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THE

Peary Auxiliary Expedition of 1894

BY

HENRY G. BRYANT

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Peary Auxiliary Expedition of 1894

BY

HENRY G. BRYANT
RECORDING SECRETARY GEOGRAPHICAL CLUB
OF PHILADELPHIA

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With Supplementary Reports

BY

PROF. T. C. CHAMBERLIN (Geology)

DR. AXEL OHLIN (Zoölogy)

PHILADELPHIA

JUNE, 1895

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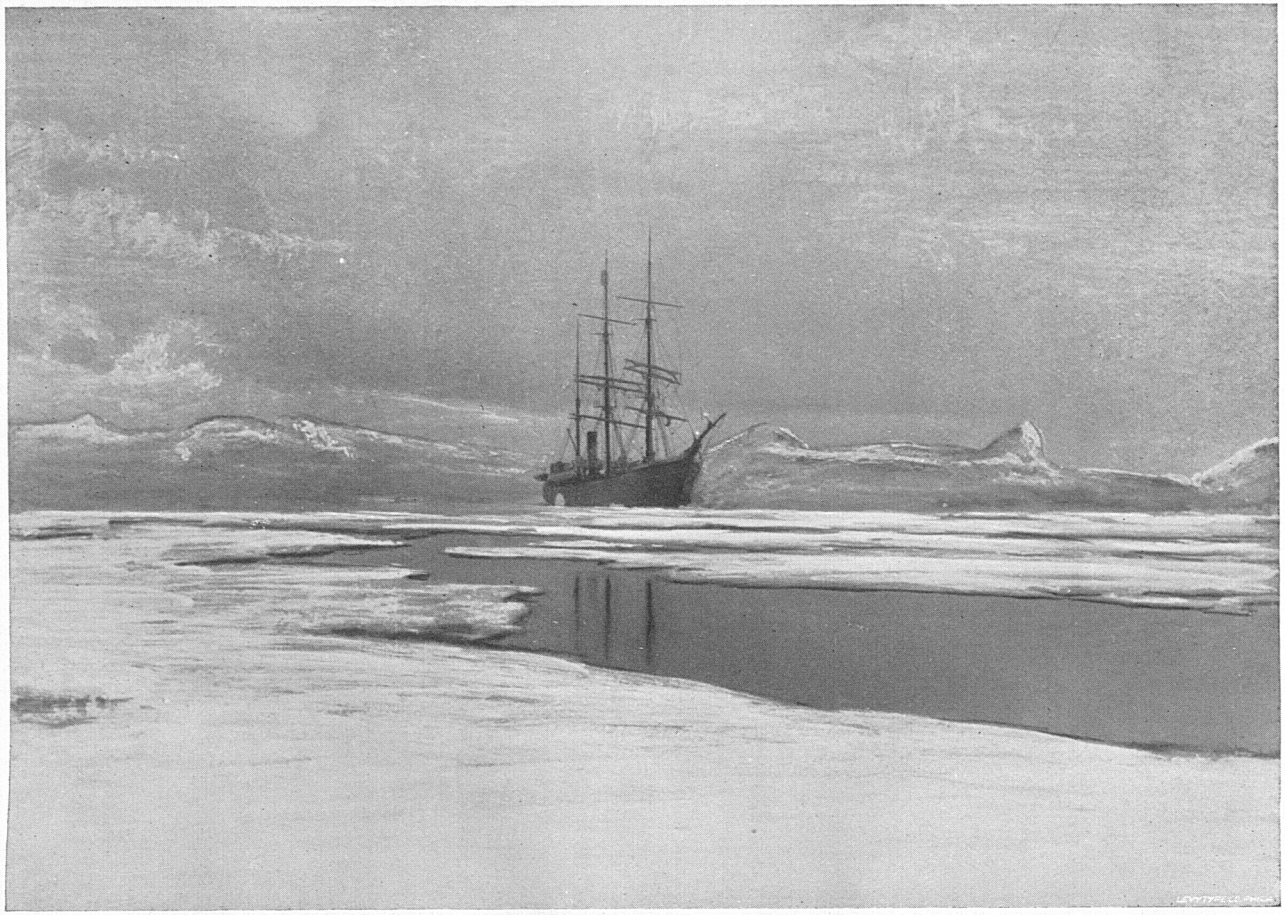


THE "FALCON" IN THE ICE OF INGLEFIELD GULF

THE

Peary Auxiliary Expedition of 1894

BY

HENRY G. BRYANT

Greenland may be regarded as one of the few countries which still present problems of primary importance to the explorer. Known to Europeans since the days of Erik the Red, the wandering Viking who is credited with discovering and colonizing the region in the latter part of the 10th century, the northern and northeastern outlines of this great continental area are still represented on our maps by lines of conjectural rather than ascertained exactness. Yet, in view of the physical disadvantages attending research in the region, the achievements of the past cannot be lightly estimated and the eventual survey of the unknown

area may justly be regarded as a geographical work requiring the highest qualities on the part of the Arctic traveller.

