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POSTGLACIAL TECTONIC AND SEA LEVEL HISTORY OF THE CENTRAL CANADIAN ARCTIC

Arthur S. Dyke, Thomas F. Morris, and David E.C. Green

1991

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Cover description

Remains of a bowhead whale at 58 m elevation on the west
side of Prescott Island dated at 9335 ± 145 BP (S-2913)
GSC 204879

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Preface

One of the major results of glaciation and deglaciation of Canada during the multiple ice ages of the Quaternary Period of the last 2 million years was that the weight of the ice sheets depressed the crust and when the weight was removed the crust recovered slowly; it is still recovering. By studying postglacial crustal movement, geologists can infer much about the physics of the crust and of the mantle below the crust. For the most part this deformation of the crust by the ice sheets took the form of a gentle flexing and unflexing. But we have long known that in places the unflexing during and after deglaciation was accompanied by brittle failure forming small faults in bedrock. Such faults are well known from several sites in Atlantic and Cordilleran areas of Canada. By dating them we can infer a long term record of seismic activity and crustal deformation.

This report documents the postglacial sea level history of a large part of the Canadian Arctic and provides evidence that the process of postglacial crustal rebound was complicated by the reactivation of large regional tectonic structures, particularly the Boothia Arch. The authors propose a hypothesis of "Holocene (postglacial) block tectonics" wherein the Arctic Archipelago recovered from glacial depression as a mosaic of blocks, some of which tilted during uplift while others did not. These findings have broad implications regarding regional crustal structure and postglacial seismic history. They also demonstrate the importance of carefully documenting the postglacial sea level history of Canada so as to understand better the nature of the sea level changes currently affecting our entire coastline.

Elkanah A. Babcock
Assistant Deputy Minister
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Préface

Une des principales conséquences de la glaciation et de la déglaciation du Canada pendant les nombreuses époques glaciaires de l'ère quaternaire au cours des deux derniers millions d'années est que le poids des inlandsis a déprimé la croûte et, à la disparition de ce poids, que la croûte a lentement commencé à reprendre sa position initiale; d'ailleurs elle continue à se soulever. En étudiant le mouvement de la croûte postglaciaire, les géologues peuvent beaucoup apprendre sur la physique de la croûte et du manteau qui se trouve au-dessous de celle-ci. Dans la plupart des cas, cette déformation de la croûte causée par les inlandsis a pris la forme d'un affaissement et d'un soulèvement faibles. Mais nous savons depuis longtemps qu'à certains endroits, le soulèvement pendant et après la déglaciation a été accompagné de ruptures fragiles donnant naissance à de petites failles dans le socle. Ces failles sont bien connues en plusieurs emplacements de l'Arctique et de la Cordillère canadiens. En les datant, on peut déduire l'histoire ancienne de l'activité sismique et de la déformation de la croûte.

Le présent rapport, étudie soigneusement l'évolution du niveau de la mer postglaciaire d'une grande portion de l'Arctique canadien et fournit des preuves afin de montrer que le processus du relèvement postglaciaire de la croûte se compliquait par la réactivation de grandes structures tectoniques régionales, notamment l'arche de Boothia. On propose l'hypothèse d'une «tectonique cassante (postglaciaire) pendant l'Holocène» selon laquelle le rebondissement de l'archipel s'est fait sous la forme d'une mosaïque de blocs dont certains ont basculé au cours du soulèvement, et d'autres pas. Ces découvertes jettent un éclairage nouveau sur la structure régionale de la croûte et l'histoire sismique postglaciaire. Elles montrent également l'importance de l'étude attentive de l'évolution du niveau de la mer postglaciaire du Canada afin de mieux comprendre la nature des changements du niveau de la mer qui influent actuellement sur tout le littoral canadien.

Elkanah A Babcock
Sous-ministre adjoint
Commission géologique du Canada

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Abstract

More than 130 new radiocarbon dates form the basis for 14 emergence curves for Prince of Wales and adjacent smaller islands. These curves and 14 additional curves from a large surrounding area are the primary basis for a set of central Arctic isobase maps.

During and just after deglaciation the Boothia Arch was reactivated, producing 60-120 m of relief on the regionally elevated 9.3 ka shoreline. This deformation could have the form of a symmetrical ridge or a ridge with a fault zone on its western side. The ridge is flanked on the west by a large isobase plateau where the emerged 9.3 ka shoreline has little gradient. The 8 ka and younger shorelines are not affected by the Boothia Arch, but the Prince of Wales Island isobase plateau persisted as the predominant regional isobase feature throughout postglacial time. Since 8 ka all of Prince of Wales Island has emerged without delevelling of shorelines — a glacioisostatically abnormal pattern. We propose a Holocene block tectonics hypothesis: that postglacial rebound of the archipelago involved movement of a mosaic of blocks, some tilting, others not tilting. Small postglacial lineaments on eastern Prince of Wales Island may indicate that minor tectonism has continued until present.

The emergence history of Prince of Wales Island since 8 ka can be described by a single exponential least squares regression curve based entirely on 41 driftwood dates. Addition of two select shell dates produces a curve for the area of earliest deglaciation at about 11 ka. The curve has narrow 99% confidence limits, explains 94.72% of data variance, and has a correlation coefficient of 0.97. The half-response time — the time during which one half of remaining emergence is accomplished — is 2000 years.

Résumé

Plus de 130 nouveaux âges obtenus par datation au carbone constituent la base de 14 courbes d'émersion pour l'île Prince-de-Galles et pour de petites îles adjacentes. Ces courbes et 14 autres provenant d'une grande région avoisinante constituent la base principale d'un ensemble de cartes d'isobases pour l'Arctique central.

Au cours de la déglaciation et immédiatement après celle-ci, l'arche de Boothia a été réactivée, donnant un relief de 60 m à 120 m sur le littoral régionalement élevé, datant de 9,3 ka. Cette déformation pourrait avoir la forme d'une crête symétrique ou d'une crête avec une zone faillée sur son flanc occidental. La crête est flanquée à l'ouest d'un grand plateau isobase où le littoral émergé, datant de 8 ka et plus jeunes ne subissent pas l'influence de l'arche de Boothia, mais le plateau isobase de l'île Prince-de-Galles a persisté et est resté la structure isobase régionale prédominante pendant toute la période postglaciaire. Depuis 8 ka, l'île Prince-de-Galles entière a émergé sans déranger les lignes de rivage, phénomène anormal en glacio-isostasie. Nous proposons l'hypothèse d'une tectonique cassante pendant l'Holocène: le rebondissement postglaciaire de l'archipel s'est fait par mouvement d'une mosaïque de blocs dont certains ont basculé et d'autres pas. Des petits linéaments postglaciaires observés sur la partie orientale de l'île Prince-de-Galles peuvent indiquer qu'une tectonique secondaire s'est poursuivie jusqu'à nos jours.

On peut décrire l'histoire de l'émersion de l'île Prince-de-Galles depuis 8 ka par une seule courbe exponentielle de régression établie par la méthode des moindres carrés et fondée entièrement sur 41 datations de bois flottants. Deux autres datations choisies de coquilles fournissent une courbe, pour la région, d'une première déglaciation remontant à environ 11 ka. La courbe a un intervalle de confiance étroit à 99 %, exprime 94,72 % de la variance des données et a un coefficient de corrélation de 0,97 %. La période de la demi-réponse, temps pendant lequel la moitié de l'émersion restante se fait, est de 2000 ans.

SUMMARY

More than 130 new radiocarbon dates on driftwood, whale bone, marine shells, and organic detritus from Prince of Wales and adjacent smaller islands form the basis for 14 local emergence curves representing small sample areas. Some curves or segments of curves are well controlled, but others are minimum emergence curves based on maximum limiting radiocarbon dates on relative sea level positions. These dates, along with constraints provided by a well surveyed marine limit configuration and dated deglaciation pattern, make the sea level history of Prince of Wales Island better known than that of any other area of comparable size in Canada. Fourteen other emergence curves are presented from sites and areas of various size throughout the broad central Arctic region, from Melville and Devon islands in the north to Pelly Bay and Bathurst Inlet in the south. Four of the better controlled curves are from Somerset Island, adjacent to Prince of Wales Island. These 28 emergence curves, along with other radiocarbon dates on isolated samples scattered throughout the region, are used to construct a set of isobase maps showing the amount of elevation of the crust that has occurred since 11 ka, 10 ka, 9.3 ka, 9 ka, 8.5 ka, 8 ka, 7 ka, and 6 ka.

The isobase patterns suggest that during and just after deglaciation of the Somerset-Boothia-Prince of Wales region, the Boothia Arch (or Boothia Horst) was reactivated and produced 60-120 m of local relief, increasing southward, on the 9.3 ka shoreline. This deformation could have the form of a symmetrical ridge or of a ridge with a steep, faulted, western side along Peel Sound, between Prince of Wales and Somerset islands. Either solution equally satisfies the paleoshoreline data. The ridge trends north-south across Boothia Peninsula and western Somerset Island. On the west, in the area of Prince of Wales Island, the ridge is flanked by a large isobase plateau wherein the emerged 9.3 ka shoreline has very little tilt. The Boothia-Somerset isobase ridge dampened quickly following deglaciation and the 8 ka shoreline is not affected by it. The Prince of Wales Island isobase plateau, on the other hand, persisted as the most prominent regional isobase feature throughout postglacial time and had lost any measurable gradient by 8 ka. In other words, since 8 ka the entire region of Prince of Wales and adjacent smaller islands, and possibly a larger area, has rebounded without tilting. This is glacioisostatically abnormal and we are not aware of any similar feature elsewhere.

The possible correlation between the Boothia-Somerset isobase ridge and the structural Boothia Arch (Horst) is obvious, but there is no obvious crustal structure that accounts for the Prince of Wales Island isobase plateau. Starting from Kerr's (1980) tectonic model of the Arctic Archipelago, which proposes that the archipelago is a continental subplate severely fragmented by rifting, with the interisland channels occupy-

SOMMAIRE

Plus de 130 nouvelles datations au carbone établies sur des bois flottants, des os de baleine, des coquillages marins et des détritus organiques provenant de l'île Prince-de-Galles et de petites îles adjacentes constituent la base de 14 courbes d'émersion locale représentant de petites parcelles d'essai. Certaines courbes ou segments de courbe sont bien contrôlés, mais d'autres sont des courbes d'émersion minimale fondées sur des âges limites maxima au carbone de positions relatives du niveau de la mer. Ces âges, ainsi que les contraintes fournies par une configuration bien établie de la limite de l'extension des mers et un mode de déglaciation daté, permettent de mieux connaître l'évolution du niveau de la mer de l'île Prince-de-Galles que celle de n'importe quelle autre région de taille comparable au Canada. On présente 14 autres courbes d'émersion provenant de sites et de zones de taille variable, réparties dans une large région de l'Arctique central, allant des îles Melville et Devon au nord à la baie Pelly et l'inlet Bathurst au sud. Quatre des courbes les mieux contrôlées proviennent de l'île Somerset, contiguë à l'île Prince-de-Galles. Ces 28 courbes d'émersion, ainsi que d'autres âges au carbone établis sur des échantillons isolés, éparpillés dans toute la région, servent à construire un ensemble de cartes d'isobases montrant l'ampleur du rebondissement de la croûte depuis 11 ka, 10 ka, 9,3 ka, 9 ka, 8,5 ka, 8 ka, 7 ka et 6 ka.

Les configurations des isobases laissent supposer que pendant la déglaciation de la région de Somerset-Boothia-Prince-de-Galles et immédiatement après cette déglaciation, l'arche de Boothia (ou môle de Boothia) a été réactivé et a donné un relief local de 60 m à 120 m, augmentant vers le sud, sur le littoral datant de 9,3 ka. Cette déformation pourrait avoir la forme d'une crête symétrique ou d'une crête avec un flanc occidental abrupt et faillé, le long de Peel Sound, entre l'île Prince-de-Galles et l'île Somerset. L'une ou l'autre de ces solutions répond d'une façon satisfaisante aux données sur le paléolittoral. La crête de direction nord-sud traverse la presqu'île de Boothia et la partie occidentale de l'île Somerset. À l'ouest, dans la région de l'île Prince-de-Galles, la crête est flanquée d'un grand plateau isobase dans lequel le littoral émergé datant de 9,3 ka est très peu incliné. La crête isobase de Boothia-Somerset a été submergée rapidement après la déglaciation et la ligne de rivage datant de 8 ka n'a pas été modifiée par ce phénomène. Par contre, le plateau isobase de l'île Prince-de-Galles a persisté et est resté la structure isobase régionale prédominante au cours de toute la période postglaciaire; tout gradient mesurable y avait disparu il y a 8 ka. En d'autre termes, depuis 8 ka, toute la région de l'île de Prince-de-Galles et de petites îles adjacentes, et probablement une région plus grande, s'est soulevé sans basculer. Ce phénomène est anormal en glacio-isostasie et nous ne connaissons pas de structures similaires ailleurs.

La corrélation possible entre la crête isobase de Boothia-Somerset et l'arche (môle) structurale de Boothia est évidente, mais il n'existe aucune structure évidente de la croûte qui explique le plateau isobase de l'île Prince-de-Galles. Partant du modèle tectonique de Kerr (1980) de l'archipel arctique, modèle d'après lequel ce dernier est une sous-plaque continentale très fragmentée par des bassins d'effondrement, où les chenaux entre les îles occupent de grands fossés d'effondrement du Tertiaire, on propose une hypothèse de tectonique cassante pendant

ing large Tertiary rift valleys, we propose a hypothesis of Holocene **block tectonics**, which is that postglacial isostatic rebound of the archipelago has proceeded by movement of a mosaic of blocks, some blocks rebounding and tilting, some rebounding without tilting. Direction of shoreline tilt may be dictated glacioisostatically on some blocks but on other blocks may be precluded or may be otherwise dictated by structural configuration. This means that we cannot use paleoshoreline geometry to infer safely the configuration of former ice loads. A fruitful line of future research will be to explore possible correlations between shoreline deformation patterns and regional structural geology. Meanwhile paleoice-sheet reconstructions must proceed independently of the sea level reconstructions to avoid an automatic and potentially meaningless correlation.

Apart from the paleoshoreline deformations, there is no definitive structural geological evidence of postglacial tectonism in the Somerset-Boothia-Prince of Wales region. There are, however, small unusual postglacial lineaments at several sites along the east coast of Prince of Wales Island that cross raised beaches, till, and bedrock. We feel that these features are not of periglacial origin and that they may be tectonic. If so minor tectonism has continued into late postglacial time, a not surprising conclusion in light of the current seismicity of the Boothia Arch.

The fact that shorelines dating from about 8 ka and younger on Prince of Wales Island have not been delevelled means that the last 8000 years of emergence history of the entire island can be described by a single curve. We present such a curve based on 41 driftwood dates. A mathematical good fit to the data is produced by a simple exponential curve.

Extension of this curve before 8 ka by addition of two radiocarbon age determinations on shells dating marine limit from the first part of Prince of Wales Island to be deglaciated produces a curve with a half-response time of 2000 years that explains 94.72% of variance in the data and has a correlation coefficient of 0.97. This is one of only two places in glaciated North America (the other being Cape Storm, Ellesmere Island) where we have sufficient driftwood dates to empirically test the form of emergence curves. Shells and whale bone dates cannot be used for this purpose because they must plot on or below emergence curves, that is, they should not be fitted using regression techniques.

l'Holocène selon laquelle le relèvement isostatique postglaciaire de l'archipel s'effectue par mouvement d'une mosaïque de blocs dont certains se soulèvent et basculent, et d'autres se soulèvent sans basculer. La direction du basculement du littoral pourrait être dictée sur certains blocs par glacio-isostasie, à laquelle échapperaient d'autres blocs, à moins que la direction de ces derniers ne soit dictée par une configuration structurale. Cela veut dire qu'on ne peut utiliser les formes géométriques du paléolittoral pour déduire d'une façon certaine la configuration des charges antérieures de glace. L'exploration des corrélations possibles entre les configurations des déformations du littoral et la géologie structurale régionale est une voie de recherches prometteuse. Entre temps, il faut poursuivre les reconstructions des paléo-inlandsis indépendamment des reconstitutions des niveaux de la mer afin d'éviter une corrélation automatique et éventuellement dénuée de sens.

Outre les déformations du paléolittoral, il n'existe aucun indice géologique structural net d'une tectonique postglaciaire dans la région de Somerset-Boothia-Prince-de-Galles. Mais on trouve toutefois de petits linéaments postglaciaires peu communs, dans plusieurs sites le long de la côte orientale de l'île Prince-de-Galles, qui traversent des plages surélevées, des tills et le socle. Nous pensons que ces structures ne sont pas d'origine périglaciaire et qu'elles peuvent être d'origine tectonique. Le fait que de faibles déformations tectoniques se sont poursuivies à la fin du Post-glaciaire ne surprend pas si l'on considère la sismicité actuelle de l'arche de Boothia.

Le fait que les lignes de rivage l'île Prince-de-Galles, datant d'environ 8 ka ou de moins longtemps n'aient pas été dénivelées prouve que les 8000 dernières années de l'histoire de l'émersion de l'île entière peuvent être décrites par une seule courbe. Nous présentons une telle courbe en nous basant sur 41 âges établis sur des bois flottants. Une simple courbe exponentielle permet d'obtenir un bon lissage mathématique applicable aux données.

L'extrapolation de cette courbe avant 8 ka - par ajout de deux datations au carbone de coquillages contemporains de la limite de l'extension des mers et prélevées de la première partie déglacée de l'île Prince-de-Galles - donne une courbe dont la période de demi-réponse est de 2000 ans, courbe qui explique 94,72 % de la variance des données et qui a un coefficient de corrélation de 0,97. C'est là un des deux seuls endroits recouverts de glace de l'Amérique du Nord (l'autre étant le cap Storm de l'île Ellesmere) où un membre suffisant de datations au carbone de bois flottants, permet de vérifier empiriquement la forme des courbes d'émersion. On peut utiliser à cet effet les âges des coquillages et des os de baleine, car ils doivent se situer sur ou sous les courbes d'émersion, c'est-à-dire qu'ils ne doivent pas être ajustés par régression.

INTRODUCTION

One of the aims of most Quaternary geological studies in the Canadian Arctic has been and remains resolution of postglacial sea level history and definition of patterns of glacial rebound in order to infer past ice sheet geometries. With the exception of Blake's (1975) benchmark study of postglacial emergence at Cape Storm, Ellesmere Island, however, this aim normally has been subordinated to other objectives such as reconnaissance mapping. Consequently the paleosea-level data base has grown haphazardly and is of uneven quality. Furthermore, datable materials are unevenly distributed, with driftwood being abundant on some coasts but absent on others, for example, and many datable materials have no precise relationship to a former sea level position. For these reasons, there are few well controlled relative sea level curves from the Arctic Islands. Curves have been assembled by using low quality data from large areas to define single curves (e.g. Walcott, 1972), but this approach precludes recognition of all but the coarsest geometric patterns.

The present study began in 1975 as a component of regional mapping that eventually involved Somerset Island, Boothia Peninsula, northern District of Keewatin, King William Island, and Prince of Wales Island (Fig. 1; Dyke, 1983; 1984; Hélie, 1985; Green, 1986; Morris, 1988; Dyke and Green, in press; Morris and Dyke, in press). Dyke (1979, 1980) presented a family of emergence curves and isobase maps for Somerset Island based on 36 radiocarbon dated samples of marine pelecypods, boreal driftwood, and bowhead whale bones, and Dyke (1984) presented an isobase map showing the present elevation of the 9.3 ka[1] shoreline in the central Arctic. No reliable data were available from Prince of Wales Island at that time, but the 9.3 ka isobase pattern predicted that the shoreline of that age should exceed 160 m, its elevation on western Somerset Island. The first reliable paleosea-level date from Prince of Wales Island was on exceptionally well preserved marine molluscs related to a marine limit of 95 m a.s.l. The date of 9470 ± 100 BP (GSC-3697) placed the 9.3 ka shoreline about 100 m below the level "predicted" by the regional isobases of Dyke (1984). More importantly, it firmly showed that the pattern of shoreline delevelling documented for Somerset Island could not be extrapolated correctly westward to eastern Prince of Wales Island, across the 30 km width of Peel Sound. The large difference between the actual and predicted elevations of the 9.3 ka shoreline on eastern Prince of Wales Island and the difficulty of fitting this single new data point into the regional isobase pattern, suggested an initial working hypothesis that early Holocene shorelines are tectonically disturbed, perhaps offset in the vicinity of Peel Sound by faulting (Dyke and Dredge, 1989). Hence, during three field seasons on Prince of Wales Island considerable efforts were made to collect material for radiocarbon dating of postglacial shorelines in order to clarify the regional patterns of emergence and to evaluate these patterns of paleoshoreline delevelling in light of former ice sheet configurations and regional structural geology. These efforts resulted in 117 radiocarbon dates from 14 reasonably small sample areas. The dates are used here to construct 14 local emergence curves; 13 other dates provide additional control from intervening areas.

This report presents the new emergence data and emergence curves from Prince of Wales Island, uses this new data along with existing data from adjoining areas (Table 1)[2] in constructing regional isobase maps, and interprets the regional pattern of paleoshoreline uplift and delevelling in terms of glacial and tectonic controls. Table 1 (at the end of this report) summarizes the radiocarbon age determinations used to construct the isobase maps.

STRUCTURAL GEOLOGY

The structural geology (Fig. 2) is dominated by the Boothia Arch in the south and by Parry Islands Fold Belt in the north. The Boothia Arch results from uplift of the Boothia Horst, a northern salient of the Churchill Province of the Canadian Shield, and from attendant folding of overlying and flanking Paleozoic carbonate strata. Boothia Horst is exposed on central Boothia Peninsula and western Somerset Island and in a narrow area along the eastern fringe of Prince of Wales Island. It plunges into the subsurface north of Somerset Island. East and west of the Cornwallis Fold Belt on Somerset Island and on Prince of Wales Island, the Paleozoic carbonate rocks are nearly flat lying. The contact of the Boothia Horst and rocks of the Cornwallis Fold Belt is faulted along much of its length, with high angle normal faults occurring along the eastern side and high angle reverse or thrust faults along eastern Prince of Wales Island. Small grabens and half grabens occur both within and adjacent to Boothia Horst, as at Wrottesley Inlet, Stanwell-Fletcher Lake, and Cunningham Inlet, and the central part of the horst between Stanwell-Fletcher Lake and Wrottesley Inlet is topographically arranged into a series of blocks separated by north-south and east-west trending linear valleys, suggestive of block faulting (Blackadar, 1967). The Boothia Arch was intermittently active from late Precambrian through to Tertiary time (Kerr, 1977, 1980).

The Parry Islands Fold Belt strikes generally east-west across Melville and Bathurst islands and from there curves northward into Ellesmere Island. It resulted from intensive folding of the sedimentary rocks of the Franklinian Geosyncline during the Ellesmerian Orogeny during the middle to late Paleozoic (Harrison et al., 1988).

The last major tectonic disturbance of the Arctic Archipelago occurred during the Eurekan Deformation when rocks of the Cretaceous-Tertiary Eureka Sound Group were folded in the northern part of the archipelago but were faulted and downdropped in the southern part. During the rifting phase of the Eurekan Deformation the small grabens at Wrottesley Inlet, Stanwell-Fletcher Lake, and Cunningham Inlet were formed. According to Kerr (1980), it was also during

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[1]ka = thousand year (old understood).

[2]Table 1 is at the end of this report; its 28 sections correspond to the 28 emergence curves of Figures 12 and 13.

the Eurekan Rifting Episode that the major interisland straits and channels were formed as rift valleys and this phase extended possibly into the Pliocene. Rifting is thought to have propagated simultaneously eastward from Beaufort Sea and westward from Baffin Bay and hence to have affected the Peel Sound-Barrow Strait area during its culmination. Also according to Kerr (1977, 1980), Somerset Island is surrounded by normal faults coincident with the remarkably straight coastal cliffs, and Christie and Thorsteinsson (1972) portrayed faults close to and paralleling much of the Franklin Strait and Peel Sound coasts of Prince of Wales Island.
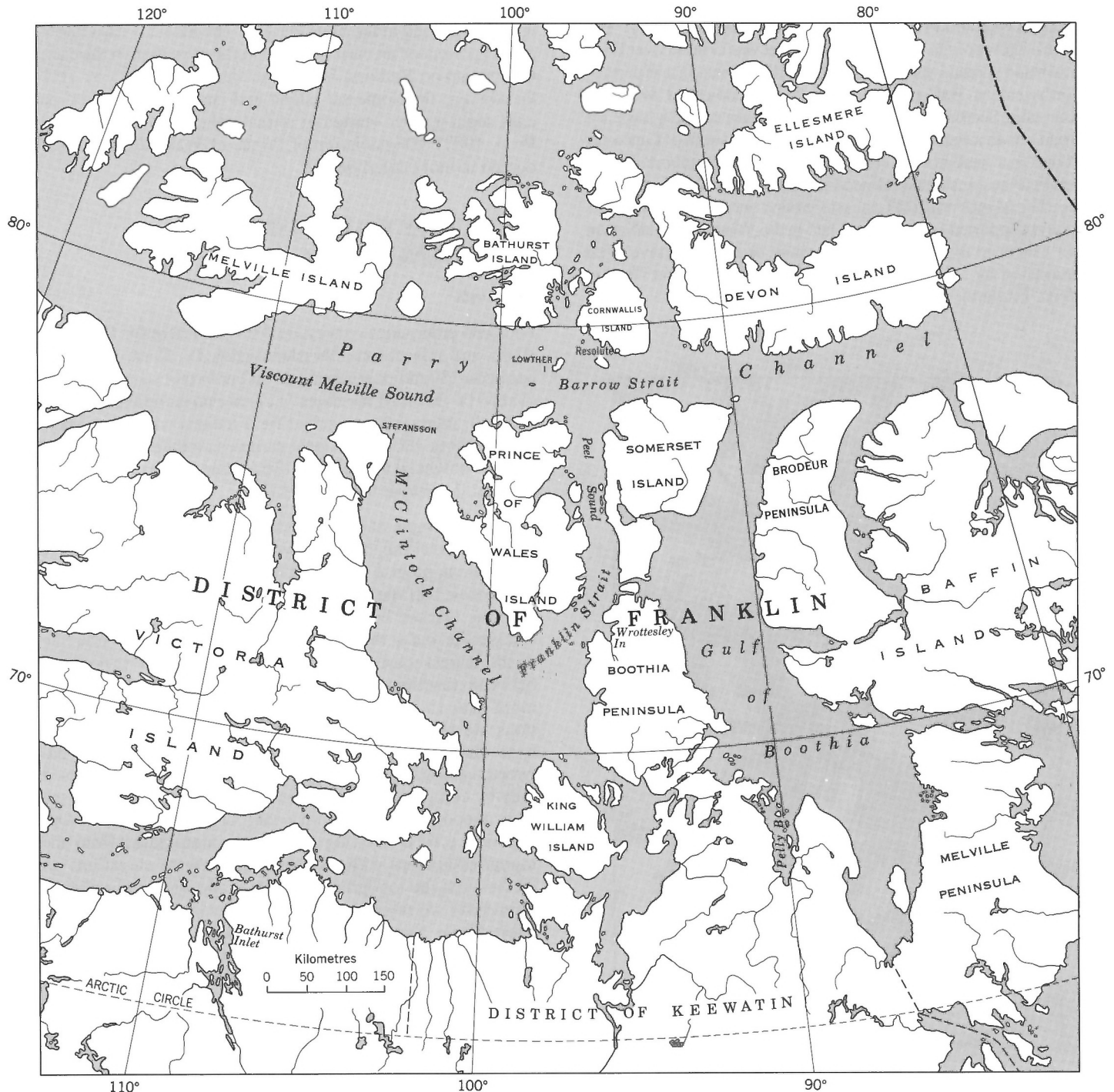
Figure 1. Location map, central Canadian Arctic.

GLACIAL GEOLOGY

The area under consideration here was affected by several different ice masses during the Wisconsin (last) Glaciation (Fig. 3). The Keewatin Sector of the Laurentide Ice Sheet covered the mainland west of Hudson Bay and extended northward to the north shore of Viscount Melville Sound. The earliest known flow of the Keewatin Sector was northwestward on Prince of Wales Island but later flow switched to an eastward course, spreading from an ice divide located west of Prince of Wales Island (Dyke and Prest, 1987; Morris and Dyke, in press). The Baffin Sector of the Laurentide Ice Sheet was centred over Foxe Basin and spread westward over Melville Peninsula and parts of northwestern Baffin Island and likely coalesced with the Keewatin Sector in Gulf of Boothia to form either a large ice stream or an ice shelf. Peninsulas and islands south of Lancaster Sound that were not covered by Laurentide ice supported independent ice caps that coalesced in most places with Laurentide ice. The islands north of Lancaster Sound and Viscount Melville Sound supported large ice caps late in the Wisconsin Glaciation but earlier in that glaciation they may or may not have been inundated by a thicker and more extensive ice sheet (Blake, 1970; England, 1976; Dyke and Prest, 1987).
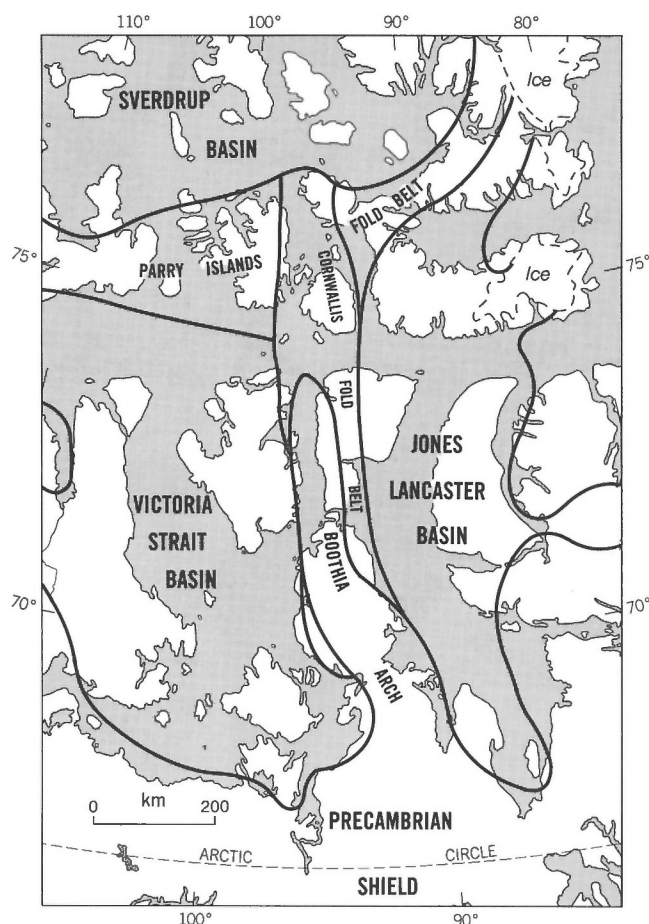
Figure 2. Structural and stratigraphic provinces, central Canadian Arctic Archipelago (from Kerr and Christie, 1965).

Deglaciation was regionally asymmetric. Ice retreat, and hence crustal rebound, started before 12.6 ka along the northwest margin of Keewatin Ice at the west end of Viscount Melville Sound. Retreat had progressed eastward to northwestern Prince of Wales Island by 11 ka. In contrast, the sea did not penetrate to the eastern margin of Keewatin Ice until about 9.3 ka. Keewatin Ice had retreated to the northern mainland of Mackenzie and Keewatin by 8.5 ka but the Baffin Sector (Foxe Ice) had barely started retreating from its last maximal configuration by that time, and in fact was advancing along much of its margin. The local ice caps likely also experienced an earlier retreat in the west than in the east; the ice cap on Bathurst Island had started to retreat by 10.2 ka whereas the Somerset Island and Brodeur Peninsula ice caps seem to have started to retreat about 9.3 ka (Dyke and Prest, 1987). Deglaciation of Prince of Wales Island is discussed in more detail below.

PRINCE OF WALES ISLAND EMERGENCE DATA

Methods

Fourteen emergence curves are presented here for Prince of Wales and adjacent smaller islands (Fig. 4). These curves are based on 130 radiocarbon dates, all but two of which are new (Table 1). Most of the dates (117) are on samples collected in small, intensively searched field locales with an average area of about 200 km^2. Dated samples include 46 driftwood logs, 39 bowhead whale bones, 36 marine molluscs, 3 organic detritus, 2 narwhal tusks, and 1 peat.

