Résumé de l'article

Dans les Territoires du Nord-Ouest, près de la localité de Arctic Bay, dans l’île de Baffin, on a échantillonné une coupe de 3 m effectuée dans des sédiments renfermant des matériaux organiques. On en a tiré sept datations au radiocarbone. Entre 182,5 et 290 cm, trois datations font remonter les sédiments entre 14 185 ± 760 et 16 849 ± 860. Entre 82,5 et de 87,5 cm, la datation les fait remonter à 8635 ± 565. L’inversion apparente des dates au 14C pourrait indiquer qu’un plissement des sédiments s’est associé au glissement du dépôt ou à l’accumulation rapide de sédiments organiques. Les trois datations effectuées à la base de la coupe représentent les premiers sédiments terrestres de l’île de Baffin à remonter avant 10 000 BP, soit entre 10 000 et 20 000 BP. L’analyse pollinique des sédiments a révélé que le pollen y est plutôt rare. L’assemblage pollinique est dominé par les pollens de Salix, de cyperacées et de graminés : quelques types de pollens exotiques (Pinus, Picea, Betula, et Alnus) apparaissent de façon sporadique dans toute la coupe.
ABSTRACT A 3 m exposure of sediment containing organics was sampled near the settlement of Arctic Bay, Baffin Island, N.W.T. A total of seven radiocarbon dates have been obtained from the deposit. Three dates between 182.5 and 290 cm depth gave radiocarbon ages between 14,185 ± 760 and 16,849 ± 860. A date from 82.5 to 87.5 cm resulted in an age of 8635 ± 565. An apparent reversal in $^{14}$C dates may reflect folding of the sediments associated with the downslope creep of the deposit or rapid accumulation of organics. The three basal dates are the first terrestrial sediments from Baffin Island to date from older than ca. 10,000 BP and less than 20,000 BP. Analysis of the sediment for pollen indicated that it is generally sparse. The pollen assemblage is dominated by Salix, Cyperaceae, and Gramineae pollen and exotic pollen types (Pinus, Picea, Betula, and Alnus) occur sporadically throughout the section.

RÉSUMÉ Un dépôt organique de 16 000 ans dans le nord de l'île de Baffin : palynologie et importance. Dans les Territoires du Nord-Ouest, près de la localité de Arctic Bay, dans l'île de Baffin, on a échantillonné une coupe de 3 m effectuée dans des sédiments renfermant des matériaux organiques. On en a tiré sept datations au radiocarbone. Entre 182,5 et 290 cm, trois datations font remonter les sédiments entre 14 185 ± 760 et 16 849 ± 860. Entre 82,5 et de 87,5 cm, la datation les fait remonter à 8635 ± 565. L'inversion apparente des dates au $^{14}$C pourrait indiquer qu'un plissement des sédiments s'est associé au glissement du dépôt ou à l'accumulation rapide de sédiments organiques. Les trois datations effectuées à la base de la coupe représentent les premiers sédiments terrestres de l'île de Baffin à remonter avant 10 000 BP, soit entre 10 000 et 20 000 BP. L'analyse pollinique des sédiments a révélé que le pollen y est plutôt rare. L'assemblage pollinique est dominé par les pollens de Salix, de cyperacées et de graminées ; quelques types de pollens exotiques (Pinus, Picea, Betula, et Alnus) apparaissent de façon sporadique dans toute la coupe.


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INTRODUCTION

Continuous accumulation of organic rich sediment since ca. 16,000 BP has preserved a pollen record of high arctic conditions and also provides a constraint on glacial reconstructions for the area. The sediment section is described, its significance discussed, and the first Late Pleistocene pollen diagram from the eastern Canadian Arctic is presented.

Over two decades of research in Arctic Canada has failed to uncover clear, unequivocal evidence for the maximum extent of glaciation during the Late Wisconsinan (late Foxe Glaciation in local Baffin Island terminology) Glaciation (Miller and Dyke, 1974; Dyke et al., 1982; Nelson, 1982; Andrews and Miller, 1984). Several authors have noted that collections of marine shells from various marine and glacial marine facies, especially along the outer coast of eastern Baffin Island, either date from: 1) < 11,000 BP and most commonly less than 10,000 years; or 2) > 40,000 years (Pheasant and Andrews, 1973; Miller et al., 1977; Mode, 1980; Brigham, 1983). This gap in the stratigraphic record has been used to argue for different histories of glaciation (Denton and Hughes, 1981; Andrews and Miller, 1984).