Interest in Greenland exploration has been stimulated in America within the last four years, by the two expeditions of Civil Engineer Robert E. Peary, U. S. N., and many of that generation which followed the achievements of Kane, Hayes and Hall with acclamation are still interested in the outcome of this latest attempt to wrest from nature the secrets which still lie hidden in the solitudes of the far north.

As a result of a preliminary journey to the west coast of Greenland, and a reconnaissance on the inland ice, in the summer of 1886, Lieutenant Peary determined to organize an expedition with headquarters in the Inglefield Gulf region, where the inland ice was more accessible than farther south. The uniqueness of his plan consisted in the utilization of the smooth surface of the interior snow-cap as a means of advance, and he asserted that, to a properly equipped sledge party, this great white plain presented an "imperial highway" to the north. The success of this new departure in Arctic travel was fully demonstrated by the results of the Peary North Greenland Expedition of 1891-92. By minute attention to the details of his equipment, the use of concentrated food and the adoption of a light, Eskimo style of dress, Lieutenant Peary, with one companion,[1] succeeded in making a remarkable sledge journey of some 1300 miles over the inland ice. He eventually reached 82° N. Lat. and made observations which led him to believe that Greenland was an island, separated by a well defined channel from the detached land masses which extended towards the north.

On his second expedition, which reached Bowdoin Bay—a northern indentation of Inglefield Gulf—on August 3rd, 1893, Lieutenant Peary hoped to profit by the lessons of his first attempt, and furthermore, by making an earlier start, to reach Independence Bay, the limit of his former journey, early enough in the season to undertake a dash over the sea ice towards the outlying islands which he had observed stretching to the north towards

1. Mr. Eivind Astrup, of Christiania, Norway.

Mr. Emil Diebitsch. Dr. H. E. Wetherill. Prof. Wm. Libbey, Jr.
Mr. H. L. Bridgman. Mr. Henry G. Bryant. Prof. T. C Chamberlin.

SIX MEMBERS OF THE PEARY AUXILIARY EXPEDITION OF 1894.

the polar area. His plans also included the despatching of a subsidiary party from Independence Bay down the unknown northeast coast of Greenland as far as Cape Bismarck (Lat. 76° 47′), from which point a retreat was to be made across the interior to the headquarters at "Anniversary Lodge" on Bowdoin Bay. The successful execution of these plans would have been a noteworthy achievement in Arctic annals, and great interest was manifested in the issue of Lieutenant Peary's undertaking.

Before leaving for the north on his last journey, Lieutenant Peary had arranged for the despatch of the steam whaler "Falcon" with a relief party, whose mission should be to reach "Anniversary Lodge" and afford the explorers the opportunity to return in safety to the United States. Lieutenant Peary himself provided the greater part of the money required and the direction of the undertaking—known as the Peary Auxiliary Expedition of 1894—was placed in the hands of the officers of the Geographical Club of Philadelphia. In the spring of the year 1894 the organization of the party was entrusted to the writer, while a committee was designated to assist in an advisory capacity. To the members of this committee, Prof. Angelo Heilprin, Mr. Amos Bonsall, Mr. Talcott Williams and Mr. G. W. Hart, I am indebted for much valuable aid in perfecting the preliminary arrangements.

As subordinate to the main object—the relief of Lieutenant Peary's party—the plans of the expedition included a search for traces of the Swedish naturalists Björling and Kallstenius, and an examination and survey of the unknown north shore of Jones Sound.

I esteem myself singularly fortunate in the personnel of the party. Those who volunteered on the expedition united to scientific attainments of the first order, varied experience in travel, enthusiasm for their work and a philosophical cheerfulness which never failed them during the many somewhat trying experiences of the journey.

The following "gentlemen adventurers"—to use an Elizabethan phrase—met together for the first time in Brooklyn, N. Y., on June 20th, 1894, and subsequently sailed on the S. S. "Portia" for St. Johns, Newfoundland: Prof. William Libbey, Jr.,

Geographer; Prof. T. C. Chamberlin, Geologist; Dr. Axel Ohlin, of Sweden, Zoölogist; Mr. Emil Diebitsch, Civil Engineer; Mr. H. L. Bridgman, Historian, and Dr. H. E. Wetherill, Surgeon.

After a speedy and uneventful voyage the "Portia" reached St. Johns on June 25th. Here we were to go on board our own vessel, the steam whaler "Falcon," a bark-rigged craft of 311 tons net register, which had been chartered for the voyage. In past years, the citizens of St. Johns have witnessed the departure and return of nearly all the American Arctic expeditions, and they extended a cordial welcome to the members of our party. Our vessel not being in readiness, a tedious delay of eleven days intervened before we were able to move on board the "Falcon." The time was agreeably occupied, however, in excursions in the neighborhood and in accepting the social attentions extended to the members of the party by the Governor of the colony, the officers of Her Majesty's North Atlantic Squadron and others.

Here the final additions were made to our equipment, a year's provisions placed on board the "Falcon" and last messages sent to friends in the South. Captain Henry Bartlett, who had conducted Lieutenant Peary north the previous year, was again secured as Ice Master, and under him was the ship's complement of fifteen men—all hardy Newfoundlanders—veterans of the Arctic whaling service and northern sealing trade.