A few sample and paleoshoreline elevations were determined by levelling, but most were determined from Wallace and Tiernan precise surveying barometric altimeters, read to the nearest half metre. Every effort was made to minimize the time elapsed between altimeter readings (Table 1) at a sample site and at the reference datum, usually high tide line on the nearest coast, because changes in atmospheric pressure between readings make the altimetry inaccurate. Where more than 15 minutes elapsed between readings, the elevations are regarded as approximations with potential errors exceeding 2 m. Where more than 30 minutes elapsed between readings the accuracy of the altimetry can be assessed only by comparing the result to the elevation as interpolated from a topographic map with a contour interval of 30 m. Our experience of comparing elevations interpolated from the topographic maps with accurately altimetered elevations indicates that the topographic contours are accurately placed. Therefore, we regard map-derived elevations for far inland sites, where accurate altimetry without aircraft support is impossible, as acceptably accurate (±10 m or so). Where possible, two sets of altimeter readings were taken per sample (i.e., readings at sample site, at sea level, and at sample site again), and if not in agreement within 0.5 m, a third reading was taken.

All radiocarbon dating was done by the laboratory at the Geological Survey of Canada (GSC) and under contract at the Saskatchewan Research Council (SRC), both proportional gas counting facilities. All SRC data are reported in
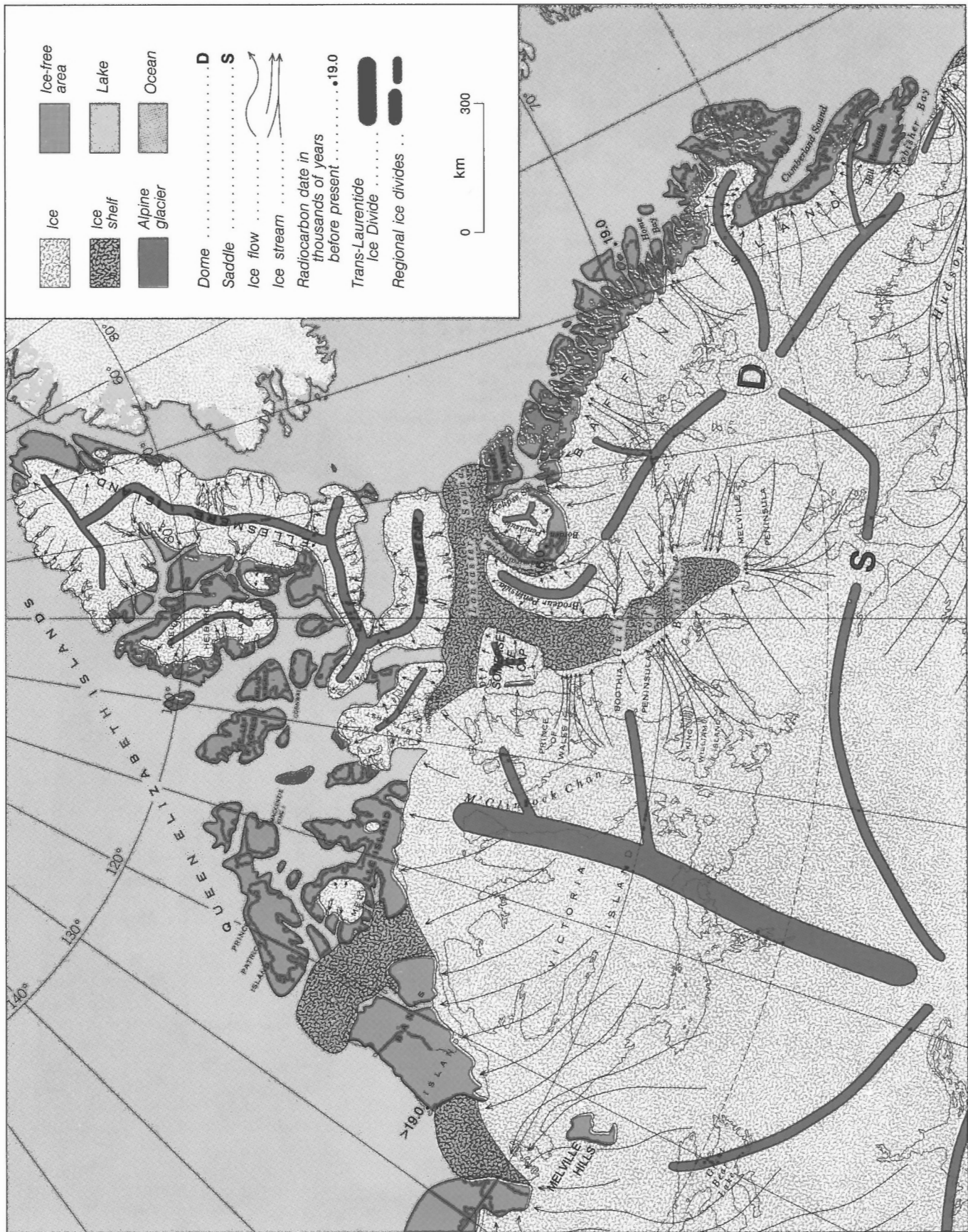
Figure 3. Regional glacial reconstruction, last glacial maximum (from Dyke and Prest, 1987).

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Map of Prince of Wales Island region with station/sample location labels.

Coordinates: 103°, 100°, 96° (longitude); 74°, 73°, 72° (latitude)

Water bodies and features:
PEEL SOUND
M'CLINTOCK CHANNEL
FRANKLIN STRAIT
Baring Channel
Mecham I.
Reliance Bay
Arabella Bay
Drake Bay
Smith Bay
Ommanney Bay
Scott Bay
Browne Bay
Inner Browne Bay
Young Bay
Pandora Island
Prescott Island
Fisher L.
Willis Bay
Coningham Bay
Guillemard Bay
Crooked Lake
Dolphin River
Allen Lake
Back Bay
Flexure Bay
Le Feuvre Inlet
Transition (Kennedy) Bay

Island labels:
PRINCE OF WALES ISLAND
RUSSELL ISLAND
Northwest Russell Island
Eastern Russell Island
Muskox Hill-Pandora Island
Lock Island
Vivian Island
Edgeworth Island
Tasmania Islands
Dixon Island
Graham

Cape/Point labels:
Cape Berkeley, Cape Dundas, Milne Point, Ede Point, Cape John Dyer, Harrison Point, Charles Richards Pt, Minto Head, Point Gell, Hollist Pt, Dean Point, Cape Richard Collinson, Cape Ackworth, Hamilton Point, Crozier B, Allen Young Pt, Sydney Webb Pt, Harvey Point, Thackeray Point, Cape Haughton, Foster Point, Cape Swinburne, Charles Dickens Point, Cape Hardy, Lyons Point, Cape Briggs, Whitehead Point, Sherard Head, Cape Henry Kellett, Cape M'Clure, Savage Point, Cape Brodie, Cape Dalgety, Cape Eyre, Cape Hobson, Lady Murchison B, Raised Beaches, Hollist Point

Sample station labels (approximate):
S-2664 Palmerston Point
GSC-4001, S-2662, S-2671, GSC-4002, GSC-3999, GSC-2300, S-2672, GSC-3978, GSC-2240, GSC-3994
S-2708, S-2592, S-2591, GSC-4033, GSC-4227, GSC-4241, S-2587, S-2709, S-2680, S-2593
S-2585, S-2586, GSC-3954, S-2704, S-2705, S-2707, S-2702, GSC-4250, S-2706, S-2710, S-2711, S-2703
GSC-3975, S-2685
GSC-4408, GSC-4527, GSC-600, S-2914, S-2910, S-2917, S-2923, S-2911, S-2912, GSC-4428, GSC-4427, GSC-4417, GSC-4525, GSC-3679, S-2918
Browne Bay: S-2684, S-2679, GSC-4031, GSC-4045, S-2689, S-2688
GSC-4459, GSC-2915, GSC-4503, GSC-4458, GSC-4442, S-2965, GSC-4456, GSC-4457, S-2921, GSC-4523, S-2920, GSC-4524, GSC-4515, S-2913
GSC-4025, GSC-3936, S-2588, GSC-4479, GSC-4387, S-2922, GSC-4398, GSC-4343, GSC-4361, GSC-3945, GSC-4478, GSC-4528, S-2919, GSC-2964, GSC-3977, GSC-3962, S-2589, S-2590, S-2683, S-2916
S-2864, S-2859, S-2839, S-2837, S-2838, S-2831, S-2836, GSC-235, S-2714, S-2715, S-2835, S-2833, S-2832, S-2834, S-2828, S-2829, S-2716, S-2720, S-2862
S-2860, S-2830, S-2719, S-2861, S-2596, GSC-4049, S-2597, S-2598, L-571B, GSC-3996, S-2599, S-2717, S-2718
GSC-3989, S-2604, S-2601, GSC-3985, S-2603, S-2600, GSC-3967

Scale: 0 Kilometres 50

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"uncorrected" (unnormalized) form as $\delta^{13}C$ values were not measured. GSC dates are normalized to 0‰ $\delta^{13}C$ for marine carbonate and to -25‰ $\delta^{13}C$ for wood and terrestrial organic material which builds in a 400 year correction for the marine reservoir effect. Differences between normalized and unnormalized GSC shell dates are almost always within the standard error of the age determination and are commonly only a few decades. Therefore, the unnormalized SRC shell dates are regarded here as comparable to the GSC shell dates. Bone dates have not been corrected for fractionation or for reservoir effect.

Sample selection and preparation

One of the most important considerations in assessing the reliability of a radiocarbon date is the quality of material used for dating. Each type of sample — wood, shell, and bone — has sources of contamination that must be considered in selecting samples for dating. Driftwood on and in raised beaches in the central Arctic, even wood of early Holocene age, is generally dry and sound because these substrates are well drained and unvegetated (Fig. 5). They are, however, commonly cracked and the cracks host molds and windblown organic dust. Driftwood buried in thin beach sediments that overlie moisture-retaining till or on seepage slopes is usually severely splintered, soft, and slimy from algae or fungus, and considerable effort is required at the collection site to recover enough uncontaminated material for dating.

Marine mollusc shells are generally in pristine conditions where recently exposed from permafrost, but shells that have been exposed at the surface or have resided in the active layer for thousands of years usually have brownish encrustations of secondary calcite formed by dissolution and reprecipitation of shell carbonate. Because of exchange of CO_2 with the atmosphere, the calcite crusts have younger ages than the shells. Careful searching at such sites normally will result in a large enough calcite-free sample for dating. But some critical sites, for example a surface occurrence of shells right at marine limit, may have no unencrusted or otherwise uncontaminated (lichen or algae growth) shells, and in such cases it is hoped that mechanical removal of crusts followed by acid leaching to remove the outer shell material yields a reliably clean sample. This is potentially a problem with only one or two samples reported here.

Whale bone is the most difficult material both to sample and to clean for dating. The procedures that we used for sampling and preparing bone evolved as we gained experience of sources and prevalence of contamination and of the physical characteristics of various bone types. Dyke's initial experience with dating whale bone showed that contaminants are not necessarily eliminated in the process of "collagen extraction" at the radiocarbon laboratory and that if samples are submitted in field condition the resulting age

Figure 5. Driftwood log protruding from a raised beach. 204788-T

determinations can be much younger than the true age of the samples (Dyke, 1980). Age determinations on several other samples collected from Prince of Wales Island in 1984 and submitted in field condition (Table 1, comments) confirmed this problem and led to more careful selection of sample material in subsequent field seasons and to more rigorous sample pretreatment prior to submission for dating.

Most postglacial whale bone in the central Arctic has been contaminated either by penetration of plant roots into porous or cracked bone (Fig. 6), by accumulation of organic dust (humic material in bone pores), or by penetration of green algae below the bone surface. Radiocarbon dates are calculated for the so-called collagen fraction, which is really the total organic fraction of the sample. Porous bone penetrated by plant roots is nearly uncleanable but is easy to recognize and avoid. Organic, along with inorganic, dust will penetrate exposed porous whale bone such as vertebrae to depths of more than 10 cm and can be detected only if the bone is sawed into small cubes; the bone surface may be bleached white and clean looking. After cubing, the dust can be removed with compressed air jets. Green algae has been observed to penetrate even the densest, nonporous bone by as much as 1 cm but is not easily detected unless the bone is sectioned. When exposed, the contaminated bone can be sawed, ground, or sandblasted off. The best parts of a bowhead whale skeleton for radiocarbon dating are the ear bones, as pointed out by Barr (1971). The ear bone assemblage (Fig. 7), consisting of the otic capsule and periotic bone by which the capsule is connected to the cranium, commonly contains 1-2 kg of bone of ivory-like density, completely devoid of macroscopic pores. The ear bones are located in channels in the massive cranial base about 30 cm to either side of the spinal opening (Fig. 8). We were able to recover ear bones from about 60% of the craniums located, but extraction often requires much excavation and blind probing beneath a cranium anchored in permafrost. Most ear bones can be cleaned readily by sandblasting to remove adhering organic material and the outer millimetre or so of bone to reveal a pale yellow unweathered subsurface.

Figure 4 (opposite). Location of radiocarbon-dated samples and areas for which emergence curves were constructed, Prince of Wales Island

Error sources and assumptions

Apart from potential errors of measurement (field site elevations, counting errors), several sources of error or "noise" can lead to incorrect interpretations of the paleosea-level positions that pertain to dated samples. Driftwood is probably the most straightforward indicator of paleosea-level positions because it tends to float ashore and become stranded and either buried in beach sediment or left on the surface, isolated from the coastline by emergence. Some pieces, however, are pushed above high tide line by sea ice after or during stranding. On steeper coasts beach material, hence potentially driftwood, is moved as much as 4 m above high tide line by this process as shown by the height of ice pushed ridges and hummocks (Fig. 9). In the central Arctic the lower 10 m of raised beach terrain is more disturbed by ice pushed features than are higher beaches, so some driftwood from this range especially may plot above the emergence curve. Other pieces of driftwood are redeposited downslope by streams, or less significantly, by solifluction after initial stranding and emergence. This is much less a problem in the lowlands of the central Arctic than along fiord coasts of the high Arctic (e.g. Stewart and England, 1983), where most Holocene driftwood seems to have been redeposited downslope. Only a few samples of wood from Prince of Wales Island that are
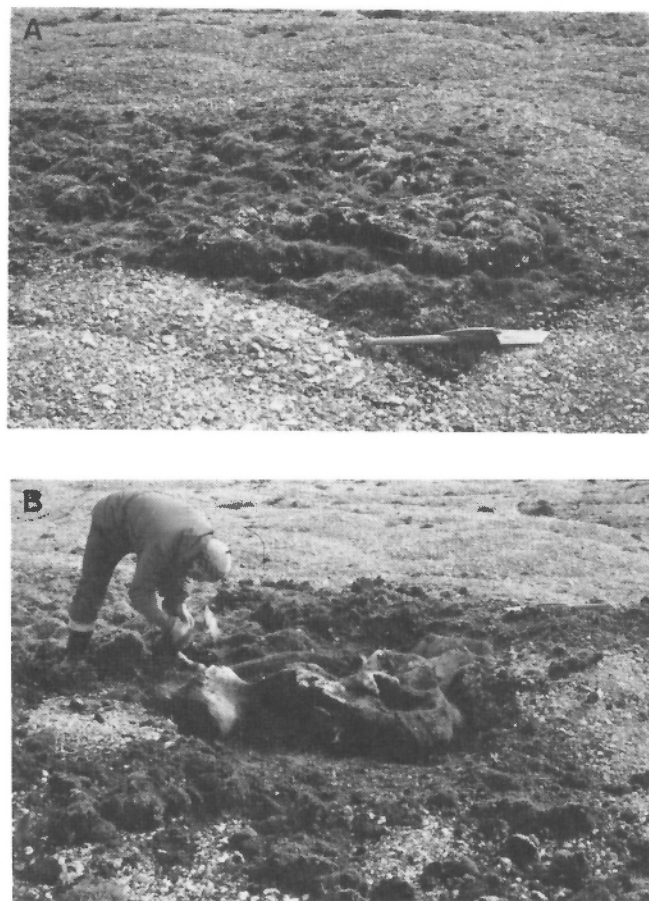
Figure 7. Otic capsule (right) and periotic bone of a bowhead whale. 204787-A

anomalously old for their elevations are best explained in this manner. Finally, surface driftwood may have been moved by man and very small pieces may have been moved by wind. Two small logs from Prince of Wales and Prescott islands, both at 32 m a.s.l., dated modern and must have been carried inland by people. We draw the local emergence curves for Prince of Wales Island through the dated driftwood control points, except where this would increase the slope of a younger segment of the curve, and hence would indicate the unlikely result of a temporarily increased emergence rate.

Bowhead whales also float after they die and while they decompose. Hence their carcasses either float ashore and become stranded or they sink some distance offshore if access to the shoreline is prevented by landfast ice or dense pack ice. Some whales may also run aground in shallow water when their sonar echo becomes confused, particularly on gently sloping sandy or muddy bottoms (Barr, 1971), but bowheads are not known to beach themselves as do some of the toothed whales. Bones enclosed in deepwater sediment clearly represent animals that sank offshore, but bones enclosed in beach sediment do not necessarily represent animals that floated ashore because the bones could have been incorporated in the beach during shoreline regression. For these reasons, whale bone dates are plotted on or below the emergence curves.

Most marine shells in and on raised beaches in the central Arctic are detrital clasts reworked from the seafloor and incorporated into beaches during emergence. They provide maximum ages on emergence of the sites at which they now rest and minimum measures of sea level elevation at time of shell growth. Processes observed operating on the modern beach at Browne Bay explain incorporation of articulated bivalves into beach sediment. The beach face and shallow offshore areas there have slopes of only 2° to 3°. Sea ice grounds in water 1-2 m deep and ploughs and carries much sediment to the beach where it forms hummocks up to 1 m high. Many shells that are carried ashore by the ice are undamaged and retain their periostracum and articulating ligaments. The beach sediment, here sand and gravelly sand, is formed by waves generated in small open water areas along

Figure 6. Bowhead whale cranial base and rib on raised beach gravel covered by peat, A) before excavation and B) after excavation. 204788-L, 204788-J

the shore that wash the ice-pushed, shell-rich hummocks. The wave energy is so low that the shells remain articulated and unabraded.

Shells from deltaic sediment normally pertain to a paleosea-level at or above the level of a terrace above the sample site, provided the terrace is not an erosional feature. Because topset beds sitting unconformably on foreset beds of a constructional delta are not distinguishable from fluvial sediments sitting unconformably on deltaic sediment under an erosional terrace, it usually is not possible to interpret terrace origin with certainty. However, the marine limit delta terrace is invariably constructional and shells from sediment directly below it, as well as from prodeltaic sediment just in front of it, can be interpreted safely as dating from establishment of marine limit, unless they have been glacially transported and redeposited. In the central Arctic, such shell collections normally provide the least ambiguous means of dating marine limit. Otherwise the minimum limiting date on marine limit is provided by the oldest radiocarbon date on postglacial material near the site or at an adjacent site deglaciated later.

Figure 9. Sea ice pushed ridges and hummocks, Prince of Wales Island. The ridges are 1-3 m high. See honda tricycles (circled) for scale. 204788-B2
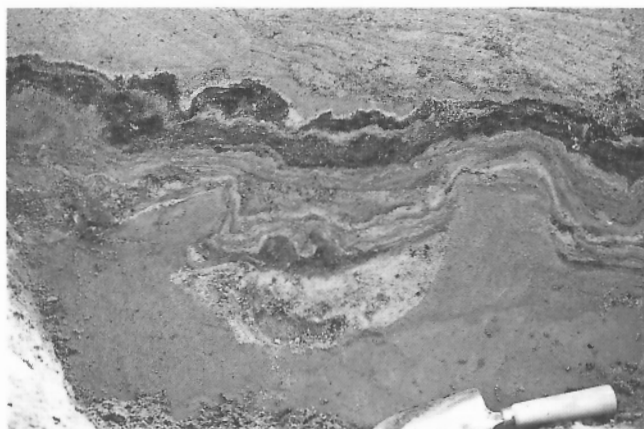
Figure 10. Deformed intertidal sediments with black organic beds, Back Bay. 204788-M

Detrital plant material forming almost pure, black beds of leaf, grass, sedge, and moss litter is an important constituent of sediments thought to be of intertidal origin (Fig. 10). The enclosing sand and mud form horizontal or deformed beds a few centimetres thick and exhibit bright orange and red oxidation colours alternating with grey and greenish reduction colours. These sediments are capped by thin (1 m), foreset-bedded, shell-bearing beach sand. The detrital plant material provides a limiting maximal age on the overlying beach sediment and on emergence. A potential source of error is redeposition of older plant debris, but the assumption is that most plant litter delivered to the intertidal flat in the summer derives from the previous autumn's plant litter production. Hence, dates on plant detritus are plotted on or below the emergence curve.

Figure 8. A. Bowhead whale cranial base showing location of ear bones (arrows). B. Close-up of the ear bone, 204942-A, 204941-B.

Marine limit and deglaciation ages

In areas behind the glacial limit, as is the entire central Arctic, marine limit age and date of deglaciation are synonymous. Where the deglaciation pattern is revealed by distribution of ice marginal landforms, the relative ages of local marine limits are also known. This provides a powerful tool in assessing the accuracy of radiocarbon dates pertaining to marine limit.

The ice retreat pattern on the northern and eastern parts of Prince of Wales Island is defined by large end moraine systems and by lateral meltwater channels (Fig. 11; Dyke and Green, in press; Morris and Dyke, in press). The first area to become ice free was in the northwest about 11 ka and final deglaciation occurred shortly after 9.2 ka. Deglaciation isochrones shown in Figure 11 represent the most internally consistent interpretation of the set of radiocarbon dates that either pertain directly to or provide minimum limiting dates on marine limit. There are only two important internal inconsistencies in this set of radiocarbon dates: a date on northern Prescott Island and another at the mouth of Transition Bay, both from marine limit, are too young to represent the true age of local deglaciation because older materials have been dated from sites farther up ice. These discrepancies are discussed further below.

LOCAL EMERGENCE CURVES, PRINCE OF WALES ISLAND

The local emergence curves for Prince of Wales Island or segments of these curves are portrayed as either solid or broken lines (Fig. 12). Solid curves are considered to be well controlled whereas broken curves are either approximate extrapolations of trends through intervals with little or no control or are "minimum curves" based on limiting dates. The curves are discussed below in a clockwise geographic sequence starting in the northwest.

Cape Richard Collinson

The emergence curve for Cape Richard Collinson (Fig. 12A) is well defined for the last 8.5 ka and can be reasonably extrapolated back to time of deglaciation on the basis of minimum limiting dates on marine limit and a measured marine limit elevation at an adjacent site deglaciated later. The younger part of the curve is based on eight almost perfectly accordant driftwood and whale bone dates. The wood at 5 m (GSC-4398; 1400 ± 50 BP) was buried in beach gravel but the wood at 6.5 m, 17 m, 22 m, and 24 m (GSC-4478, 1860 ± 70 BP; GSC-4387, 4070 ± 60 BP; GSC-4479, 4630 ± 60 BP; GSC-4361, 5270 ± 70 BP, respectively) was exposed entirely at the surface. The wood at 59 m (GSC-4343, 8680 ± 90 BP) was one of numerous pieces protruding from soliflucting marine silt on a steep slope below a bench 4 m higher. This wood obviously has moved downslope so the sample is plotted slightly below the curve. The whale bone sample from 16.5 m (S-2919, 4550 ± 90 BP) consisted of ear bone fragments from the surface of beach gravel. Other whale bones, likely from the same animal, are scattered along

100 m or so of this raised strandline and are partly buried by the gravel. The age of the bone, in relationship to dated driftwood, indicates that this animal either floated close to shore after death or grounded in water only 2 m or so deep. The bone sample from 57 m (S-2964, 8555 ± 165 BP) consisted of ear bone fragments recovered from a pit dug beside a large cranial fragment protruding from solifluxting till. Although the cranium is firmly anchored in permafrost and is not likely moving downslope at present, it could have moved downslope some distance before being frozen in so the curve is drawn just above the sample point. The bowhead whale bone at 66.5 m (S-2922, 10 000 ± 145 BP) must have sunk offshore because the sea was still as high as 60 m or so until about 8.5 ka, as shown by the wood and ear bone samples from 59 and 57 m, respectively.

The Cape Richard Collinson sample area and most surrounding land lies below marine limit. The area may have been deglaciated as early as 11 ka and certainly was deglaciated before 10 ka, the age of the oldest whale bone (Fig. 11). A marine limit delta at 136 m, 24 km to the southeast, comprises part of an end moraine that was formed after deglaciation of the Cape Richard Collinson area. Shells behind that moraine dating 10 070 ± 150 BP (S-2683, Fig. 4) and bowhead whale bone from glaciomarine silt on the flank of the moraine dating 10 005 ± 120 BP (S-2916, Fig. 4) provide minimum limiting dates on both the moraine and the 136 m relative sea level position. We have extrapolated the Cape Richard Collinson curve back in time to pass slightly below 136 m at 10 ka.

Hollist Point

The Hollist Point curve (Fig. 12B) is defined by four accordant driftwood dates and by an estimate of relative sea level position at time of deglaciation, dated about 10 ka. The wood at 4 m (GSC-3945, 1060 ± 50 BP) was protruding from cryoturbated till near the edge of a raised beach face and had likely moved downslope by a metre or so since stranding. The other pieces of dated wood (GSC-3977, 920 ± 60 BP at 2 m; GSC-3962, 3660 ± 60 BP at 12 m; GSC-3936, 8230 ± 110 BP at 58.5 m) were resting fully exposed on till and on raised beach shingle.

The Hollist Point sample area was deglaciated about 10 ka (Fig. 11). It lies entirely below marine limit and the nearest site at which marine limit was measured is the 136 m delta 35 km to the southwest with minimum limiting dates of about 10 ka, discussed above. Because most marine limits measured on northwestern Prince of Wales Island, especially those in areas deglaciated about 10 ka, are at similar elevations, the curve is extrapolated back to 136 m at 10 ka.

Three bowhead whale bone dates fall below the curve by various amounts. The whale bone at 12 m (S-2589, 4155 ± 100 BP) is about 500 years older than driftwood at the same elevation, and the whale bone at 58 m (S-2588, 8875 ± 135 BP) is about 650 years older than driftwood 0.5 m higher. Both these bones were from beach surfaces. The 66 m sample (S-2590, 9605 ± 140 BP) came from the surface of a large deposit of deepwater marine silt and represents an
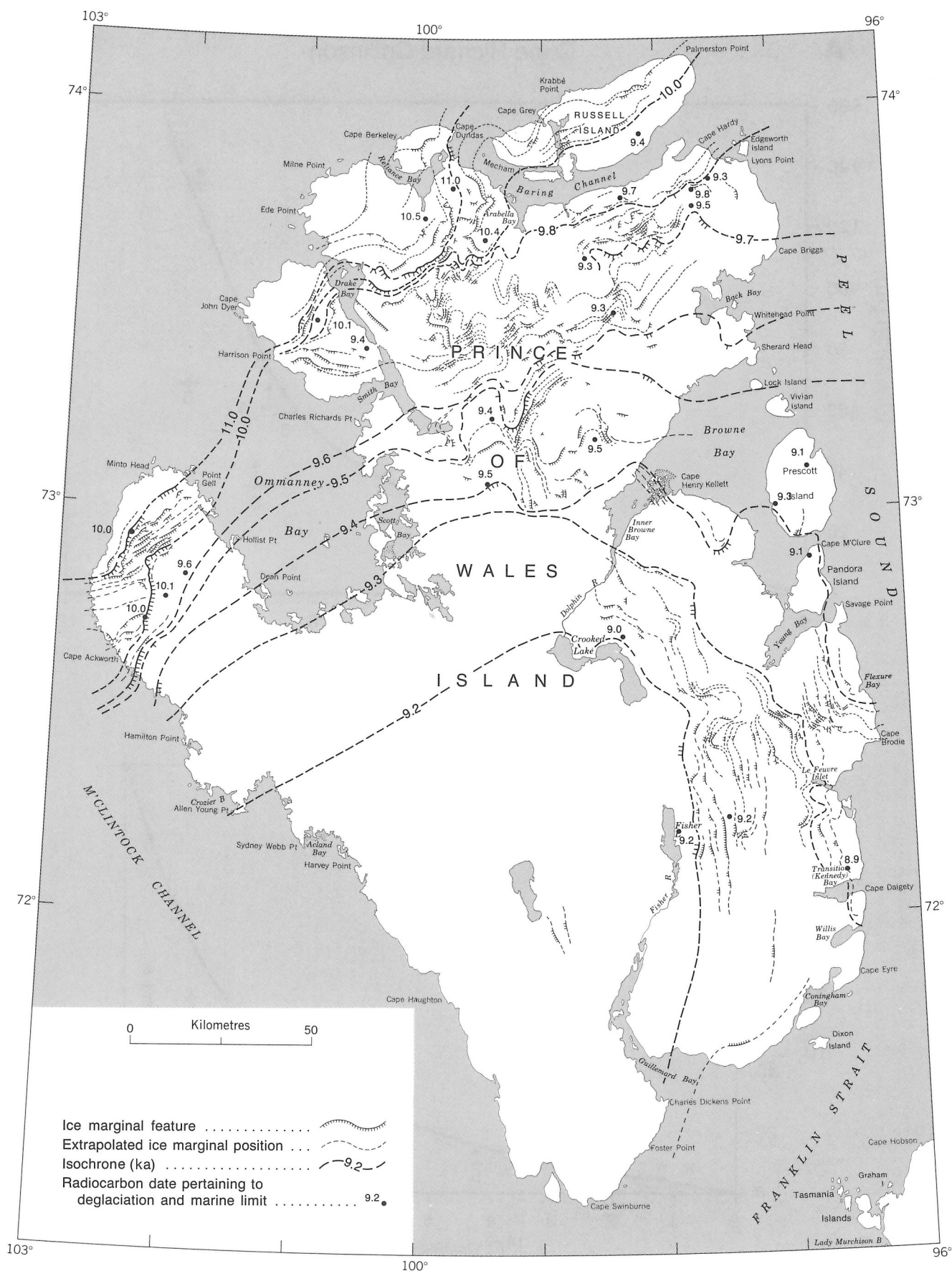
Figure 11. Ice retreat pattern and radiocarbon dates pertaining to deglaciation, Prince of Wales Island.

