Potonié) Pflug; 401(1), SC-23, 87.5 21, 650X, Polar.

Figure 6. Tetraporites sp. 1 of McIntyre 1974; 414(1), SC-301, 68 12.5, 650X, Polar.

Figure 7. Tetraporites sp. 2; 408(1), TC-115, 82 12.4, 650X, Polar.

Figure 8. Wodehouseia gracile (Samoilovitch) Pokrovaskaya; 370(1), SC-24, 92.3 9.5, 650X, Mid-focus.

Figure 9. Wodehouseia sp. 1; 415(3), SC-207, 83.3 8, 650X, Mid-focus.

Figure 10. Singularia aculeata Samoilovitch; 415(1), SC-207, 76 13.8, 1300X, Mid-focus.

Figure 11. Mancicorpus trapeziforme Mtchedlishvili; 402(2), SC-201, 105.9 13.2, 650X, Oblique.

Figure 12. Aquilapollenites scabridus Tschudy; 414(2), SC-301, 94.9 12.8, 650X, Equatorial.

Figure 13. Aquilapollenites sp. 1; 402(1), SC-201, 91.2 12.6, 1300X, Equatorial.

Figure 14. Unknown Specimen 1; 411(1), TC-109, 82 10, 650X, Proximal.

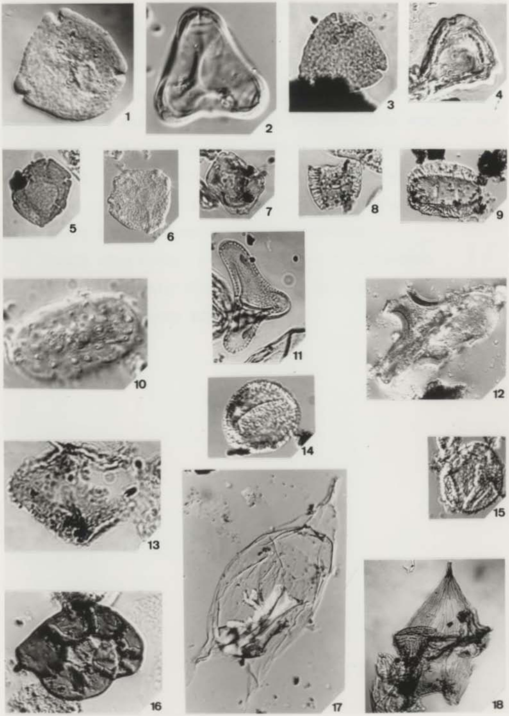
Figure 15. Unknown Specimen 2; 403(1), TC-115, 86.3 12.4, 650X, Proximal.

Figure 16. Pesavis parva Kalgutkar and Sweet; 416(1), TC-114, 79.2 5.1, 1300X, Mid-focus.

Figure 17. Ceratiopsis diebelii (Alberti) Vozzhennikova; 402(1), SC-201, 105.2 19, 520X, Oblique.

Figure 18. Palaeoperidinium kozlowskii (Gorka) Davey; 394(3), SC-33, 87 16.6, 416X, Mid-focus.

6



Appendices A_1 - A_4

Stratigraphic Sections

Four complete stratigraphic sections are included for late Cretaceous strata on Bylot Island (Appendices A_1 - A_4). Locations for all palynomorph and sedimentology samples are specified on the appropriate sections. Section C, Appendix A_3, is occasionally informally referred to as the "Twosnout Creek Gorge (TCG)" section. As well, note that Sections C and D are vertically exaggerated.

Grain size scale: m = mudstone, s = siltstone, sandstone: vf = very fine, f = fine, m = medium, c = coarse, vc = very coarse.

SECTION A – APPENDIX A1

Location:	Twosnout Creek
Latitude:	73° 14' N
Longitude:	79° 48' W
Airphoto:	A26077
Number:	179

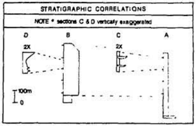
SECTION STATUS:

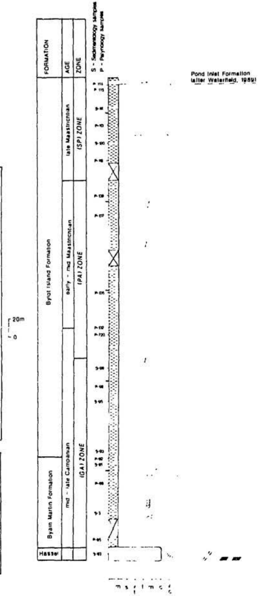
Bylot Island Formation	Type Section
Byam Martin Formation	Type Section
Hassel Formation	Additional