At length, all preparations being completed, on the afternoon of July 7th, our staunch little steamer swung out from her pier and slowly made her way down the harbor. As we passed the British cruiser "Cleopatra," the blue jackets manned the yards and gave us three rousing cheers. With this fraternal farewell ringing in our ears, we soon passed "The Narrows" whose stern and lofty walls guard the entrance to St. Johns, and ere long found ourselves embarked on the last stage of the long journey to the north.

During the ensuing few days the time was passed in unpacking trunks and boxes and in accommodating ourselves to the routine of life on shipboard. On the "Falcon" the food was plain and the passenger accommodations, especially on the return voyage, exceedingly restricted. But one scarcely looks for luxurious

surroundings on an Arctic cruise, and we became reconciled to the absence of many creature comforts as we realized the peculiar requirements of a vessel engaged in this northern work and observed how admirably the "Falcon" met these requirements.

On the morning of the fifth day out Cape Desolation, just north-west of the southernmost point of Greenland, was sighted 25 miles to the north-east, and we soon found ourselves approaching the belt of broken ice which is carried by the current down the east coast of Greenland and thence northward along the west coast for a distance of about 150 miles. Skirting along the edge of the loose pack, the delicate emerald and sapphire tints of the floating ice masses, weathered into strange shapes, aroused general admiration, while the lengthening twilights prepared us for the nightless day of the Arctic summer. For two days we pushed through or skirted the edge of the east coast ice, which compelled us, at times, to veer off several points to the westward of our course. Notwithstanding our distance from shore, which was usually about 25 miles, the outlines of the coast stood out with marvelous distinctness; so clear and still is the atmosphere in these northern latitudes. Here, too, we observed numbers of the large hooded seals (*Cystophora cristata*) sunning themselves on the ice pans. Of the five males which were shot for specimens the largest measured seven feet. Their heads were marked by the singular bladder-like appendage over the nose which distinguishes this variety of seal. The tenacity for life shown by these creatures was something extraordinary. While stretched out in the lee scuppers, long after we supposed the merciful bullets had done their work, one of these seals would raise his head and look defiance to his enemies.

About four P. M. on July 13th, we passed the Frederikshaab Glacier in the distance, and at eight o'clock the same evening slacked our speed for an hour while the surface drag nets were cast over, for the purpose of securing some of those minute marine animals whose presence forms so important a part in the economy of bird and fish life in the north. The evening being calm and warm, a successful "catch" was secured, to the delight of Dr. Ohlin, who promptly set to work to assort his prizes and

stow them away in the dark room and laboratory which had been built on the poop deck.

By dinner time next day (12.30 P. M.) we ran into a fog which enveloped the outlying islands and veiled the face of "Sukkertoppen," a prominent landmark of this part of the coast. Feeling our way through the fog, we must have encountered a strong northeasterly current; for, while at supper, the lookout startled us with the cry "breakers ahead," and rushing on deck we beheld across our starboard bow a line of surf beating against a rocky shore. The engines were stopped and we just had space to swing out in time to escape a rub on the rocks, which might have proved disastrous to our enterprise.

Nine days after leaving St. Johns the "Falcon" dropped anchor in the harbor of Godhavn, the Danish colony on the island of Disco, where lives Herr Anderson, the Inspector of North Greenland, a mild autocrat who presides over the destinies of some 135 Eskimo subjects. The Danes re-established colonies in Greenland in 1721, and thirteen trading districts are comprised within the North and South Inspectorates—the two principal political divisions of the country. Of late years the value of the Greenland trade has fallen off greatly, and it is understood that only pride in the ancient colonies and a sense of obligation to the dependent natives prevent the subsidized monopoly known as the Royal Greenland Trading Company from abandoning the country altogether.

The appearance of the "Falcon" entering the harbor with a brave display of bunting and thundering forth a salute from her ancient cannon, brought joy to the hearts of the natives who were soon swarming on our deck offering various specimens of Eskimo curios for barter and sale. The officials of the colony had received word from Denmark of our coming and extended a hearty welcome to our party, as did also Captain Bunde, the master of the Danish brig "Tialfe," which chanced to be in port during our stay. After paying an official call on Governor Elmquist, most of our party started on an excursion up a glacial river valley known as the "Blaese Dael;" this jaunt proved to be most interesting, taking us, as it did, past the sculptured, basaltic

columns of the region, over miles of rich green sward dotted with countless wild flowers glowing in the splendor of their summer beauty; high up the mountain side, across glaciers and over snow banks to the base of the ice-cap of Disco Island. Here, from an elevation of 1800 feet, a glorious view of Disco Bay, dotted with hundreds of icebergs from the Jacobshavn Glacier, entranced our vision and made a picture which will long live in memory.

Some seal-skin boots, to complete our equipment, were obtained here, and also specimens of the so-called meteoric stones of Disco Island. The two days of our visit passed quickly enough and after attending a ball given by the Eskimos in our honor, we boarded the "Falcon" on the evening of July 17th, and were soon steaming once more towards the north.