13
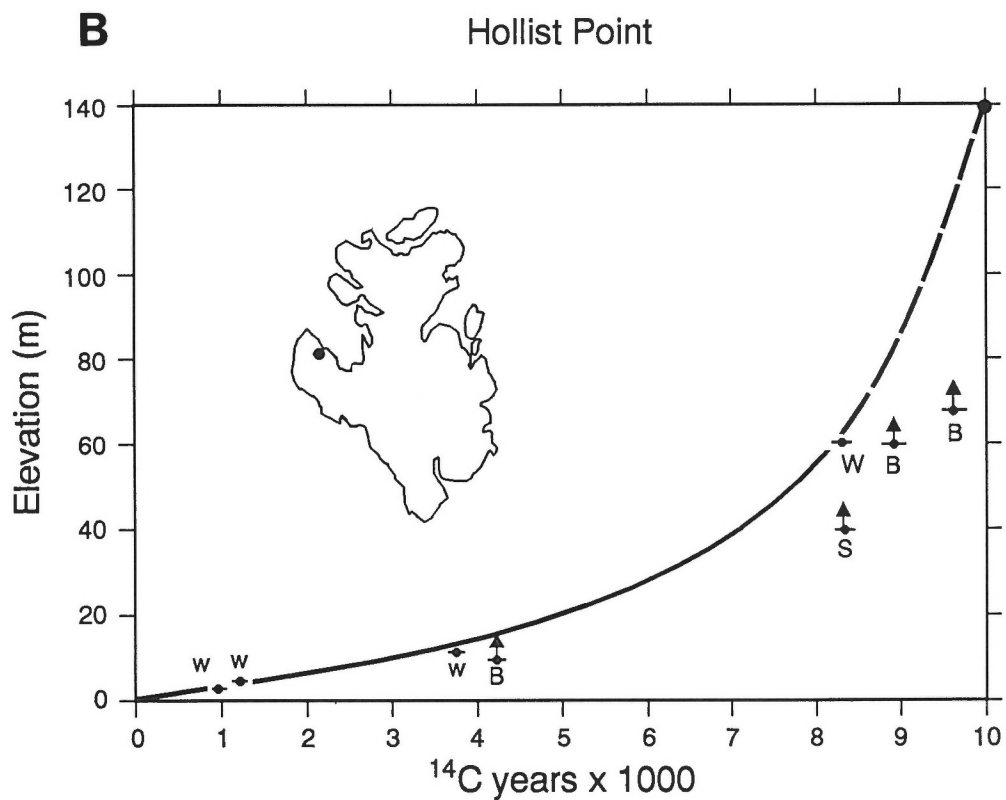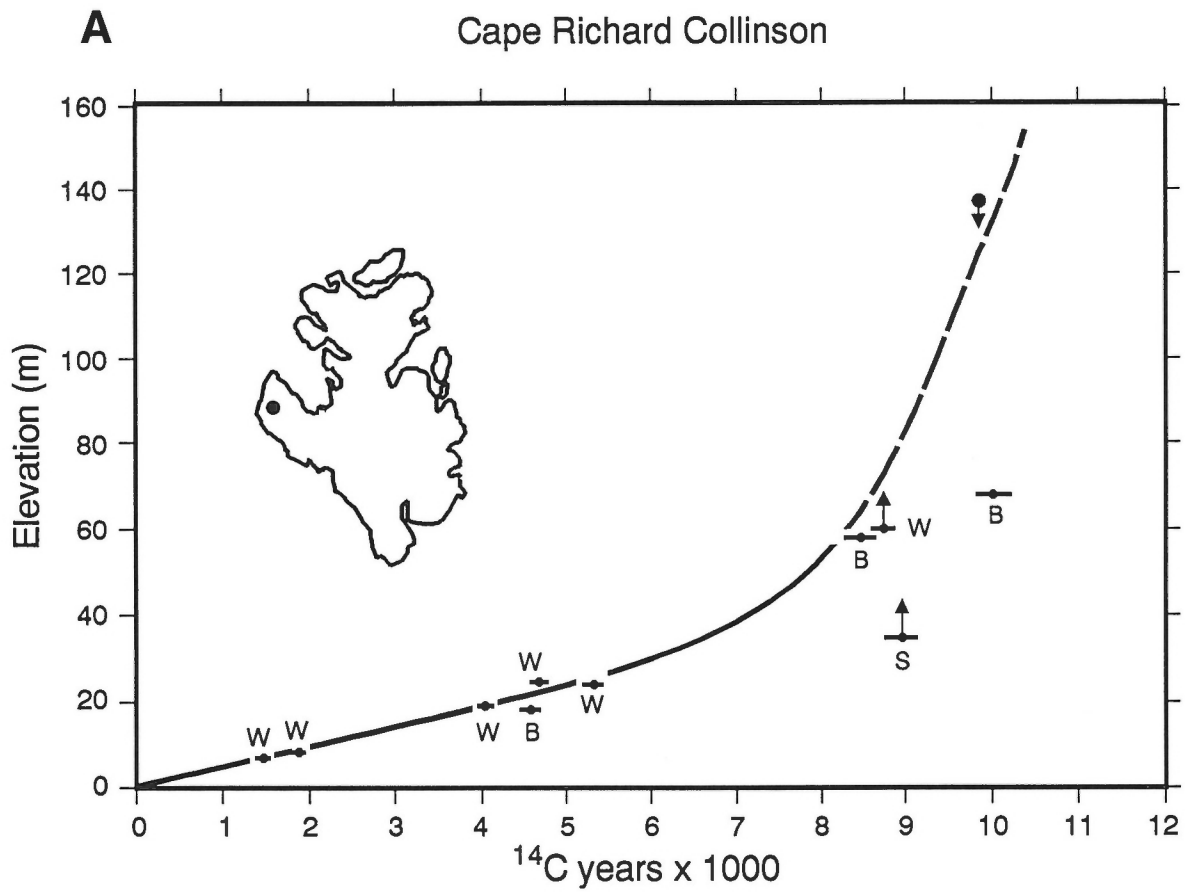
Figure 12. Local emergence curves for 14 areas on Prince of Wales Island and vicinity.

C Drake Bay

D Smith Bay

Figure 12 (cont'd.)

15

E

Arabella Bay

F

Northwestern Russell Island
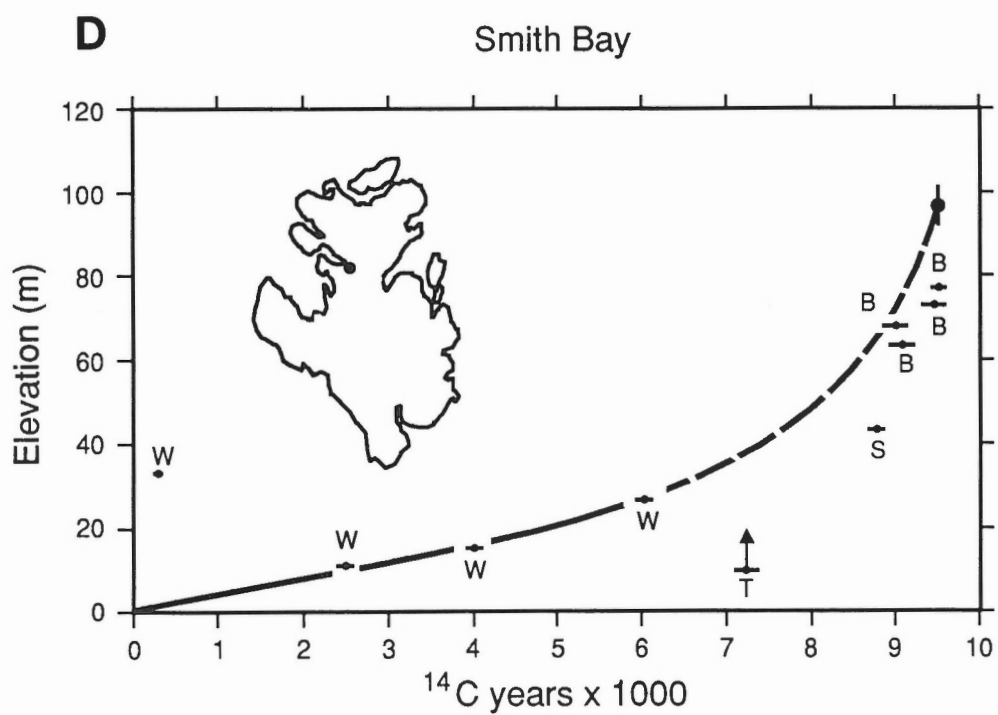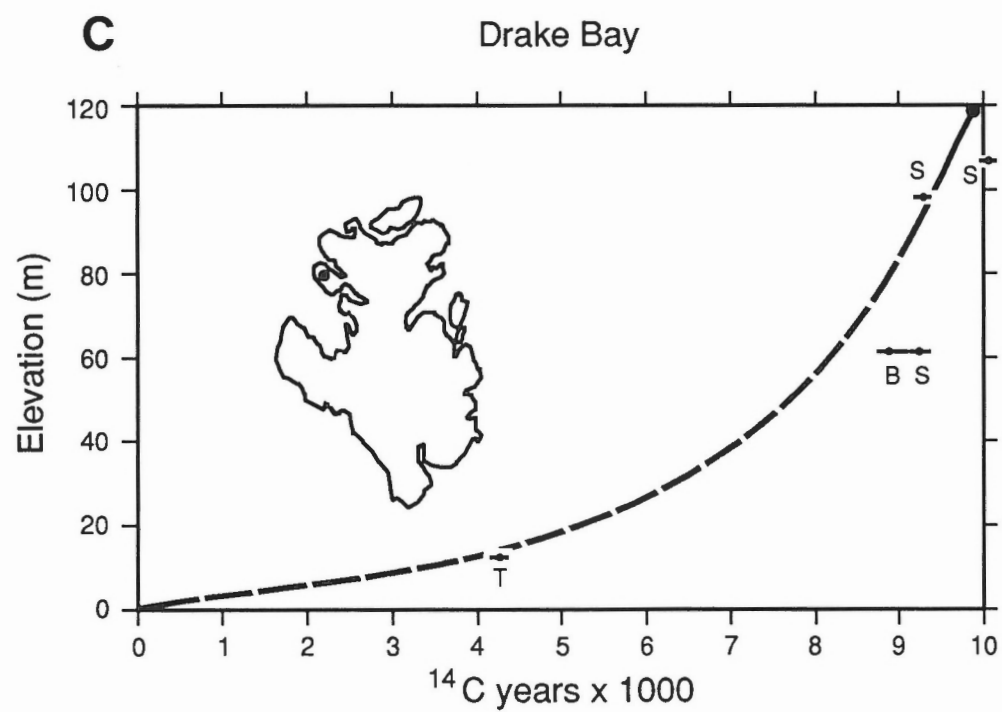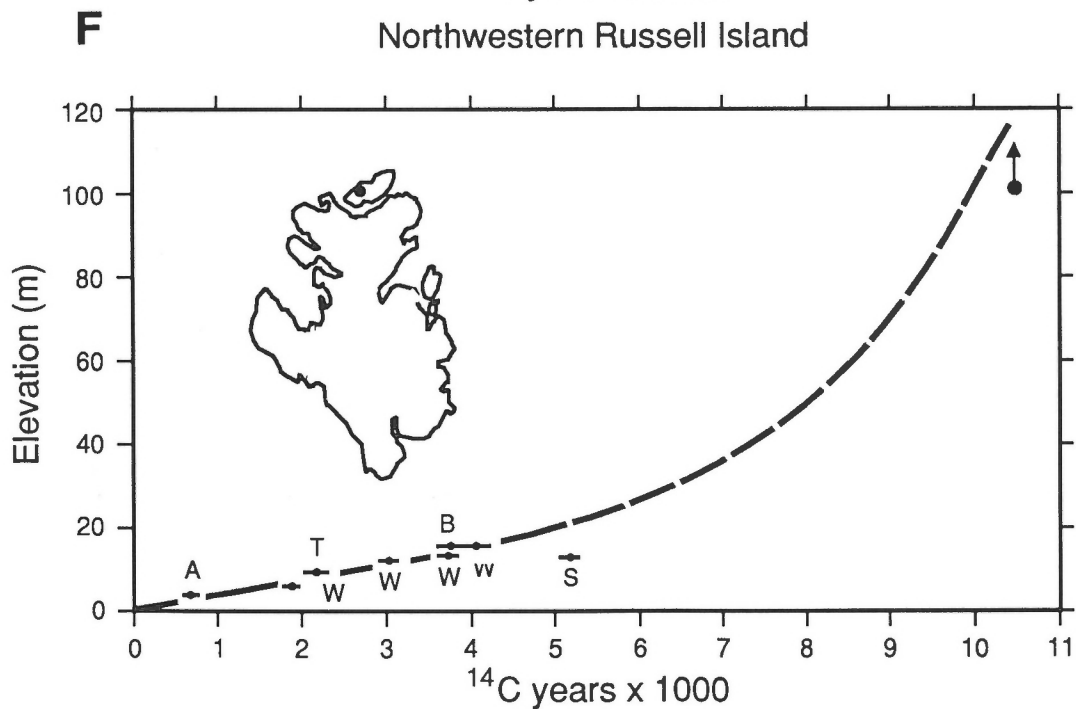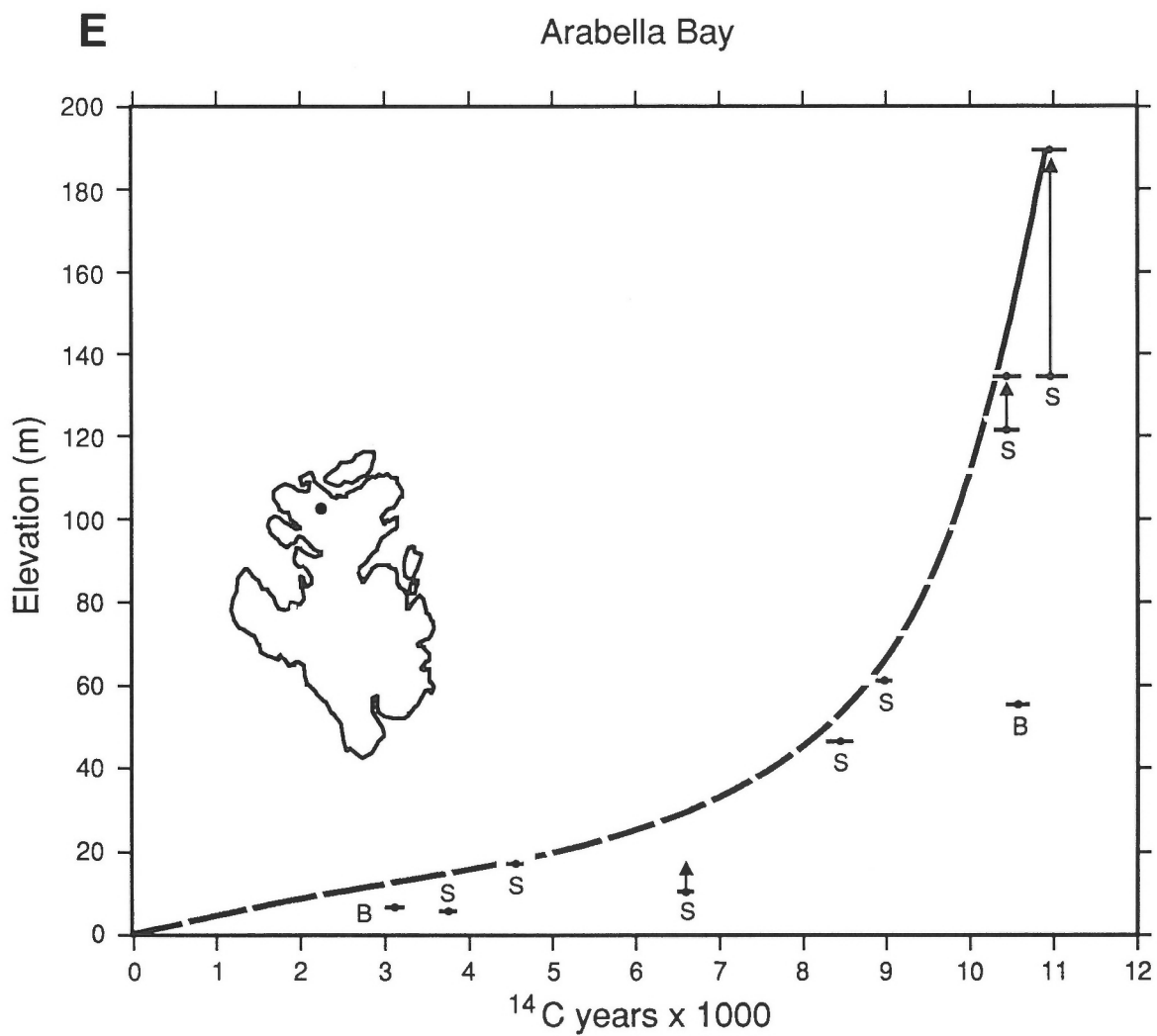
Figure 12 (cont'd.)

Figure 12 (cont'd.)

I Cape Hardy

J Browne Bay

Figure 12 (cont'd.)

K Prescott Island

L Muskox Hill, Pandora Island

Figure 12 (cont'd.)

M Dolphin River

N Guillemard Bay
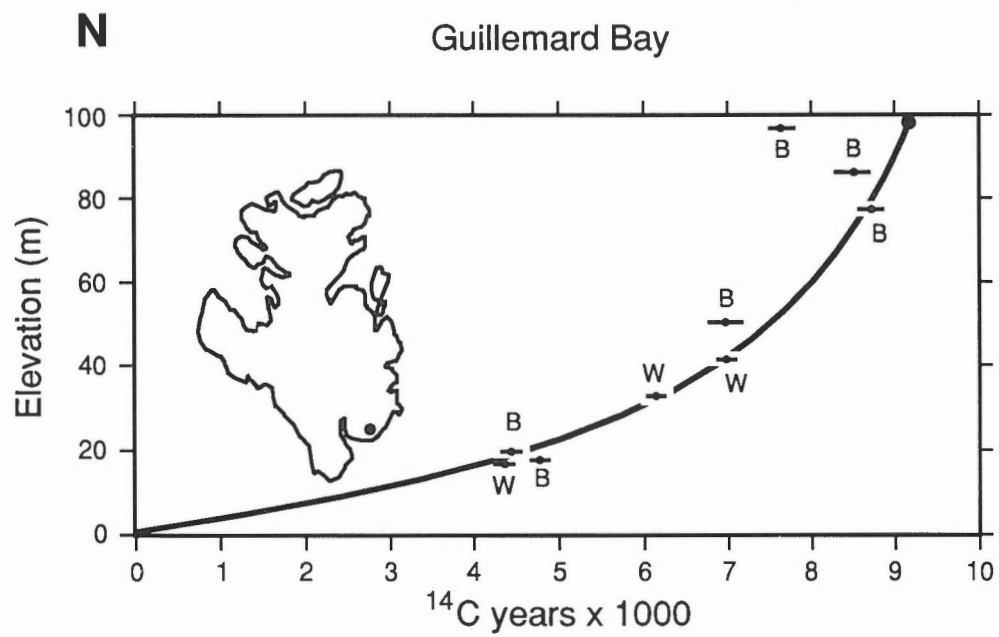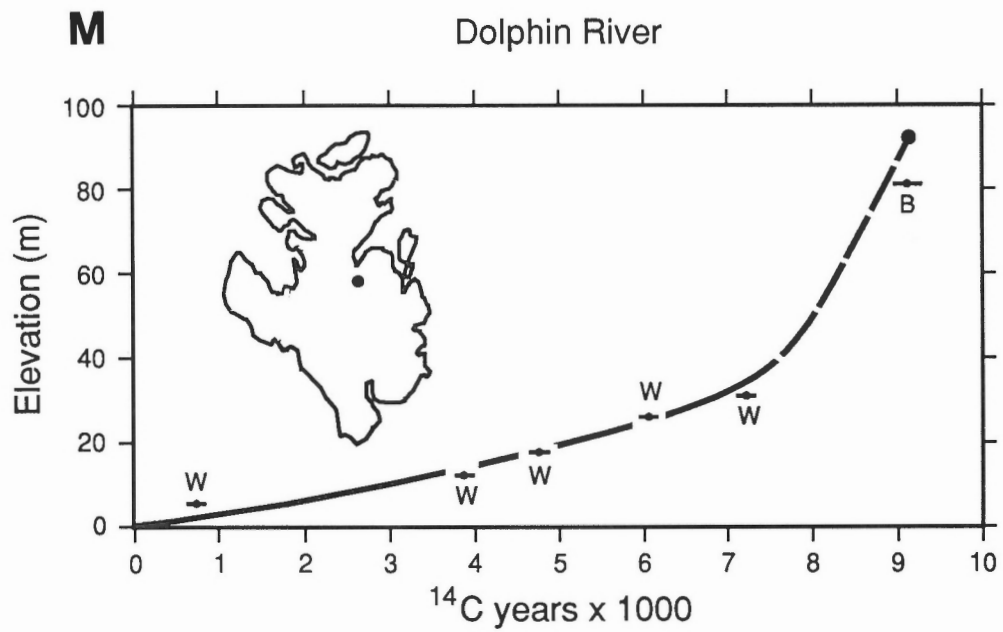
Figure 12 (cont'd.)

animal that sank in about 45 m of water. The silt was deposited near the ice front during deglaciation and deposition must have been negligible after 9.6 ka or the whale skeleton would have been buried. This supports the interpretation of a deglaciation date of 10 ka or so.

The 36 m shell sample (GSC-4025, 8225 ± 80 BP) dated younger than expected on the basis of its sedimentary context. The shells come from a small deposit of horizontally bedded fine sand and silt with conspicuous striated dropstones that suggest ice proximal sedimentation. If the sediments are ice proximal, the shells must have colonized the substrate nearly 2000 years after deposition. Alternatively, small pockets of dropstone-rich sediment were deposited sporadically long after local deglaciation.

Drake Bay

Five radiocarbon dated samples from Drake Bay provide only maximum limiting dates on relative sea level positions (Fig. 12C). The highest marine fossils recovered are shells from the surface of a small glaciomarine stony clay deposit occupying the floor of a kettle in a large end moraine ridge. Marine limit was not recognized in the sample area, but on the adjacent north side of Drake Bay it lies at about 120 m and is recorded by a washing limit on till and the lowest lateral meltwater channels. The 104 m shell sample dated 10 100 ± 100 BP (GSC-4408) provides a reasonable minimum limiting age on marine limit. The sea was at least as high as 96 m at 9350 ± 110 BP (GSC-4527), the age of shells from the surface of a raised beach at that elevation, so the 120 m marine limit is not likely much older than the minimum limiting date of 10.1 ka, given rapid initial emergence. The bowhead whale at 59 m (S-2910, 9000 ± 130 BP) must have sunk in about 20 m of water for it is unlikely that the slope of the emergence curve increases below 96 m. The younger part of the curve is constrained only by a date on a narwhal tusk fragment that protruded from soliflucted till at 12 m (S-2914, 4180 ± 80 BP). Hence, the Drake Bay curve is considered a "minimum emergence curve", showing the minimum amount of emergence that has occurred since a given time, but the first thousand years or so of the curve (10-9 ka) is probably close to the true curve.

Smith Bay

The last 6 ka of emergence at Smith Bay (Fig. 12D) is defined by three accordant driftwood dates, whereas the earlier part is a minimum curve defined by whale bone dates, one of which is a reasonable minimum limiting date on marine limit. The oldest driftwood at 25.5 m (GSC-4417, 5910 ± 80 BP) is from a log almost completely buried in beach gravel but the lower samples (GSC-4427, 4020 ± 70 BP at 15 m; GSC-4428, 2350 ± 60 BP at 10 m) were from the surface of raised beaches. The highest driftwood found in the sample area was a small log (50x5x2 cm) of spruce resting on beach gravel at 32 m (GSC-4412; 130 ± 70 BP). The modern age clearly indicates that some boreal driftwood has been moved from its stranding site within the last century or so and placed at higher elevations. However, the sample is one in a small series of dates that indicates that boreal driftwood spends a negligible time in transit on the ocean prior to stranding in the Arctic Archipelago. This confirms an important assumption in constructing emergence curves based on driftwood (cf. Blake, 1975). The upper part of the emergence curve is based on the minimum limiting age of marine limit provided by a date of 9505 ± 120 BP (S-2918) on bowhead whale ear bone from beach gravel at 74.5 m and by a date of 9440 ± 135 BP (S-2912) on bowhead whale ear bone from beach gravel at 70 m. The regional context of these dates indicates that they are likely good approximations of the true age of deglaciation and marine limit (Fig. 11). Marine limit in this area is not well defined at a site close enough to the coast to allow accurate altimetry, but it lies between 90 and 100 m by interpolation of topographic contours. If this is the correct age of marine limit, three of the early Holocene bowhead whales (S-2923, 8990 ± 130 BP at 61.5 m; S-2912, 9440 ± 135 BP at 70 m; S-2918, 9505 ± 120 at 74.5 m) must have sunk just offshore in 10 m or so of water. The most useful constraint on the form of the upper part of the curve, other than marine limit elevation and age, is the date of 8875 ± 120 BP (S-2917) on dense bone collected from a bowhead mandible protruding from beach gravel at 65 m.

A narwhal tusk at 7 m, dating 7075 ± 120 BP (S-2911), records an animal that sank in about 30 m of water. The tusk was enclosed in the upper part of a stony clay, a widespread deposit thought to be of glaciomarine origin overlain locally by 4 m of organic-rich marine silts, typical of postglacial estuarine deposits. Another narwhal tusk was recovered from the same stratigraphic level less than 100 m from the dated sample, so more than one animal died at this site at the same time. Because the tusks were enclosed by the stony clay, we thought that they might date close to deglaciation, but the date likely indicates that the tusks were driven into the clays by sea ice before deposition of the estuarine sediments.

Arabella Bay

The Arabella Bay curve (Fig. 12E) is a minimum emergence curve except for its uppermost part where it is well controlled. The curve area includes the highest measured marine limit on Prince of Wales Island and the site of the oldest radiocarbon date. Shells from glaciomarine stony clay at 133 m, distal to a large end moraine (Dyke, 1987), dated 11 005 ± 170 BP (S-2708). The deposit extends upslope to a washing limit at 188 m that coincides with the lowest elevation of lateral meltwater channels. Because deposition of the stony clay likely coincided with the marine limit sea level stand, the 11 ka shell date likely pertains to a 188 m relative sea level. Behind the end moraine the lip of a glaciofluvial delta terrace at 133 m records local marine limit. Shells from bottomset stony silt and clay at 120 m, just in front of the marine limit terrace, dated 10 435 ± 160 BP (S-2709), must have lived when the sea was at or had just started to fall from the delta terrace. Hence, the Arabella Bay area emerged 55 m in about 570 years at about 9.6 m/century. This is the only site in the region that affords the opportunity of measuring emergence rates prior to 10 ka.

The lower part of the curve is best constrained by dates on shells from uppermost deltaic sediments from two sites. Shells from topset fine gravels under a small terrace remnant at 59.5 m, the highest of a flight of delta terraces, dated 8970 ± 90 BP (GSC-4033). Because the shells are from traction load gravel, they were redeposited and record a higher relative sea level. The shell sample at 17 m (GSC-4227; 4490 ± 70 BP) is from horizontally bedded silt and clay below a terrace capped by discontinuous topset gravel extending to 19.5 m. These shells had excellently preserved periostracum and articulating ligaments and they likely date the overlying terrace.

The bowhead whale sample at 54 m, dating 10 530 ± 145 BP (S-2591), is the oldest dated whalebone from Prince of Wales Island. This sample was taken from one of two large and excellently preserved cranial fragments, each about 1 m across, partly buried in solifluced till; a large sample of dense bone around the spinal opening was utilized for dating.

Northwestern Russell Island

Six accordant dates on four driftwood samples (GSC-2300, 1800 ± 50 BP at 5.7 m; GSC-3978, 2930 ± 60 BP at 12.1 m; GSC-2240, 3630 ± 60 BP at 14.3 m, and GSC-4002, 3820 ± 70 BP at 14.7 m, all elevations levelled), a narwhal tusk (S-2672, 2075 ± 135 BP at 9 m), and a bowhead whale rib (S-2662, 3675 ± 110 BP at 14.6 m) define the emergence curve for northwestern Russell Island for the last 4 ka. The upper part of the curve is guided only by a minimum measure of local marine limit recorded by the highest recognized beach at 108 m (Green, 1986) and by an estimated date of deglaciation based on moraine trends and radiocarbon dates on adjacent Prince of Wales Island (Fig. 11). The marine limit likely is higher than 108 m in light of the height of the 10 ka shoreline at Arabella Bay.

Eastern Russell Island

The curve for eastern Russell Island (Fig. 12G) is a minimum curve, except for the last 2.5 ka of record which is controlled by a date of 2250 ± 60 BP (GSC-4001) on driftwood enclosed in coarse beach gravel at 8.23 m (levelled). Surface shell fragments from 85 m were dated 9360 ± 150 BP (GSC-3994). The marine limit on eastern Russell Island is marked by a consistent upper limit of beaches at 96 m (Green, 1986; Dyke and Green, in press), which is close to the marine limit elevation on adjacent northeastern Prince of Wales Island (Cape Hardy, below). Two dates on shells from northeastern Prince of Wales Island (S-2710, 9845 ± 150 BP; GSC-3954, 9660 ± 90 BP), which lay up ice of Russell Island during deglaciation (Fig. 11), provide minimum dates on deglaciation of eastern Russell Island. However, the 96 m marine limit shoreline on eastern Russell Island cannot be much older than 9.9 ka in light of the age of the shells at 85 m, assuming rapid rates of initial emergence.

The bone dates from eastern Russell Island area on both bowhead whales and seals. All samples were submitted for dating in field condition. Two of the bowhead dates (S-2671, 3685 ± 155 BP at 10.8 m and S-2664, 4510 ± 165 BP at 15.6 m, both levelled) are acceptable in that they fall slightly below the curve extrapolated from the younger wood date. The other seven bone dates are all too young to be accommodated by any reasonable exponential decay curve. The three dates least above the curve could be accommodated by a linear curve for eastern Russell Island, but this would imply that the form of this curve is unique among central Arctic curves. We prefer the more conservative interpretation that the samples were contaminated or were moved. Contamination is the most likely explanation for the bowhead dates above the curve, but the seal bones could have been moved upslope by birds or animals.

Allen Lake

Four shell and one bowhead whale bone date define a minimum emergence curve for the Allen Lake area (Fig. 12H). Marine limit in this area is marked by a washing limit and weakly developed beach at 120 m. An extensive glaciomarine deposit of horizontally bedded sand and silt with dropstones, as much as 1 m across, extends to 100 m elevation. Shells from this deposit at 70 m to 88 m dated 9660 ± 90 BP (GSC-3954), which is a reasonable age for deglaciation and marine limit (Fig. 11). Shells from the surface of sand at 68 m, dated 8890 ± 130 BP (S-2680), provide a maximum age for that sea level position. They also indicate that the bowhead whale skull from solifluced till at 71 m, which dated at 9285 ± 135 BP (S-2593), sank in at least 15 m of water. The dated lower shells (S-2585; 1890 ± 90 BP; S-2586, 4770 ± 100 BP) are from horizontally bedded deltaic sand underlying terraces at 4 m and 9.5 m.

Cape Hardy

The Cape Hardy emergence curve is defined by five accordant dates (Fig. 12I). Marine limit at 95 m is recorded by the highest beaches and deltas and by the lower limit of lateral meltwater channels. Shells from a marine limit beach and underlying delta foresets were dated 9845 ± 150 BP (S-2710). The three driftwood dates that define the middle part of the curve are on large logs that were buried nearly completely in beach gravel at 18 m, 25 m, and 64.5 m (S-2703, 4945 ± 95 BP; S-2705, 5595 ± 100 BP; S-2702, 8695 ± 130 BP, respectively). The driftwood at 6 m is from the surface of beach gravel and is younger than expected for material at that elevation (S-2704, 765 ± 65 BP). Taken at face value, this would indicate contemporary emergence rates of nearly 1 m/century, but more likely the sample was pushed above high tide by sea ice. Of the three bowhead whale bone samples, one — a vertebra from the beach surface at 11.5 m (S-2711, 3500 ± 80 BP) — is accordant with the driftwood dates whereas the others fall 10 to 15 m below the curve (S-2707, 8645 ± 135 BP at 51.5 m; S-2706, 9375 ± 140 BP at 69-71 m).

Paired shells from the base of a very stony glaciomarine diamicton, just above its contact with till at 20 m, dated 9280 ± 90 BP (GSC-4250). Such sediment is commonly assumed diagnostic of an ice proximal environment but by 9.3 ka the ice front had retreated to the south end of Peel Sound (Fig. 11). The date indicates that deposition of coarse

glaciomarine sediment occurred from icebergs more than 200 km north of the main calving ice front about 500 years after local deglaciation.

Browne Bay

The Browne Bay curve is controlled by three dates on plant detritus from intertidal sediments and by marine limit (Fig. 12J). Marine limit in the area is at 95 m; it is a remarkably clear limit of deposition of thin discontinuous marine sediment and of wave modification of the till surface and also is marked in places by short beaches. Marine limit has not been dated in the Browne Bay sample area but shells from glaciomarine sediment at 85 m at a site to the southeast deglaciated a little later dated 9470 ± 100 BP (GSC-3697, Fig. 11). Hence, the sea stood at marine limit (95 m) in the sample area about 9.5 ka.

The three dates on plant detritus are from similar stratigraphic contexts. Each is from the uppermost plant bed in intertidal sediments underlying thin beach sands. The surface of the overlying beach sediment is the sea level to which each date pertains. The faithful decrease in age of these materials with decrease in elevation (S-2679, 7620 ± 220 BP at 49.5 m; GSC-4045, 2920 ± 60 BP at 7.5 m; S-2689, 1210 ± 240 BP at 4 m) indicates that they are reliable materials for dating intertidal sediment, hence paleosea-levels.

At the two lower sites, shells from the beach sands directly overlying the sampled plant detritus were also dated. The shell samples (*Astarte borealis*) were excellently preserved, many had complete periostracum covers, and the sample at 7.5 m (GSC-4031, 3760 ± 80 BP) included many articulated valves. The samples were dated to assess the usefulness of such shells for dating beach sediments. In both cases the shells dated much older (540 and 840 years) than the plant detritus underlying the beach, so even articulated bivalves from beach sediment do not reliably date beach formation.

The shell sample at 42 m consisted of articulated valves of *Astarte borealis* with complete periostracum covers collected from a 1 m thick beach sand. They dated 8515 ± 125 BP (S-2684). Because the beach at 42 m can be no older than 7 ka according to the dates on plant detritus, these excellently preserved shells must have been about 1500 years old before being incorporated into the beach sediment.

