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PREFACE

This paper presents part of the results of a general survey of southern King William Island and the adjacent mainland area by the Geographical Branch in 1956. It discusses the physical geography of an area historically significant as the scene of the Franklin disaster of a century ago. The paper is intended as a contribution to the study of the glaciation of northern Canada.

Grateful acknowledgement is made to the Royal Canadian Air Force for the air photographs that illustrate this paper.

N. L. Nicholson,
Director
Geographical Branch

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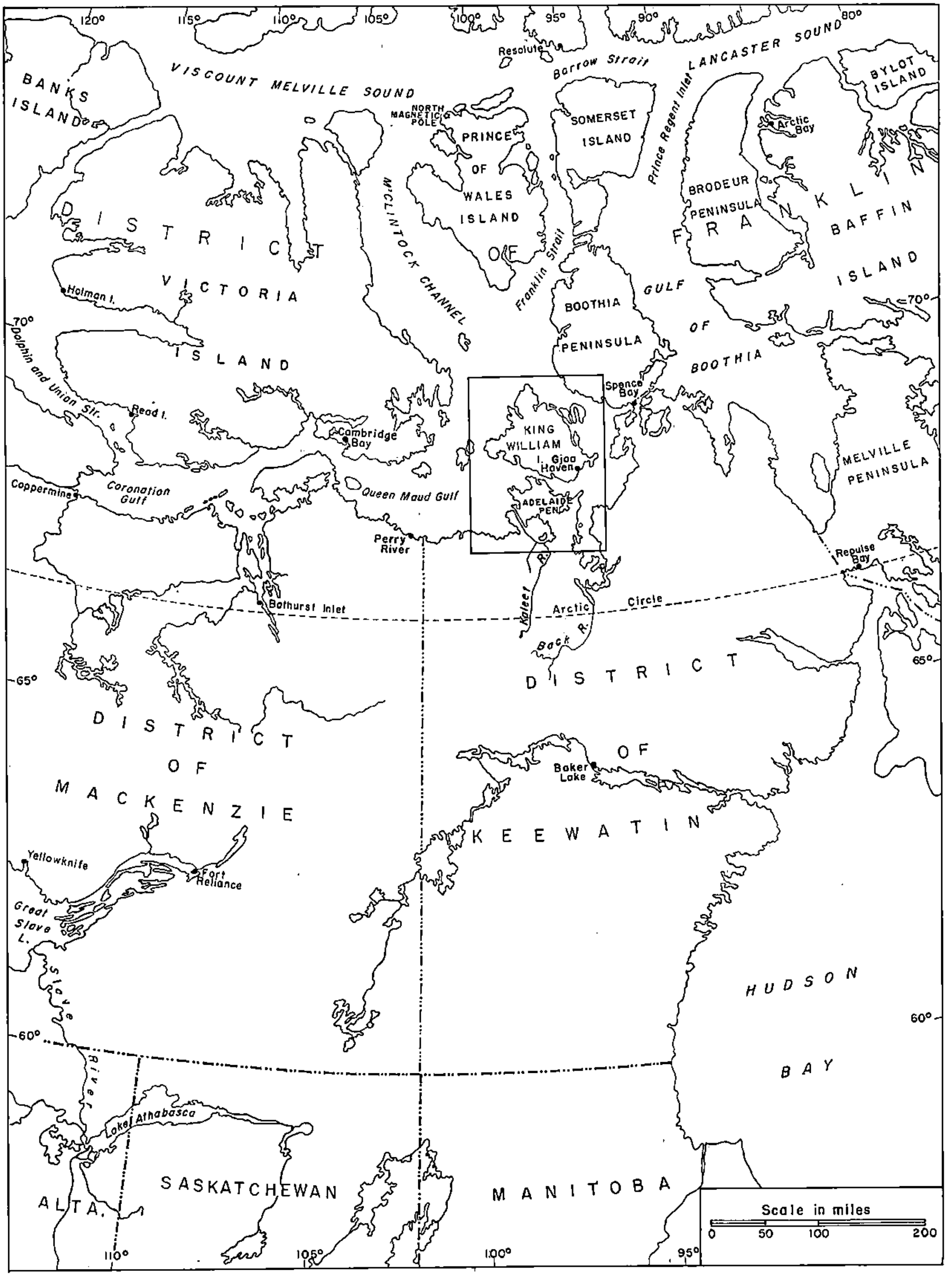

Figure 1. Location Map.

NOTES ON THE GLACIATION OF KING WILLIAM ISLAND AND ADELAIDE PENINSULA, N.W.T.

King William Island lies almost at the geographic centre of the Canadian Arctic, at the eastern end of the western Arctic passages (Figure 1). In a circle around it lie Victoria and Prince of Wales islands, Boothia Peninsula and the northern coast of the District of Keewatin, Northwest Territories. Twelfth in size among the islands of the Canadian Arctic Archipelago, King William Island is one of the lowest in elevation, rising nowhere more than 300 feet above the sea. It comprises 5,161 square miles and is separated from Adelaide Peninsula on the mainland by Simpson Strait, less than three miles wide at its narrowest point. The island is roughly square, measuring 106 miles from Cape Felix in the north to Booth Point in the south, and approximately the same from Cape Francis Crozier in the west to Matheson Point in the east.

The surrounding waters are notoriously shallow and contain several groups of low islands. Off the northeast coast lie Tennent and Matty islands and the smaller Clarence Islands. To the west are the Nordenskiold and Royal Geographical Society islands. Partly submerged drumlins almost block Simpson Strait and shoals occur in James Ross and Franklin straits.

Adelaide Peninsula has an area of approximately 2,400 square miles and is joined to the mainland by McCrary Isthmus, 18 miles wide at its narrowest point. The west side of the peninsula almost encloses Sherman Basin which debouches into Queen Maud Gulf via Sherman Inlet, a narrow passage about 30 miles long.

EXPLORATION OF THE AREA

King William Island was first discovered in 1830 by James Clark Ross, who sledged from Boothia Peninsula across the strait now bearing his name to the northern coast, rounding Cape Felix and mapping the coast as far as Victory Point (Ross, 1835). Ross named this land King William's Land and his map shows it connected with Boothia Peninsula to the southeast. George Back, in 1834, saw and named Booth Point on the south coast of King William Island (Back, 1836; King, 1836). Thomas Simpson discovered Simpson Strait in 1839 and mapped the south coast from the Peffer River to Cape John Herschel (Simpson, 1843). It remained for John Rae to prove that the land was an island when in 1854 he discovered that a body of water, subsequently named Rae Strait, separated the southeastern part of King William Island from the mainland (Rae, 1855). It was not until M'Clintock and Hobson completed their sledge trips around King William Island in 1859 that the extent of the island was truly known (M'Clintock, 1859).

In 1834, Back discovered Chantrey Inlet by way of the Back River. Simpson outlined the north coast of Adelaide Peninsula in 1839; Schwatka discovered Sherman Inlet in 1879 (Gilder, 1881). Following Schwatka's explorations, the King William Island area was not visited until Amundsen's historic voyage of 1903-06, during which he wintered two years at Gjoa Haven on the island (Amundsen, 1908).

Rasmussen spent the summer of 1926 in southern King William Island, his main camp being at Malerualik on Simpson Strait (Rasmussen, 1927). In the same year and at the same location, the first trading post was established on the island, but was subsequently moved to Gjoa Haven. Here the Hudson's Bay Company has maintained a post for some 25 years; in 1954, a Roman Catholic mission was built, and a small mission school for Eskimo orphans in 1956.

Scattered reports on the geography of King William Island and to a lesser degree Adelaide Peninsula are available (Burwash, 1931; de Poncins, 1940; Gibson, 1932, 1940). Priests from Pelly Bay and, more recently, Gjoa Haven, have visited native camps on the mainland. The police have made tours of inspection by sledge to

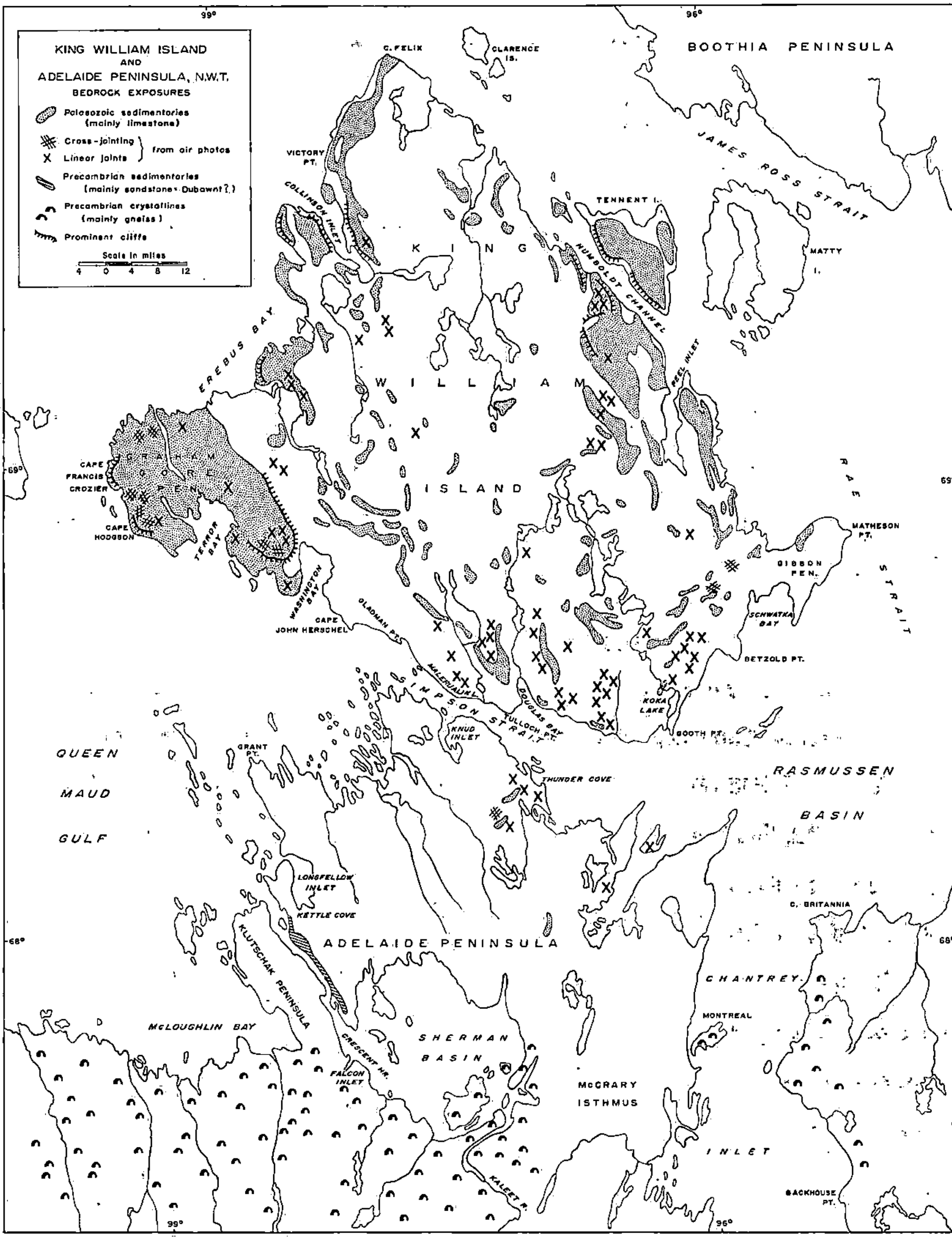

Figure 2. Bedrock Exposures.

the Kaleet River in Sherman Basin, and to northern King William Island. Recent investigations concerning the Franklin expedition have included three summer visits by Cooper (Cooper, 1955).