A heavy fog settled down on us after leaving Disco, and, to guard against collision with the numerous icebergs about us, the engines were run at half speed and a sharp lookout posted. When off Hare Island the curtain of mist lifted and we went ahead at our regular seven and a half knot speed. By nine P. M. the wide expanse of Umanak Fiord was crossed, where a majestic procession of icebergs was observed floating out to sea. Sanderson's Hope, the well-known landmark of Arctic chroniclers, which was reached by that famous old navigator, Davis, in 1587, loomed up over our starboard bow the next morning. Later in the day the weather again became "thick" and much excitement was caused by our encountering three polar bears, all of whom fell victims to the rifles of our party. The skinning of these huge ice-bears proved to be exhausting work to our amateur taxidermists, who were engaged on the work from six-thirty P. M. until midnight. At that hour the sun was shining brightly in the northern heavens and the distant peaks of the mainland reared their massive outlines above the bank of fog which hung along shore. All about us extended vast quantities of loose pack ice chilling the air and adding a desolate splendor to the scene. We had already encountered considerable of this heavy pack ice and were anticipating some difficulty in the passage of Melville Bay. The "Falcon" entered the confines of this dreaded battleground of Arctic navigators early in the morning of July

20th. We found the pack still substantially unbroken; but the presence of occasional "leads" of open water induced Captain Bartlett to attempt to advance by the "middle passage." After several hours of ineffectual effort, however, the outlook became so discouraging that it was deemed best to retreat to the southeast. Holding on our course as best we could through heavy ice and enveloped in a dense fog we made but slow progress and were compelled to stop the engines for an hour at 6.10 A. M. By 11 A. M. we had advanced a few miles, and the fog lifting, showed our position to be a little south of the Devil's Thumb. All day we made our devious way through favoring "leads" in sight of this landmark. In the afternoon thicker ice was encountered, many of the severed pieces revealing edges of fully forty inches. Oftentimes our approach to a favoring "lead" would be barred by a "neck" of this thick ice forty or fifty feet in width. Against this the "Falcon" would advance at full speed. Not only once, but over and over again would this maneuver be repeated. The staunch old ship, with her prow sheathed in iron and protected below the water line with greenhart planking, stood the force of these impacts with impunity, although the havoc wrought among the dishes in the saloon and cook's galley was something to be remembered. Two weeks earlier in the season this ice would have effectually stopped our advance, but we found it considerably weakened by the all-pervading sunshine, and the first westerly gale would probably disintegrate the greater part of the floe. The experience of the four Peary expeditions which have crossed Melville Bay eight times during the past four years go to prove that the traverse can be successfully made, in an average season, any time after the third week in July. By noon on July 21st, we had arrived off Cape Walker in Latitude 75° 50′ N. Some time before this we had entered the "Inner Run" of the whalers—this is the narrow leadway formed by the tidal crack between the fixed floe ice of the shore and the slowly moving drift ice of the bay. This course led us comparatively close to the shore of the bay, so illy defined on the charts. From our coign of vantage in the "crow's nest" we studied the coast as we moved ahead through the canal-like open-

ing in the ice-field. The inland ice here sweeps down to the sea, where it breaks off in huge sections, forming great tabular bergs and revealing a glacier wall perhaps unexampled for height and unbroken front. The mirage which hung persistently over the horizon distorted the outlines of the grounded bergs and imparted fantastic shapes to the nunataks which at intervals formed promontories in the great ice-wall. Comparatively few bergs were visible in the outer bay. This may be explained by the fact mentioned by the Danish officials, that violent north winds prevailed during the previous autumn. Coming from that quarter, at a time when the bay is free from ice, these storms would effectually disperse the fleet of bergs which usually ground here, and whose presence has been noted by most travelers to this region.

On Sunday morning, July 22d, when in sight of Cape York, which is regarded as the northern boundary of Melville Bay, we reached the end of the lane of water which we had followed so successfully, and at 6 o'clock found ourselves beset in the ice, just as we were congratulating one another on our good fortune in crossing the bay with comparatively little detention. I transcribe the following from my notes written at the time: "Our position is anything but pleasant, held as we are, between the fixed shore ice and the broken floe of the bay. Immediately after breakfast the ice about us, impelled by some mysterious force, closed in with a harsh, grinding noise. In front and to the rear of our position the huge "pans" crunched together, forming hummocks along the line of resistance, and at the same instant impelling the superimposed sheets against the sides of the vessel with great force. Slowly the black hulk of the "Falcon" was raised up, and directly after, given a "list" of nine degrees to the port side. All day we have remained in this helpless position, enveloped part of the time in a dense fog. Had we been thus beset while in the hard, thick ice of day before yesterday our position would have been indeed a critical one. As it is, the power revealed by the impact of this comparatively soft ice is strenuous enough to excite the concern of all on board."