Prescott Island

The lower half of the Prescott Island curve (Fig. 12K) passes smoothly through five dates on driftwood and bowhead whale bone. The driftwood samples from 11 m (GSC-4503, 3470 ± 70 BP) and 21 m (GSC-4459, 5300 ± 80 BP) were partly buried in beach sediment. Wood samples from 32 m (GSC-4447, 70 ± 50 BP) and 12.5 m (GSC-4457, 560 ± 60 BP) were from the surface and clearly have been carried inland by people as they are too far above any reasonable curve position to be explained by sea ice push. The same explanation could pertain to the sample from 8 m (GSC-4458, 1380 ± 60 BP),

also a surface sample, although this sample is close enough to the curve that its position could be accounted for by ice push. The sample from 23.5 m (GSC-4456, 5070 ± 90 BP) is from a severely splintered, largely disintegrated "log" enclosed in saturated beach sand at a site kept wet by a late lasting snowbank. The wood was cleaned of surface contaminants at the collection site, but some internal discoloration penetrated throughout and possibly signifies a slight algal or fungal contamination. Hence, the date on the dry, sound wood from 21 m (GSC-4459) is considered more reliable and the curve is drawn through it. Alternatively, the slight discrepancy between the ages of the wood samples from 21 m and 23.5 m could be due to ice pushing of the younger sample. The sample from 21 m was not likely moved downslope and reincorporated in beach sediment because it came from a slope of very low gradient.

The bowhead whale bone samples at 3.5 m, 9 m, and 14 m that are accordant with the wood samples from 11 m and 21 m were collected from raised beach material. The sample at 3.5 m (S-2920, 1585 ± 70 BP) was a frost shattered otic capsule recovered from beach gravel within 1 m or so of a cranium. The samples at 9 m (S-2921, 3315 ± 75 BP) and 14 m (S-2915, 4635 ± 80 BP) consisted of dense periotic bone collected from beach sand; the former had fallen from the cranium whereas the latter was still attached. Two higher bowhead whale ear bone samples (S-2965, 8765 ± 160 BP at 50.5 m; S-2913, 9335 ± 145 BP at 57.5 m) must be from animals that sank slightly offshore because shells from a higher site are younger than the whale bones (GSC-4515, 8650 ± 120 BP at 65 m). The sample at 50.5 m was from the surface of weathered sandstone and was resting beside a broken, partly decomposed cranium. The sample at 57.5 m was from a wind eroded deltaic sand where a nearly complete skeleton has been exposed (cover photo).

The minimum date of deglaciation of Prescott Island and formation of local marine limit is 9335 ± 145 BP (S-2913) based on the bowhead whale at 57.5 m. Marine limit on the northeastern part of the island is recorded by an ice contact delta terrace at about 107 m. The uppermost deltaic sediment is a 1 m thick topset gravel which has been eroded in places to expose shell-rich stony muds. Whole valves of *Mya truncata* collected from the surface of the mud are well preserved but most have hard secondary calcite encrustations. A subsample of least encrusted shells, from which the crusts were removed mechanically, was dated 9080 ± 90 BP (GSC-4442) after further cleaning by acid to remove the outer 30% of the sample. Because the shells are only about 1 m below marine limit, they cannot be appreciably younger than marine limit. Yet the 9335 ± 145 BP date on the bowhead whale at 57.5 m and the regional pattern of deglaciation, with its limiting radiocarbon dates from adjacent areas (Fig. 11), suggest that the marine limit on northeastern Prescott Island should be about 9.4 to 9.5 ka. We conclude, therefore, that the marine limit shell sample from Prescott Island included a slight contamination, likely by secondary calcite, that made the age too young by 200 to 300 years, and we plot the sample slightly on the young side of the emergence curve.

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Between marine limit and the highest driftwood the curve is best constrained by a date of 6960 ± 110 BP (GSC-4524) on paired valves of juvenile *Hiatella arctica* from a narrow interval of delta foreset beds at 20 m. Although they were not in life position, the narrow range of sizes of shells in those beds and the fact that the pairs have not been separated indicates that the shells are close to contemporaneous with sedimentation. Commonly only juvenile shells are found in delta foresets, which likely indicates rapid burial by sedimentation. Directly above the sample site, the foreset beds are truncated by 0.5 m of gravel underlying a sloping surface at 29 m. This gravel, likely offlap beach gravel, slopes up to a terrace at 36.5 m which likely represents relative sea level position during deposition of the delta foresets.

Muskox Hill-Pandora Island

The Muskox Hill-Pandora Island curve (Fig. 12L) is defined by seven dates on driftwood, bowhead whale bone, and shells that indicate a smoothly decelerating emergence rate. Two young driftwood samples, one enclosed in beach material at 4 m (S-2714, 275 ± 105 BP) and the other on a beach surface at 7 m (S-2834, 845 ± 60 BP), plot 2 to 4 m above the curve, which likely indicates displacement by sea ice, whereas anomalously old wood on a beach surface at 10 m (S-2832, 8265 ± 120 BP) implies repositioning of the wood downslope. The driftwood that falls on the curve at 23 m (S-2829, 5795 ± 90 BP) was enclosed in beach sand.

The highest marine feature recognized on Pandora Island is a beach sand at 94 m. Shells from the surface of this sand had some encrustations of secondary calcite which was scraped off partly prior to acid leaching and dating. The resulting age estimate of 9140 ± 130 BP (S-2828) should be regarded as a minimum age of the shells due to possible inclusion of some secondary calcite in the dated fraction, although the estimate of the date of deglaciation of 9.3 to 9.4 ka, based on dates from adjacent areas (Fig. 11), is almost within one standard deviation of the shell date.

At Muskox Hill beaches extend to about 100 m. A bowhead whale rib from silty gravel beach material at 100 m, capped by a mat of plants and humus, was dated 8905 ± 405 BP (S-2716). This age agrees reasonably well with the shell and marine limit date from 94 m from Pandora Island, provided the true age of the bone is at the old end of the standard error range.

Two bowhead whale bone samples from beach material at 68 m and 66 m yielded similar ages (S-2864, 8655 ± 130 BP; S-2835, 8565 ± 125, respectively). They are reasonable maximum limiting dates on these relative sea level positions. The bowhead whale bone at 10 m (S-2715, 2270 ± 230 BP) was enclosed in beach gravel and sand. The bone fragment was large and covered with plants. Material from the centre of the bone was selected for dating but some small amount of contaminants may have remained.

Dolphin River

The Dolphin River emergence curve (Fig. 12M) is controlled by five dates on driftwood enclosed in beach material, by a maximum limiting date on relative sea level provided by bowhead whale bone, and by an estimate of the relative sea level position at time of deglaciation. All dated driftwood samples were enclosed in beach gravel and four of them fall on a straight medial segment of the emergence curve (S-2837, 3765 ± 80 BP at 12 m; S-2839, 4890 ± 90 BP at 19 m; S-2821, 5965 ± 95 BP at 25 m; and S-2838, 7100 ± 110 BP at 30 m). The lowest driftwood (S-2859, 605 ± 65 BP at 6 m) plots about 4 m above the curve, likely because of ice push. The bone date from 79.5 m is on clean inner bone from a bowhead whale rib enclosed in beach gravel (S-2836, 9040 ± 130 BP).

The bowhead whale date from 79.5 m also is a minimum date on deglaciation of the Dolphin River sample areas (Fig. 11). Marine limit was not measured within the sample area, but the highest beaches extend just above the 300 foot (90.5 m) contour on the topographic map. Morris (1988) measured the highest beach just east of the sample area at 103 m and on the north shore of inner Browne Bay the marine limit is at 95˙ m. Hence we start the Dolphin River minimum curve at 95 m at 9.25 ka.

Guillemard Bay

The Guillemard Bay emergence curve (Fig. 12N) is based on three driftwood dates and on an estimate of relative sea level position at time of deglaciation. All three driftwood samples were from large logs, several metres long, nearly buried in beach gravel, and they provide good control on the critical medial segment of the curve (GSC-3989, 4400 ± 70 BP at 16 m; GSC-3985, 6100 ± 80 BP at 31.5 m; and GSC-3967, 6910 ± 80 at 39 m). Control of the medial segment allows safe extrapolation, particularly in the younger direction.

The highest beaches in the Guillemard Bay area extend just above the 300 foot (90.5 m) contour. In the Fisher Lake area, due north of Guillemard Bay, marine limit is defined by small sandurs and proglacial meltwater channels that grade downslope to glaciomarine deposits at about 100 m. Poorly preserved (pitted and encrusted) *Hiatella arctica* from the surface of silt at 97 m dated 9190 ± 170 BP (GSC-4049). Bone from a bowhead whale cranium at 99 m, also near Fisher Lake, dated 9225 ± 215 BP (S-2597), which is in good agreement with the shell date from 97 m both as an estimate of time of deglaciation and as an age of the 97 m to 99 m relative sea level. Because the Guillemard Bay sample area was deglaciated about the same time as the Fisher lake area (Fig. 11), we start the Guillemard Bay curve at 100 m at 9.2 ka.

Clearly one and likely three of the dates on bowhead whale bone samples from Guillemard Bay are too young. Rib bone protruding from beach gravel at 98 m, and with some plants growing on the surface of the bone, was submitted in

field condition for dating and yielded an age of 7650 ± 120 BP (S-2602). This animal must be about 9.2 ka old because it is situated at or very close to marine limit. Because the bowhead whale bone samples at 48 m and 84 m (S-2601, 6940 ± 155 BP; S-2604, 8520 ± 190 BP) both had plant material on them and were not prepared for dating prior to submission (other than by scraping off surface plant material), the dates are regarded here as being too young and precedence is given to the driftwood date from 39 m for curve control. The emergence curve indicates that the bowhead whale sample at 48 m is at least 7.5 ka old and that the one at 84 m is at least 8.8 ka old. Excess material from S-2601 contained a small amount of humic material in bone pores well below the surface, which verified the suspicion that the date is too young.

Three other bowhead whale bone samples from Guillemard Bay yielded acceptable ages in that they fall on or below the driftwood-based curve. A rib from beach gravel at 75.5 m gave an age of 8675 ± 135 BP (S-2603), and excess material returned by the laboratory after dating appeared free of any contaminant. Hence this date is taken as valid and it adds useful verification to the upper part of the curve. The sample from 18 m consisted of a rib collected from a site where a nearly complete skeleton lies mostly buried in beach gravel. The dated sample (S-2861, 4505 ± 85 BP) consisted of cubes of dense, solid, subsurface bone lacking any obvious contaminant so the date is likely good. The sample from 17 m (S-2600, 4870 ± 95 BP) was also from a rib protruding from beach gravel. The date is acceptable in that it falls slightly below the curve, but the fact that the sample was submitted in field condition, other than for surface cleaning, means we cannot be confident that it is not older.

Radiocarbon dates from other sites

Fourteen radiocarbon dated samples pertinent to the Holocene sea level history of Prince of Wales Island are from sites outside the 14 areas for which curves were drawn. Several of these have been discussed in reference to construction of curves for nearby areas and information on all samples is given in the Table 1. One of them requires further evaluation because the quoted age likely is slightly too young. *Mya truncata* shells from the surface and active layer of the highest marine sediment in the Transition Bay area at 115.5 m dated 8940 ± 130 BP (GSC-3996). This site is thought to be at marine limit so the shells should date from deglaciation. However, both shells and whale bone from the Fisher Lake area which is up ice of Transition Bay, date about 9.2 ka (discussed above). So the Transition Bay shells should be older than 9.2 ka. Furthermore, shells from 115 m just north of Transition Bay date 9200 ± 160 BP (L-571B). Some of the shells submitted from Transition Bay had crustose lichens adhering and our experience is that lichen hyphae can penetrate through shells and impart a pale grey discoloration that cannot be entirely removed. We conclude, therefore, that the true age of the 115 m Transition Bay shells is about 9.3 ka, a century or two beyond the error range of the date.

OTHER CENTRAL ARCTIC EMERGENCE CURVES

Several emergence curves have been published for other sites or reasonably small areas in the central Arctic (Barr, 1971; McLaren and Barnett, 1978; Dyke, 1979, 1980, 1984; Hodgson et al., 1984; Washburn and Stuiver, 1985). In addition, data scattered in the literature, primarily in GSC Radiocarbon Date Lists, along with a few unpublished dates, allow construction of curves, mostly minimum emergence curves, for a few other sites in the central Arctic. These curves are collected and redrawn here (Fig. 13) to make the entire set available in one place and to ensure that the same principles guide the drawing of all curves. The controlling radiocarbon dates are listed in Table 1. Individual curves are not discussed in the same detail as were the new curves for Prince of Wales Island because either details are available in the original articles or only limited data are available in the date lists.

The discussion below proceeds clockwise from Melville Island in the northwest, through Bathurst, Cornwallis, Devon, and Somerset islands, to northern District of Keewatin, King William Island, and Bathurst Inlet.

Melville Island

Two concentrations of radiocarbon dates on marine deposits on Melville Island allow construction of minimum emergence curves for the Winter Harbour area (Fig. 13A) and for the southeast coast (Fig. 13B). The Winter Harbour minimum curve is constrained by 10 shell dates ranging between 5.7 and 11.7 ka and by a date of 8980 ± 400 BP (GSC-2060) on marine algae from a beach at 27 m. Marine limit in the Winter Harbour area lies at or above 90 m and nonfossiliferous deltas occur at 120 m (Hodgson et al., 1984). The minimum age of marine limit is the age of the oldest shells, 11 700 ± 100 BP (GSC-3249). Shells at 79 m date 10 900 ± 150 BP (GSC-786); unless the emergence rate before 10.9 ka was slower than after that, which is unlikely, at 11.7 ka the sea must have stood at or above 120 m. Hence, the deltas at 120 m are likely marine features. The younger 5 ka of sea level history is not sufficiently constrained to know whether Winter Harbour has continued to emerge slightly since then or whether sea level passed below its present position about 4 ka and is now slowly rising. Driftwood in the modern storm beach at 1.6 m, dated 625 ± 100 BP (I-842), does not preclude either possibility.

The minimum curve for southeastern Melville Island (Fig. 13B) is constrained primarily by two dates: shells at 98 m dating 9680 ± 90 BP (GSC-1981), and organic detritus from a delta at 14.6 m (levelled) dating 5400 ± 410 BP (GSC-2089). The highest marine limit reported by McLaren and Barnett (1978) from this coast is 101 m. Unless the real marine limit is much higher, there must have been a local ice cap on this part of the island which extended to the present coastal area until 9.7 ka. Any such late ice could not have
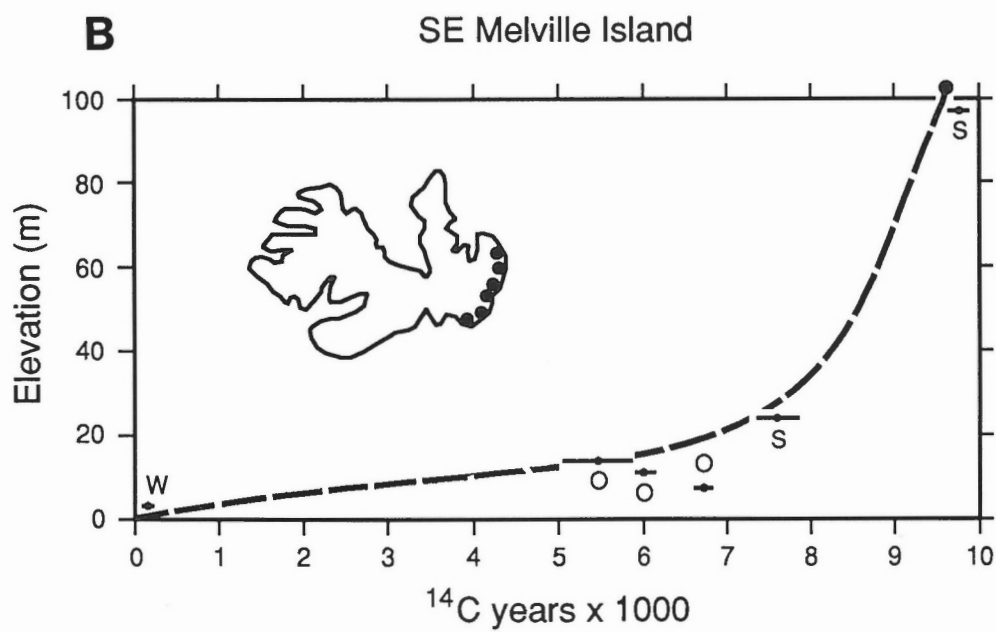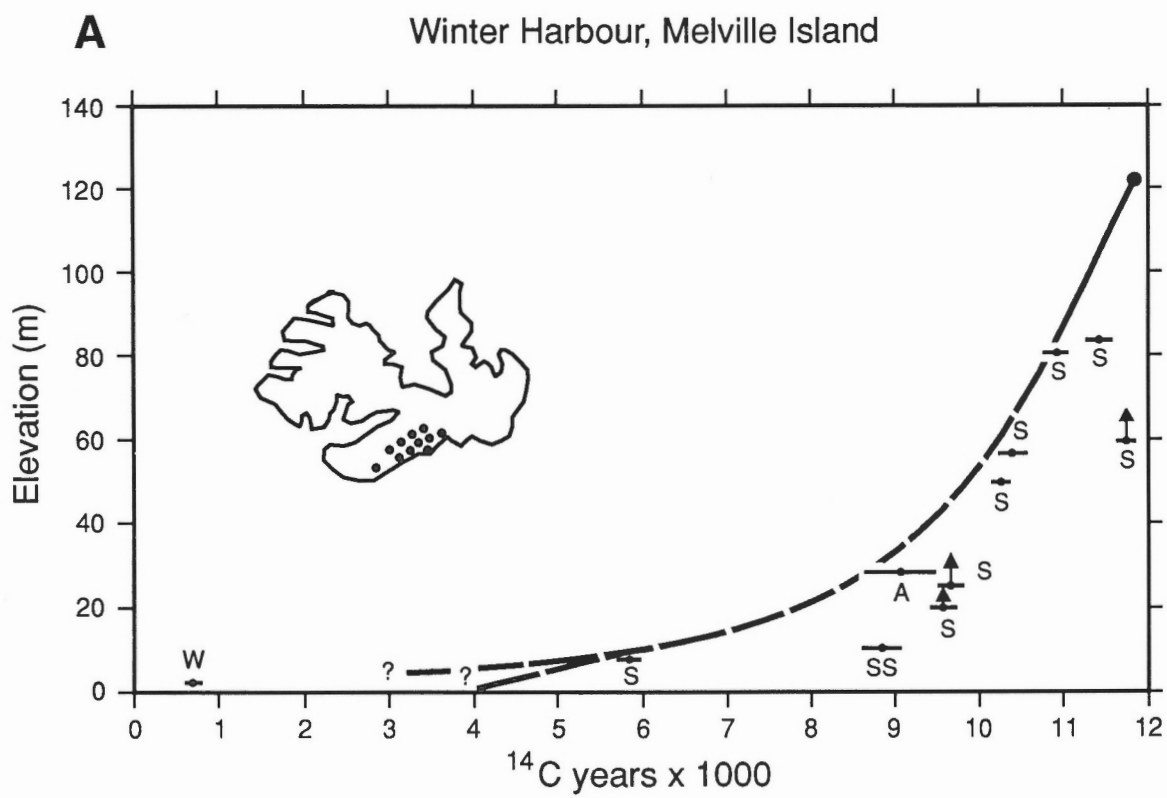
Figure 13. Other central Arctic emergence curves.
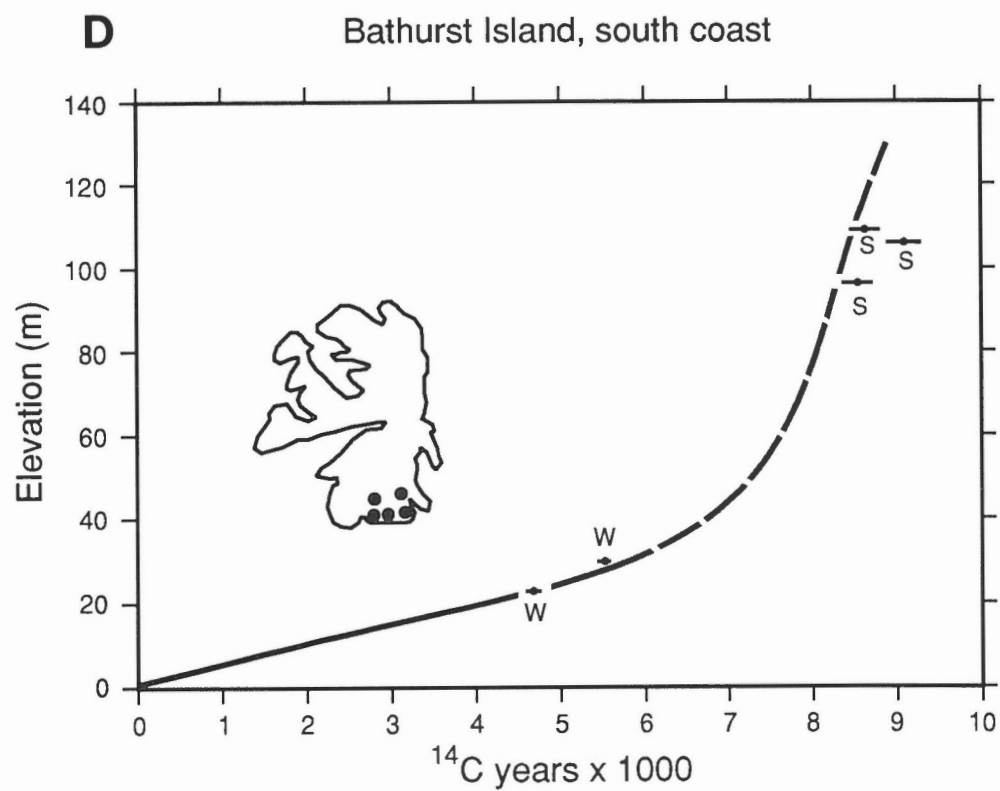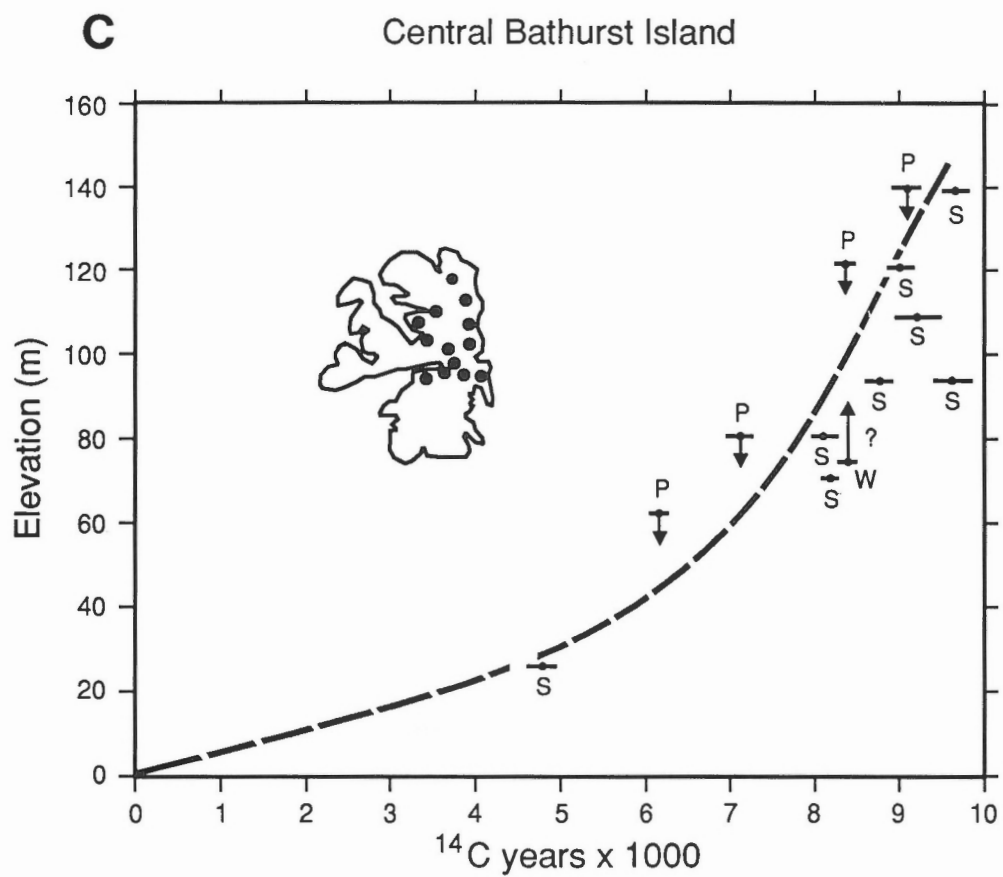
C Central Bathurst Island

D Bathurst Island, south coast

Figure 13 (cont'd.)

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E Resolute Bay, Cornwallis Island

F Truelove Inlet, Devon Island

Figure 13 (cont'd.)

G   Radstock Bay, Devon Island

H   Cape Anne, Somerset Island

Figure 13 (cont'd.)

29

I Cunningham Inlet, Somerset Island

J Rodd Bay, Somerset Island

Figure 13 (cont'd.)

K Southern Somerset Island

Figure 13 (cont'd.)