In 1956, the writers carried out geographical research along the southern coast of King William Island and northern Adelaide Peninsula. Although hindered by bad weather in the latter part of the summer, the writers traversed the south coast of the island from Matheson Point to Gladman Point, visited Knud Inlet* on Adelaide Peninsula, and penetrated Sherman Inlet to the entrance to Sherman Basin (Figure 2). This paper is part of the results of these investigations, and is based on field observations in the areas visited, and on the examination of air photos for the remainder of the area.

GEOLOGICAL BACKGROUND

King William Island and part of Adelaide Peninsula form part of a basin of Palaeozoic sedimentary deposition, which Fortier and Morley have termed the Victoria Strait Basin (Fortier and Morley, 1956). Exposed rocks of the Canadian Shield surround this basin on the south, and arches of similar rocks confine the basin on the east and west. The sediments of the basin occur as relatively low and level terrain, mainly mantled by glacial deposits resulting from the last glaciation.

No systematic geological survey has been made of King William Island or Adelaide Peninsula. The observations made by various explorers were summarized by Washburn (Washburn, 1947). The following description of the geology is based on this summary, and on observations by the authors in 1956.

The rocks of the Canadian Shield appear south of Adelaide Peninsula, controlling the relief south of Sherman Basin and on part of McCrary Isthmus. They extend

*A list of the new or revised placenames subsequently adopted by the Canadian Board on Geographical Names appears in the Appendix.

west along the shores of McLoughlin Bay and east along the shores of Chantrey Inlet. They are predominantly gneissic, but granites occur in the east. On the east side of Chantrey Inlet, granites were reported at Cape Britannia by Simpson. George Back found "reddish granite of moderately fine grain" at Backhouse Point (Back, 1836, p. 562). According to Anderson, red granite is the prevailing rock on the eastern side of Chantrey Inlet (Anderson, 1941). Haughton describes gneiss on Montreal Island (Haughton, 1859). Specimens collected by Alexander from the southeast side of McLoughlin Bay and from southern Sherman Basin were identified as gneiss (Washburn, 1947, p. 8). A representative sample collected by the writers at Falcon Inlet in western Sherman Basin was identified by Y.O. Fortier, Geological Survey of Canada, as biotite feldspar-quartz gneiss or granitic gneiss. The northern limit of the crystalline rock exposures of the Shield is indicated on Figure 2, plotted from field observations and air photos.

Outcrops of sandstone, limestone and conglomerate, but mainly sandstone, were discovered in 1956 on the east side of Sherman Inlet, from Crescent Harbour north almost to Kettle Cove. The beds dip slightly north-northeast, varying in height above sea level from 135 feet in the north to 190 feet in the south. They are composed of apparently non-fossiliferous layers of limestone, limestone with sandstone, sandstone with carbonate cement, sandstone with conglomerate, limestone and sandstone. Some of the sandstone contains cement of hematite and limonite. The layers are from a few inches to 1 or 2 feet thick. They may be related to apparently similar sandstones (Dubawnt group) north of Baker Lake and if so are of late Proterozoic age (Wright, 1955, 1957).

The north part of Adelaide Peninsula is shown as belonging to the Palaeozoic era on Map 1045A (1955), Geological Survey of Canada. Simpson mentions limestone at Grant Point (Simpson, 1843, p. 365) and according to Gibson, "limestone or dolomitic rocks fringe the northern portion of Adelaide Peninsula"(Washburn, 1947, p. 31). However, no bedrock exposures were found along the northwestern coast of the peninsula in 1956 between Knud Inlet and Grant Point; the latter feature results from a reworked esker and associated outwash. North of the Canadian Shield (except for the sandstones in Sherman Inlet), Adelaide Peninsula is covered with unconsolidated materials which mantle effectively the rocks beneath. However, there is some indication on air photos that limestones may lie close to the surface and may be exposed near Thunder Cove on the northeast coast. An exposure of limestone or dolomite was observed about 4 miles south of Barrow Inlet in 1957. Sandy limestone was also observed in a stream gully on the eastern shore of Sherman Basin by T.H. Manning and A.H. Macpherson in 1957 (A.H. Macpherson, personal communication). This may be related to the Dubawnt (?) series along Sherman Inlet (See also Manning 1958).

King William Island is composed of limestones and dolomites of Palaeozoic age. Both Ordovician and Silurian fossils are contained in these rocks which outcrop at various places along the southern coasts (Washburn, 1947, p. 24, 25, 32). Although the southern shoreline is seldom formed of bedrock, exposures in stream beds at M'Clintock Bay and near Douglas Bay, and as ledges along the south coast of Gibson Peninsula, indicate that the overburden is shallow. Much of Graham Gore Peninsula is made up of exposed limestone, grooved and fluted by glacial action. Cliffs of sedimentary rock form the shores of Humboldt Channel between northeast King William Island and Tennent Island, and extensive exposures of sedimentary rocks occur along the northeast and northwest coasts. Inland, there are numerous outcrops, generally occurring as low ridges or scarps, often hardly distinguishable as bedrock because of the greatly shattered detritus formed <u>in situ</u>.

Fossils were collected in two localities in 1956, at M'Clintock Bay and at the head of Douglas Bay. The M'Clintock Bay assemblage appears to be Lower Ordovician, perhaps as low as the Trenton formation (Gionoceras sp. included). The Douglas Bay specimens cannot be dated more accurately than to state that they are either late Middle Ordovician or Upper Ordovician.*

Known and interpreted (from air photos) exposures of bedrock are mapped in Figure 2. It is a relatively simple matter to identify outcrops of hard gneissic or granitic rocks from air photo examination. To identify softer and generally level-bedded sedimentaries in areas of low relative relief (10 to 50 feet) is more difficult. Extensive level stretches of exposed limestone (as on Graham Gore Peninsula) are generally identifiable, but smaller exposures associated with glacial deposits and marine strands are not. Strands are frequently coincident with outcropping strata. Low scarps may be confused with ice-contacts or wave-cut banks of glacial drift. Emerged bars of intermingled drift and shattered limestone may help to conceal sedimentary exposures. Aids to air photo recognition of limestone beds include the presence of a fine cross-jointing, one set of parallel lines cut by another parallel set occasionally but usually not at right angles (Washburn, 1950), (Figure 3). Limestone covered by a thin mantle of drift, usually ground moraine, may occasionally be recognized by the presence of shallow, linear trenches (Figure 4), often intersecting and occasionally radiating, and varying in length from a few hundred yards to over a mile. The trenches and cross-jointing patterns are plotted on the map (Figure 2) from the examination of air photos. The trenches are almost unnoticeable on the ground, as there may be only 3 to 5 feet difference between their marshy floors and their edges. They are emphasized on air photos by the dark tones resulting from poor drainage in their bottoms and by their remarkable straightness. It is speculated that these are

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*These fossils were identified and discussed by G.W. Sinclair, Geol. Surv. Can., ms. Report 0-9, 1956/57.

Figure 3. Looking west over Terror Bay, King William Island. Much of the light-toned area is shattered limestone exposures. The cross-jointing pattern appears in the midground and low scarps appear to the left.

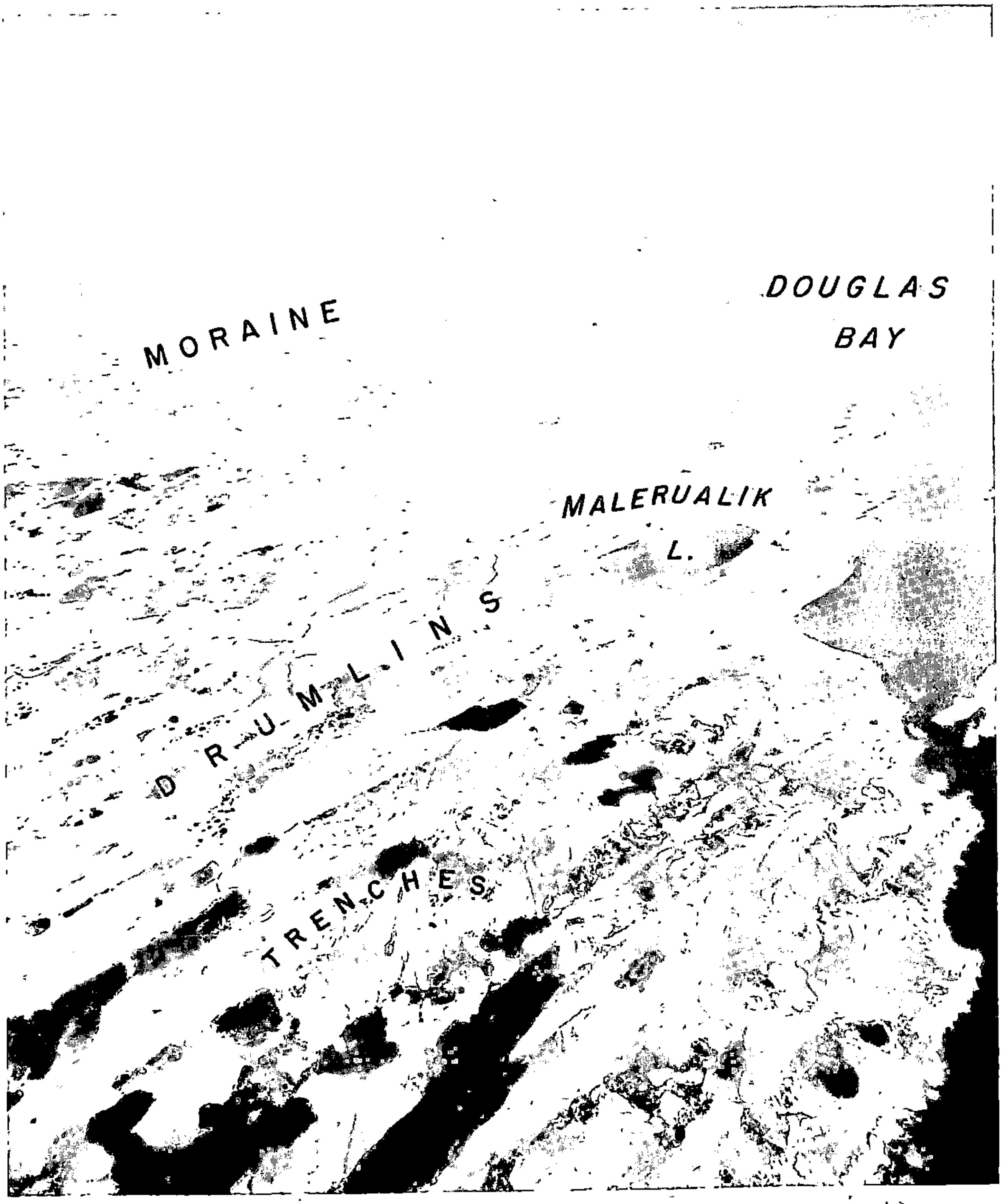

Figure 4. Looking east towards Malerualik Lake and Douglas Bay, King William Island. Trenches radiating from small lakes occur in drumlin terrain (see also Figure 9).

joints, mantled by a thin cover of moraine which does not conceal the underlying, slight relief. The trenches occur more widely along coasts and inlets, the linear characteristics of which imply a fault origin, and less commonly in the interior of the island or on Adelaide Peninsula. A system of tension joints is likely to be associated with major faults. However, their absence may be due merely to the greater thickness of glacial overburden. The occasional radiating nature of some of the trenches, emanating from a present depression, might be due to preglacial karst action, although no other evidence of karst phenomena is recognized.