After a detention of thirty-three hours, the ice mysteriously

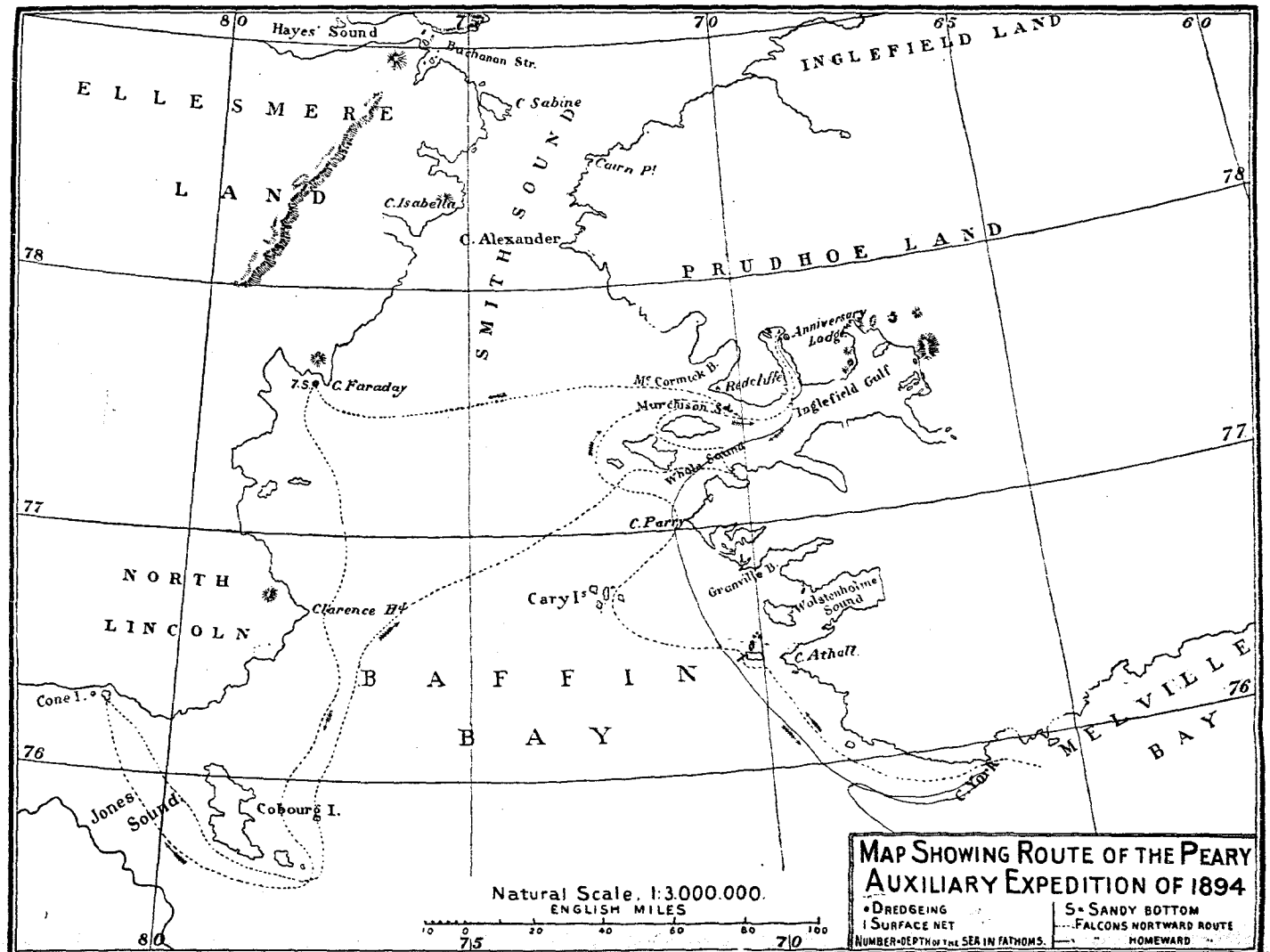
opened up and permitted us to proceed to Cape York, where we arrived at midday on July 23d. This promontory marks the southern boundary of the habitat of the Northern Eskimos, who were named "Arctic Highlanders" by the first white men who visited them in 1818. From time immemorial Melville Bay, with its inhospitable shore line, has been the impassable barrier between the primitive Eskimos of the north and the more civilized natives of the Danish settlements.

The "Falcon" was anchored for some hours to the shore floe near Cape York, and the natives were soon swarming about the ship. A number of us visited their camp, somewhat east of the cape proper, and found it comprised seven "tupics" or sealskin tents. Here we obtained our first news of the safety of Lieutenant Peary's party, and here also I had the pleasure of renewing my acquaintance with a number of these hardy hunters whom I had first met while in this region in the summer of 1892. The natives seemed prosperous and happy and received us with their proverbial friendliness. Four typical young matrons of the tribe submitted to the ordeal of the camera with varying degrees of acquiescence, as may be seen from the accompanying reproduction of the photograph.