L   Pelly Bay, Shepherd Bay
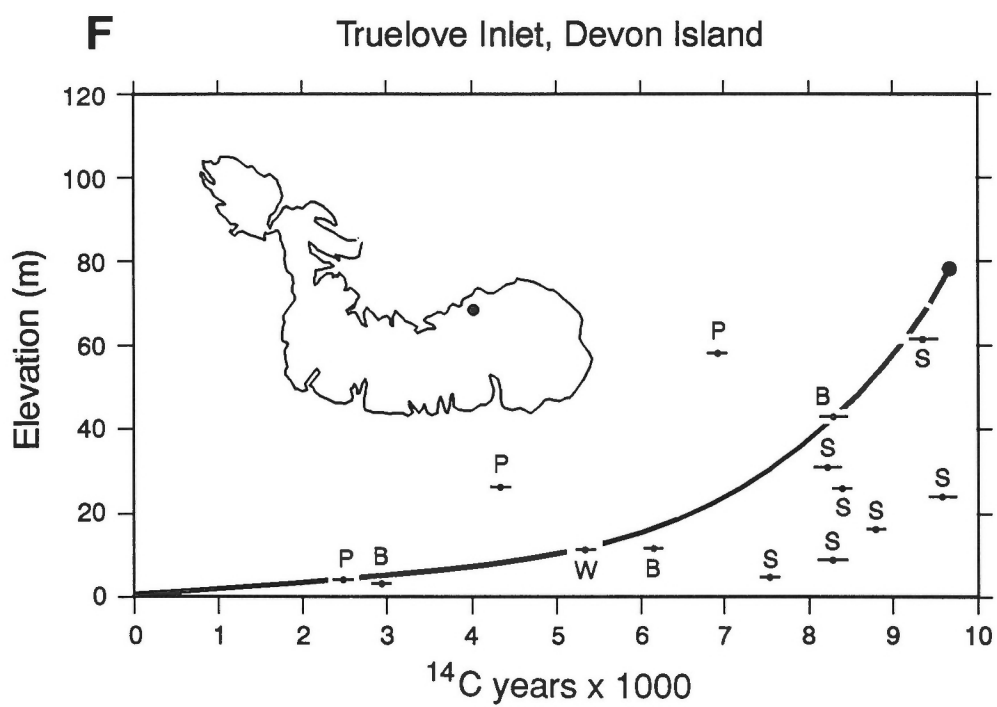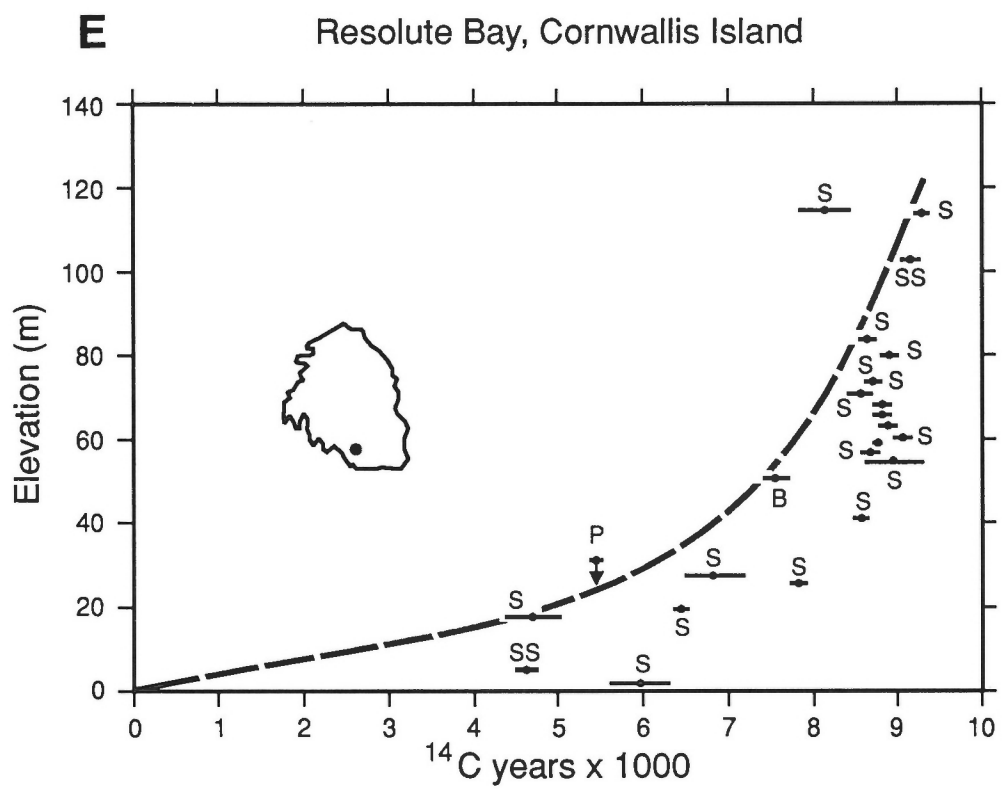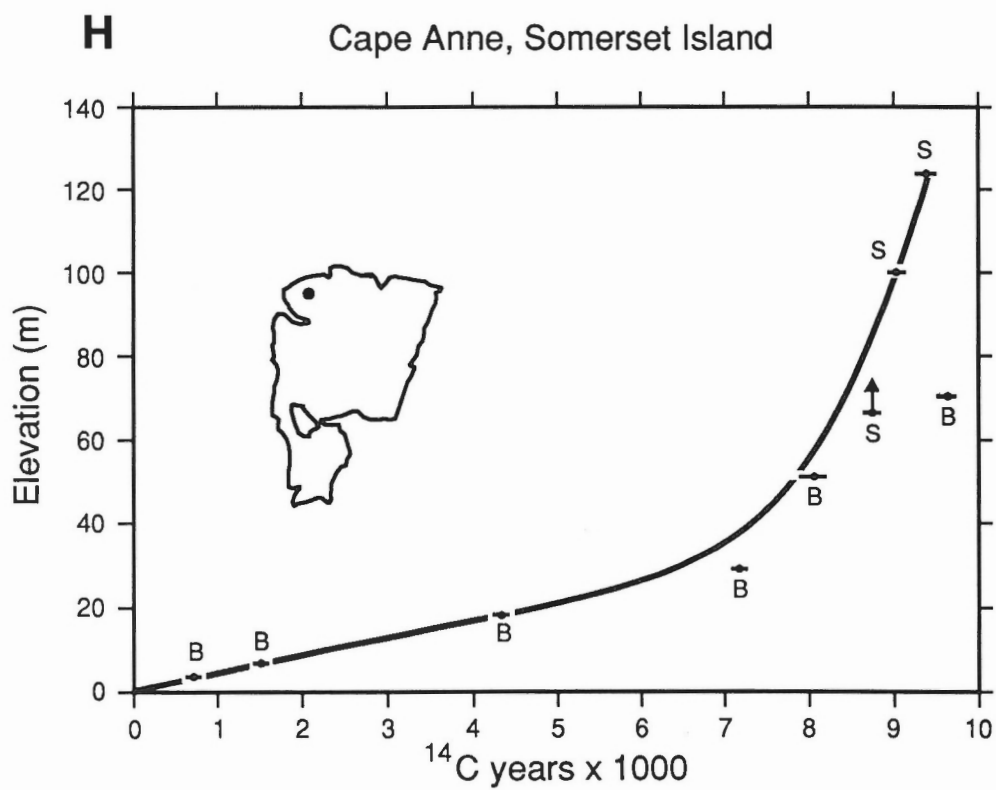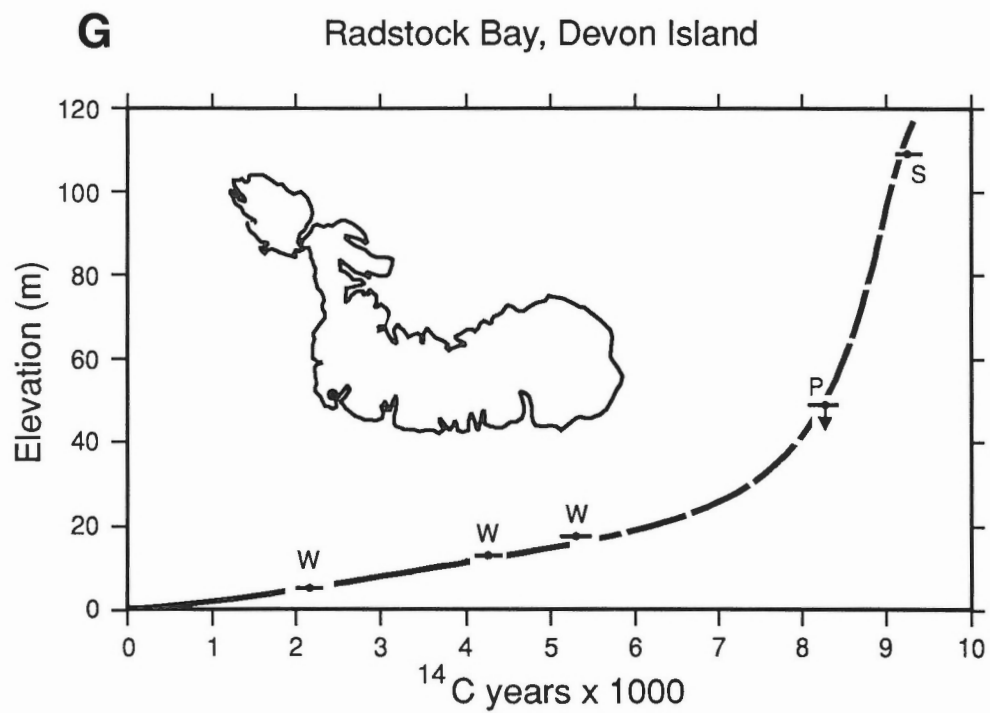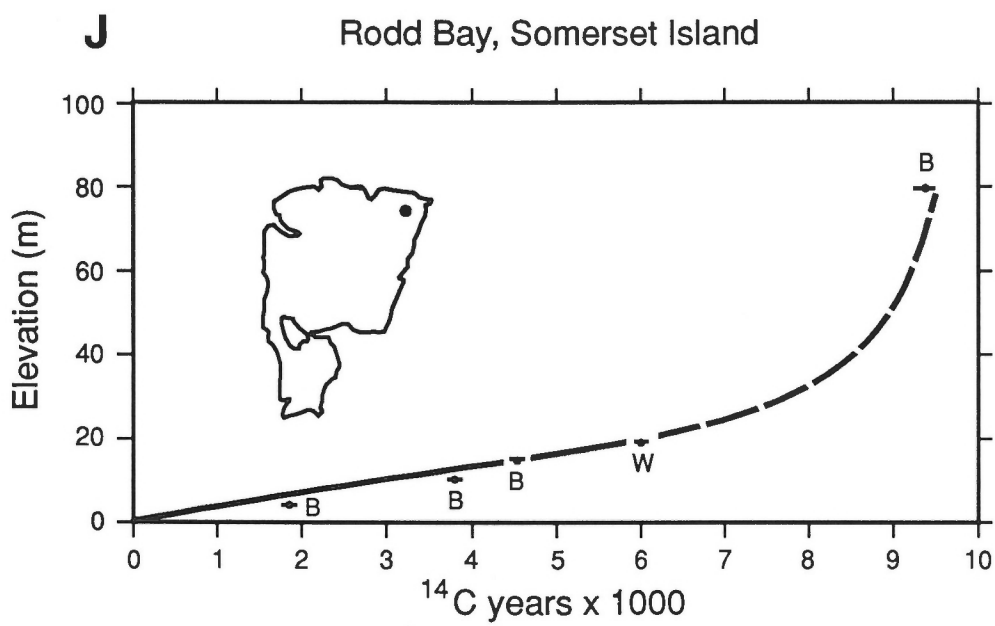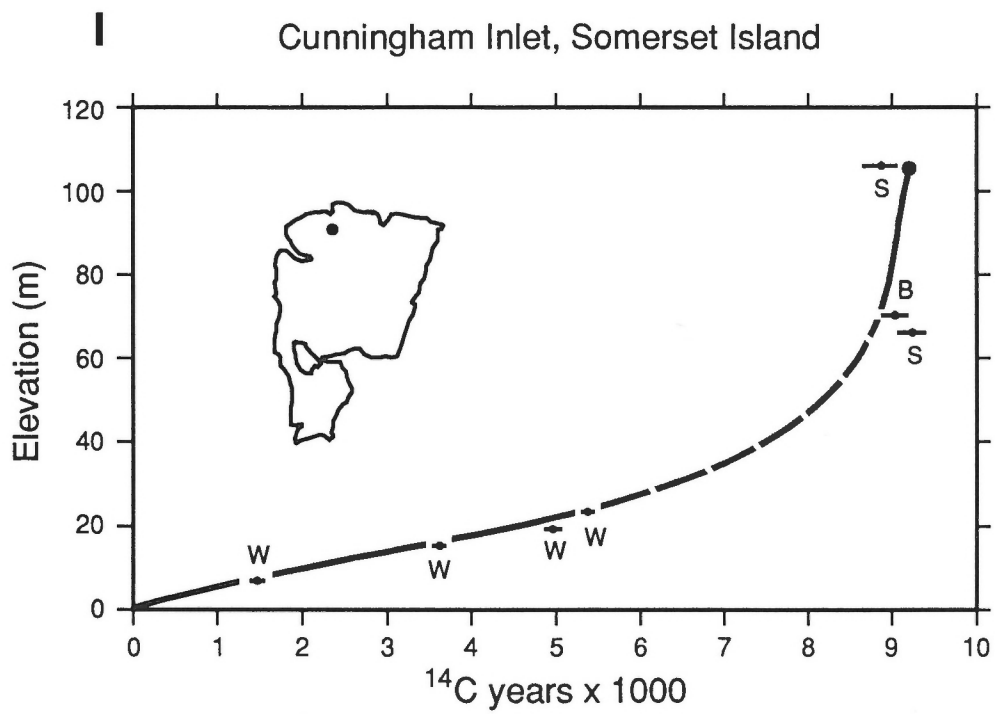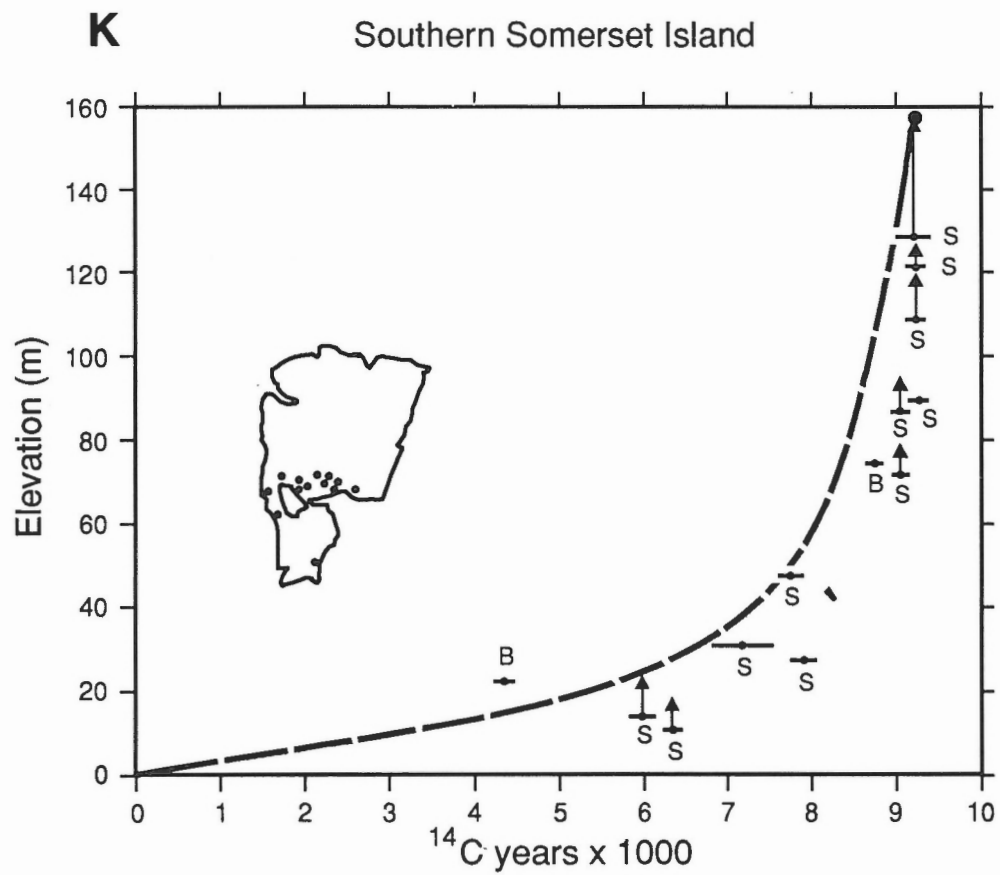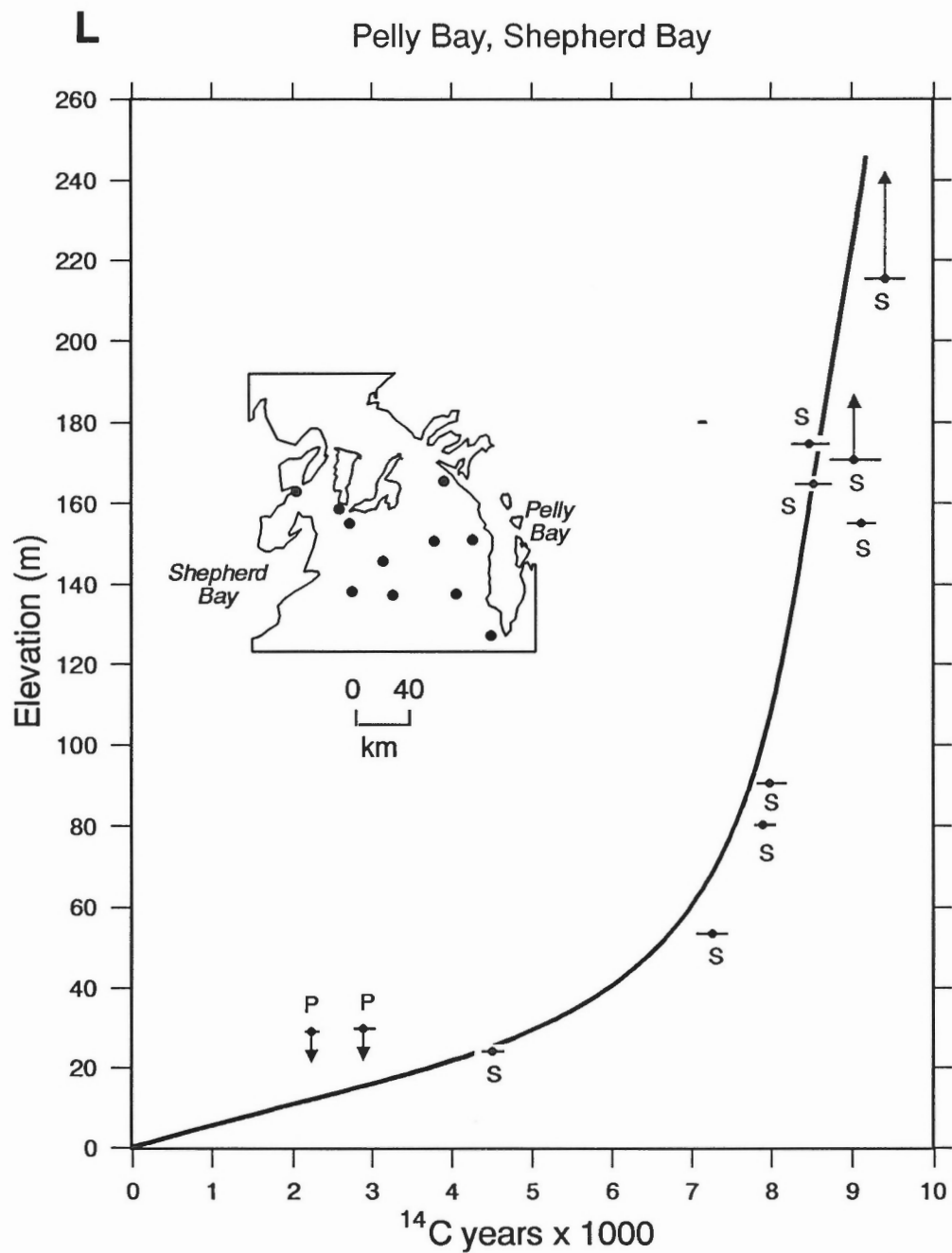
Figure 13 (cont'd.)

M King William Island
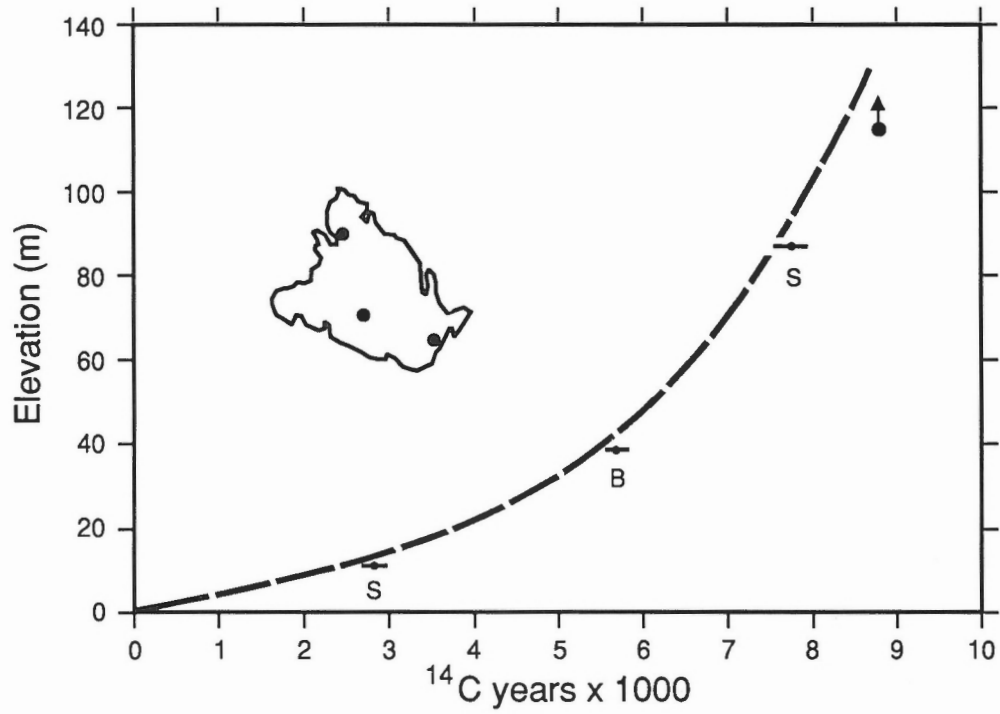
N Bathurst Inlet
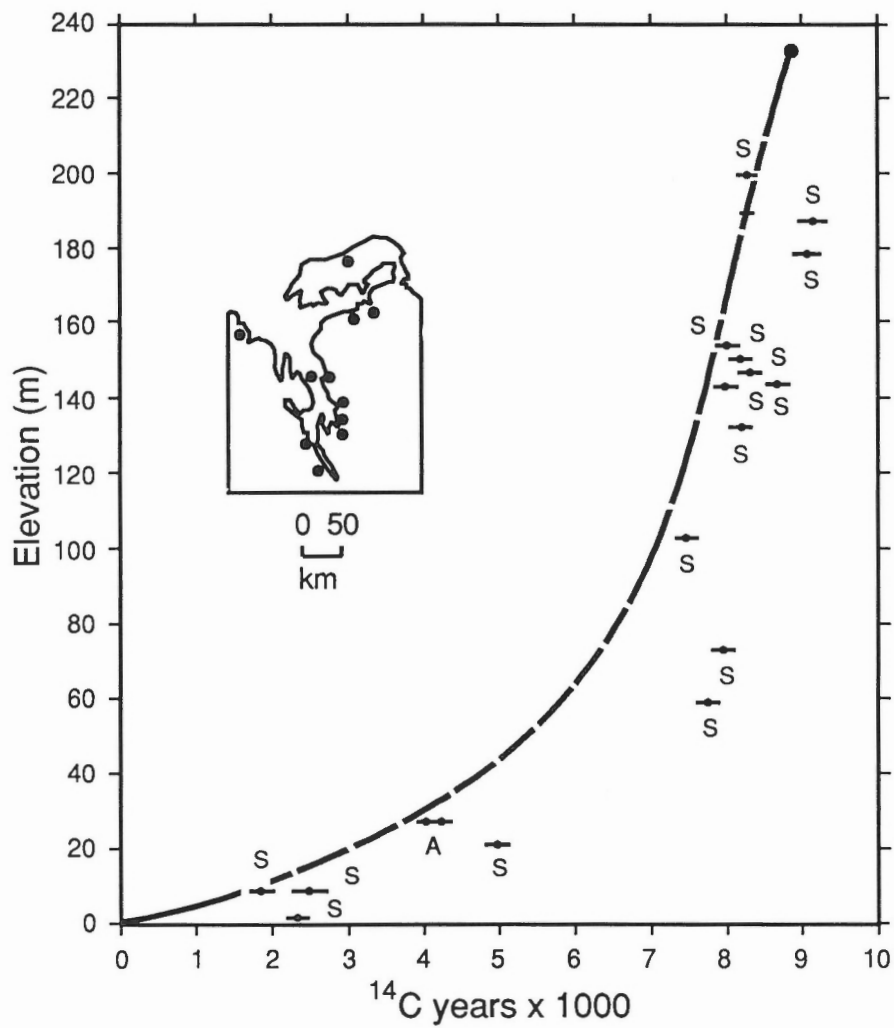
Figure 13 (cont'd.)

Fifteen dated samples from a large area of east-central Bathurst Island constrain the general form of a minimum emergence curve, but the sample area is so large that different parts of it may have emerged at different rates (Fig. 13C). The primary constraint is provided by four shell samples from 25 m, 79 m, 119 m, and 137 m, while five dated peat samples limit the extent by which the curve may be too low. The curve is best constrained in its uppermost part where shells and peat from similar elevations have age differences of only 500 years or less.

The curve for the south coast of Bathurst Island (Fig. 13D) is based on samples from a much smaller area. Two driftwood dates (GSC-2405, 4530 ± 70 BP at 22 m; GSC-4105, 5380 ± 70 BP at 29 m) reliably define the younger half of the curve and shells provide maximum limiting dates on the higher relative sea level positions.

There are no data on marine limits on Bathurst Island other than that they occur at or above the levels of the highest dated shells (Hodgson, 1989).

Cornwallis Island

Washburn and Stuiver (1985) presented an "emergence-curve envelope" for the Cornwallis Island area based on many dates on surface marine shells, primarily from the Resolute Bay area, but also included dates from adjacent Griffith, Lowther, Baillie-Hamilton, and Truro islands. The data from Resolute Bay only are recompiled here and form the basis of a minimum emergence curve (Fig. 13E)[1]. A date of 8550 ± 300 BP (W-1220; equivalent to 8150 ± 300 by GSC method) on shells at 114 m is clearly anomalous (cf. Blake, 1970; Washburn and Stuiver, 1985) and is ignored in drawing the minimum emergence curve. Marine limit at Resolute Bay lies at 114 m or more; Washburn and Stuiver (1985) felt that it could be about 10 m higher. This elevation of marine limit and its limiting minimum age of 9.3 ka compares favourably with marine limit elevation and age on adjacent northwest Somerset Island (Dyke, 1979, and below).

Devon Island

The emergence curve for Truelove Inlet, northeast Devon Island, published by Muller and Barr (1966) was among the earliest curves published for Arctic Canada. The Muller and Barr (1966) curve was based entirely on marine shell dates and included some erroneous dates on shell samples of mixed Holocene and "infinite" ages (S-412, 12 800 ± 160 BP and Y-1297, 16 000 ± 240 BP; Barr, 1971). Barr (1971) revised the curve by adding dates on driftwood at 11 m (S-431, 5280 ± 100 BP) and on three bowhead whale bone samples (S-433, 2900 ± 85 BP at 3 m; S-432, 6100 ± 125 BP at 11 m; GSC-991, 8270 ± 150 BP at 42.4 m). He also drew attention to the superior quality of bowhead ear bone as dating material.

The lower part of the curve (Fig. 13F) is well controlled by a date of 2450 ± 90 BP (I-3231) on peat at 3.6 m and by the 3 m bowhead whale bone date. Marine limit is at 76 m and has a minimum limiting age of 9360 ± 160 BP (Y-1299).

At Radstock Bay on southwestern Devon Island three driftwood samples define the lower half of an emergence curve (Fig. 13G; GSC-1456, 2030 ± 130 BP at 4.7 m; GSC-1402, 4170 ± 130 BP at 12.2 m; and GSC-1467, 5170 ± 140 BP at 16.5 m; McNeely, 1989). The upper half of the curve is a minimum curve based on shells at 107 m dating 9260 ± 150 BP (GSC-1502) and peat in "niveo-alluvial sand" at 48.5 m dating 8260 ± 160 BP (GSC-1479). The peat is said to be "in situ" by the collector (Lowdon and Blake, 1976, p. 15); if so the site must have emerged before 8.2 ka.

Somerset Island

Dyke (1979, 1980) presented three emergence curves for the north coast of Somerset Island and they are reproduced here without modification (Fig. 13H, I, J) The Cape Anne curve (Fig. 13H) is defined by seven accordant bowhead whale bone and shell dates, one of which is at or close to marine limit at 122 m. The lower half of the Cunningham Inlet curve (Fig. 13I) is defined by four dates on driftwood embedded in beach gravel but the upper half is a minimum curve based on a whale bone at 66 m and shells from marine limit at 102 m. The Rodd Bay curve (Fig. 13J) is well controlled by accordant driftwood and whale bone dates spanning the last 6 ka and marine limit at 76 m is dated by whale bone at 9210 ± 120 BP (S-1390).

Samples collected from a large area of southern Somerset Island constrain a minimum emergence curve for the most uplifted part of the sample area (Fig. 13K). The lower part of the curve is constrained primarily by shell dates; a 22 m whale bone date is left above the curve because the sample was submitted in field condition and may have been slightly contaminated. Marine limit varies within this large area from about 125 m in the eastern part to about 160 m in the western part. The higher marine limit in the western part is recorded by delta terraces at the head of Creswell Bay, measured at 157 m (Dyke, 1979), by a distinct washing limit on till south of Stanwell-Fletcher Lake, which plots above the 500 foot contour (more than 151 m), and by raised beaches which extend above the 500 foot contour farther south (Dyke, 1983). Craig (1964) remarked that marine limit was better expressed in the latter area than anywhere else on Somerset Island and measured its elevation at about 159 m. Marine limit in the entire Barrow Strait-western Gulf of Boothia region dates close to 9.3 ka (Dyke, 1983, 1984) and marine limit dates on southern Somerset Island are no exception. This point is emphasized here because marine limit elevation and age on southern

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[1]Unlike other sites in Arctic Canada, most of the shell dates from Resolute Bay were determined by laboratories (University of Washington, QL; United States Geological Survey, W) that normalize the δ^{13}C fractionation to -25‰ rather than to 0‰ as done by the Geological Survey of Canada. This results in a 400 year age discrepancy between these laboratories and the GSC laboratory and on Figure 13B non-GSC dates are plotted as "GSC equivalent" ages by subtracting 400 years from the reported age.

measured its elevation at about 159 m. Marine limit in the entire Barrow Strait-western Gulf of Boothia region dates close to 9.3 ka (Dyke, 1983, 1984) and marine limit dates on southern Somerset Island are no exception. This point is emphasized here because marine limit elevation and age on southern Somerset Island and on Boothia Peninsula are important considerations in the discussion below of isobase patterns and possible tectonic influences on shoreline geometry.

Pelly Bay-Shepherd Bay

Eleven radiocarbon dated samples from a 17 000 km^2 area between Pelly Bay and Shepherd Bay provide the best indication available of the emergence history of northern District of Keewatin (Fig. 13L; Dyke, 1984). This curve represents the minimum amount of emergence that has occurred in the most uplifted part of the area. The older dates pertain to local marine limits within the sample areas: shells from 225-230 m on the surface of silt provide a closely limiting minimum age of 9430 ± 210 BP (GSC-2093) on local marine limit at 240-250 m; shells from the surface at 171 m provide a minimum age of 8730 ± 230 BP (GSC-3072) on a local marine limit of 184 m which is marked by a distinct washing limit and beach. Two dates on peaty soils at 29 m and 30 m limit the extent by which the younger part of the minimum curve may be too low.

King William Island

Dates from three sites on King William Island form the basis of a new minimum emergence curve (Fig. 13M). Paired valves of *Astarte* from a sand bed at about 10 m, 2 m below the surface, dated 2760 ± 120 BP (GSC-3548). *Hiatella arctica* and *Mya truncata* shell fragments from the surface of till at 85 m dated 7715 ± 205 BP (S-2682). A bowhead whale fin bone from the surface of raised beach gravel at 37 m dated 5620 ± 95 BP (S-2681).

King William Island was deglaciated between about 8.8 and 8.6 ka (Dyke and Prest, 1987) but the entire island lies below marine limit. Relative sea level during deglaciation was higher than the highest land at about 120 m. The data from adjacent northeastern District of Keewatin suggest that it was probably at or about 180 m.

Bathurst Inlet

Eighteen dates from the Bathurst Inlet area, District of Mackenzie, constrain a minimum emergence curve for the most uplifted part of that area (Fig. 13N). Shells dating 1850 ± 140 BP (GSC-137) from growth position in sand just below the top of a 9 m delta control the lowest part of the curve but all other dates are on surface shell litter. The highest beaches in the area are at about 230 m and the area was deglaciated during the interval about 9.6 to 8.6 ka (Dyke and Prest, 1987). Because of the size of the area and the long interval of local deglaciation, a single minimum emergence curve is an inadequate treatment of the emergence history.

CENTRAL ARCTIC ISOBASE MAPS

Method

The primary data source for constructing the isobase maps presented here is the set of 28 emergence curves discussed above. Well controlled emergence curves contribute unambiguous paleoshoreline elevations, the accuracy of which is limited only by inherited errors of elevation measurement and radiocarbon counting errors. Elevations on the isobase maps taken from minimum emergence curves are followed by a plus sign (+), and elevations taken from poorly controlled extrapolated curve segments are followed by a plus or minus sign (±). In addition, elevations read from the extraordinarily well controlled Cape Storm curve (Blake, 1975), from a site just beyond the northeastern part of the map area, are used to guide isobase orientations across central and western Devon Island.

Radiocarbon dates from sites outside the areas represented by emergence curves are scattered in published date lists and are more readily available from the GSC radiocarbon data bank (McNeely, 1985). All dates pertaining to postglacial sea levels currently available from the data bank for the area between 68° and 76°N and 80° and 112°W were reviewed and provide additional control on isobase patterns.

Two assumptions guided the drawing of isobases. We assumed that gradients (i.e. shoreline tilts) between control points are constant. This assumption precludes recognition of any abrupt discontinuities (faults) and may not be realistic. It remains the most objective initial approach, but the assumption is re-evaluated below following the discussion of isobase patterns. We also assumed that there were no major transgressions during the course of general emergence, so a shoreline always has to lie below an older shoreline. This assumption is realistic insofar as no such transgressions have been recognized in the area on geomorphic or sedimentological grounds.

Isobase maps are drawn at 1000 year intervals starting at 11 ka and at smaller intervals for the period around 9 ka when most of the central Arctic was deglaciated, hence when the rate of unloading was highest.

11 ka and 10 ka isobase maps

Most of the central Arctic was still ice covered at 11 ka so information on the elevation of the shoreline of that age is restricted to the northwest (Fig. 14A). The 11 ka isobases decline toward the west-northwest from 200 m over Prince of Wales Island to 75 m over central Melville Island. The 10 ka isobases display a similar pattern declining from about 250 m over the northern mainland in the southeast to about 50 m over Melville Island in the northwest (Fig. 14B). The increase in elevation of eastern Bathurst Island since 10 ka has exceeded the increase in elevation of northern Prince of Wales Island. Hence there is an embayment in the 10 ka isobase surface over Viscount Melville Sound.