The linear nature of much of the coastline configuration and river valleys indicates a structural control. The presence of steep rock cliffs along the eastern shore of Sherman Inlet and their absence along the western shore implies a fault origin, supported by the remarkably straight alignment of the inlet with parts of the lower Kaleet River, Franklin Lake and other lakes. Barrow Inlet, on the northeast coast of Adelaide Peninsula, may also be associated with the configuration of the estuary of the Kaleet River and adjacent inlets. Humboldt Channel, between Tennent and King William islands is continued to the northwest between Clarence Islands and King William Island, and sedimentary formations occur as steep cliffs opposite Tennent Island. Low scarps face inwards along Collinson Inlet and occur some distance inland from the shores of Douglas Bay, Washington Bay, Terror Bay and Peel Inlet. Simpson Strait separates King William Island from Adelaide Peninsula and the island coast suggests a linear extension from Cape Hodgson to Tulloch Point. Fortier and Morley speculate that the strait was the valley of a tributary river which was part of a network of streams draining a continuous land that is now the Archipelago (Fortier and Morley, 1956, p. 7). Recent hydrographic soundings in the strait support this view, as they indicate a submarine trench 70 to 150 feet deep occupying the strait. Glacial deposits have partially filled and somewhat obscured the contours of this trench, but the steep slopes of the ancient valley may be seen in the cross sections. It is suggested that Simpson Strait originated by faulting, after which a preglacial river occupied the resulting depression.

The position and shape of many of the small and large lakes on the Shield are controlled by fractures in the crystalline rocks. Figure 6 illustrates such control by faults and joints in the rock knob terrain in western Sherman Basin.

GLACIAL EROSION

The crystalline rocks surrounding the south end of Sherman Basin were scoured by the ice sheets, leaving a mamillated surface with prominent stoss-and-lee characteristics. In the Falcon Inlet area, striae and grooves are oriented southwest-northeast and the stoss-and-lee topography indicates a general movement of ice towards the northeast (Figure 6).

The only striae observed in areas of soft rocks were on slabs of limestone exposed in the valley of the river emptying into M'Clintock Bay (Figure 5). This limestone is horizontally bedded and overlain by till and marine clays and silts. About 3

Figure 5. Striated limestone in river bed, M'Clintock Bay, King William Island.

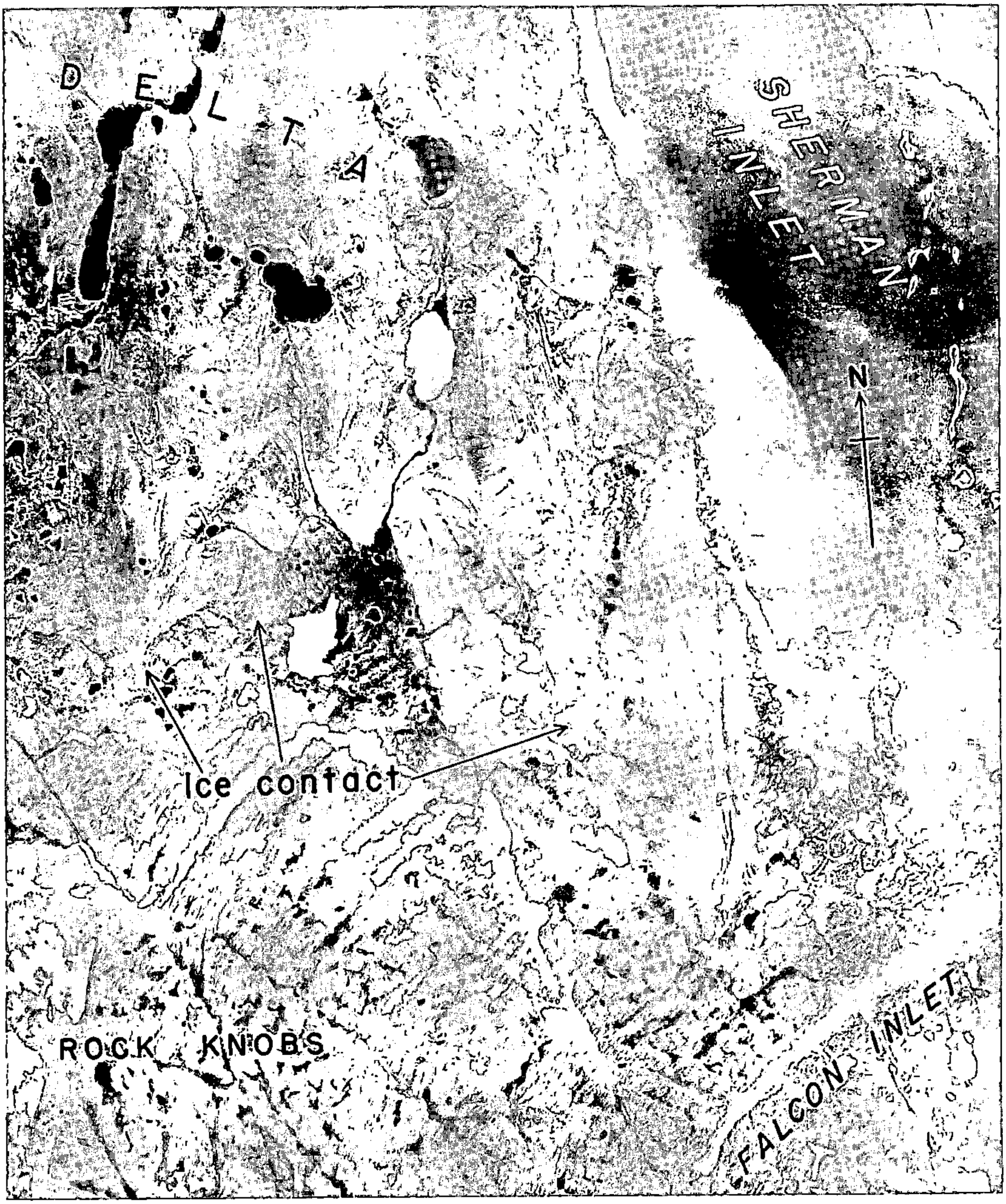

Figure 6. A vertical photograph taken at 30,000 feet showing the proximal ice-contact face of the glacio-marine delta north of Falcon Inlet, Klutschak Peninsula. The typical fracture control of lake patterns in bare crystalline rock is illustrated here.

feet above the flood level of the river, polished and striated surfaces were observed where the rock had been protected by the overburden. Although the scratches could be attributed to river ice in some cases, the polishing could not have been done by this agent. Glacial grooving in limestone is prominent on Graham Gore Peninsula on air photos.

GLACIAL DEPOSITION

Glacial drift of several types was deposited on King William Island and the adjacent mainland (Figure 7). This material includes basal till, ablation moraine, drumlins, outwash and delta sands and gravels, ice-rafted boulders and silts laid down in postglacial seas. Taken together, drift of all types is the most characteristic and significant element in the terrain.

Drumlins and drumlinoids

Drumlin forms occur widely in the area, both as true, well-defined drumlin fields (Figure 8) and as less definite drumlinoid forms associated with ground moraine (Figure 9). Their parallelism gives an indication of the direction of movement of lobes of the ice sheet. Although their method of formation is still in doubt, geomorphologists agree that they indicate the direction of local ice flow and that they were formed beneath the ice sheet from subglacial and englacial material.

A large drumlin field extends from the northeast end of Sherman Basin to Simpson Strait and is continued across the strait along the southwest coast of King William Island. This ice movement can be traced across the islands in Franklin Strait and northwards along the east coast of Victoria Island to Stefansson Island. This field has a northwest orientation and other fields in northwest and central King William Island having the same trend may be associated with this movement. West of Humboldt Channel in northeast King William Island, another drumlin field

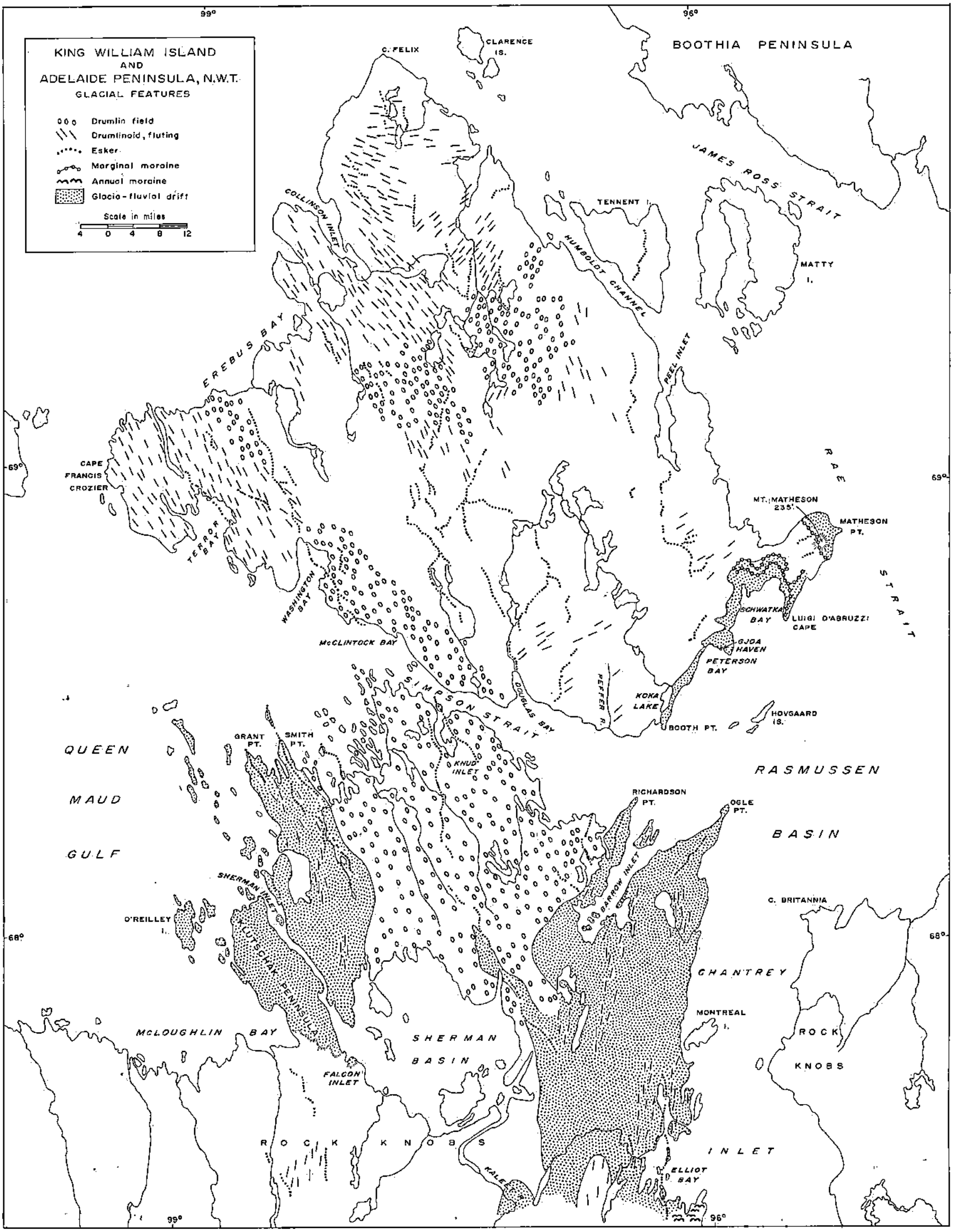

Figure 7. Glacial Features.