LEGEND

- Sandstone
- Siltstone
- Mudstone

- planar x-beds
- trough x-beds
- parallel laminations
- scours
- contorted beds
- burrows
- > 90% bioturbation
- flame structures
- sandstone dykes
- pebbles – boulders
- conformable contact
- ripples
- coal
- bones
- shark teeth
- shells
- woody detritus
- concretions
- rip up clasts
- roots
- lost section





SECTION B - APPENDIX A_2

Location	South Coast
Latitude	72°54' N
Longitude	78°17' W
Airphoto	A26078
Number	3

SECTION STATUS

Sermilik Formation	Type Section
Byam Martin Formation	Additional

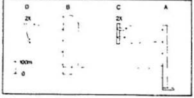
LEGEND

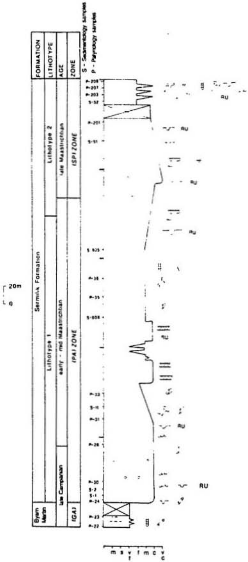
- Sandstone
- Siltstone
- Mudstone

- planar x beds
- trough x beds
- parallel laminations
- scours
- contorted beds
- burrows
- ±90% bioturbation
- flame structures
- sandstone dykes
- pebbles boulders
- conformable contact
- ripples
- coal
- bones
- shark teeth
- shells
- woody detritus
- concretions
- rip up clasts
- roots
- ost section

STRATIGRAPHIC CORRELATIONS

NOTE * sections C & D vertically exaggerated



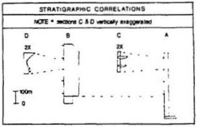


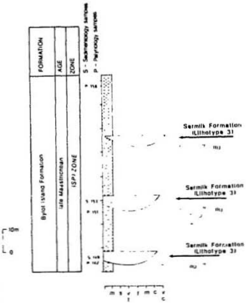
SECTION C - APPENDIX A_3

Location:	Twosnout Creek
Latitude:	73°09'N
Longitude:	79°40'W
Airphoto:	A26077
Number:	161

SECTION STATUS

Sermilik Formation	Reference
Bylot Island Formation	Additional





SECTION D - APPENDIX A_4

Location	South Coast
Latitude	72°53 N
Longitude	79°33 W
Airphoto	A26078
Number	3

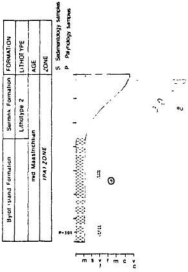
SECTION STATUS

Sermilik Formation	Additional
Byiot Island Formation	Additional

LEGEND

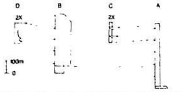
- Sandstone
- Siltstone
- Mudstone

planar x-beds	ripples
trough x-beds	coal
parallel laminations	bones
scours	shark teeth
contorted beds	shells
burrows	woody detritus
+ 90% bioturbation	concretions
flame structures	RU rip up clasts
sandstone dykes	roots
pebbles - boulders	ost section
conformable contact	



STRATIGRAPHIC CORRELATIONS

NOTE • sections C & D vertically exaggerated



APPENDIX B_1

. PETROLOGY

Methods:

Seventeen samples of sandstones from the Sermilik, Byam Martin and Bylot Island Formations were thin-sectioned for petrographic analysis (Appendices B_2-B_3). Unconsolidated beds were rare, comprising less than 10% of strata in examined sections. For this reason, all samples collected were lithified, allowing for the accurate determination of matrix, cement, porosity, roundness, sorting and original texture.

A minimum of 300 point counts per thin section supplied data on the mineralogical composition. This number ensures that for the major constituents, the volume of the observed constituents is between 2.5-6.0% of the actual volume, with a confidence level of 95.4% (Carver, 1971). Sandstone samples were classified according to McBride (1963). This system is designed to be purely descriptive, with end member constituents being grouped to indicate gross provenance.

Framework grains counted were classified as follows: (1) Quartz - monocrystalline and polycrystalline; (2) Feldspar; and (3) Rock fragments - volcanic, plutonic, metamorphic and sedimentary. Other grains counted included micas (muscovite and biotite), opaques, glauconite and miscellaneous minerals.