SITE DESCRIPTION AND BACKGROUND

In 1982, as part of a study on Holocene palynology of Arctic North America (Andrews et al., 1981; Diaz and Andrews, 1982; Short and Jacobs, 1982; Short et al., 1985), a field party flew to Arctic Bay, northern Baffin Island (Fig. 1) to sample a 5 m thick exposure, the middle of which had been sampled by G. Falconer in 1961 and dated to 9360 ± 120 (I-1315) (in Andrews and Drapier, 1967). The exposure (72°03'N, 85°02'W, 61 m asl) lies in a valley below King George V Mountain between Arctic and Victor bays. The deep trough of Admiralty Inlet lies 10 km due west and the site is flanked by two fiords that head into Admiralty Inlet (Adams Sound and Strathcona Sound).

Geologically the area is complex with a wide variety of sedimentary and volcanic rocks exposed along the fiords. The rocks range in age from Precambrian to Paleozoic and consist for the most part of sandstones, shales, limestones and dolostones (Thorsteinsson and Tozer, 1970). The dominant lithology around Adams Sound is quartz arenites with a small outcrop of Proterozoic limestone and dolostone occurring to the east of the outcrop.

STRATIGRAPHY, COLLECTIONS, PREPARATION AND RADIOCARBON DATES

The section consisted of 300 cm of sandy "peat" overlying 175 cm of sands and gravels (Table I). The word "peat" is used (i.e. Table I) because field observations indicate that the bulk of the section consists of an in situ sedge peat. The high inorganic content (Table II) is associated with the influx of sediment, as colluvium and eolian inputs, from the nearby slope. Permafrost was encountered at 60 cm from the present surface and the section sloped steeply below that point. Blocks of sediment were collected back to the permafrost face and transported back to the laboratory. Samples were then taken at 2.5 cm intervals to 150 cm, and at 5 cm from that depth to the base of the section. Modern moss and lichen polsters were collected from the area, including the present surface of the deposit.
The radiocarbon dates from the Arctic Bay section are reported in Table II and plotted on Figure 2. Prior to submission, all samples were prepared in the INSTAAR Sedimentology Laboratory; organic carbon content ranged from 2% to 20%. There was no evidence of carbonate in the samples as the pH of the sediment was < 5.9. The 8635 ± 565 BP (GX-9685) date is from a similar level to that reported by Falconer (Andrews and Drapier, 1967) and thus confirms the early Holocene age for the middle peats. We have obtained three dates from between 182 and 290 cm; these range between 14,185 ± 760 (GX-9304) and 16,849 ± 860 BP (GX-9303), but the dates are in apparent reversed stratigraphic order. However, the dates are in agreement with the original counts: except for one level (10 cm), pollen recovery was improved. Percentage values, however, did not generally change nor did diversity (i.e., number of taxa). The pollen count data are summarized in Table III.

Two pollen diagrams were constructed. Because of problems in dating the Arctic Bay section, the pollen data were arranged in both stratigraphic (Fig. 3, Table III) and chronological order. The latter diagram was constructed by assuming that the radiocarbon dates are correct and then rearranging the intervening levels; little "squeezing" of levels had to be done. This scheme suggests a period of slow peat growth, with the accumulation of only 30 centimeters of peat in some 5000 years (levels 150 through 170 cm), between 8000 and 13,000 BP. The stratigraphic sequence will be presented here (Fig. 3); the two diagrams do not present significantly different vegetation histories, particularly in the middle and late Holocene. If the Arctic Bay section accumulated relatively rapidly in the late Pleistocene, as the overlap of the three basal dates suggests, the minor differences seen near the base of the section may not be of great significance. Out of 30 total taxa, the most important local pollen types, plus the four exotic pollen types, are included in the diagram. Mean pollen percentages for the six polsters are indicated on the top line.

Pollen densities are generally low in the modern samples, with 100-counts common. The spectra are dominated by *Salix*, Gramineae (grass family, and/or Filicales (ferns); exotic conifer pollen values are low. These data can be compared to the regional pollen rain of the Clyde region, 650 km to the southeast. *Salix* and Gramineae (i.e., a High Arctic assemblage) dominated the pollen rain in the Clyde area and the latter reached...
FIGURE 2. Age/depth curve, Arctic Bay peat. Error bars represent one standard deviation. X marks approximate location of Falconer's date.

Courbe âge/profondeur, tourbe de Arctic Bay. Les barres d'erreur représentent une déviation standard. Le x donne la localisation approximative de la date de Falconer.

ARCTIC BAY, BAFFIN ISLAND - STRATIGRAPHIC PERCENTAGE DIAGRAM
Pollen Sum Excludes Cyperaceae

FIGURE 3. Percentage pollen diagram from the Arctic Bay peat site. Levels arranged in stratigraphic order. Includes the most important local pollen types plus the four exotic pollen types. Pollen concentration values (number of grains per gram dry weight) are listed to the right of the diagram. The five levels with less than 10 pollen grains are marked with a circle.