Although enjoying none of the so-called advantages of civilization, these natives contrasted most favorably with the southern Eskimos, who have been under the Danish influence for more than a hundred years. The latter have so large an admixture of white blood among them that it is well nigh impossible to find a genuine Eskimo type in the more important settlements, while in spite of the well-meant solicitude of the home government many of them, weakened by the excessive use of coffee, tobacco and European clothing, are losing their skill as hunters and falling victims to pulmonary and other diseases. On the other hand, we found no signs of deterioration among the small tribe of "Arctic Highlanders," who number all told only about 250 members. These interesting people possess all the virtues of isolated, primitive savages and seem to be holding their own from year to year in that bleak region, where, to a

THE "FALCON" BESET OFF CAPE YORK.

ESKIMO WOMEN OF CAPE YORK SETTLEMENT.



ADAPTED FROM THE GEOGRAPHICAL JOURNAL, 1893.

white man, mere existence seems to be naught but a hopeless struggle with the forces of nature.

Leaving Cape York, we slowly made our way through extensive fields of loose pack ice, northward past the Crimson Cliffs of Sir John Ross and the great Petowik Glacier to the mouth of Wostenholm Sound. The expanse of open water usually found at this season, beyond Cape York, and which is called the "North Water," we found to be entirely absent this year. A circumstance which argued much for the severity of the winter just past.

Wishing to replenish our supply of fresh meat, two parties landed on a small island called Dalrymple Rock, and, in the course of three hours, secured some 87 ducks—welcome additions to our larder.

Since leaving Melville Bay our desire to view the superb scenery of the region and the succession of incidents attending our visits to Cape York and Dalrymple Rock had kept all of us on the alert for hours beyond the usual working day of more southern latitudes. Since passing the Arctic circle the distinction between night and day had been a purely arbitrary one, yet there seemed to be something in the constant daylight and pure air of the Arctic which stimulated all and enabled us to get along with a scant modicum of sleep.

Pressing on, we now set our course for the Cary Islands to visit the site of the last camp of the Swedish explorers. As some of my readers may not be acquainted with the history of the Swedish expedition, I venture briefly to relate the incidents which led to this last search for records of the unfortunate young explorers.[2]

Alfred Björling, an accomplished young botanist of Stockholm, was but twenty-one years of age when he undertook the leadership of this expedition to the Smith Sound region. Although so young he had already made his mark as a resolute and ambitious traveler. He was the first to ascend the peak of

2. Professor A. E. Nordensklöld, in a lecture before the Society of Anthropology and Geography, of Stockholm, December 15th, 1893, gave an authentic history of the Björling expedition, which was printed in the Society's periodical, Ymer.

Kebnekaisse, the highest mountain in Sweden. Later on, he visited the west coast of Spitzbergen as a member of a Swedish expedition. In 1891 he reached Upernavik on board a Danish trading ship, and, with a native crew in a small boat, made a journey as far north as the Devil's Thumb in Melville Bay. In May, 1892, with a fellow-student named Kallstenius, he arrived in St. Johns, Newfoundland, to perfect plans for reaching Ellesmere Land. Finding he was too late to secure passage on any of the whalers, with the scanty means at his disposal he purchased a small schooner named the "Ripple," which was regarded as unseaworthy by the prudent skippers of St. Johns. After much difficulty he succeeded in obtaining a crew and, at length, with high hopes for the future, and heedless of impending dangers, embarked on his last fatal voyage.

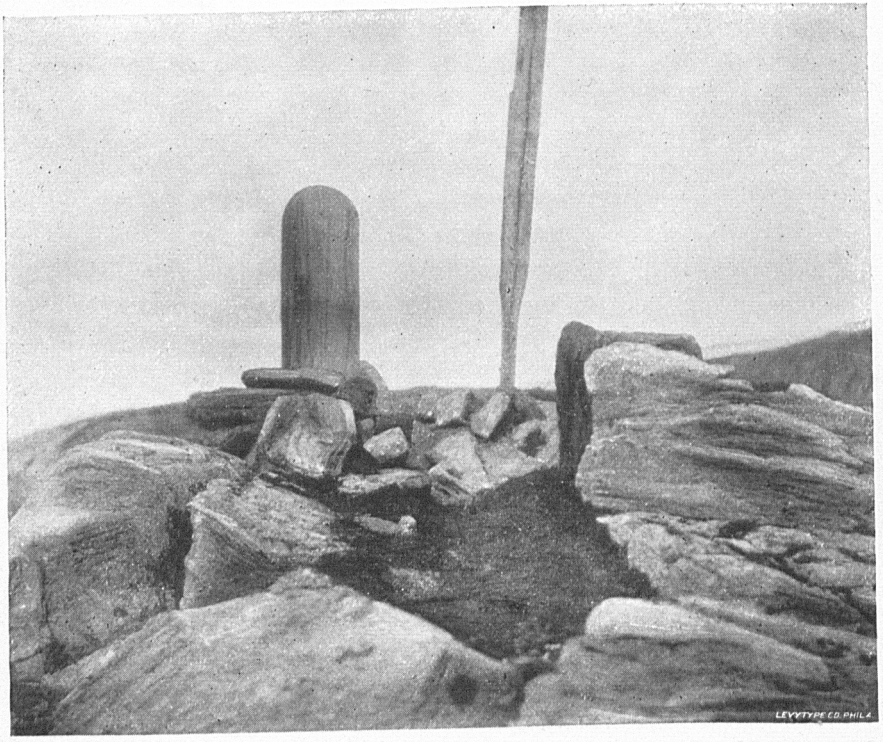
The "Ripple," with its crew of two sailors and a cook, brought them in safety to Godhavn, where they purchased a rifle, shotgun and a small boat. On August 3d, the five men sailed from Godhavn and were never afterwards seen alive. When autumn passed and no news of them reached Europe, their friends in Sweden, including Professor Nordenskiöld, took measures to ascertain their fate. In a letter sent from Godhavn, Björling had stated that he would leave a message on the Cary Islands, whither he proposed to go to replenish his stores from the English depot left there by Nares in 1875. The Scotch whalers sailing from Dundee were requested to visit the Cary Islands and look for this message. At length, in November, 1893, the whaler "Aurora" arrived at Dundee and brought the first news of their movements. Captain McKay reported that in June, 1893, the lookout on his vessel had discovered the wreck of a schooner on the shore of Southeast Cary Island, which, on examination, proved to be the "Ripple." The landing party also found the body of a man under a heap of stones near by, and in a cairn discovered four messages written by Björling.