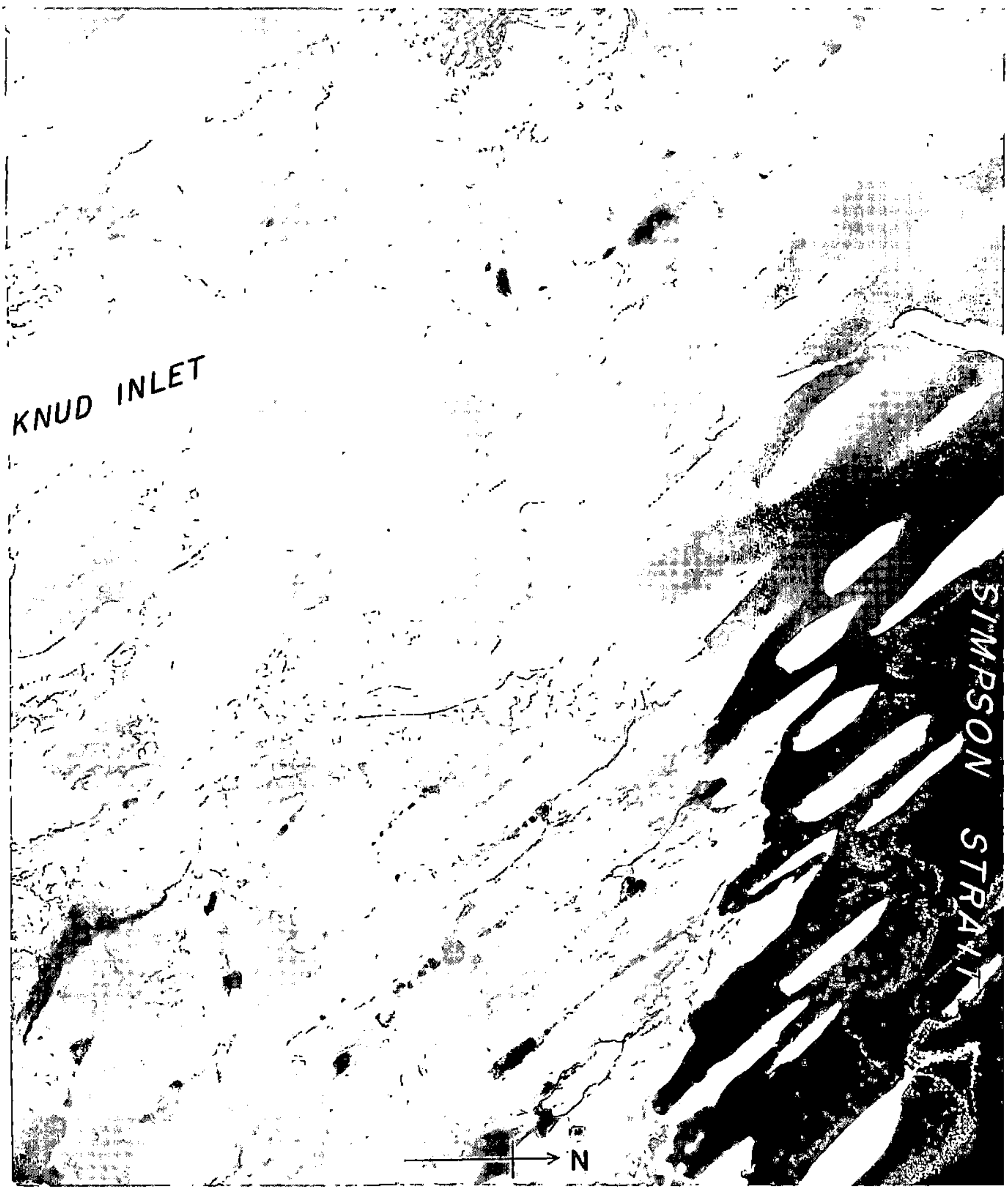

Figure 8. Knud Inlet area, Adelaide Peninsula; a vertical photograph taken at 30,000 feet showing the drumlin field oriented northwest-southeast. Two eskers flank the inlet, and localized marine plains appear as light-toned mottled areas to the left. Strands occur on the drumlins.

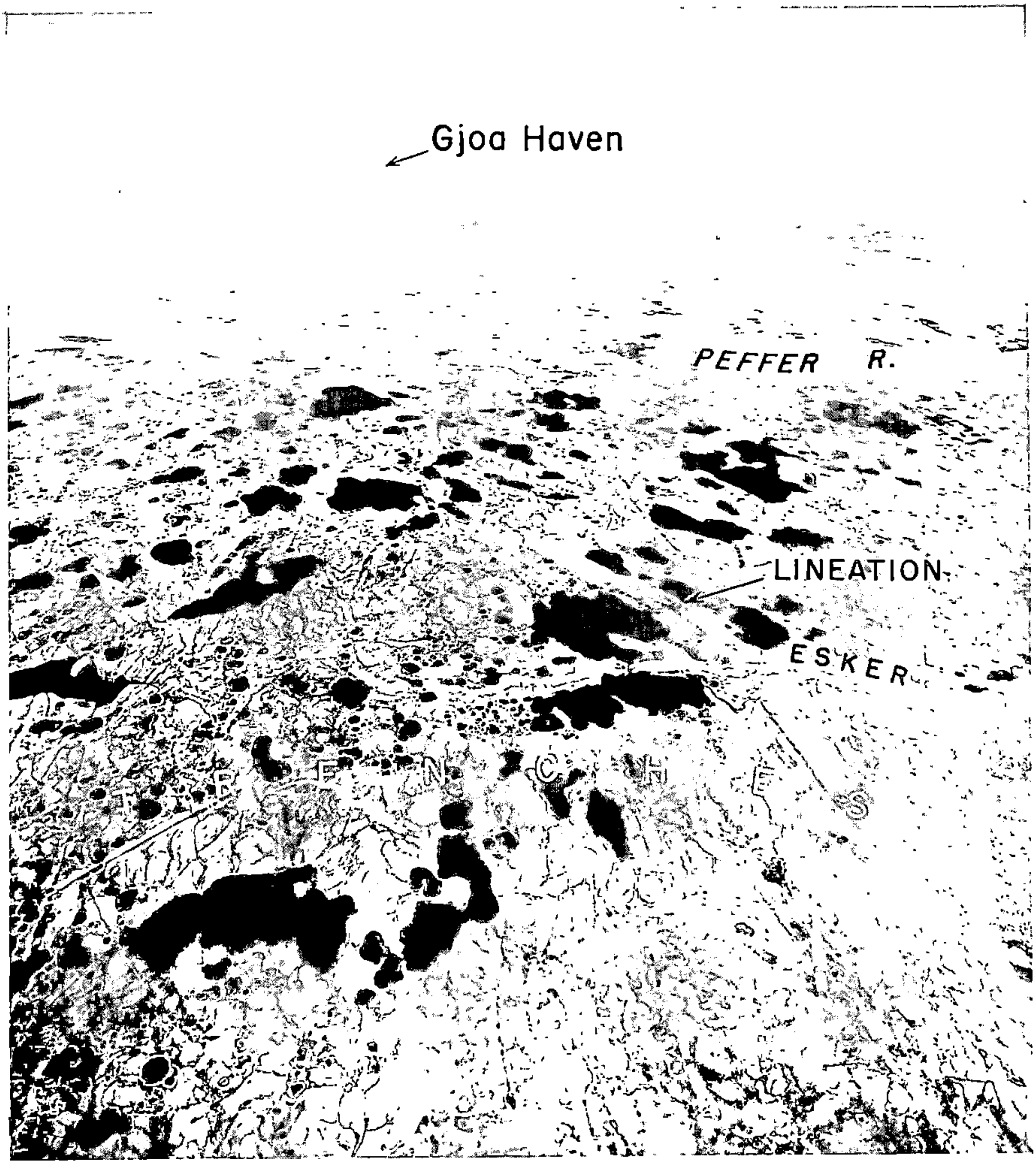

Figure 9. Looking east from Douglas Bay, King William Island. Glacial lineation is suggested to the northeast just beyond the esker in the midground. Trenches in ground moraine are shown clearly here.

is oriented a little east of north, and drumlinoids south of Cape Felix are oriented almost east-west. The less well-developed or less well-preserved drumlin forms on McCrary Isthmus trend north. In southeastern King William Island, there are scattered drumlin forms which indicate a northeast movement, perhaps associated with the drumlin fields with similar trends north of Shepherd Bay and on Boothia Peninsula. These conflicting orientations indicate a complex Pleistocene history of ice movements.

The drumlin forms of northwestern Adelaide Peninsula and southwestern King William Island exhibit a more classical as well as a fresher appearance than those elsewhere in the area. The islets which fringe this coast are submerged drumlins, their stoss ends rising rather abruptly and their lee ends sloping gently and continuing as shoals to the northwest. Across the central part of the peninsula are long, low drumlinoid forms, spindle-shaped in plan, that control the drainage pattern. In eastern Adelaide Peninsula, the drumlin forms appear to have been modified and partially surrounded by glacio-fluviatile and marine deposits. Only their summits appear, and result in long, low ridges that are visible on air photos only by careful inspection.

The drumlin forms in the area vary from over 3 miles long, a few hundred yards wide and 80 to 150 feet high to only about half a mile long and correspondingly narrower and lower. The slopes are generally convex and considerably modified by solifluction lobes, frost trenches and strands (Figure 10). Strands are best formed and preserved on the higher slopes, where small emerged bars are common, sometimes connecting two drumlins lying en echelon. Some wave-cut terraces are so strongly developed that they resemble rock cliffs from a distance.