11 ka

Figure 14A
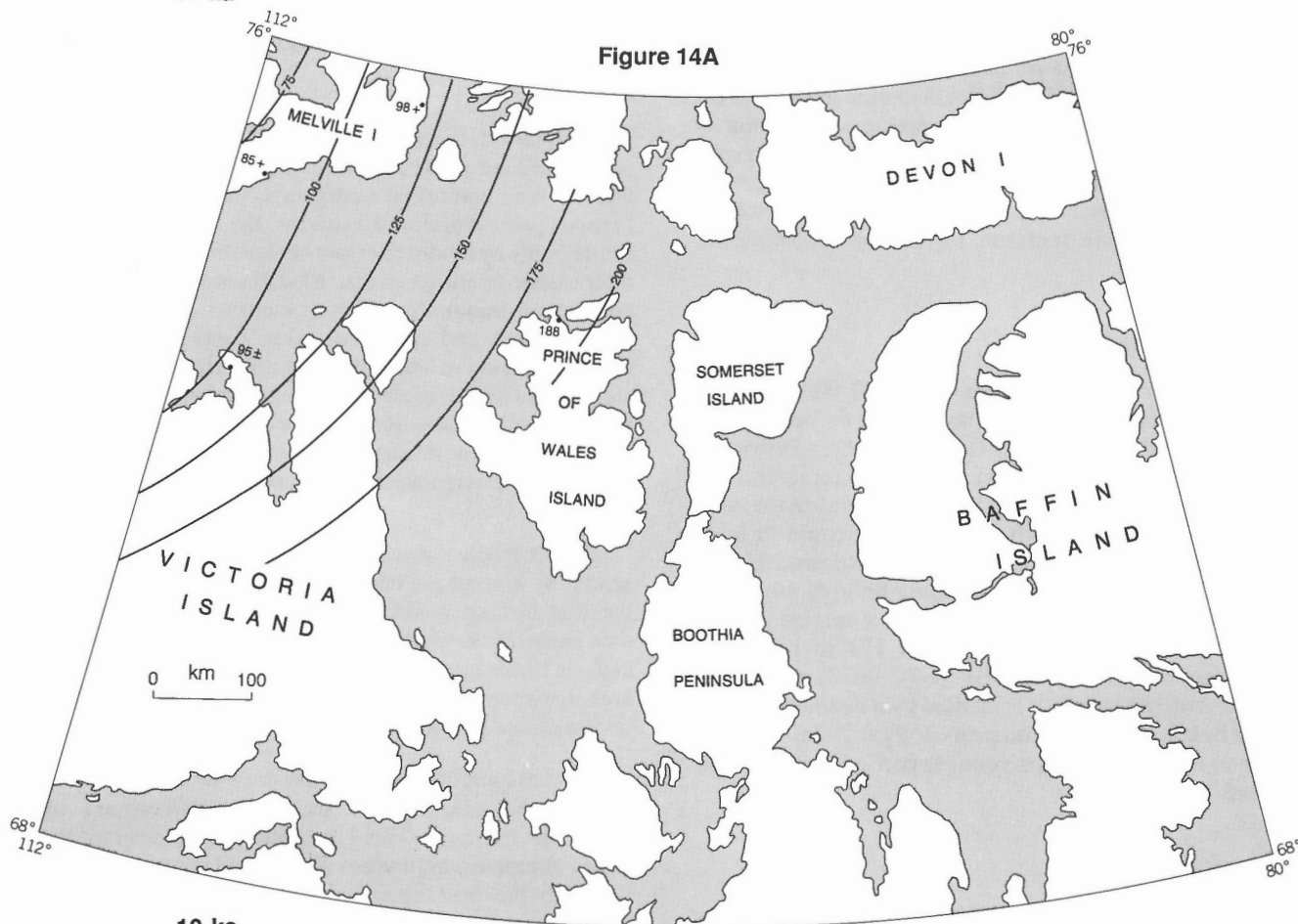
10 ka

Figure 14B
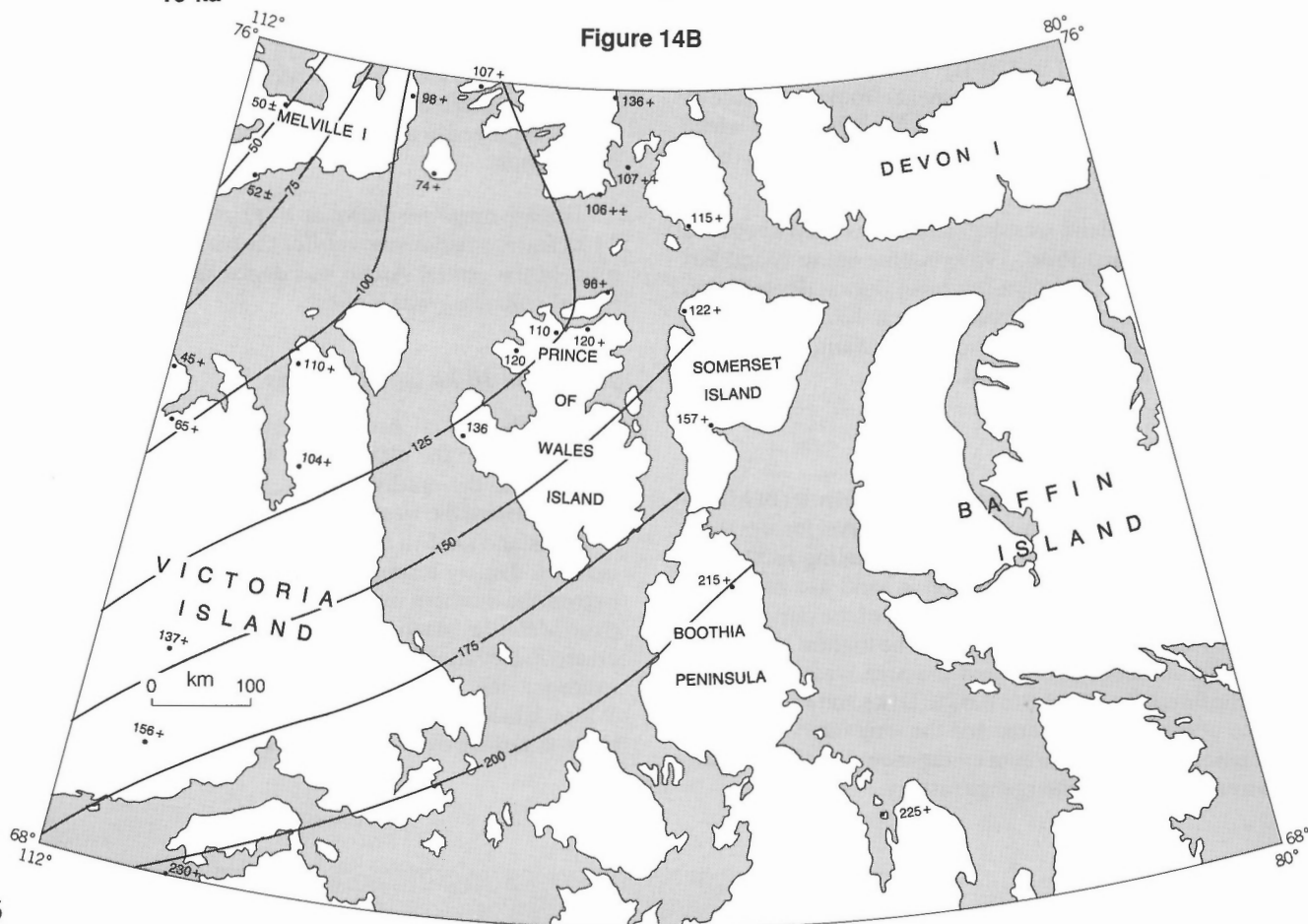
9.3 ka

Figure 14C

9 ka

Figure 14D

37
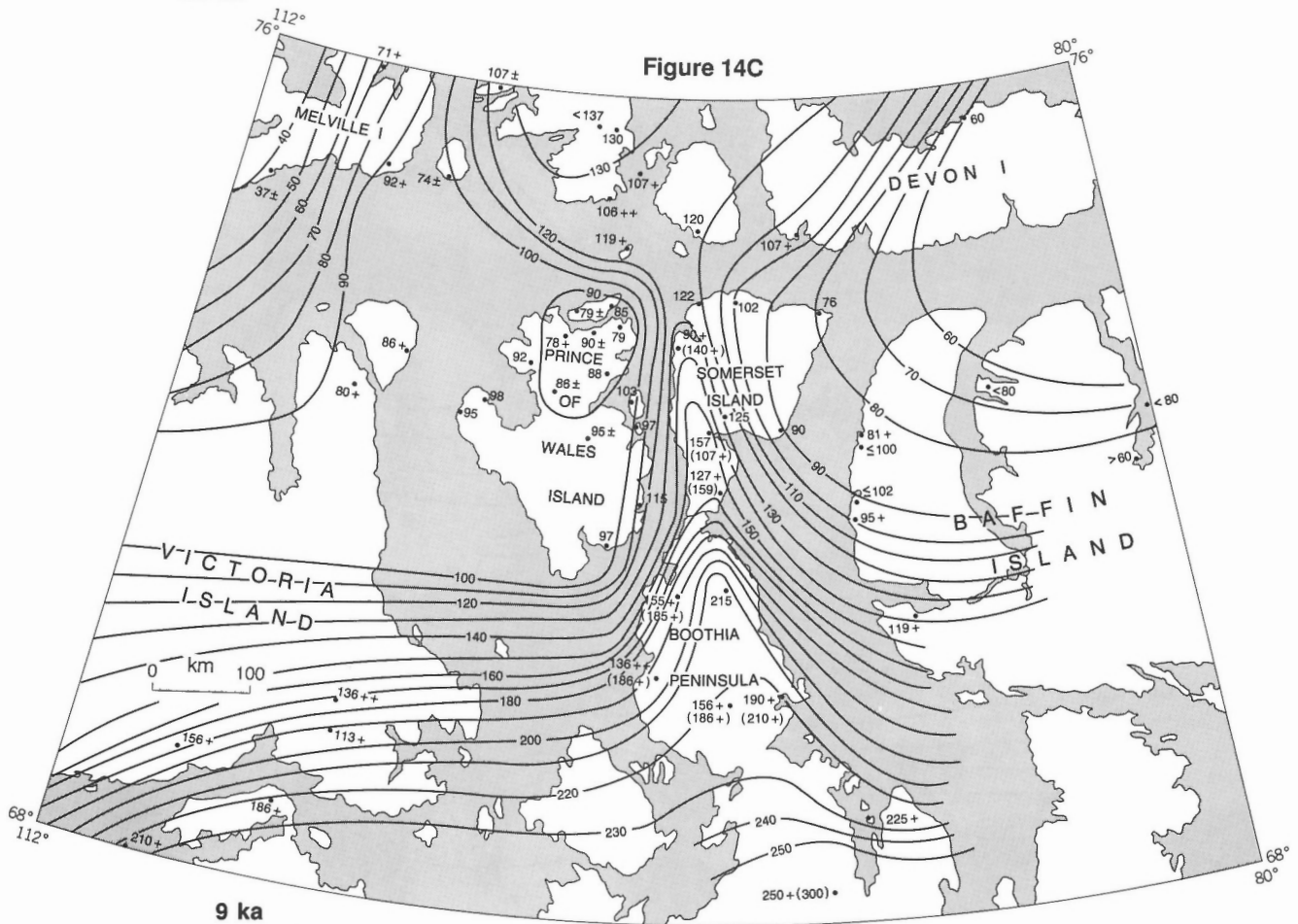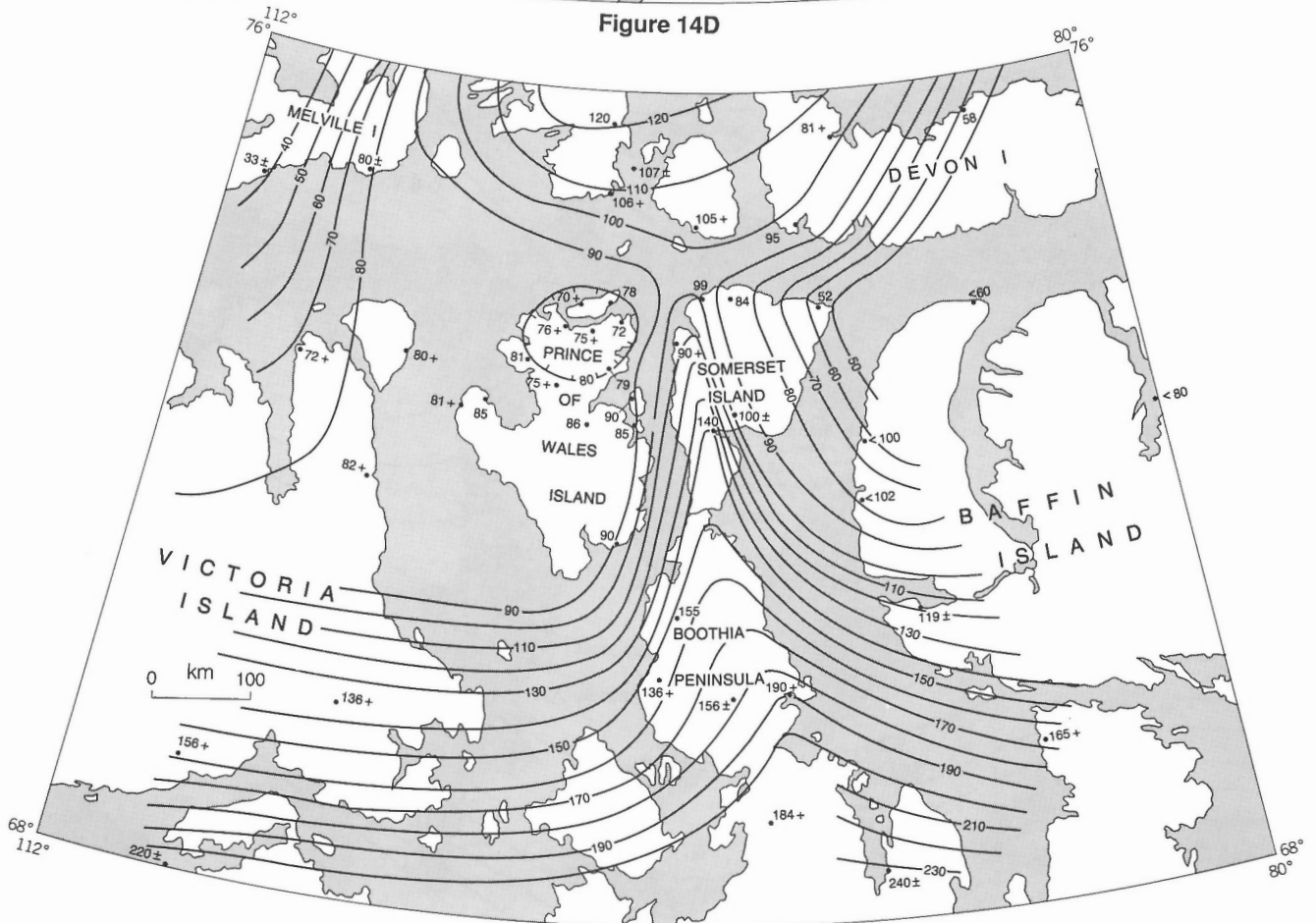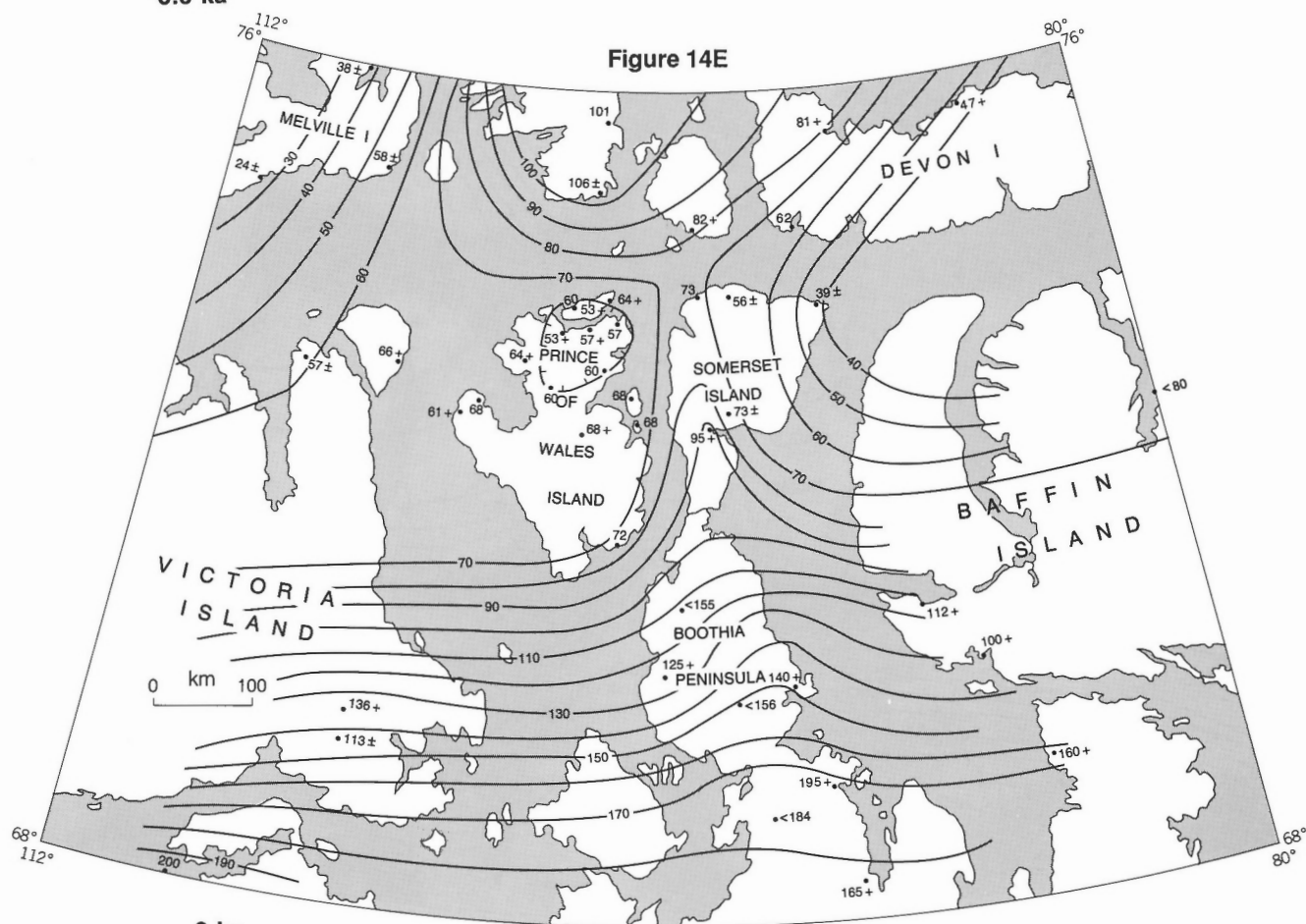
8.5 ka

Figure 14E

8 ka

Figure 14F

7 ka

Figure 14G

MELVILLE I

DEVON I

58±

22±

15±

20±

42±

42±

24±

PRINCE

34+ ● 41±

34+ ● 34+ 40

38± ● 42 ●

36+ ●

38 ● 37

38 ●

OF

30 ● 39

SOMERSET
ISLAND

31±

32+

33+

22±

60±

WALES
Horizontal at 40±2 m

ISLAND

40

B A F F I N

I S L A N D

VICTORIA

ISLAND

0   km   100

50

BOOTHIA

PENINSULA

80±

100

98±

110

60

120

100±

130

140

100±

150+

70

70+●

80

53±

150

150+

90

90±

90

68°
112°

80°
76°

6 ka

Figure 14H

MELVILLE I

DEVON I

42±

40

14

10

12

16

31

36

32

31±

20

12

16

16

24

21+

26

29

26

23±

28

27± PRINCE

26

30±

28 SOMERSET
ISLAND

26 ● 24

24

18

20

28

26

20

45±

28 29

27

OF

28

25

26

21+

21+

WALES
Horizontal at 28±2 m

ISLAND

B A F F I N

I S L A N D

VICTORIA

ISLAND

0   km   100

32

29

BOOTHIA

PENINSULA

36

40

50

60

70±

60+

45±

40±

70

80

90

100

110±

110

68°
112°

80°
76°

39

9.3 ka, 9 ka, and 8.5 ka isobase maps

By 9.3 ka many of the marine channels in the central Arctic were ice free so data on the elevation of the 9.3 ka shoreline are widespread. The shoreline rises from low elevations of less than 40 m and less than 60 m in the northwest and northeast (Fig. 14C) to elevations in excess of 250 m in northern District of Keewatin and in excess of 130 m on Bathurst Island; so two dominant emergence centres are apparent.

The most dramatic feature of the 9.3 ka isobase surface is a pronounced ridge centred over Boothia Peninsula and western Somerset Island. The ridge is flanked by a steep and continuous slope to the east and by a steep slope descending to a broad plateau over Prince of Wales Island to the west. The plateau-like isobase surface over Prince of Wales Island has a broad shallow depression in the north. The ridges and plateau features were not present on the 9.3 ka isobase map previously published by Dyke (1984) but they result from the large body of new data now available from Prince of Wales Island. The crust may have been deforming in a similar pattern during the period of deglacial rebound before 9.3 ka but it is not possible to demonstrate this.

These isobase features are surprising because they have no obvious glacioisostatic explanation. The ridge does not coincide with a centre of glacial loading, which was located far west of the ridge (Dyke and Prest, 1987), and is not the pattern that would be expected to result from glacial loading beneath the nearby flat central part of an ice sheet.

When the existence of the ridge in the isobase pattern was first suspected (see Introduction), our efforts focused on verifying or disproving it. Consequently, the Boothia-Somerset isobase ridge and bounding eastern slope and western plateau are by far the best controlled features on the 9.3 ka isobase surface. These features could only be wrong if there are large errors, 60-100 m, in interpretation of the elevation of the 9.3 ka shoreline on either Prince of Wales Island on the one hand or on Somerset Island and Boothia Peninsula on the other. Such errors are almost inconceivable in light of the internal consistency of the data sets from both areas and in the light of the similarity of field and laboratory techniques and of interpretive criteria applied to both areas. The possibility that the 9.3 ka shoreline could be higher than shown over Prince of Wales Island, thus eliminating the ridge to the east, can be rejected because the marine limit along eastern Prince of Wales Island lies at 115 m or less (at less than 100 m in the northeast) and along the entire coast it dates from about 9.3 ka to 9.8 ka. In contrast, shells dating 9.3 ka and less on western Somerset Island come from elevations of over 120 m (e.g. 122 m at Cape Anne, 125 m at Creswell Bay) and in all likelihood pertain to the marine limit shoreline which rises to nearly 160 m (see discussion of Somerset Island emergence curves).

Several radiocarbon dated shell samples from sites beyond the emergence curve areas provide additional control on the isobase ridge over Somerset Island and Boothia Peninsula. Near the northwest end of Somerset Island, shells from the surface of a raised beach at 90 m were dated at 8780 ±

110 BP (GSC-3745). Emergence rates on Somerset Island during and right after deglaciation were about 10 m/century (Dyke, 1979; Fig. 13H-K), as they were in adjacent areas (Blake, 1975; Washburn and Stuiver, 1985; Fig. 13). Therefore, at that site the sea at 9.3 ka would have stood about 50 m higher than at 8.8 ka, or at about 140 m. That calculation agrees well with other measured elevations of the 9.3 ka shoreline on Somerset Island, particularly 122 m at Cape Anne, and with the 120 m value at Resolute Bay, Cornwallis Island. On northeastern Boothia Peninsula, shells from deltaic foreset sand at 185 m dated 9230 ± 130 BP (GSC-2720). The sample site is just in front of the marine limit delta terrace at 215 m and this delta is one of a series of several ice contact marine limit deltas along the northeast flank of Boothia Peninsula, all of which plot on the 700 foot (211 m) contour. On southeastern Boothia Peninsula, shells from the surface at 190 m dated 8950 ± 150 BP (GSC-597). Because early emergence rates were about 10 m/century here as well (Dyke, 1984; Fig. 13L), at 9.3 ka the sea must have stood at or above 210 m. Just west of that site a marine limit delta lies at 156 m and dates about 9 ka (Dyke, 1984). Hence elevation of that site since 9.3 ka has exceeded 186 m. On west-central Boothia Peninsula, a 136 m marine limit delta terrace has been dated at 8790 ± 80 BP (GSC-2917) by shells from 130 m, just below the terrace. Elevation of that site since 9.3 ka likely exceeded 186 m. Finally, a 155 m marine limit on northwestern Boothia Peninsula dates 9040 ± 100 BP (GSC-2722), and elevation of that site since 9.3 ka likely exceeded 185 m. Hence, emergence of the entire area from Resolute Bay through western Somerset Island and Boothia Peninsula has exceeded emergence to both east and west by several tens of metres. The maximum relief of the Boothia-Somerset isobase ridge is about 120 m between southeastern Prince of Wales Island and central Boothia Peninsula.

The contours on the 9.3 ka isobase map (Fig. 14C) are drawn conservatively. Therefore, the relief and extent of the isobase features is at least as large as that shown. The Boothia-Somerset isobase ridge may persist farther southward than shown and the Prince of Wales Island isobase plateau may extend farther south and west than shown. It apparently does not extend much north of Prince of Wales Island, for shells at 112-119 m on Lowther Island have been dated at 9470 ± 150 BP (GSC-322). Still the emergence history of Lowther Island is poorly known. The plateau appears to extend to Stefansson Island and northeastern Victoria Island but the 9.3 ka shoreline lies at much higher elevations on southern Victoria Island and at Bathurst Inlet. These few higher values control the nearly right angled bend in isobases south of Prince of Wales Island, but the true form of the isobase surface over that region could be quite different. The east coast of Victoria Island is a crucial area for further refining these large and interesting isobase features.

The Prince of Wales Island isobase plateau increases the separation and distinctiveness of the southern (Laurentide) and northern (Innuitian) emergence centres. Without it, the postglacial uplift of the entire area west and north of Hudson Bay might have formed a single dynamic unit. Therefore, the origin of this plateau and associated ridge to the east bears on the question of the origin of the secondary uplift centre over

the Queen Elizabeth Islands (Andrews, 1970; Blake, 1970; Walcott, 1972; England, 1976, 1987; Mayewski et al., 1981). This point is addressed further below.

The form of the 9 ka and 8.5 ka isobase surfaces (Fig. 14D, E) resembles the form of the 9.3 ka surface. The Boothia-Somerset isobase ridge has a relief of 50-80 m on the 9 ka surface and only 20-40 m on the 8.5 ka surface. Hence, the ridge appears to be a feature that had strong relief during and just after local deglaciation but that dampened quickly. In contrast, the Prince of Wales Island isobase plateau maintained its extent during this interval and the small local relief on it diminished. The plateau continued to separate northern and southern uplift centres, the amplitudes of which remained proportionally similar.

8 ka and later isobase maps

By 8 ka the Boothia-Somerset isobase ridge has disappeared but the Prince of Wales Island isobase plateau remains and is by far the best documented feature on the isobase surface. Although there are no data from Boothia Peninsula for this time the 8 ka shoreline on western Somerset Island climbs to, but does not exceed, its level on Prince of Wales Island. This suggests that by 8 ka the plateau had extended eastward across western Somerset Island, an area previously occupied by the Boothia-Somerset isobase ridge. The plateau also still extended as far westward as eastern Stefansson Island. The plateau, along with embayments in the isobase surface east and west of it, continued to separate northern and southern uplift centres and this general isobase configuration persists after 8 ka (Fig. 14G, H). The axis of the northern uplift remains apparently stable over Bathurst Island, while the orientation of isobases on the southern (Laurentide) uplift swings after 8 ka to reflect the dominance of isostatic response to late deglaciation (ca. 7 ka) of the Foxe Basin region (Dyke and Prest, 1987).

On isobase surfaces predating 8 ka, the Prince of Wales Island isobase plateau has a small but measureable tilt, but on 8 ka and younger isobase surfaces it has no measurable relief or tilt. The variation from the mean of the best control points on the isobase plateau at 8 ka is ±3 m, which is a reasonable, or even minimum, limitation on accuracy imposed by altimetry and standard radiocarbon dating errors for samples in that (55 m) elevation range. At 7 ka the isobase plateau is at 40 ± 2 m, at 6 ka at 28 ± 2 m, and at 5 ka at 20 ± 2 m.

The only control point that departs seriously from this pattern is the 30 m value at 7 ka derived from the Dolphin River emergence curve on central eastern Prince of Wales Island (Fig. 12M and 14G). That curve at 7 ka is controlled by driftwood from 30 m dated at 7100 ± 110 BP (S-2838). Although the date is accordant with younger dated driftwood on the Dolphin River curve, it is regionally anomalous and therefore, likely has been redeposited downslope by 10 m.

In geophysical terms, the crust under Prince of Wales Island and western Somerset Island, and possibly over a larger area, since 8 ka has been uplifting without tilting; shorelines of that age range have not been delevelled. The

size of the area is so large, about 400 km x 400 km minimum, that delevelling, had it occurred, would have been measurable, as it is on Somerset Island. Tilted raised shorelines are the theoretically expected result of glacioisostatic recovery. The data presented here document the first known example from glaciated North America of a large region recovering without delevelling.

DISCUSSION

Postglacial tectonics

In the part of the central Arctic where postglacial recovery is best documented, the crust during and just after deglaciation deformed into a steep sided, north-south oriented ridge in the region of Boothia Peninsula and western Somerset Island. The isobase ridge was flanked on the west by a large isobase plateau that was elevated by about 100 m but tilted very little in comparison to surrounding areas. By 8 ka the isobase ridge feature had dissipated but all of Prince of Wales Island and some adjoining areas continued to emerge without delevelling.

These crustal deformation (isobase) features are not explainable in terms of independently derived ice sheet geometries during the last glaciation. The ice divide during the last glacial maximum was located west of both the isobase ridge and the isobase plateau and generated eastward glacial flow across both areas (Dyke and Prest, 1987). Although the ice divide migrated eastward during deglaciation, it did not reach Boothia Peninsula, which was deglaciated by a westward retreating ice front. Even if a north-south oriented ice divide had overlain Boothia Peninsula and Somerset Island for a long time during the last glaciation, it would not have generated a steep-sided, ridge-shaped depression beneath it because there is very little gradient on an ice sheet surface near an ice divide. We conclude, therefore, that these unusual crustal deformation features are the results of tectonic complications of glacioisostatic rebound.

Simple spatial correlation between the Boothia-Somerset isobase ridge and the structural Boothia Arch (also known as Boothia Horst, Boothia Uplift) suggests that the Boothia Arch is the controlling feature and the chronology of the isobase ridge (9.3 to 8.5 ka) suggests that the arch was reactivated during deglaciation. During deglaciation glacioisostatically induced stresses are at their maximum. The arch did not influence the pattern of crustal recovery after 8 ka so its reactivation may have been confined to as brief an interval as 1000 years.

The Boothia Arch is the predominant structural element in the central Arctic. It has been intermittently active since late Precambrian time and was active during the Tertiary (Kerr, 1980). Today it is one of only three areas of moderately high seismicity in Canada east of the Cordillera (Basham et al., 1977). Most of its pulses of uplift were accompanied by faulting, especially along its margin. The isobase maps presented above (Fig. 14) suggest that the Holocene shorelines are deformed by arching, but this is a product of the assumption embedded in contouring data — that there is

a constant gradient between data points, i.e. no abrupt discontinuities. It is entirely possible that the early Holocene shorelines are faulted along the western side of the arch, along Peel Sound between Prince of Wales and Somerset islands. A possible solution of the 9.3 ka paleoshoreline data involving faulting is shown in Figure 15. Observations are as fully satisfied by this solution as they are by conventional contouring. The fault zone is placed along Peel Sound because there are no data points controlling the western slope of the isobase ridge (Fig. 14C). Hence, it could be an artifact of the contouring. In contrast, the eastern slope of the ridge across Somerset Island is well controlled and apparently not faulted.

Correlation between the Boothia-Somerset isobase ridge and regional structural elements is obvious, but there is no obvious regional structure that accounts for the Prince of Wales Island isobase plateau. This feature is intriguing because it is the only known example of an area of substantial isostatic recovery without delevelling. At the least, the data demonstrate that large areas can recover without delevelling side-by-side with areas that are recovering differentially. Kerr (1980) has suggested that the Canadian Arctic Archipelago is a severely rifted continental subplate, with the large interisland channels such as Peel Sound and Barrow Strait occupying deep rift valleys while the islands stand as horsts. He ascribed this rifting phase to the Tertiary. Not all Canadian Arctic geologists agree with this interpretation of the tectonic and physiographic history of the Archipelago (e.g., Thorsteinsson and Mayr, 1987), but it offers us a convenient starting point for a hypothesis of Holocene "block tectonics" in order to explain our data. Specifically, we propose that in the Arctic Archipelago island-sized crustal blocks have responded to glacioisostatic depression with some independence of style, such that some blocks have recovered without delevelling while others have been delevelled during recovery. Furthermore, some blocks may have been overcompensated compared to neighbouring blocks, thus allowing areas that had less ice load (e.g., Somerset Island) to uplift more than areas with more ice load (e.g., Prince of Wales Island). If a block can be either tilted or not tilted, it is entirely conceivable that on some blocks (islands) raised shorelines may be tilted in a direction apparently incompatible with former ice load geometry.

Andrews (1982) has pleaded that Quaternary geologists base their interpretations of former ice sheet configurations and extents on direct glacial geological evidence (e.g., striae, glacial deposits) rather than on indirect evidence such as shoreline geometry. The mismatch between glacial history and sea level history documented here for the central Arctic adds urgency to Andrews' plea. More importantly, the central Arctic data illustrate the minimum size of a paleosealevel data base that will be required from the archipelago in order to define adequately local sea level histories and test the Holocene block tectonics hypothesis. Smaller islands, like Cornwallis Island, will require at least three well controlled emergence curves from sites that form a triangle. Larger islands, like Devon and Melville, will require more.

We cannot presently identify other elements of the postglacial shoreline deformation patterns that are as likely to be tectonically controlled as are the Boothia-Somerset isobase ridge and the Prince of Wales Island isobase plateau. But the northern uplift cell, which either is centred on or has the southern end of its axis on northern Bathurst Island, bears consideration in this regard. There are two contrasting current models of the last glaciation of the Bathurst Island area. Model one proposes that Bathurst Island lay beneath the south-central part of the Innuitian Ice Sheet, which covered all or most of the Queen Elizabeth Islands (Blake, 1970; McLaren and Barnett, 1978; Mayewski et al., 1981); model two proposes that Bathurst Island, along with Melville, Cornwallis, Devon, Ellesmere and Axel Heiberg islands, supported local ice caps that were partly coalescent (England, 1976, 1987; Dyke and Prest, 1987). There was at least as much ice over the Queen Elizabeth Islands as proposed by model two because there is morphological evidence in the form of ice flow features and meltwater channels, particularly lateral channels, that large island-centred ice caps existed (Blake, 1964; Edlund, in press; Hodgson, 1989). The question is whether the ice cap phase of glaciation was preceded during the Late Wisconsinan by an ice sheet phase. If the local ice cap model is correct, the ice caps on Melville, Bathurst, Cornwallis, and Devon islands would have constituted merely an extension of the Laurentide Ice Sheet load because they were close to or coalescent with the Laurentide margin. They would not thus have generated a separate uplift centre unless deglaciation were delayed greatly after Laurentide deglaciation, and this did not occur. Even a continuous ice cover over the Queen Elizabeth Islands would not have generated a separate uplift centre (with closure of isobases) unless its axial part were thicker than the coalescent axial part of the Laurentide Ice Sheet.

The northern region of high uplift is undoubtedly real (Andrews, 1970; Blake, 1970; Walcott, 1972; Fig. 14), so there is a mismatch between the glacial history as proposed by model two and the postglacial sea level history. In light of the tectonic influences on postglacial crustal movements in the Boothia-Somerset-Prince of Wales area, possibly the high Bathurst Island uplift will resolve, with further dating, to be a tectonically influenced feature. It may be part of a larger feature correlating with the Perry Islands Fold Belt, a local feature caused by movement of an island-sized crustal block, or something not presently predictable. It remains possible that there is a simple correlation between emergence pattern and ice sheet configuration as in model one, but the reasoning here is circular for the model one ice extent and thickness configuration is based exclusively on the shoreline deformation data. Discussion of this critical issue has tended to travel the endless loop it was set upon nearly 20 years ago. The most productive future line of inquiry will be exploring the possible correlation between postglacial shoreline deformation and known (e.g., fold belts) or possible (e.g., island-size blocks) tectonic structures. In the meantime paleoglaciological reconstructions should rely entirely upon glacial geology rather than shoreline deformation data.