From these messages it appeared that Björling reached the Cary Islands on August 16, 1892, and that his schooner was driven ashore the following day while the men were engaged in transferring the provisions from the English depot to the ship.

ALFRED BJÖRLING,
BOTANIST,
AGED 21 YEARS.

EVALD G. KALLSTENIUS,
ZOOLOGIST,
AGED 24 YEARS.

From "Ny Illvstrerad Tidning," No. 47, Nov., 1893.



GRAVE OF A MEMBER OF THE SWEDISH EXPEDITION
On Southeast Cary Island.

This was the greatest misfortune that could have befallen the party, and not only destroyed their hopes of exploring Ellesmere Land, but endangered their chances of returning to the Danish Colonies. The most obvious course for them to have pursued was to have embarked in their small boat for Cape Parry, twenty-five miles to the eastward, and to have made the most of what remained of the summer in retreating south. On the Greenland coast they would possibly have been picked up by the "Kite," the vessel which passed Cape Parry on August 24th, having Lieutenant Peary on board, who was returning home from his first expedition. In any event, had winter caught them unprepared, they would have been assured of kind treatment at the hands of the Whale Sound Eskimos. Instead, however, of taking measures to escape, Björling, after wasting valuable time in a northern boat journey, conceived the desperate project of undertaking a voyage in an open boat to Clarence Head, on the western side of Baffin Bay. In his letter he stated that he would endeavor to return to Cary Islands by July 1st, 1893, in hopes of meeting a whaler, and closed by appealing as follows to any whaling captain that might receive his message: "I shall be very much obliged to you if you will go to Clarence Head (50 miles off), where I shall leave in a cairn information relative to our fate during the winter. Our provisions, if I cannot find Eskimos, will not last beyond January 1st. We are now five men, one of whom is dying." This last letter was dated October 12th, 1892.

The "Aurora" was headed for Clarence Head, but owing to the ice which constantly hangs along this coast, she was unable to get within twenty miles of shore. No further intelligence was received and this was the state of affairs when Dr. Ohlin joined our party as the accredited representative of Professor Nordenskiöld and the friends of the lost travelers.

Let me ask you to accompany me, when, on July 24th, 1894, in carrying out our mission to look for traces of the gallant young Swedes, we landed on Southeast Cary Island. It was late in the afternoon of an ideal Arctic day that the "Falcon" reached this bleak and desolate island, which a wealth of bright sunshine

could not relieve of its aspect of dreariness. No sign of the wrecked schooner "Ripple" could be found, but the site of the last camp of the Swedes was located. Here the retreating snow revealed scattered about in confusion numerous memorials of the brave but foolhardy adventurers. A silver watch, zoölogical note book, botanical press and a few other articles were selected from the mass of relics. We left a record of our visit in a cairn on the highest point on the island; but a careful search here, as well as on the middle island of the group, where we subsequently landed, revealed nothing which would shed further light on the fate of the travelers. We found, however, in a conspicuous cairn on the southeast island, a note stating that the whaler "Eclipse" had arrived at the island on July 6th, and that Mr. Elis Nilsson, the Swedish representative on board, had searched in vain for information about his countrymen. We noted also, that the grave of the man who had died there, had been despoiled, presumably by the huge burgomaster-gulls of the island. A feeling of compassion filled our hearts as we viewed the scene of this grievous struggle against fearful odds. The dismembered bones of the ill-fated voyager were collected and a new grave and headstone made, and thereupon, in the Arctic stillness and under the light of the midnight sun, a simple burial service was read, after which we left the island, and turning our faces northward invoked better tides and fortunes for ourselves and our friends at "Anniversary Lodge."