Drumlins vary greatly in their composition, having been reported to consist of boulder clay, roughly stratified silts and sands, and sand and gravel. The drumlins

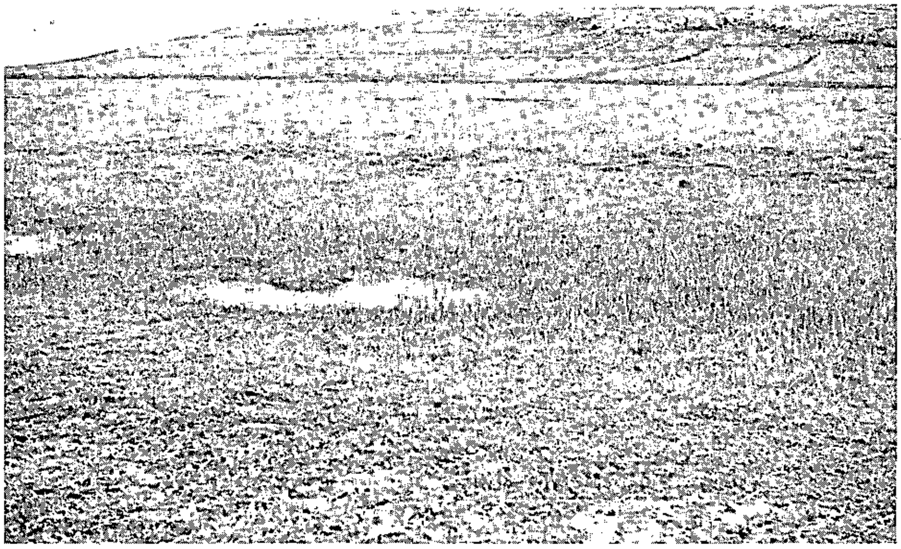

Figure 10. Drumlin in Knud Inlet, Adelaide Peninsula, showing fissures, strands and lobes.

Figure 11. Material in drumlin strand, "Island Inlet", Adelaide Peninsula. Sand beneath a veneer of gravel and limestone fragments.

in this area are composed mainly of sand and gravel, with minor components of limestone fragments and boulders. Non-sorted circles on their summits indicate that finer materials are present which may be attributed to silts deposited in the postglacial seas. The summit surfaces are mainly of coarse to fine gravel from which most of the sand and silt has been winnowed by wind, or removed by waves during emergence. Boulders are commonly strewn on the summits. Beneath the veneer of gravel, fine sand with some silt extends to permafrost (Figure 11). A test pit excavated on the summit of a representative drumlin on the shore of "Island Inlet" revealed the following material:

A surface layer of fine gravel

$1\frac{1}{2}$ feet of fine sand with some silt and pebbles

1 foot of fine dry sand

1 foot of fine sand saturated with water

Permafrost in fine sand at $3\frac{1}{2}$ feet depth.

Ground Moraine

Much of King William Island is mantled by rather featureless ground moraine which in some areas exhibits a faint fluting. Apparently the ice sheet or sheets deposited a cover of basal till in many places without creating drumlin forms. The local relief in such terrain is low, ranging from 20 to 50 feet, and the hummocky topography has been further subdued by the deposition of marine sediments and smoothing of the hills by wave action and solifluction (Figure 12). Marine strands were superimposed on the slopes of the higher or more exposed hills and are found even in the interior, indicating a complete post glacial submergence of the island.

Ice Margin Features

Adjoining the belt of drumlins west of Douglas Bay is a line of low ridges about

Figure 12. Peffer River valley, King William Island. In foreground, hill summit of till with many limestone fragments.

10 miles north of the coast. These ridges appear to be composed of sandy material with many limestone fragments, with strongly formed strands and some indication of sedimentary rock outcrops. Small kettle-like lakes are contained by this ridge, which is probably the result of a contact between an active ice lobe moving to the northwest and a more stable mass occupying central King William Island. The presence of limestone outcrops as manifested by low south-facing scarps and trenches may indicate that even such a slight structural barrier had a controlling effect on local ice movement and drumlin formation.

The peninsula terminating at Luigi D'Abruzzi Cape appears to be an interlobate moraine formed between two lobes of the retreating ice sheet which occupied Schwatka Bay and Rasmussen Basin. The peninsula is characterized by sandy material on top of and in which great numbers of boulders occur. Because of its exposed position, the peninsula has been greatly affected by wave action, which created bars and beaches, now emerged. Many of the boulders on the ridges were no doubt left by stranded ice in the postglacial sea. Low sandy ridges extend around the north shore of Schwatka Bay and may be marginal moraines representing the edges of the Schwatka Bay lobe as it shrank southward. The sandy ridges along the west coast of Schwatka Bay and Petersen Bay probably resulted from ice-contact, water-laid materials.

Between northwestern Sherman Basin and McLoughlin Bay is an ice-contact feature indicating a stand of the retreating ice sheet (Figure 5). A less well defined marginal zone occurs a few miles east of the lower Kaleet River on McCrary Isthmus. The western coast of the north part of Chantrey Inlet may also represent the margin of an ice lobe occupying the inlet. Features believed to be annual moraines occur on the coastlands just south of Elliot Bay in Chantrey Inlet.

Eskers

On both the island and the mainland, eskers are significant features of the ice retreat. In general, the largest eskers have a trend paralleling the main ice movement, varying from north to about 30 degrees west of north (Figure 13). Occasionally they reach the coast and appear as small islands or islet chains, as in Knud Inlet, and in Washington, Terror, and in McGilliveray bays. On Adelaide Peninsula, the features terminating at Ogle Point, Smith Point and Grant Point appear to have been formed by the reworking of eskers and associated sandy outwash. The esker at Smith Point is almost unrecognizable on the ground, having been strongly washed by waves during emergence and its material resorted and shifted into bars and spits. Boulder groups characterize its summit. Farther south, between Longfellow Inlet and Sherman Inlet, a "steptoe" esker has been partly buried by outwash and marine deposits.

The most prominent hill in southern King William Island (though not the highest elevation on the island) is Mount Matheson on Gibson Peninsula (Figure 14). This

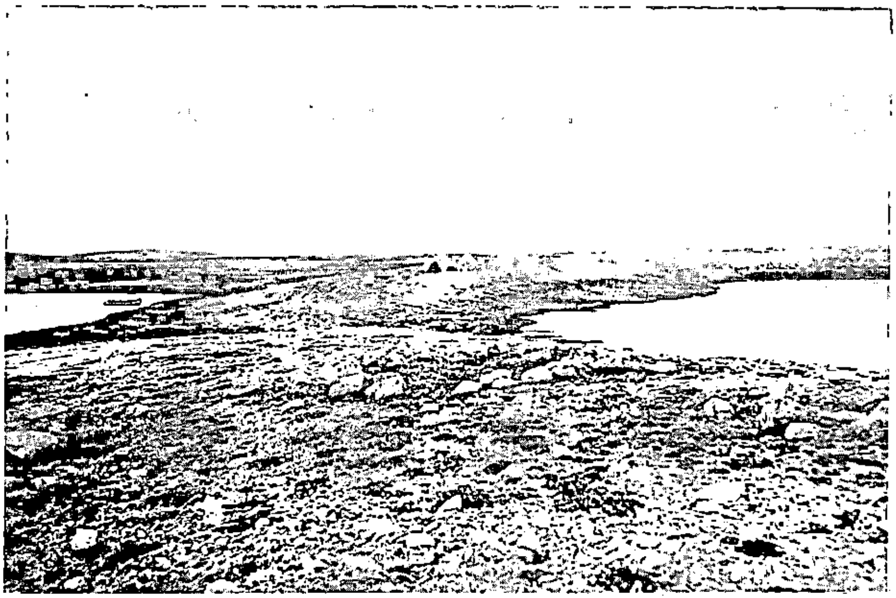

Figure 13. Esker in Knud Inlet, Adelaide Peninsula.

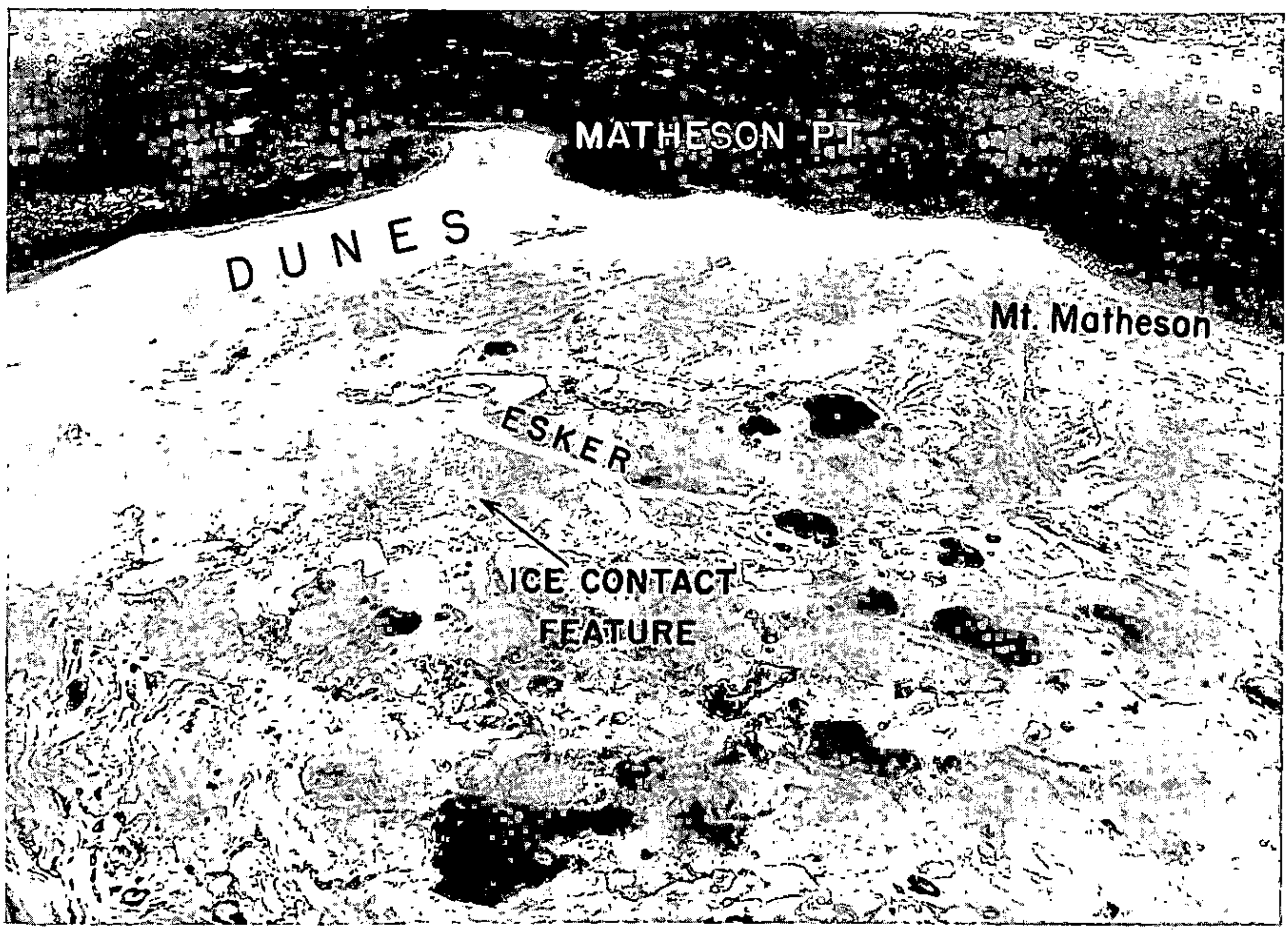

Figure 14. Mount Matheson, King William Island, looking east towards Rae Strait. The eskers and esker delta are crossed by a line speculated to represent the ice margin at the time of the creation of the esker delta.

flat-topped hill rises 245 feet above the sea and about 180 feet above the surrounding plain. It has strongly formed strands around its contours and has its steepest slopes on the southwest where there is an average slope of 18 degrees. An excavation on its summit reveals bedded sand within 10 feet, with thin gravel lenses. Esker-like features are associated with the hill, which is presumed to be an esker delta, the flat summit indicating the level of the body of water (probably the sea) into which the material was deposited by a subglacial stream. In this respect, Mount Matheson may be similar in origin to Mount Pelly on Victoria Island which, although much higher (675 feet a.s.l.), has much the same form and composition (Washburn, 1947, p. 53).