There is one indication that the Bathurst Island postglacial uplift high is not simply glacioisostatic. Isobase values on the 9.3 ka to 6 ka maps (Fig. 14) decline from northern Bathurst Island to northern Prince of Wales Island and ascend again to the southern (Laurentide) high south of Prince of Wales Island. A simple glacioisostatic interpretation would be that the boundary between the isostatic domains of the Laurentide and Innuitian ice sheets lay east to west across central Prince of Wales Island. This can be categorically rejected because there is clear evidence that the Laurentide Ice Sheet extended into and across Viscount Melville Sound, which requires that the ice load increased southward across Prince of Wales Island, not northward from Prince of Wales Island to northern Bathurst Island; meanwhile, there is no evidence that any archipelago-centred ice sheet ever flowed southward across Prince of Wales, let alone during the last glaciation. So there is a mismatch between the southern slope of the Bathurst Island isobase high and known Late Wisconsinan glacial history which suggests an overriding tectonic control.

Possible postglacial tectonic lineaments

If major tectonic structures of the scale of the Boothia Arch were reactivated during deglacial and postglacial time, especially if early Holocene shorelines are fragmented by faults with a collective throw of 60 to 100 m (Fig. 15), we might expect to find fault traces of postglacial age, especially in the vicinity of Peel Sound. There are no major escarpments in the region that can be assigned a postglacial tectonic origin. No likely postglacial fault traces were observed during mapping of Somerset Island or Boothia Peninsula. But along the Peel Sound coast of Prince of Wales Island there are groups of minor postglacial lineaments that may be tectonic. These lineaments occur at only a few sites and they have various expressions. The most common orientation is parallel to Peel Sound.

On Dixon Island, a small island off the southeast coast of Prince of Wales Island, two parallel sets of lineaments, with a difference in orientation of about 30°, cross raised beach ridges and till (Fig. 16). Where the lineaments cross raised gravel beaches they have the form of V-shaped trenches that

9.3 ka

Hypothetical fault zone . . . . . . ▨▨▨▨▨▨▨
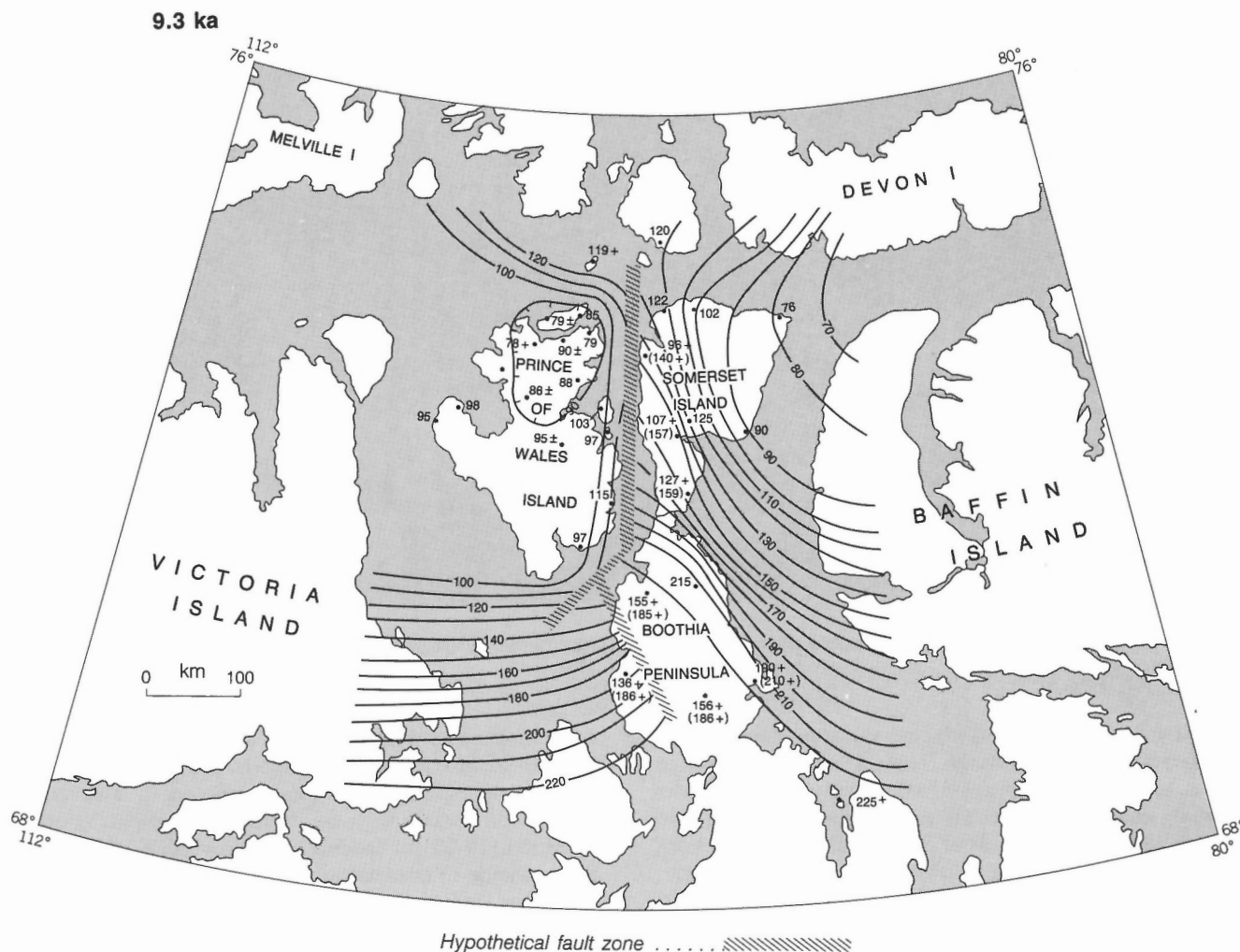
Figure 15. Isobase map for 9.3 ka showing hypothetical fault zones.

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Figure 16. Possible postglacial tectonic lineaments (arrows) on Dixon Island.

resemble ice wedge troughs, which result from thermal contraction cracking during winter. They differ from ice wedge troughs and other kinds of frost fissures only in their greater continuity and in their lack of microtopographic control. Ice wedge troughs or other kinds of periglacial frost fissures are ubiquitous on gravel and sand substrates in the central Arctic, as they are at this site. But normally ice wedge troughs on flights of raised beaches form rectangular polygons, with the long sides seated in the raised strandlines and the short sides connecting at right angles across the swales. The lineaments of interest here cross entire flights of raised beaches obliquely and continue across other materials (Fig. 16). Where the

same lineaments were traced across till, they are picked out by lines of active looking mudboils with fresh unvegetated centres. Conglomerate bedrock exposed in a stream cut through till on line with one of these lineaments is closely fractured (10-20 cm spacing) by two vertical joint systems that coincide in orientation with the two sets of lineaments that cross the beaches. The fractures interrupt the glacially polished and striated bedrock surface. Because finely fractured rock would not have survived glacial erosion capable of faceting, polishing, and striating, the fractures must postdate glacial erosion. Although identical rock fractures can be caused by periglacial processes, the alignment of the

Figure 17. Possible postglacial tectonic lineaments (arrows) north of Flexure Bay, Prince of Wales Island. A) vertical view, B,C) oblique aerial views.

fractures with the lineaments that cross both the raised beaches and till suggests that they all have a common origin. No lateral or vertical offset was noted on either the rock fractures or the trenches crossing the raised beaches.

Similar parallel, north-south lineaments cross raised beaches, till, and Precambrian granitic bedrock just north of Flexure Bay on the Peel Sound coast (Fig. 17). Again, where the lineaments cross raised beach gravels they have the form of V-shaped trenches similar to ice wedge troughs, and where they cross till there are alignments of mudboils that look more active than those on either side. Here the lineaments are undoubtedly bedrock seated, for they can be traced into small rock scarps. These scarps are about 1 m or less high and all (about 6-10 features) are east facing. If these small scarps represent postglacial offsets by faulting, the east faces should be devoid of glacially abraded facets, glacial polish, or striae. All the east faces examined are glacially unmodified, whereas the horizontal rock facets above the scarps and westward

sloping outcrops commonly display signs of glacial abrasion. At a few sites the rock scarps have a dark green mineral coating on the pink granite, and this coating has sets of sweeping, steeply inclined scratches that may have formed during movement of rock faces against each other. They are definitely not glacial striae and their unweathered nature indicates that they have been subaerially exposed only during postglacial time. If these small features are postglacial faults, the throw is down to the east by a few metres collectively. This is the reverse of the direction postulated for offset of the 9.3 ka shoreline (Fig. 15) and may indicate that the style of faulting was not simple. The lineaments north of Flexure Bay cross raised beaches that are of middle and late Holocene age and the lineaments on Dixon Island cross raised beaches that descend to within a few metres of the presently active beach. If they are of tectonic origin then minor tectonism has continued until present. This is not surprising in light of the current seismicity of the Boothia Arch.
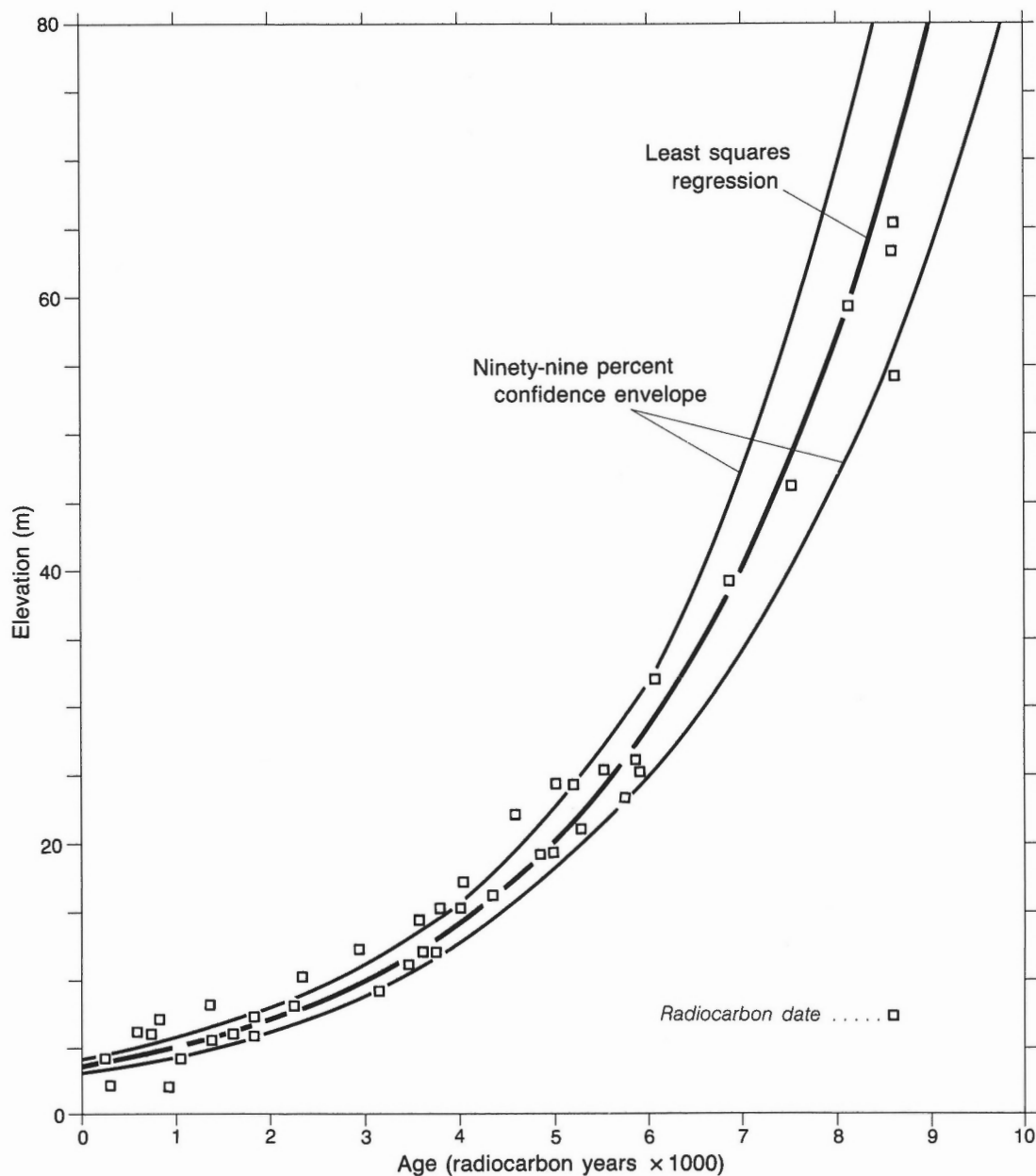
Figure 18. Exponential least squares regression relative sea level curve for Prince of Wales Island based entirely on driftwood dates.

Emergence curve form

Because shorelines dating about 8 ka and younger on Prince of Wales Island are not delevelled, the sea level history since 8 ka can be defined by a single curve for the entire island. Furthermore, because of the large number of dated driftwood samples available (46), this curve can be based on the singly most suitable material for radiocarbon dating and on the material that is least ambiguous in respect to its relationship to former sea level positions. Measurement errors are reasonably small and can place a dated sample either slightly above or slightly below the true curve, in the case of elevation measurements, or slightly on the old side or on the young side

of the curve, in the case of radiocarbon counting errors. Also ice push can move driftwood slightly above its contemporary sea level, whereas refloatation, solifluction, or stream action can move wood downslope after initial standing. Hence all potential sources of error or noise (elevation measurement, age measurement, sample movement) create a more or less equal tendency for driftwood samples to plot above or below the true emergence curve. Therefore, it is appropriate to define the emergence curve for Prince of Wales Island by fitting the driftwood data with a least squares regression curve (Fig. 18). It would not be appropriate to apply the same technique to the shell or whale bone data because these materials can fall only on or below an emergence curve.
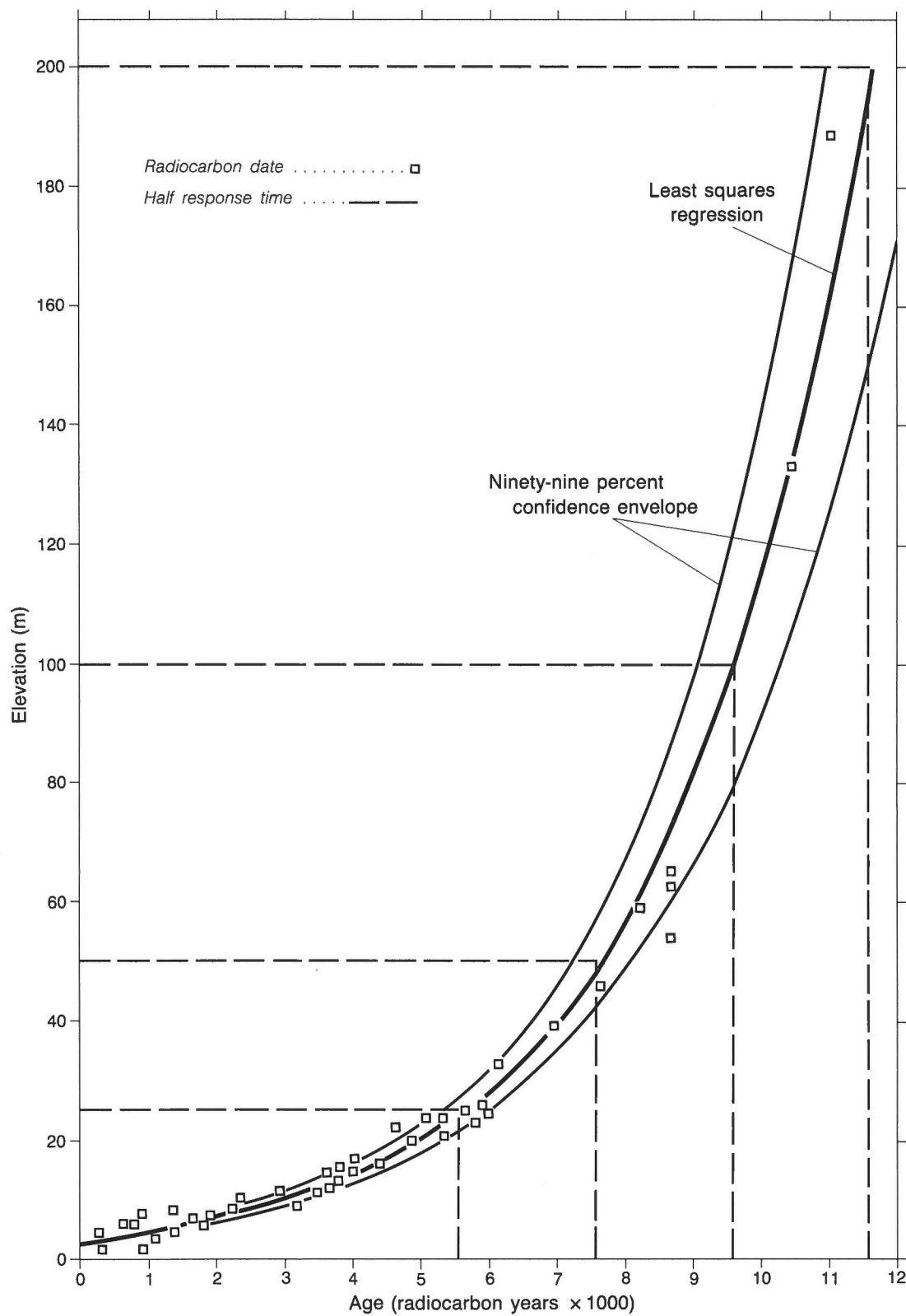
Figure 19. Exponential least squares regression relative sea level curve for Prince of Wales Island based on driftwood dates and two high-level shell dates.

The Prince of Wales Island driftwood data are well described by an exponential curve (Fig. 18). This curve is based on 41 of the 46 driftwood dates excluding those thought to have been moved by man or redeposited far downslope (see discussions above). The correlation coefficient of 0.96 and r^2 value of 92.88% are improved over values from a linear regression of 0.93 and 86.93%, respectively. The relatively high correlation coefficient and amount of variance explained by the linear regression reflects the fact that the data are from the lower half of the elevational range below marine limit. When two nonwood (shell) dates are added to define the top part of the curve (Fig. 19), the correlation coefficient and r^2 values for the exponential fit increase further to 0.97 and 94.72%, respectively, whereas the same parameters for the linear fit drop to 0.82 (from 0.93) and 67.93% (from 86.93%). The two shell dates added to the curve are those pertaining to local marine limits of 188 m (S-2708, 11 005 ± 170 BP) and 133 m (S-2709, 10 435 ± 160 BP), both within the Arabella Bay sample area. Because the samples pertain to local marine limits, that is, to discrete local shorelines, they should, like driftwood, fall on the curves or within the limits of error. Hence, the curve of Figure 19 is an objective reconstruction of the emergence history of one of the first parts of Prince of Wales Island to have been deglaciated, the Arabella Bay area. The part of the curve above about 65 m is valid only for that area but the part below 65 m is valid for all of Prince of Wales and neighbouring smaller islands. The envelopes bracketing the curves (Fig. 18 and 19) are the 99% confidence limits.

The young ends of the curves (Fig. 18, 19) are not entirely realistic because they intersect the y-axis slightly above the origin (present sea level). This indicates that, at least in the lower 5 to 10 m or so, upslope displacement of driftwood by sea ice push predominates over downslope displacement by other processes. As noted above, morphological evidence of past disturbance of raised beaches by sea ice on Prince of Wales Island is conspicuous in the lower 10 m and particularly the lower 5 m. Hence, the lower part of the curve can be subjectively improved simply by drawing a straight line from the origin to the point at which it becomes tangential to the exponential curve at about 3 ka.

The part of the emergence curve of most use to archeologists, who routinely use emergence data as an aid in prospecting for paleoeskimo coastal habitations and also for providing maximum ages on sites, is the part for the last 5 ka. The best controlled subjectively drawn local emergence curves (Fig. 12) as well as the least squares exponential curves (Fig. 18, 19) all place the 5 ka shoreline at 20 m. A sufficiently accurate rule of thumb to apply in the field on Prince of Wales Island is that relative sea level has fallen at a constant rate from 20 m at 5 ka, or at 40 cm/century. Current emergence rates are approximately the same.

The subjectively drawn Arabella Bay curve gives an average emergence rate during the interval of local deglaciation of the sample area of that curve of 9.6 m/century for about 5 centuries. This is similar to early postglacial emergence rates calculated for northern Somerset Island (Dyke, 1979) and Cape Storm (Blake, 1975). The least squares regression curve (Fig. 19) indicates a lower emergence rate in early postglacial because the 188 m marine limit date falls above the curve. The subjective curve is probably more reliable in the early stages of emergence because there is no reason to believe that the 188 m elevation measurement is in error by 30 m.

The best fit exponential curve for Prince of Wales Island has a half-response time of 2000 years, with relative sea level at 200 m at 11.6 ka, 100 m at 9.6 ka, 50 m at 7.6 ka, and 25 m at 5.6 ka. A fundamental question, central to the benchmark study of Andrews (1970), is whether postglacial emergence curves from all sites have the same response times or whether response time is geographically variable. If the half-response time is the same everywhere, curves can be constructed from very few good paleosea-level dates; if the half-response time is geographically variable there is less opportunity for economy of effort, but mapping the variability would allow us to determine the factor(s) that controls the response time (e.g., ice load history, crustal property).

Andrews (1970) concluded from his inspection of 21 preliminary curves from Arctic Canada (as available, July 1967) that, for similar recovery periods, the half-response time was the same for all curves. He computed a half-response time for these "uplift" curves (eustatically "corrected" emergence curves) of about 1800 years. Because uplift curves are steeper than emergence curves, the half-response time of the uncorrected curves used by Andrews would be more than 1800 years, likely close to 2000 years, as for the Prince of Wales Island curve. Most of the 21 curves used by Andrews were poorly controlled as studies of postglacial rebound were then in their early stages; this tended to make his conclusion regarding predictability of curve form less convincing. The closely similar half-response times of the Prince of Wales Island least squares curve and that of the 21 curves used by Andrews from widely scattered sites in Arctic Canada suggests that Andrews' basic thesis may be correct. Although we clearly need several more well dated curves to adequately confirm this, and although some areas may have emerged differently because of tectonic complications, it is significant that the Cape Storm curve can also be approximated well by a curve with a half-response time of 2000 years. The Prince of Wales Island curve further demonstrates that, despite the tectonic influence on rebound of the island, the form of the recovery through time remained normal.

Future research

The major lesson of this research may be that the patterns of postglacial crustal recovery are much more complicated than we have thought and that the magnitudes of postglacial tectonic movement may be much larger than we have suspected. We have not detected this previously because the quality and quantity of postglacial sea level data have been inadequate. But when adequate data are available we cannot only determine the magnitudes of tectonic movements to within metres but we can bracket the tectonism in time within two to three centuries.

As long as we have only one or two relative sea level curves for each of the islands in the Arctic Archipelago, especially if these are minimum curves based on widely scattered samples, we will always draw smooth isobase solutions to the form of any given age of raised shoreline and the deformation patterns indicated by these isobases will always be compatible with a conceivable ice load history. The real patterns may be much different and our data suggest that these will be revealed only when we have several well controlled relative sea level curves for each island. Each island, or large part thereof, should be considered a potential crustal block that may exhibit a pattern of postglacial emergence incongruous with that of a neighbouring block.

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Table 1. Radiocarbon dates used in constructing emergence curves for the central Arctic.

Laboratory no.	14C Date (years BP)			Material	Elevation (m)	Elevation method	Altimetry time interval (minutes)	Location	Comments
1. Cape Richard Collinson area and vicinity (Fig. 12A)[1]									
GSC-4398	1400	±	50	Wood	5	altimetry	2	72°54.5'N, 102°38'W	partly enclosed in beach gravel
GSC-4478	1860	±	70	Wood	6.5-7.0	altimetry	2	72°53'N, 102°37'W	from surface of beach gravel
GSC-4387	4070	±	60	Wood	17.0-17.5	altimetry	9	72°55'N, 102°37'W	from surface of beach gravel
S-2919	4550	±	90	Bowhead ear bone	16.5	altimetry	9	72°50'N, 102°44'W	partly enclosed in beach gravel
GSC-4479	4630	±	60	Wood	22	altimetry	6.5	72°57'N, 102°32'W	from surface of beach gravel
GSC-4361	5270	±	70	Wood	24	altimetry	10	72°53'N, 102°33'W	from surface of till
S-2964	8555	±	165	Bowhead ear bone	57	altimetry	22	72°51'N, 102°35'W	partly enclosed in soliflucted till
GSC-4343	8680	±	90	Wood	59	altimetry	23	72°54'N, 102°34'W	partly enclosed in silt
GSC-4528	8920	±	120	Shells	33.5	altimetry	18	72°52'N, 102°31'W	from surface of stony clay
S-2922	10 000	±	145	Bowhead skull	66.5	altimetry	38	72°56'N, 102°28'W	partly enclosed in soliflucted till
S-2916	10 005	±	120	Bowhead skull	62	altimetry & map	69	72°42'N, 102°22'W	partly enclosed in silt
2. Hollist Point area and vicinity (Fig. 12B)[1]									
GSC-3977	920	±	60	Wood	2.0-2.3	altimetry	3	72°52'N, 101°30'W	from surface of till
GSC-3945	1060	±	50	Wood	3.5-4.0	altimetry	3	72°53'N, 101°33'W	partly enclosed in cryoturbated till
GSC-3962	3660	±	60	Wood	12	altimetry	5	72°51'N, 101°33'W	from surface of beach gravel
S-2589	4155	±	100	Bowhead vertebra	12	altimetry	5	72°50.0'N, 101°32'W	partly enclosed in beach gravel
GSC-4025	8225	±	80	Shells	38	altimetry	10	73°5'N, 101°58'W	from silt and sand with dropstones
GSC-3936	8230	±	110	Wood	58.5	altimetry	10	73°2'N, 101°54'W	from surface of beach gravel
S-2588	8875	±	135	Bowhead rib	58	altimetry	10	73°2'N, 101°54'W	from surface of beach gravel
S-2590	9605	±	140	Bowhead rib	66	altimetry & map	30	72°49.5'N, 101°58'W	from surface of silt
S-2683	10 070	±	150	Shells	70	altimetry & map	60	72°46'N, 102°7'W	from surface of large glaciomarine silt deposit
3. Drake Bay area (Fig. 12C)[1]									
S-2914	4180	±	80	Narwhal tusk	12	altimetry	2.5	73°22'N, 100°22'W	partly enclosed in colluviated till
S-2910	9000	±	130	Bowhead ear bone	59	altimetry	15	73°19'N, 100°36'W	entirely enclosed in beach gravel
GSC-600	9200	±	150	Shells	59	altimetry		73°23'N, 100°40'W	from surface
GSC-4527	9350	±	110	Shells	96	altimetry	13	73°23'N, 100°29'W	from surface of beach gravel
GSC-4408	10 100	±	100	Shells	104	altimetry & map	120	73°27.5'N, 100°54'W	from surface of stony clay
4. Smith Bay area (Fig. 12D)[1]									
GSC-4412	130	±	70	Wood	32	altimetry	2	73°14'N, 99°59'W	from surface of beach gravel
GSC-4428	2350	±	60	Wood	10	altimetry	3	73°11'N, 99°59'W	from surface of beach gravel
GSC-4427	4020	±	70	Wood	15	altimetry	3.5	73°12'N, 99°57'W	from surface of beach gravel
GSC-4417	5910	±	80	Wood	25.5	altimetry	5	73°11.5'N, 100°2'W	partly enclosed in beach gravel
S-2911	7075	±	120	Narwhal tusk	7	altimetry	45	73°14'N, 99°45'W	partly enclosed in stony clay
GSC-4525	8640	±	110	Shells	40	map		73°10.5'N, 99°27'W	from surface of stony clay
S-2917	8875	±	120	Bowhead jawbone	65	altimetry	11	73°18'N, 100°8'W	partly enclosed in beach gravel
S-2923	8990	±	130	Bowhead skull	61.5	altimetry	14	73°14'N, 99°27'W	partly enclosed in soliflucted till
S-2912	9440	±	135	Bowhead ear bone	70	altimetry	3	73°13'N, 99°26'W	partly enclosed in beach gravel
S-2918	9505	±	120	Bowhead ear bone	74.5	altimetry	5	73°4'N, 99°28'W	partly enclosed in beach gravel
5. Arabella Bay area (Fig. 12E)[1]									
S-2592	3025	±	90	Bowhead rib	7	altimetry	3	73°46'N, 100°2'W	partly enclosed in soliflucted till
S-2587	3720	±	95	Shells	2-3.5	altimetry	4	73°41'N, 99°8'W	from silt below terrace at 6 m
S-2427	4490	±	70	Shells	15-17	altimetry	19	73°43'N, 99°17'W	from silt below delta terrace at 19.5 m
GSC-4241	6570	±	80	Shells	8-10	altimetry	23	73°42'N, 99°15'W	from deltaic sand below terrace at 13 m
GSC-3975	8410	±	140	Shells	45	map		73°36'N, 100°22'W	from stony diamicton
GSC-4033	8970	±	90	Shells	59.5	altimetry	10	73°43'N, 100°0'W	from delta topset gravel
S-2709	10 435	±	160	Shells	120	altimetry	30	73°39'N, 99°30'W	from stony silt and clay in front of delta terrace at 133 m
S-2591	10 530	±	145	Bowhead skull	54	altimetry	10	73°43'N, 100°0'W	partly enclosed in soliflucted till
S-2708	11 005	±	170	Shells	133	altimetry	30	73°47'N, 99°46'W	from slumped stony clay
6. Northwestern Russell Island area (Fig. 12F)[2]									
I-11769	575	±	75	Fox bone	4				from Thule site
GSC-2300	1800	±	50	Wood	5.7	levelling		73°57.5'N, 98°58'W	partly enclosed in beach gravel
S-2672	2075	±	135	Narwhal tusk	9	levelling		73°56'N, 99°17.5'W	partly enclosed in beach gravel
GSC-3978	2930	±	60	Wood	12.1	levelling		73°56.5'N, 99°11'W	partly enclosed in beach gravel
GSC-2240	3630	±	60	Wood	14.3	levelling		73°57'N, 98°59'W	from surface of beach gravel
S-2662	3675	±	110	Bowhead rib	14.6	levelling		74°2.5'N, 98°36'W	partly enclosed in beach gravel
GSC-4002	3820	±	70	Wood	14.7	levelling		74°2'N, 98°34'W	partly enclosed in beach gravel
GSC-3999	5100	±	100	Shells	12	levelling		73°58'N, 98°46'W	from silt

Table 1 (cont'd.)