Diagramme pollinique en pourcentage du site de Arctic Bay. Les niveaux sont illustrés par ordre stratigraphique. Le diagramme comprend les types de pollen les plus importants et les quatre types de pollen exotique. Les valeurs de concentrations polliniques (nombre de grains par gramme de poids sec) sont données à la droite du diagramme. Les cinq niveaux ayant moins de 10 grains de pollen sont indiqués par un cercle.
A SIXTEEN THOUSAND YEAR OLD ORGANIC DEPOSIT

TABLE III
Pollen Data Summary, Arctic Bay Peat

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* excluding Cyperaceae  
** 40X count (all others are 16X counts)  
*** Total number of traverses possible on 16X count = 35.4  
R = repreparation

its percentage maximum along a north-south eastern Arctic transect (Mode, 1980; Short et al., 1985). Pollen concentrations in the Clyde area, the lowest for that transect, are comparable to this study. The importance of Filicales in the Arctic Bay modern pollen rain was not observed in the Clyde area.

The fossil spectra are also dominated by local pollen types, primarily Salix, Gramineae, Filicales, and Cyperaceae. Gramineae percentages peak in the upper part of the diagram (Fig. 3) and reach a secondary maximum just above the base. Salix percentages fluctuate strongly with high peaks in the middle of the section. Large Cyperaceae percentages are recorded before ca. 6000 yr BP, contrasting with the low late Holocene and modern values for this group. Pollen concentration values vary widely, reflecting both the stratigraphy of the section (i.e., low values are generally correlated with increased sand content) and the occasional accumulation of very large values of one pollen type. The values, however, are comparable to those reported by Miller et al. (1977, Table 9) for Holocene-age organic-rich sediments in the Clyde region to the southeast.

Exotic pollen influx is low (< than 200 grains/gm dry weight) and variable in the Arctic Bay section, especially between 14,000 and 7000 BP. Betula (birch), the most common exotic pollen type, presently grows as shrubs ca. 1000 km to the southeast and 800 km to the southwest (Porsild, 1964; Porsild and Cody, 1980). Alnus (alder), Picea (spruce), and Pinus (pine) pollen are rare in the section, although occasionally large percentages are registered due to low counts.

DISCUSSION
Preliminary pollen analyses of the Arctic Bay section indicate that the environment of the site has been characterized by a high arctic assemblage dominated by willow and grass. Increased accumulation of exotic birch and pine pollen in the late glacial suggests more frequent advective transport of these grains from southerly sources into an impoverished local vegetation. The sources for pine pollen are presumed to be located some 3400 km to the south or west in the northern United States. It has been suggested that dwarf birch...
succeeded on coastal forelands (nunataks) of the eastern Canadian Arctic during the Late Wisconsinan glaciation (Short, 1978; Davis, 1980; Mode, 1980; Short et al., 1985); this possible source of birch pollen is located approximately 1900 km southeast of the study site. Advection of birch pollen from the west (the Birch Zone of Alaska) may also be proposed as a more distant source.

The increase in sedge pollen between ca. 14,000 and 8000 BP suggests an increase in moisture availability at the site. This may indicate a rise in the permafrost level in the region or possibly a greater frequency of North Atlantic derived air masses.

The Arctic Bay sequence can be compared to other pollen records from eastern and southern Baffin Island which date close to this time period where higher-than-present exotic shrub and/or tree values are recorded between ca. 10,000 and 8700 yr BP (Miller et al., 1977; Davis, 1980; Mode, 1980; Short et al., 1985). The pollen record of the Devon Island ice core (McAndrews, 1984), 250 km to the northeast, also provides a comparative data set. The late Holocene and last interglacial assemblages are dominated by alder pollen and relatively high pollen concentrations, whereas the early Holocene and Wisconsinan assemblages are dominated by birch and sage (Artemisia) and much lower pollen concentrations. In contrast, alder is of little importance in the Arctic Bay site, in pollen samples from recent levels in the Penny Ice Cap (Short and Holdsworth, 1985), and in the modern pollen fallout for central and northern Baffin Island (Elliott-Fisk et al., 1982). Similarly, sage is of little importance in the Arctic Bay section and the Penny Ice Cap. This suggests that different dominant air masses are responsible for the pollen fallout between Baffin Island and Devon Island. However, the importance of birch pollen in the early Holocene samples from Devon Island is similar to the Arctic Bay record, suggesting a closer and hence regional source for this pollen type.