A feature of uncertain origin is associated with Mount Matheson. A remarkably straight border between the predominantly sandy area on the northeast part of Gibson Peninsula crosses Mount Matheson in a northeast direction. This border is scarcely distinguishable on the ground, but is quite obvious on oblique air photos. It may represent the margin of the ice sheet at the time of formation of the esker delta. Northeast of the border, glacio-fluvial sand and finer materials were spread over the peninsula from the glacial streams, while the terrain southwest of this border was protected from such deposition by the presence of the ice. The straightness of this line leads to an alternative speculation that it may be related to structure; however, no evidence of bedrock was observed in the vicinity of Mount Matheson.

GLACIAL HISTORY

The last stages of Keewatin ice apparently occupied a shifting elongate zone in the Wager Bay-Baker Lake area and the ice-flow patterns occurring in the King William Island-Adelaide Peninsula area reflect part of the recession towards this ice divide (Bird, 1953; Fyles, 1955; Craig, 1957). These ice-flow features appear to lead back to the divide and indicate local northerly movements during the general recession. The different drumlin trends do not appear to be contemporaneous but may reflect changes in direction and intensity of local advances, resulting from differential accretion or ablation. They may also result from crustal warping during recession. No precise levelling has been carried out which could show the presence of hinge lines around the northern margins of the ice sheets as has been done in the northern United States; however, there seems no reason to believe that such relatively abrupt isostatic uplifts would not have taken place north of the area, or areas, of maximum ice thickness.

There are two main directions of ice-flow features in the area. The movement to the northeast, manifested by the drumlins of northeastern Adelaide Peninsula is apparently associated with similar trends in southeastern King William Island and southern Boothia Peninsula. A movement to the northwest is indicated by the drumlins on northwestern Adelaide Peninsula and southwestern King William Island, where flutings on the exposed limestones also occur. This trend may be associated with the drumlin features on the island groups in Queen Maud Gulf and eastern Victoria Island (Fortier, 1948). The northwesterly-trending features exhibit a fresher, more recent appearance, in contrast to the northeasterly-trending drumlins which appear to have been partly mantled by non-lineated moraine. Although the relative sequence of events cannot be determined with certainty from the available evidence, the distribution and character of the various features resulting from ice recession makes possible reasonable inferences about the history of deglaciation in this area.

Evidence is sufficient to indicate that continental ice completely covered the entire Victoria Strait basin, extending northwesterly to Victoria Island as far as M'Clure Strait and northeasterly across Boothia Peninsula to the Gulf of Boothia. Whether or not this ice came into contact with Baffin Island ice in the Gulf of Boothia is open to question and requires further investigation. The direction of the last ice movements, however, were undoubtedly from the south.

The northern margin of the Victoria Strait ice retreated in a general southerly direction, gradually uncovering Boothia Peninsula and King William Island. At this time, sea level stood several hundred feet below the present level, due to glacio-eustatic withdrawal of water accumulated in the Pleistocene ice sheets. The land was also depressed an unknown amount, but may have commenced to rise according to isostatic adjustment. King William Island was covered by over 200 feet of water, illustrated by the summit of the Mount Matheson esker delta.

Associated with Mount Matheson in the Gibson Peninsula area are ice margin features indicating a position of the ice front along the southern coast of the island. During this stand, the Mount Matheson delta and associated eskers were created, sandy deltas were formed by proglacial streams and interlobate features were built between small ice lobes which stood in Petersen Bay, Schwatka Bay and east of Luigi D'Abruzzi Cape. Kettles, including the harbour of Gjoa Haven, resulted from the incorporation of ice blocks in the glacio-marine deposits (Figures 15, 16).

During the retreat of the ice front across Adelaide Peninsula, the eskers forming the peninsulas terminating at Ogle Point, Smith Point, and Grant Point were created. When the ice margin reached a stage where it extended across the base of Klutschak Peninsula, vast amounts of sand and gravel were deposited in the sea by supraglacial or englacial streams, forming a large delta centred about the present Sherman Inlet (Figure 18). The proximal face is clearly defined just north of Falcon Inlet and the limits of the delta material may be traced on Adelaide Peninsula several miles west of Sherman Inlet (Figure 5). Boulders, sands and gravels of several hundred feet thickness formed this glacio-marine delta; typical bottom-set and top-set bedding were observed in several gullies in the area.

After the delta was formed, an upwarping took place and King William Island,

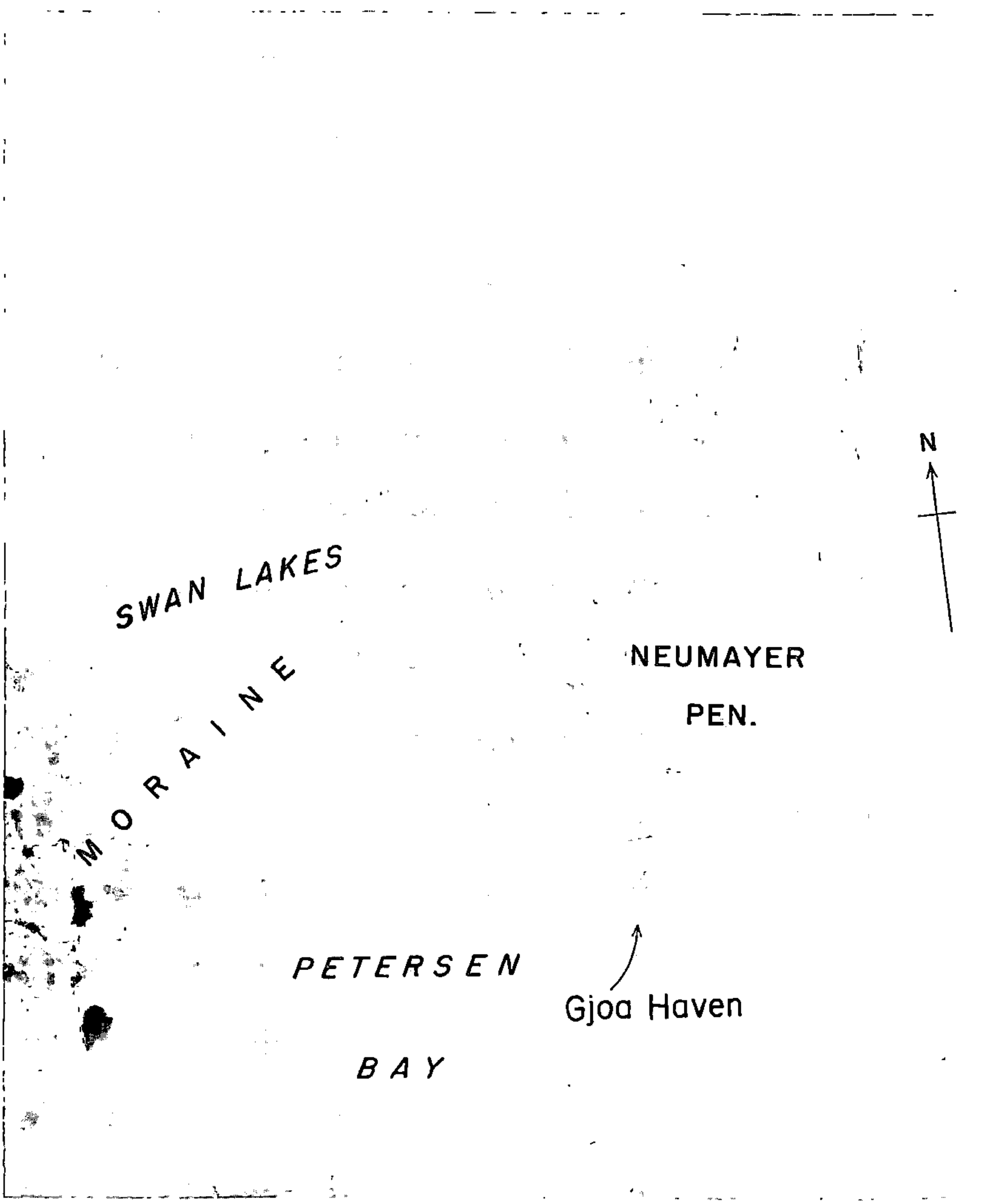

Figure 15. Neumayer Peninsula, King William Island; a vertical photograph taken from 30,000 feet. Gjoa Haven is a kettle in glacio-marine marginal deposits.

Adelaide Peninsula and Klutschak Peninsula were raised several hundred feet above the sea (Kuenen, 1955). The glacial streams feeding the delta now began to cut through

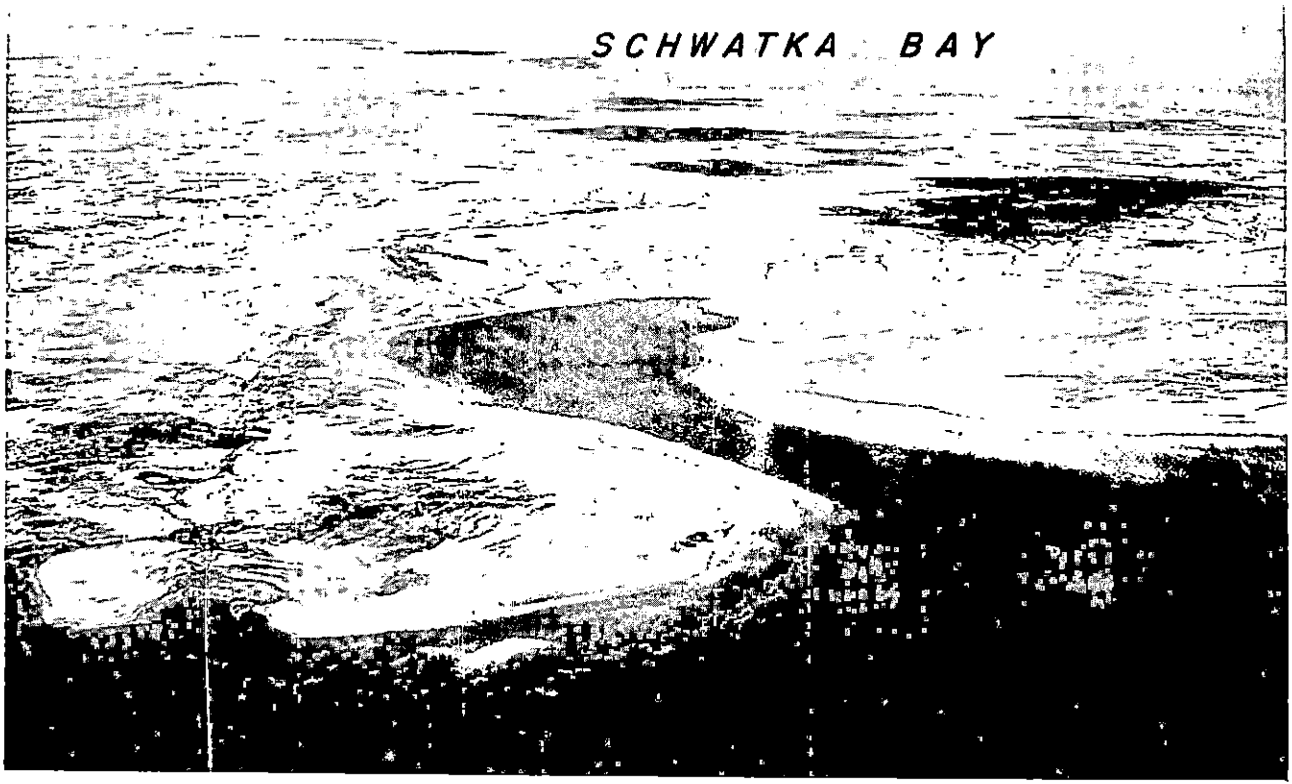

Figure 16. A low level oblique photograph of Gjoa Haven, King William Island, looking northeast. Strands surround the harbour and gullies have been cut in the sands and gravels.