Appendix B_2

Petrology - Detrital Mode Percentages

Formation	Sp	Qtz	F	Rf
Hassel	83	96.5	3.1	0.4
Byam Martin	3	91.9	7.7	0.4
	91	95.4	4.0	0.4
Bylot Island	93	95.3	4.3	0.4
	95	90.8	8.8	0.4
	99	89.2	10.4	0.4
	111	94.8	4.4	0.4
	120	96.5	3.1	0.4
Sermilik	149	71.0	16.7	12.3
	153	76.7	14.2	9.1
	1	91.8	5.4	2.8
	2	81.3	16.6	2.1
	11	94.5	3.4	2.1
	806	87.8	10.3	1.9
	905	91.6	7.1	1.3
	51	89.9	9.3	0.8
	52	79.6	15.9	4.5

Sp = sample, Qtz = quartz, F = feldspar, Rf = rock fragments

Appendix B_3
Petrology - Pointcount Percentages
(percent by number of detrital grains)

Formation	Sp	Qp	Qm	K	Pl	Ig	Mm	Sed	Bi	Gl	Op	Mi
Hassel	83	0.3	96.3	2.3	0.6	-	-	-	-	-	T	0.3
Byam Martin	3	15.0	73.0	4.6	2.6	-	-	-	-	2.3	1.0	1.3
Byam Martin	91	-	92.6	1.3	2.6	-	-	-	1.6	1.6	-	0.3
Bylot Island	93	0.3	67.6	1.3	2.0	-	-	-	1.6	24.3	2.0	0.9
Bylot Island	95	1.0	77.6	5.0	2.6	-	-	-	2.0	10.0	1.0	1.6
Bylot Island	99	1.3	79.0	7.6	1.6	-	-	-	2.3	6.6	0.6	1.0
Bylot Island	111	1.3	91.3	3.0	1.3	0.3	0.3	-	0.6	1.0	0.6	0.3
Bylot Island	120	1.0	91.6	2.0	1.0	-	0.3	-	1.0	1.0	1.6	0.3
Sermilik	149	15.0	53.0	10.6	5.3	11.0	-	0.6	2.0	0.6	0.6	0.3
Sermilik	153	12.0	61.6	9.6	4.0	8.0	0.6	-	1.6	T	1.0	1.6
Sermilik	1	5.6	84.3	4.6	0.6	2.6	-	-	1.3	-	0.3	0.6
Sermilik	2	3.0	73.6	3.6	12.0	2.0	-	-	2.0	-	3.6	-
Sermilik	11	1.3	91.0	3.0	0.3	2.0	-	-	0.6	-	1.3	0.3
Sermilik	806	1.6	83.0	8.6	1.3	1.6	-	-	0.6	-	2.3	0.9
Sermilik	905	4.6	76.0	5.0	1.3	1.0	-	-	1.3	-	10.6	0.6
Sermilik	51	0.6	83.0	2.0	6.6	0.6	-	-	1.6	1.0	1.6	2.9
Sermilik	52	8.6	69.3	5.6	10.0	2.0	-	-	1.6	0.3	1.6	1.0

Sp = Sample, Qp = Polycrystalline quartz, Qm = Monocrystalline quartz, K = Potassium feldspar,
Pl = Plagioclase, Ig = Igneous rock fragments, Mm = Metamorphic rock fragments
Sed = Sedimentary rock fragments, Bi = Biotite, Gl = Glauconite, Op = Opaque grains
Mi = Miscellaneous minerals.

T = Trace

Appendix C_1

Twosnout Creek

Field Number	Processing Number	Section
TC-114	416	A
TC-115	408	A
TC-113	404	A
TC-116	395	A
TC-109	411	A
TC-107	412	A
TC-105	396	A
TC-102	484	A
TC-720	406	A
TC-98	373	A
TC-92	421	A
TC-89	418	A
TC-85	374	A

TWOSNOUT CREEK GORGE

TCG-156	375	C
TCG-151	420	C
TCG-142	380	C

SOUTH COAST

SC-209	407	B
SC-207	415	B
SC-203	385	B
SC-201	402	B
SC-301	414	D
SC-36	372	B
SC-35	378	B
SC-33	394	B
SC-31	371	B
SC-26	381	B
SC-30	382	B
SC-24	370	B
SC-23	401	B
SC-22	399	B

APPENDIX C_2

RANGE CHART FOR ECLIPSE TROUGH STRATA