Increased exotic pollen input is again noted after 7000 BP, reflecting the establishment of more continuous vegetation in Keewatin (Nichols, 1974, 1975) and Labrador-Ungava (Short, 1978; Lamb, 1980, 1985). Subsequently, exotic pollen grains are recorded in all levels. A secondary willow episode and minimum grass percentages characterize the pollen spectrum until 5000 BP; this episode may represent the local climatic optimum, a period of environmental stability in northwestern Baffin Island. Subsequently the decrease in sedge pollen and rise in grass pollen suggests a decrease in moisture, at least locally. This correlates with a mid-late Holocene trend to more severe conditions, marked by a change from a diverse, shrub-dominated assemblage to a more impoverished graminoid spectrum, observed in other Baffin Island sites (Miller et al., 1977; Short et al., 1985).

**RELAFIGION TO LATE FOXE (WISCONSINAN) GLACIAL HISTORY**

Figure 1 shows the location of Arctic Bay in relation to two different concepts of the extent and history of the northeastern Laurentide Ice Sheet (Denton and Hughes, 1981; Dyke, 1984). These two views have been succinctly called the “maximum” and “minimum” glacial reconstructions (Denton and Hughes, 1981; Dyke, 1983; Prest, 1984; Dyke, 1984). To the east of Arctic Bay, Klassen (1982, 1985) documents an early Foxe (Wisconsinan) glacial advance that overwhelmed much of Bylot Island and required massive glaciation of Lancaster Sound. However, during the late Foxe glaciation no “foreign” ice impinged on Bylot Island. The maximum extent of late Foxe Glaciation is delimited by a glacial-marine delta and ice contact features at Cape Hatt (Fig. 1) which are associated with a 14C date of 9500 ± 180 BP (GSC-3318) (Klassen, 1982, 1985; Dyke, 1984). Hence, Klassen’s work supports the “minimum” view. This pattern of ice margins and associated 14C dates is dominant along the 1200 km outer coast of Baffin Island; glacial-marine deposits with 14C dates of > 40,000 BP (Miller et al., 1977; Mode, 1980; Nelson, 1982; Brigham, 1983) are overlain at low elevations by early Holocene transgressive facies which are associated with dates of between 10,700 and 9500 BP (Miller, 1980).

In the minimum glacial model, the terrain between the inner moraines of Cockburn age (Falconer et al., 1965; Andrews and Ives, 1978) and the outer early Foxe moraines (Miller and Dyke, 1974; Andrews and Miller, 1984) (Fig. 1) should contain some evidence for ice-free conditions between 10,000 and < 40,000 BP. Attempts to core lakes in this terrain have provided useful Holocene pollen records (Davis, 1980; Mode, 1980), but the oldest sediment recovered has been about 9000 years old. However, only three lakes have been cored to date. Investigation of fiord sediment records within this zone (Fig. 1) have provided evidence, in the form of accelerator dates on in situ molluscs and on corrected organic fraction 14C dates, that the outer reaches of several fiords were ice free during the last 12,000 years or more (Andrews et al., 1985) (Fig. 1).

Modelling ice extent and ice history by glacial isostatic theory (Quinlan, 1981, 1985) favors a “minimum” ice margin, but in order to match observed sea level curves the ice sheet remains essentially unchanged between 18,000 and 8000-9000 BP when overall recession and thinning take place. Thus the location of the Arctic Bay section, and cores from selected fiords < 14,000 BP, provide important constraints on the position of the late Foxe (Wisconsinan) ice sheet margin. Radiocarbon dates to the east and west of Arctic Bay (Fig. 1) (Dyke, 1983, 1984) record the entry of the early Holocene sea through Lancaster Sound. Dyke (1983, 1984) states that significant deglaciation occurred around 9500 BP. His map of the altitude of the 9300 BP shoreline along the northern margin of the Laurentide Ice Sheet suggests that sea level near Arctic Bay was 60-70 m above sea level. There is no indication in the stratigraphy of the section (located at ca. 80 m asl) that it lay below sea level at any time, thus supporting in a general sense Dyke’s forecast.

**CONCLUSION**

The sedge-peat section at Arctic Bay, Baffin Island, indicates that the northeastern margin of the Laurentide Ice Sheet did not extend into Lancaster Sound, at least < 16,000 years ago. Pollen data from the deposit suggest that between 12,000
An early Holocene warm period, reported for several other sites in Baffin Island (Short et al., 1985), is registered in the Arctic Bay peat. The mid-late Holocene change to milder climatic conditions (Miller et al., 1977; Short and Jacobson, 1982; Short et al., 1985) is also supported by this record.

ACKNOWLEDGMENTS
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REFERENCES