their former deposits and created channels in the sands and gravels (Figure 19). These channel scars were cut to varying depths and the streams changed their courses from time to time. The main glacial river, however, tended to re-occupy the preglacial channel confined on the east by the Dubawant (?) sandstones occurring along the east side of Sherman Inlet. The material washed out by this river was

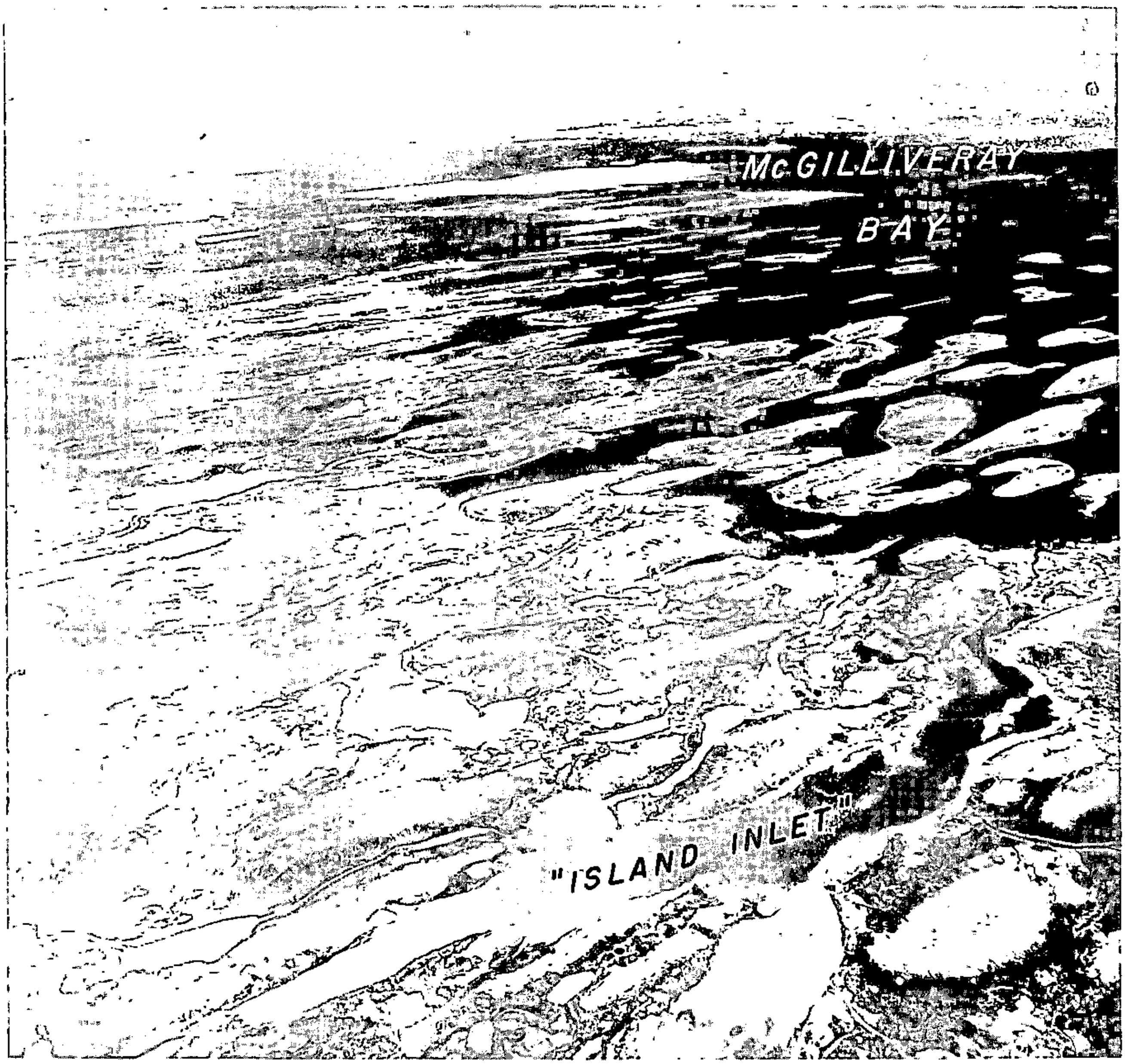

Figure 17. Drowned valleys along the drumlin coast of McGilliveray Bay, Adelaide Peninsula. Looking west over "Island Inlet".

re-deposited in Wilmot and Crampton Bay where portions of it appear today as sandy islands. Ice blocks incorporated in the sands melted later to form kettles.

The series of small, disconnected ridges which occur near Elliott Bay on the west side of Chantrey Inlet and also in the Perry River area along the south coast of

Queen Maud Gulf may represent annual ice-margin deposits formed at about the same time as the Klutschak Peninsula glacio-marine delta. Similar features of apparently the same origin exist near Chesterfield Inlet, parallel the east coast of Hudson Bay, and occur in scattered locations on Boothia Peninsula.

As the Pleistocene glaciers waned and the ice margin continued to retreat to the south, the glacioeustatic rise of sea level eventually resubmerged King William Island and Adelaide Peninsula, including the dissected delta. Complete resubmergence is indicated by strands on the highest elevations and is corroborated by evidence of marine transgression at elevations of over 700 feet on nearby Boothia Peninsula* and over 450 feet on the east side of Chantrey Inlet**. Previous to the rise of the sea, small streams on northwestern Adelaide Peninsula incised winding valleys in unconsolidated material which were then inundated by the sea (Figure 17).

The postglacial sea covered the area long enough for silts to be deposited as a thin veneer over the glacial materials. Isostatic adjustment continued and is probably still going on. During this rise of the land, which took place in short uplifts of a few feet rather than as a major upwarp, an apparently more open sea formed successive beaches on the islands and peninsulas, reworked the drift and silts and allowed ice-rafted boulders and associated material to be deposited across the area.

Evidence to suggest that a lower level of the sea existed previous to a complete inundation and subsequent uplift is found in the drowned valleys in northwestern Adelaide Peninsula and the wide channel of Sherman Inlet which connects Sherman Basin to the northern sea. Sherman Inlet could not have been formed in its present form merely by tidal currents and is evidently the result of a large river which cut

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* Personal observations, Fraser, 1953, 1958.
** Personal communication, J.B. Bird, 1957.

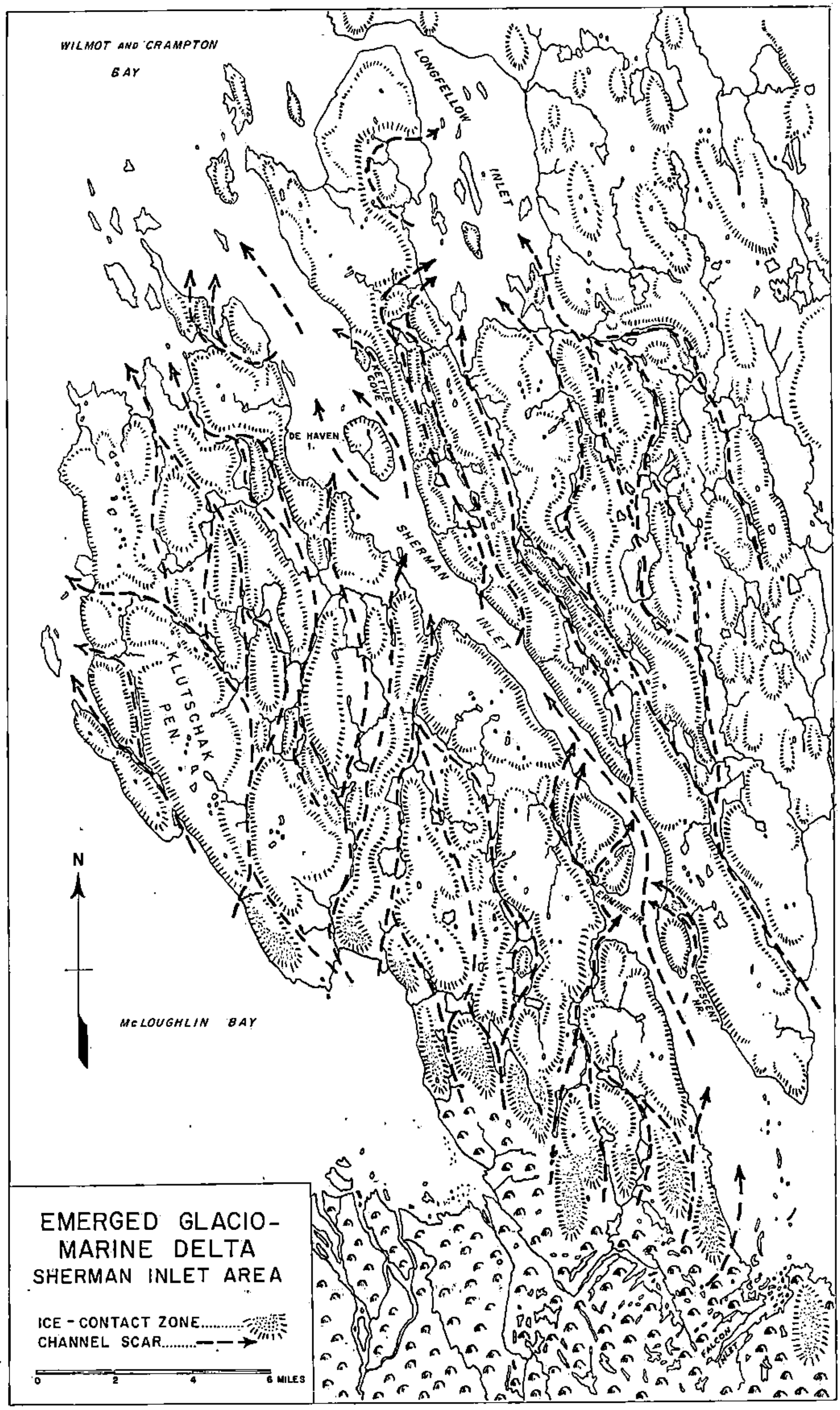

Figure 18. Map of Klutschak Peninsula, showing glacial spillways and ice contact face.

its channel below present sea level.