Laboratory no.	^{14}C Date (years BP)			Material	Elevation (m)	Elevation method	Altimetry time interval (minutes)	Location	Comments

7. Eastern Russell Island area (Fig. 12G)[2]

Laboratory no.	^{14}C Date (years BP)			Material	Elevation (m)	Elevation method	Altimetry time interval (minutes)	Location	Comments
S-2667	<100			Bowhead vertebra	3.56	levelling		74°6.5'N, 97°50'W	age too young for elevation; from surface of beach gravel
S-2669	355	±	115	Seal bone	85.04	levelling		74°2.5'N, 97°38'W	age too young for elevation; from surface of beach sand
S-2663	620	±	235	Seal bone	25.4	levelling		74°6'N, 97°59.5'W	age too young for elevation; from surface of beach gravel
S-2666	1565	±	125	Bowhead	61.34	levelling		74°0.5'N, 98°3.5'W	age too young for elevation; from surface of beach gravel
GSC-4001	2250	±	60	Wood	8.23	levelling		74°6.5'N, 97°45'W	partly enclosed in beach gravel
S-2670	2590	±	140	Bowhead skull	16.08	levelling		74°N, 97°42'W	age too young for elevation; partly enclosed in beach gravel
S-2671	3685	±	155	Bowhead	10.8	levelling		74°0.5'N, 97°39'W	partly enclosed in beach sand and gravel
S-2664	4510	±	165	Bowhead	15.6	levelling		74°7.5'N, 97°44'W	from surface of beach gravel
S-2668	5535	±	475	Bowhead skull	36.65	levelling		74°1.5'N, 97°37.5'W	age too young for elevation; partly enclosed in beach gravel
S-2665	5910	±	195	Seal bone	39.86	levelling		74°5'N, 98°9'W	age too young for elevation; partly enclosed inbeach sand
GSC-3994	9360	±	150	Shells	84.5	altimetry		73°55'N, 98°14'W	from surface of till

8. Allen Lake area (Fig. 12H)[1]

Laboratory no.	^{14}C Date (years BP)			Material	Elevation (m)	Elevation method	Altimetry time interval (minutes)	Location	Comments
S-2585	1890	±	90	Shells	0	altimetry	1	73°47.5'N, 98°27'W	from sand below delta terrace at 4 m
S-2586	4770	±	100	Shells	3.5-6.5	altimetry	4	73°47'N, 98°27'W	from slumped sand below delta terrace at 9.5 m
S-2680	8890	±	130	Shells	68	altimetry		73°41.5'N, 98°35'W	from surface of sand
S-2593	9285	±	135	Bowhead skull	71	altimetry		73°37'N, 98°38'W	partly enclosed in soliflucted till
GSC-3954	9660	±	90	Shells	70-88	altimetry & map	36	73°45'N, 98°17'W	from silt and sand with dropstones

9. Cape Hardy area (Fig. 12I)[1]

Laboratory no.	^{14}C Date (years BP)			Material	Elevation (m)	Elevation method	Altimetry time interval (minutes)	Location	Comments
S-2704	765	±	65	Wood	6.0-6.5	altimetry	5	73°52'N, 97°21'W	from surface of till
S-2711	3500	±	80	Bowhead vertebra	11.5	altimetry	3	73°47'N, 97°5'W	partly enclosed in beach gravel
S-2703	4945	±	95	Wood	18.0-18.5	altimetry	8	73°4'N, 97°00'W	enclosed in beach gravel
S-2705	5595	±	100	Wood	25	altimetry	16	73°51.5'N, 97°30'W	enclosed in beach gravel
S-2707	8645	±	135	Bowhead jaw	51.5	altimetry	16	73°50.5'N, 97°17'W	partly enclosed in cryoturbated till
S-2702	8695	±	130	Wood	64.5	altimetry	28	73°49.5'N, 97°26'W	enclosed in beach gravel
GSC-4250	9280	±	90	Shells	20	altimetry		73°49'N, 97°32.5'W	from stony mud
S-2706	9375	±	140	Bowhead skull	69-71	altimetry	15	73°44.5'N, 97°41'W	partly enclosed in beach gravel
S-2710	9845	±	150	Shells	95	altimetry	15	73°47.5'N, 97°42'W	from beach gravel and foreset sand

10. Browne Bay area and vicinity (Fig. 12J)[1]

Laboratory no.	^{14}C Date (years BP)			Material	Elevation (m)	Elevation method	Altimetry time interval (minutes)	Location	Comments
S-2689	1210	±	240	Plant detritus	4	altimetry	2	73°18'N, 97°46'W	interbedded with sand below beach at 4 m
S-2688	2750	±	70	Shells	4	altimetry	2	73°18'N, 97°46'W	from beach sand above S-2689
GSC-4045	2920	±	60	Plant detritus	7.5	altimetry	2	73°18.5'N, 97°42'W	interbedded with sand below beach at 7.5 m from paleoeskimo site
I-12137	3520	±	90	Fox bone	17.5				
GSC-4031	3760	±	80	Shell	7 5	altimetry	2	73°18.5'N, 97°42'W	from beach sand above GSC-4045
S-2679	7620	±	220	Plant detritus	47.5	altimetry	5	73°23'N, 97°55'W	interbedded with sand below beach at 49.5 m
S-2684	8515	±	125	Shells	42	altimetry		73°23'N, 97°50'W	from beach sand
S-2685	9280	±	140	Shells	80	altimetry & map		73°29'N, 98°20'W	from surface of silt
GSC-3697	9470	±	100	Shells	85	altimetry		73°10.5'N, 98°33'W	from sand, silt, and clay

11. Prescott Island area (Fig. 12K)[1]

Laboratory no.	^{14}C Date (years BP)			Material	Elevation (m)	Elevation method	Altimetry time interval (minutes)	Location	Comments
GSC-4447	70	±	50	Wood	32	altimetry	5	72°58'N, 97 2°2'W	from surface of beach gravel
GSC-4457	560	±	60	Wood	12.5	altimetry	3	73°7'N, 97°6'W	from surface of beach gravel
GSC-4458	1380	±	60	Wood	8	altimetry	1.5	73°8'N, 96°42'W	from surface of beach gravel
S-2920	1585	±	70	Bowhead ear bone	3.5	altimetry	0.5	73°3'N, 97°7'W	partly enclosed in beach gravel
S-2921	3315	±	75	Bowhead ear bone	9	altimetry	3.5	73°6'N, 97°7'W	partly enclosed in beach gravel
GSC-4503	3470	±	70	Wood	11	altimetry	1.5	73°9'N, 96°43'W	partly enclosed in beach gravel
S-2915	4635	±	80	Bowhead ear bone	14	altimetry	5	73°9.5'N, 96°43'W	enclosed in beach sand
GSC-4456	5070	±	90	Wood	23.5	altimetry	4	73°7'N, 97°4'W	partly enclosed in beach sand
GSC-4459	5300	±	80	Wood	21.0-21.5	altimetry	6	73°9'N, 96°44'W	partly enclosed in sand in swale between beach ridges
GSC-4524	6960	±	110	Shells	20	altimetry	3	73°3'N, 97°6'W	from foreset beds below a 36.5 m terrace
GSC-4523	8310	±	120	Shells	44-46	altimetry	5	73°3'N, 97°6'W	from stony clay below a terrace at 49 m
GSC-4515	8650	±	120	Shells	65	altimetry	13	73°1.5'N, 97°3.5'W	from surface of deltaic sand and gravel
S-2965	8765	±	160	Bowhead ear bone	50.5	altimetry	7	73°8'N, 97°3'W	from surface of bedrock
GSC-4442	9080	±	90	Shells	107	altimetry & map	50	73°6.5'N, 96°48'W	from surface of stony mud
S-2913	9335	±	145	Bowhead ear bone	57.5	altimetry	14	73°1'N, 97°3'W	from surface deflated deltaic sand

Table 1 (cont'd.)

Laboratory no.	14C Date (years BP)			Material	Elevation (m)	Elevation method	Altimetry time interval (minutes)	Location	Comments

12. Muskox Hill – Pandora Island area (Fig. 12L) and nearby site[3]

Laboratory no.	14C Date (years BP)			Material	Elevation (m)	Elevation method	Altimetry time interval (minutes)	Location	Comments
S-2714	275	±	105	Wood	4	altimetry	1	72°52'N, 97°23'W	partly enclosed in beach gravel
S-2833	315	±	60	Wood	2	altimetry	1	72°53'N, 96°49'W	from surface of beach sand
S-2834	845	±	60	Wood	7	altimetry	2	72°51'N, 96°54'W	from surface of beach sand
S-2715	2270	±	230	Bowhead	10	altimetry	25	72°52'N, 97°17'W	partly enclosed beach gravel
S-2829	5795	±	90	Wood	23	altimetry	8	72°46'N, 96°53'W	partly enclosed in beach sand
S-2832	8265	±	120	Wood	10	altimetry	5	72°51'N, 96°52'W	from surface of beach sand
S-2835	8565	±	125	Bowhead	66	altimetry	6	72°53'N, 96°47'W	enclosed in beach sand
S-2864	8655	±	130	Bowhead	68	altimetry	45	72°53'N, 97°30'W	partly enclosed in beach gravel
S-2716	8905	±	405	Bowhead	100	altimetry	120	72°49'N, 97°18'W	partly enclosed in beach gravel
S-2828	9140	±	130	Shells	94	altimetry	23	72°53'N, 96°53'W	from surface of beach sand
S-2720	8660	±	395	Wood	54	altimetry	90	72°36'N, 97°00'W	partly enclosed in gravel in creek bed

13. Dolphin River area (Fig. 12M) and adjacent site[3]

Laboratory no.	14C Date (years BP)			Material	Elevation (m)	Elevation method	Altimetry time interval (minutes)	Location	Comments
S-2859	605	±	65	Wood	6	altimetry	19	72°55'N, 98°22'W	small fragments in beach gravel
S-2837	3765	±	80	Wood	12	altimetry	60	72°49'N, 98°29'W	partly enclosed in beach gravel
S-2839	4890	±	90	Wood	19	altimetry	11	72°50'N, 98°27'W	partly enclosed in beach gravel
S-2831	5965	±	95	Wood	25	altimetry	5	72°46'N, 98°35'W	partly enclosed in beach gravel
S-2838	7100	±	110	Wood	30	altimetry	15	72°46'N, 98°34'W	partly enclosed in beach gravel
S-2836	9040	±	130	Bowhead	79.5	altimetry	34	72°40'N, 98°17'W	partly enclosed in beach gravel
GSC-235	6740	±	150	Shells	18			72°37'N, 98°27'W	from sand

14. Guillemard Bay area (Fig. 12N) and other sites on southern Prince of Wales Island[3]

Laboratory no.	14C Date (years BP)			Material	Elevation (m)	Elevation method	Altimetry time interval (minutes)	Location	Comments
GSC-3989	4400	±	70	Wood	16	altimetry	50	71°41'N, 98°08'W	enclosed in beach gravel
S-2861	4505	±	85	Bowhead	18	altimetry	5	71°40'N, 98°24'W	partly enclosed in beach gravel
S-2600	4870	±	95	Bowhead rib	17	altimetry	35	71°40'N, 97°15.5'W	partly enclosed in beach gravel
GSC-3985	6100	±	80	Wood	31.5	altimetry	80	71°39.5'N, 97°21'W	enclosed in beach gravel
GSC-3967	6910	±	80	Wood	39	altimetry	110	71°39.5'N, 97°22'W	enclosed in beach gravel
S-2601	6940	±	155	Bowhead	48	altimetry	120	71°41'N, 97°15.5'W	partly enclosed in beach gravel
S-2602	7650	±	120	Bowhead rib	98	altimetry	180	71°36'N, 97°21'W	age too young for elevation; partly enclosed in beach gravel
S-2604	8520	±	190	Bowhead rib	84	altimetry	270	71°36'N, 97°21'W	partly enclosed in beach gravel
S-2603	8675	±	135	Bowhead rib	75.5	altimetry	40	71°35.5'N, 97°21'W	partly enclosed in beach gravel
S-2718	1620	±	220	Wood	6	altimetry	1	71°22'N, 98°54'W	from surface of beach gravel
S-2717	1900	±	325	Wood	2	altimetry	1	71°29'N, 99°24'W	from surface of gravel between beach ridges
S-2860	3170	±	75	Wood	9	altimetry	10	72°51'N, 99°52'W	small piece in swale between beach ridges
S-2830	6630	±	100	Wood	26	altimetry	25	71°51'N, 99°38'W	partly enclosed in beach gravel
S-2719	7620	±	345	Wood	46	altimetry	20	71°57'N, 98°56'W	partly enclosed in beach gravel
S-2594	6660	±	160	Bowhead	81	altimetry	10	71°50.5'N, 98°10'W	age too young for elevation; partly enclosed in beach gravel
S-2598	8630	±	195	Bowhead	81 5	altimetry	10	72°10'N, 97°51'W	partly enclosed in beach gravel
GSC-4049	9190	±	170	Shells	97	altimetry	20	72°13.5'N, 97°31'W	from surface of marine silt in front of small for delta
S-2597	9225	±	215	Bowhead skull	99	altimetry	15	72°10.5'N, 97°51'W	partly enclosed in beach gravel
S-2599	8645	±	205	Bowhead	87	altimetry	50	72°0.5'N, 96°30.5'W	partly enclosed in beach gravel
GSC-3996	8940	±	130	Shells	115.5	altimetry	115	72°5.5'N, 96°33'W	from surface and active layer of marine silt
S-2862	360	±	65	Wood	2.5	altimetry	1	72°33'N, 96°26'W	from surface of beach gravels
L-571B	9200	±	160	Shells	115				
S-2863	4370	±	85	Wood	4	altimetry	1	72°19'N, 96°51'W	from surface of beach gravel
S-2596	660	±	95	Seal bone(?)	4	altimetry	5	71°50.5'N, 98°10.5'W	partly enclosed in beach gravel
S-2595	6275	±	175	Bowhead vertebra	103	altimetry	35	71°51'N, 98°5.5'W	age too young for elevation; partly enclosed in beach gravel

15. Winter Harbour area, Melville Island (Fig. 13A)

Laboratory no.	14C Date (years BP)			Material	Elevation (m)	Elevation method	Altimetry time interval (minutes)	Location	Comments
I-842	625	±	100	Wood	1.6	levelling		74°50'N, 110°25'W	enclosed in beach
GSC-663	5750	±	130	Shells	3			74°47.5'N, 110°39'W	from surface of sand and silt adjacent to 7 m delta terrace
GSC-668	8700	±	160	Shells	8			74°48'N, 110°38'W	from 1-2 m deep gullies in beach
GSC-666	8960	±	140	Shells	8			74°48'N, 110°38'W	same location as GSC-668
GSC-2060	8980	±	400	Marine algae	27			74°47.5'N, 112°32.5'W	from beach
GSC-339	9550	±	160	Shells	20	levelling		74°43.7'N, 110°41'W	from surface of silt and sand
GSC-665	9620	±	150	Shells	20	levelling		74°47.2'N, 110°40.5'W	from surface of sand and silt below delta terrace at 25 m
GSC-3122	10 200	±	100	Shells	45			72°4.2'N, 108°50'W	from surface of sand and silt below delta terrace at 48 m
GSC-278	10 340	±	150	Shells	55	levelling		74°41'N, 110°57 5'W	from surface of sand and silt
GSC-786	10 900	±	150	Shells	79	levelling		74°43.4'N, 110°52'W	from surface of till
GSC-3111	11 400	±	130	Shells	82			74°32.7'N, 111°32.5'W	from silt below till
GSC-3249	11 700	±	100	Shells	58			74°37.7'N, 111°42'W	from surface of silt

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Table 1 (cont'd.)

Laboratory no.	^{14}C Date (years BP)			Material	Elevation (m)			Elevation method	Altimetry time interval (minutes)	Location	Comments

16. Southeastern Melville Island area (Fig. 13B)

Laboratory no.	^{14}C Date (years BP)			Material	Elevation (m)			Elevation method	Altimetry time interval (minutes)	Location	Comments
GSC-1826	70	±	80	Wood	0.15			altimetry		75°38'N, 105°23'W	
GSC-2089	5400	±	410	Plant detritus	14.6			levelling		75°4.2'N, 106°6'W	from deltaic sediments
GSC-2092	5940	±	150	Plant detritus	13			levelling		75°19.8'N, 106°16'W	from deltaic foresets
GSC-2114	6630	±	100	Plant detritus	6			levelling		75°20'N, 106°16'W	from deltaic foresets in same section as GSC-2092
I-841	7565	±	235	Shells	22			levelling			from surface of sand
GSC-1981	9680	±	90	Shells	98			altimetry		75°53'N, 105°35'W	from delta

17. Central Bathurst Island area (Fig. 13C)

Laboratory no.	^{14}C Date (years BP)			Material	Elevation (m)			Elevation method	Altimetry time interval (minutes)	Location	Comments
GSC-401	4070	±	140	Peat	52					75°45'N, 98°32'W	peat under alluvium
GSC-783	4750	±	140	Shells	25					75°41'N, 98°48'W	below 0.6-2 m of sand and gravel
GSC-2317	6160	±	90	Peat	61					75°40'N, 97°40'W	from 78 cm depth in peat
GSC-201	7100	±	140	Peat	79					75°57'N, 97°52'W	from surface of 1.5 m thick peat
GSC-736	7670	±	150	Shells	23					75°41'N, 98°48'W	below silt and above gravel
GSC-726	8090	±	150	Shells	79					75°57'N, 97°52'W	from surface of stony silt
GSC-1873	8220	±	90	Shells	69					75°43'N, 98°9'W	from creek bed
GSC-1566	8380	±	110	Wood	73-85					76°11.2'N, 99°7'W	from surface of a terrace
GSC-1887	8420	±	80	Peat	90-120			map		75°50.5'N, 98°2.5'W	from peat hummock
GSC-387	8780	±	160	Shells	92					75°58'N, 99°18'W	from surface of delta
GSC-386	9030	±	150	Shells	119					76°0.5'N, 99°59'W	from surface of beach
GSC-180	9210	±	170	Peat	137					75°38.5'N, 99°40'W	basal peat
GSC-724	9230	±	280	Shells	107					76°11'N, 97°35'W	from surface
GSC-179	9660	±	210	Shells	92					75°57'N, 97°52'W	from surface of sand terrace
GSC-251	9690	±	140	Shells	137					76°32'N, 98°16'W	from surface

18. Southern Bathurst Island area (Fig. 13D)

Laboratory no.	^{14}C Date (years BP)			Material	Elevation (m)			Elevation method	Altimetry time interval (minutes)	Location	Comments
GSC-2405	4530	±	70	Wood	22			levelling		75°2'N, 98°1.8'W	partly enclosed in lemming mound on beach gravel
GSC-4105	5380	±	70	Wood	29					75°N, 99°3'W	
GSC-191	8520	±	150	Shells	98					75°11.5'N, 98°4'W	from surface
GSC-250	8590	±	140	Shells	107					74°59'N, 98°59'W	from surface
GSC-353	9070	±	190	Shells	104					75°6'N, 99°8'W	from surface of beach gravel

19. Resolute Bay, Cornwallis Island area (Fig. 13E)[4] . 13E)[4]

Laboratory no.	^{14}C Date (years BP)			Material	Elevation (m)			Elevation method	Altimetry time interval (minutes)	Location	Comments
QL-1609	8970 (8570	± ±	30 30)	Shells	40	±	2	altimetry		74°43'N, 95°1'W	from surface
QL-1612	9610 (9210	± ±	40 40)	Shells	102	±	2	altimetry		74°44'N, 94°57'W	from surface
QL-1741	5410 (5010	± ±	50 50)	Peat	28	±	2	altimetry		74°46'N, 95°6'W	from base of peat
QL-1751	9690 (9290	± ±	90 90)	Shells	113	±	2	altimetry		74°42.7'N, 94°52'W	from gully
QL-1753	9260 (8860	± ±	70 70)	Shells	64	±	2	altimetry		74°44.5'N, 95°1'W	from surface
QL-1754	9070 (8670	± ±	70 70)	Shells	56	±	1	altimetry		74°44'N, 95°W	from surface
QL-1755	9200 (8800	± ±	90 90)	Shells	67	±	2	altimetry		74°44.7'N, 95°W	from surface
QL-1756	9030 (8630	± ±	90 90)	Shells	83	±	2	altimetry		74°44.5'N, 94°59'W	from surface
QL-1759	9390 (439	± ±	90 90)	Shells	59	±	2	altimetry		74°45.2'N, 94°58'W	from surface
QL-1760	8220 (7820	± ±	80 80)	Shells	25	±	3	altimetry		74°41.7'N, 94°46'W	from surface
QL-1761	9290 (8890	± ±	90 90)	Shells	79	±	6	altimetry		74°43'N, 94°43'W	from surface
QL-1762	9090 (8690	± ±	90 90)	Shells	73	±	6	altimetry		74°43'N, 94°43'W	from surface
QL-1763	9160 (8760	± ±	70 70)	Shells	65	±	3	altimetry		74°43'N, 94°43'W	from surface
QL-1764	9560 (9140	± ±	90 90)	Shells	102	±	2	altimetry		74°42'N, 94°49'W	from surface
QL-1765	6785 (6385	± ±	75 75)	Shells	19	±	2	altimetry		74°44.7'N, 95°3'W	from surface
QL-1863	4880 (4480	± ±	40 40)	Shells	5	±	3	altimetry		74°49.5'N, 95°16'W	from delta
QL-1864	4980 (4580	± ±	80 80)	Shells	5	±	3	altimetry		74°49.5'N, 95°16'W	from delta
QL-1867	9160 (8760	± ±	50 50)	Shells	58	±	3	altimetry		74°43.5'N, 94°43'W	from surface of beach
GSC-1193	7570	±	140	Whale bone	ca. 50					74°42'N, 94°59'W	partly enclosed in beach
GSC-1623	8540	±	170	Shells	70	±	15	map		74°44'N, 94°42'W	from surface
W-1214	9340 (8940	± ±	350 350)	Shells	55	±	2			74°41.6'N, 94°47.9'W	from surface
W-1215	6290 (5890	± ±	350 350)	Shells	1	±	1			74°41'N, 94°53.7'W	from surface
W-1217	5050 (4650	± ±	350 350)	Shells	18	±	2			74°41.4'N, 94°50.1'W	from surface
W-1219	7200 (6800	± ±	350 350)	Shells	27	±	2			74°41.5'N, 94°48.5'W	from surface
W-1220	8550 (8150	± ±	300 300)	Shells	114	±	2			74°42'N, 94°48.7'W	from surface

Table 1 (cont'd.)

Laboratory no.	14C Date (years BP)			Material	Elevation (m)	Elevation method	Altimetry time interval (minutes)	Location	Comments
20. Truelove Inlet, Devon Island area (Fig. 13F)									
I-3231	2450	±	90	Peat	3.6	levelling		74°40'N, 84°37'W	basal peat from bog
S-433	2900	±	85	Bowhead ear bone	3	levelling		75°41'N, 84°39'W	enclosed in beach gravel
S-430	4300	±	95	Peat	26	levelling		75°38.4'N, 84°28'W	basal peat from bog
S-431	5280	±	100	Wood	11	levelling		75°40.1'N, 84°36'W	enclosed in beach gravel below peat
S-432	6100	±	125	Bowhead	11	levelling		75°40.2'N, 84°36.5'W	enclosed in beach gravel
S-428	6900	±	115	Peat	57	levelling		75°38.2'N, 84°26'W	basal peat from hummock
Y-1294	7480	±	120	Shells	3.4	levelling		75°41.2'N, 84°37'W	from surface
S-434	8200	±	140	Shells	30	levelling		75°38'N, 84°26'W	from surface of silt
Y-1295	8250	±	160	Shells	7.7	levelling		75°40.8'N, 84°37'W	from surface of beach
GSC-991	8270	±	150	Bowhead skull	42.4	levelling		75°40'N, 84°23'W	enclosed in silt
S-410	8370	±	115	Shells	25	levelling		75°38'N, 84°30'W	from solifluction lobe
Y-1296	8740	±	120	Shells	15.5	levelling		75°40.2'N, 84°35'W	from beach surface
Y-1299	9360	±	160	Shells	60	levelling		75°38.6'N, 84°27'W	from surface at 2 sites
S-413	9570	±	130	Shells	23	levelling		75°40'N, 84°33'W	from surface of beach
S-412	12 800	±	160	Shells	15.5	levelling		75°40'N, 84°35'W	from surface of beach
Y-1297	16 000	±	240	Shells	23	levelling		75°39.8'N, 84°33'W	from surface of beach
21. Radstock Bay, Devon Island area (Fig. 13G)									
GSC-1456	2030	±	130	Wood	4.7	levelling		74°40'N, 91°25'W	from beach gravel
GSC-1402	4170	±	130	Wood	12.2	levelling		74°42'N, 91°13'W	from beach gravel
GSC-1467	5170	±	140	Wood	16.5	levelling		74°40'N, 91°25'W	from beach gravel
GSC-1479	8260	±	160	Peat	48.5			74°35'N, 91°23'W	from niveo-alluvial sand
GSC-1502	9260	±	150	Shells	105			74°40'N, 91°25'W	from surface of silt and clay
22. Cape Anne, Somerset Island area (Fig. 13H)									
S-1391	635	±	50	Bowhead vertebra	4	altimetry	2	74°5'N, 94°47'W	partly enclosed in beach gravel
S-1383	1455	±	80	Bowhead vertebra	7.5	altimetry	8	74°4'N, 94°48.5'W	partly enclosed in beach gravel
S-1389	4265	±	65	Bowhead skull	18	altimetry	5	74°3.3'N, 94°48.5'W	partly enclosed in beach gravel
S-1386	7105	±	90	Bowhead rib	28	altimetry	10	74°3.5'N, 94°48'W	previously dated 4465 ± 85 BP; partly enclosed in beach gravel
S-1384	8005	±	155	Bowhead	50	altimetry	19	74°1.3'N, 94°53'W	enclosed in beach gravel
GSC-2666	8680	±	90	Shells	60-65	altimetry	25	74°1.5'N, 94°53'W	from deltaic foresets below terrace at 67 m
GSC-2660	9000	±	90	Shells	95-99	altimetry		74°1.3'N, 93°45'W	from deltaic foreset and topset beds
GSC-319	9380	±	180	Shells	119-122	altimetry		73°53.5'N, 95°19'W	from surface of beach gravel
S-1381	9590	±	115	Bowhead vertebra	69	altimetry	4	74°1.8'N, 94°48'W	partly enclosed in beach sand
23. Cunningham Inlet, Somerset Island area (Fig. 13I)									
GSC-2704	1420	±	50	Wood	5	altimetry		74°4'N, 93°34'W	partly enclosed in beach gravel
GSC-2233	3580	±	60	Wood	12.6	levelling		74°6.6'N, 94°15.5'W	partly enclosed in beach gravel
GSC-2081	4930	±	70	Wood	17	levelling		74°7.9'N, 93°53.8'W	partly enclosed in solifluction debris
GSC-2080	5300	±	70	Wood	21	levelling		74°8.9'N, 93°55'W	enclosed in beach gravel
GSC-2732	8990	±	210	Shells	102	altimetry		73°59'N, 93°20'W	from surface of gravel delta terrace
GSC-450	8990	±	140	Bowhead vertebra	66			73°59'N, 93°40'W	from surface of silt
GSC-150	9180	±	170	Shells	62			73°59'N, 93°40'W	from surface of silt
24. Rodd Bay, Somerset Island area (Fig. 13J)									
S-1405	1860	±	80	Bowhead	4.5	altimetry	1	73°57.7'N, 90°38'W	partly enclosed in beach gravel
S-1393	3825	±	75	Bowhead	10	altimetry	5	73°57.5'N, 90°38'W	partly enclosed in beach gravel
S-1387	4570	±	85	Bowhead	14	altimetry	7	73°57.3'N, 90°38'W	partly enclosed in beach gravel
S-1374	5965	±	75	Wood	18	altimetry	3	74°0.5'N, 91°19.5'W	from surface of beach grvel
S-1390	9210	±	120	Bowhead fin	76	altimetry	14	73°55.6'N, 90°37.5'W	enclosed in beach gravel
25. Southern Somerset Island area (Fig. 13K)									
S-1382	4310	±	90	Bowhead skull	22	altimetry	12	72°52.3'N, 93°32'W	partly enclosed in beach gravel
GSC-652	5960	±	140	Shells	13			72°36'N, 95°20'W	from deltaic sand below terrace at 21 m
GSC-2570	6180	±	80	Shells	10	altimetry	12	72°52.5'N, 93°30'W	from deltaic sand below terrace at 14 m
L-571-A	7150	±	350	Shells	30			72°47'N, 95°37'W	from terrace at 30 m
GSC-616	7750	±	140	Shells	46			72°58'N, 95°3'W	from surface of sand
GSC-617	7890	±	140	Shells	26			72°46'N, 94°30'W	from surface of sand
S-1388	8805	±	95	Bowhead	73	altimetry	8	72°51.6'N, 93°34'W	previously dated 5205 ± 70 BP; partly enclosed in beach gravel
GSC-2493	9030	±	80	Shells	85	altimetry		72°56'N, 93°46'W	from deltaic silt below terrace at 90 m
GSC-2563	9060	±	90	Shells	71	altimetry	25	72°46.3'N, 94°31'W	from deltaic sand below terrace at 75 m
GSC-136	9180	±	170	Shells	127			72°11.5'N, 94°5'W	from surface of deltaic sand
GSC-2445	9200	±	100	Shells	88	altimetry		72°48.8'N, 92°56'W	from sand below 2 m of beach gravel
GSC-2561	9240	±	90	Shells	107	altimetry	15	72°46.5'N, 94°21'W	from deltaic silt below terrace at 157 m
GSC-2596	9270	±	90	Shell	120	altimetry	9	72°50.7'N, 93°36'W	from deltaic sand below terrace at 125 m

Table 1 (cont'd.)

Laboratory no.	¹⁴C Date (years BP)			Material	Elevation (m)	Elevation method	Altimetry time interval (minutes)	Location	Comments
26. Pelly Bay-Shepherd Bay area (Fig. 13L)									
GSC-3017	2210	±	60	Humus	29	altimetry		69°2.3'N, 93°12'W	humic soil below soliflucted till
BGS-246	2860	±	90	Peat	30			68°30'N, 92°52'W	peat in earth hummock
GSC-45	4460	±	80	Shells	24			69°9'N, 93°59'W	from surface of beach gravel
I(GSC)-212	7160	±	160	Shells	53			68°42'N, 92°27'W	from deltaic foresets
GSC-46	7790	±	100	Shells	80			68°29'N, 92°9'W	from sand terrace
I(GSC)-213	7880	±	150	Shells	90			68°51.5'N, 90°48'W	from deltaic foresets
I(GSC)-215	8360	±	175	Shells	175			69°15'N, 91°16'W	from silt
I(GSC)-179	8370	±	200	Shells	165			68°12'N, 90°34'W	from silt
GSC-3072	8730	±	230	Shells	171			68°58.7'N, 92°56.5'W	from surface of till
GSC-44	8870	±	140	Shells	155			68°30'N, 91°5'W	from silt
GSC-2093	9430	±	210	Shells	225-230			68°58'N, 89°59'W	from surface of silt
27. King William Island area (Fig. 13M)									
GSC-3548	2760	±	120	Shells	10	map		68°37.5'N, 95°52'W	from sand 2 m below surface
S-2681	5620	±	95	Bowhead fin	37	altimetry		69°28.7'N, 97°57.5'W	from surface of beach gravel
S-2682	7715	±	205	Shells	85	altimetry		68°54.5'N, 97°26'W	from surface of till
28. Bathurst Inlet area (Fig. 13N)									
GSC-137	1850	±	140	Shells	9			66°49.5'N, 107°5'W	from deltaic sediments below 9 m terrace
GSC-785	2280	±	150	Shells	1-2			66°49.5'N, 107°5'W	from silt-clay
GSC-158	2510	±	180	Shells	9			68°11.5'N, 106°17'W	from deltaic sediments
GSC-303	4110	±	150	Shells	27			67°29.5'N, 108°8'W	from surface of silt and clay
GSC-302	4190	±	130	Marine algae	27			67°29.5'N, 108°8'W	from silt and clay
GSC-610	4960	±	140	Shells	21			67°27.5'N, 108°10.5'W	from surface
GSC-224	7480	±	160	Shells	102			67°27.5'N, 108°6'W	from surface of sand
GSC-646	7730	±	160	Shells	58			67°33.5'N, 108°8'W	from surface of silt
GSC-645	7990	±	150	Shells	72			67°27.5'N, 108°6'W	from surface of silt
GSC-230	8000	±	150	Shells	142			66°42'N, 107°55'W	from surface
GSC-604	8070	±	160	Shells	153			67°34.5'N, 106°31.5'W	from surface of beach gravel
GSC-615	8200	±	140	Shells	131			67°25'N, 107°35'W	from surface of sand
GSC-636	8230	±	140	Shells	149			67°15'N, 106°55'W	from surface of silt
GSC-344	8360	±	150	Shells	146			67°27.5'N, 108°12'W	from surface of silt and sand
GSC-115	8370	±	100	Shells	198			66°32'N, 107°42'W	from surface of silt
GSC-737	8720	±	150	Shells	143			68°6.5'N, 106°54'W	from surface of sand-silt
GSC-644	9170	±	160	Shells	177			67°47'N, 109°48'W	from surface of silt
GSC-125	9190	±	210	Shells	186			68°39.5'N, 107°1'W	from surface of beaches

1   Sample collection, elevation determination, and preparation for dating by A.S. Dyke except for GSC-600 (B.G. Craig) and I-12137 (P. Ramsden, unpublished)
2   Sample collection, elevation determination, and preparation for dating by D.E.C. Green except for I-11769 (P. Ramsden, unpublished), GSC-2300, and GSC-2240 (R.B. Taylor).
3   Sample collection, elevation determination, and preparation for dating by T.F. Morris except for GSC-235 (B.G. Craig) and L-571-B (J.B. Bird).
4   "GSC equivalent" age given in brackets; 400 years subtracted from reported QL- and W-dates.

Radiocarbon dating laboratories:
   GSC   –   Geological Survey of Canada
 I(GSC), I   –   Teledyne Isotopes
     S   –   Saskatchewan
    QL   –   Quaternary Isotope Laboratory
     W   –   United States Geological Survey
     Y   –   Yale
     L   –   Lamont
   BGS   –   Brock Geological Sciences