The dissected glacio-marine delta forming Klutschak Peninsula and the adjacent part of Adelaide Peninsula has certain physiographic characteristics which tend to confirm this suggested origin (Figure 18), (Charlesworth, 1957). The hill summits are relatively concordant at about 200 feet above sea level and most of the hills have level summits. Spillway channels may be traced (Figure 19) and their

Figure 19. Spillway channel, Klutschak Peninsula, south of Ermine Harbour.

valleys slopes are concave in contrast to the convex slopes of drumlin forms. The material is predominantly sand, with gravel and boulders, is strongly water-rounded and has interbedded lenses of clay or silt with marine shells (Figure 20). Finally, the southern margin of the delta strongly resembles a lobate proximal ice-contact face, with a remarkably abrupt topographic break between the higher delta and the lower rock knob terrain which has few sandy deposits.

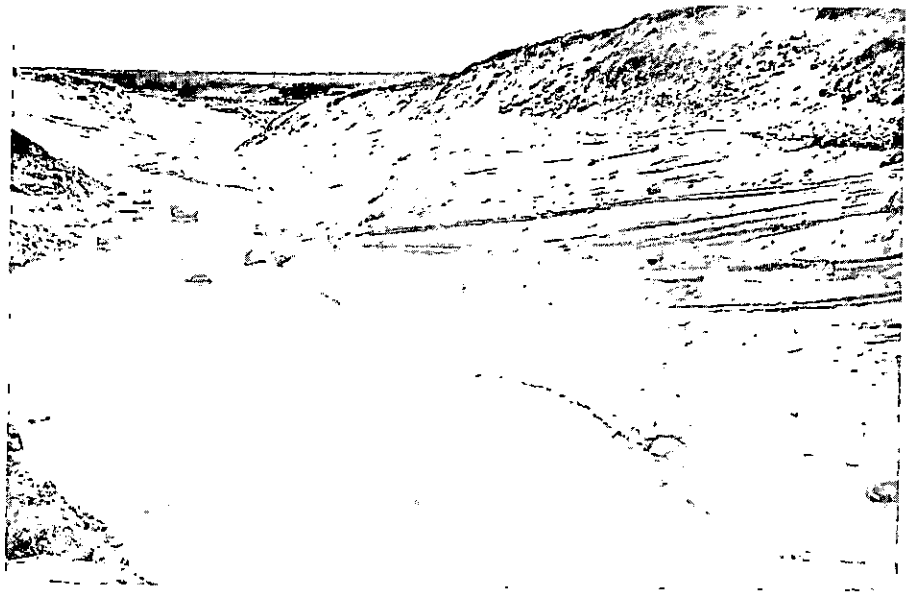

Figure 20. Stratified sands and gravels in a gully at Kettle Cove, Sherman Inlet.

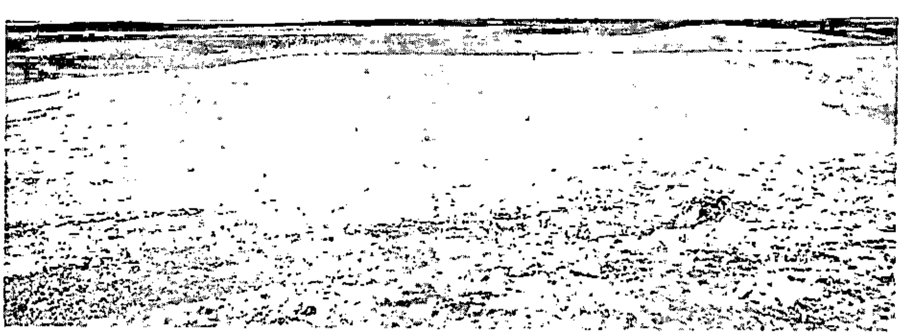

Figure 21. Strands on moraine hills north of Petersen Bay, King William Island.

POSTGLACIAL FEATURES AND PROCESSES

Strands

The drumlins, outwash deposits and morainic hills throughout the area support more or less well formed strands on their slopes (Figure 21). In several places strongly formed strands or terraces, regularly spaced vertically, appear to indicate that emergence of the land occurred at a uniform rate. The occurrence of strands on eskers and other hills in central King William Island and the interior of Adelaide Peninsula indicate a complete submergence of the area.

Strands result from the sorting action of waves and the piling up of beach material by both storm waves and sea ice. The washing out of finer components into the depressions created between successive beaches results in a strand having a well drained nature, inhibiting vegetal growth and preserving its appearance and original characteristics. Strands are affected during their formation by ice pushes and after their emergence by breaching by small streams, frost fissures and solifluction. Breaching is uncommon and fissures do not tend to destroy the original form. Solifluction lobes commonly overlap strands although the original strand material is unlikely to be unstable.

On steeper slopes and where the feature was exposed to strong wave action, wave-cut terraces with relatively steep risers have been left by emergence. Drumlins in particular are susceptible to such truncation, being relatively isolated and their sandy material in this area easily affected by wave and current action. These terraces are characterized by their position at one end of the drumlin, by their steep slope and by the accumulation of boulders along the foot of the terrace. Such terraces also occur in the emerged delta at Sherman Inlet.

Well preserved terraces on the ridge east of Koka Lake were measured at 40, 70, 75 and 90 feet a.s.l. and the relatively level summit of the ridge at 125 feet. A strong terrace at 70 feet was noted along Sherman Inlet and one of 200 feet near Crescent Harbour. On the west side of the inlet, near Ermine Harbour, there are terraces of 100, 115 and 160 feet. It is possible that some of these terraces may represent stages in the cutting of spillways. None were traced for any significant distance.

Marine shells

Shells noted commonly throughout southern King William Island and on the mainland support the occurrence of strands as evidence of marine submergence in the area. The species collected* are not indicative of deeper water or warmer climate. The highest elevation at which shells were found was at 205 feet a.s.l. south of Ermine Harbour, in gravity-bedded sands exposed in gullies along Sherman Inlet.

Strands are commonly colonized by ground squirrels (Citellus parryi) on the mainland, and material cast out from their burrows is often a useful indicator of the feature. Foxes appear to select dunes on the marine plains for their burrows rather than strands, although both are utilized. The squirrels probably prefer coarser material with some larger boulders to discourage digging by foxes.

Marine and lacustrine plains

Surrounding the drumlins in northwestern Adelaide Peninsula are wide expanses of sandy plains, containing shallow lakes and narrow winding streams. Colonized by goose grass and cotton grass, marsh areas are extensive and the level plains extend to the base of the drumlins where poorly preserved strands are

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* Astarte borealis Schumacher; A. arctica Gray; Mya truncata Linne; Hiatella arctica (Linne): identified by Geol. Surv. Can., Report P1-9-56/57.

manifested by lines of boulders from which the finer material has been removed. Much of the material forming the plains was undoubtedly washed from the drumlin summits during emergence and contains a high percentage of silt. Such plains also occur in the recent drumlin belt along the south coast of King William Island, where much of their area is bare of vegetation and provides poor travelling in the spring when the material is still well saturated with water. Streams traversing these plains carry a high content of silt which discolours them and the lakes into which they empty.

Ice rafting

During the postglacial submergence, heterogenous mixtures of boulders and material derived from slumping banks or picked up by freezing of bottom deposits were carried by sea ice and deposited widely throughout the area. In particular, ice-rafted material was more likely to be left where ice was stranded on shoals, now the higher summits of the present topography. It is impossible to differentiate between erratics left by the ice sheets and boulders left by subsequent ice rafting, but no doubt many of the boulders occurring on prominent hills resulted from the latter.

Small mounds of mixed boulders and unsorted finer materials occur on drumlin summits and other morainic hills. Some were acted upon by wave action during emergence, some may be constructional wave- and current-formed bars, and some may represent crevasse fillings formed near the edge of the retreating ice front. Such mounds, because of their prominence in terrain of low relief and the fact that they are kept swept bare of snow by wind, are commonly used by owls and ptarmigan especially in the winter, and the comparatively luxuriant vegetal growth associated with these mounds results from the enrichment of the soil by the droppings of these birds and the remains of prey. The term "owl perches" has been applied to such features by Porsild (Porsild, 1955) although he apparently confined the term to smaller hillocks or even isolated rocks, not necessarily on a hill summit, but occurring widely on lower and more level terrain.

CONCLUSIONS

1. King William Island and the adjacent mainland were covered by generally north-moving Pleistocene ice.

2. Ice-flow features suggest that local directional changes took place, possibly due to differential accretion or ablation during deglaciation.

3. The relative differences in the preservation of the two main ice-flow directions suggest that the northwesterly one was the more recent.

4. A trough shown by recent hydrographic soundings indicates that Simpson Strait was a preglacial valley.

5. Ice lobes of the retreating ice sheet occupied Schwatka and Petersen bays and Rasmussen Basin, leaving marginal deposits along the coast between Booth Point and Gibson Peninsula.

6. Mount Matheson is an esker delta formed at the retreating ice margin.

7. It is speculated that an upwarp of some 250 to 300 feet took place during the time the ice front stood in the Sherman Basin area.

8. Klutschak Peninsula and areas adjacent to Sherman Basin are glacio-marine deltaic deposits which were raised and dissected following this upwarp, after which Sherman Inlet was cut along a preglacial valley.

9. The peninsulas terminating at Ogle Point, Smith Point, and Grant Point are reworked eskers and associated outwash materials.

10. The whole of King William Island and Adelaide Peninsula was submerged

following glacio-eustatic rise of sea level, drowning Sherman Inlet and smaller valleys.

11. Subsequent emergence of the area took place at a uniform rate.

APPENDIX

The following geographic names used in this report were either recently adopted or changed in their application by the Canadian Board on Geographical Names. The name "Island Inlet" has not been officially adopted but is used for convenience.

Crescent Harbour	67°53' N., 98°09' W.
Ermine Harbour	67°54' N., 98°14' W.
Falcon Inlet	67°45' 30" N., 98°04' W.
Gibson Peninsula	68°50' N., 95°30' W.
"Island Inlet"	68°23' N., 97°45' W.
Kettle Cove	68°05' N., 98°27' W.
Klutschak Peninsula	67°55' N., 98°30' W.
Knud Inlet	entrance at 68°32' N., 97°39' W.
Koka Lake	68°31' N., 96°15' W.
Longfellow Inlet	68°10' N., 98°20' W.
Malerualik Lake	68°34'30" N., 97°19' W.
M'Clintock Bay	68°40' N., 97°44' W.
Neumayer Peninsula	68°38' N., 95°51' W.
Petersen Bay	68°35' N., 96°00' W.
Rasmussen Basin	east of Simpson Strait, south of Rae Strait and north of Chantrey Inlet.
Sherman Inlet	68°00' N., 98°21' W., new application; restricted to the narrow passage leading to
Sherman Basin	the inner, somewhat circular bay formerly named Sherman Inlet.

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