This sad duty to a fellow-wanderer like ourselves being fulfilled, we again proceeded northward. On July 25th, the day indicated in the official prospectus of the expedition as the date of arrival, we reached the neighborhood of Lieutenant Peary's headquarters, only to find that the ice had not yet broken up in Inglefield Gulf and that thirty-five miles still intervened between us and our destination. Had the condition of the ice permitted, we could easily have made a sledge trip for the remaining distance; but while compact enough to prevent the advance of the ship, the ice in places showed the effect of tidal action in the shape of open "leads" and pools of water. These effectually cut off our advance towards the Peary headquarters.

ESKIMO VISITORS FROM IGLOO D'HOMINY.
The Most Northern Settlement

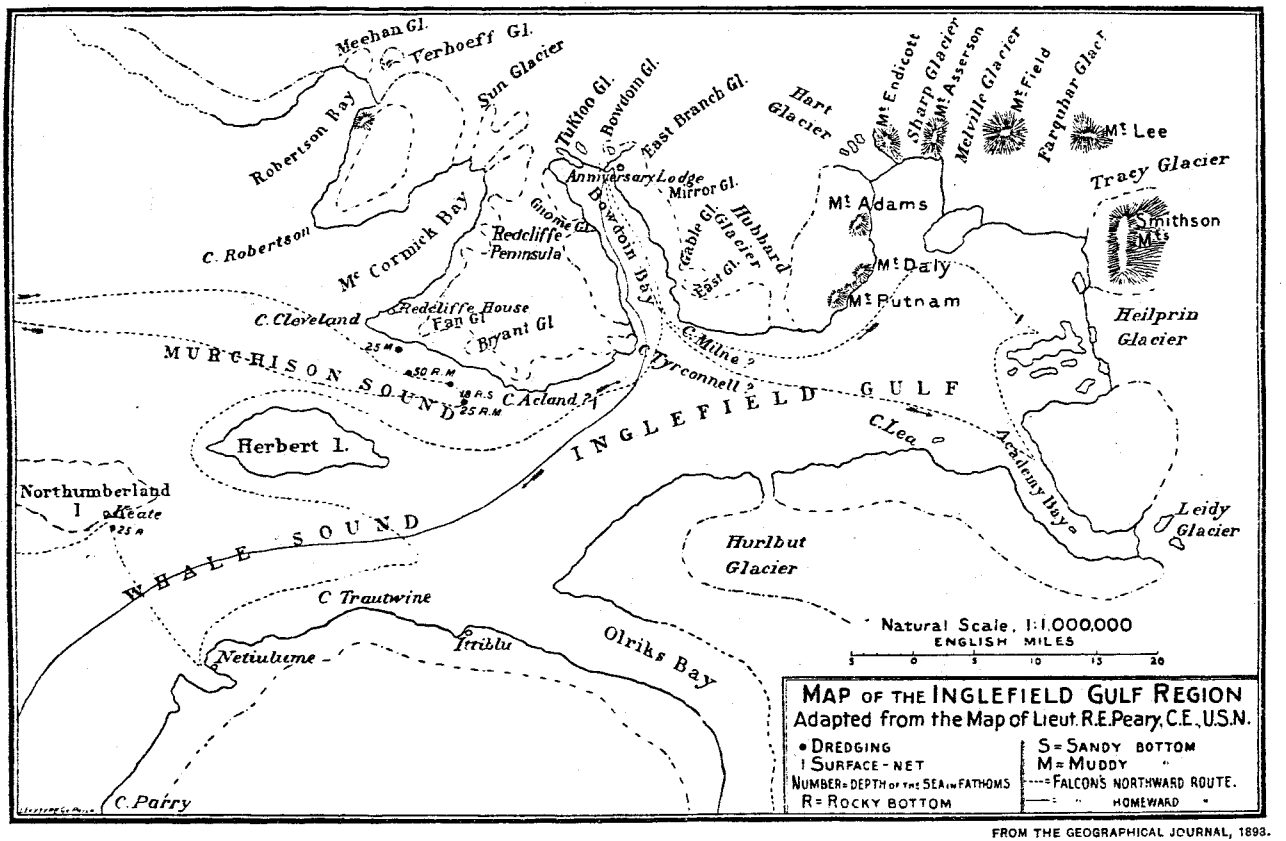
On the shore of Robertson's Bay, almost due north of our position at that time, was located the small village of Igloo d' Hominey, which may be regarded as the most northerly permanent settlement of human beings on the globe. The day following our arrival, five natives from this place came across the bay ice on their dog sledges to visit the ship, and we learned from Meuh, their spokesman, that the Peary party were all well, and, furthermore, that in his opinion, their quarters could be reached in "two sleeps." Realizing the importance of opening up communication with Lieutenant Peary at the earliest possible moment I determined to undertake a journey to his headquarters at once. On the afternoon of July 26th, therefore, in company with Mr. Diebitsch and a native guide, I left the ship for Igloo d' Hominey en route for "Anniversary Lodge." We availed ourselves of the Eskimo dogs and sledges at hand and in this way were able to carry four days' provisions, sleeping bags and a few other necessaries for the journey. From my knowledge of the neighborhood, gained on a previous visit as a member of the Peary Relief Expedition of 1892, I deemed it possible to proceed along the ice foot of McCormick Bay to the head thereof, whence, by a route used by the natives, a short cut could be made over the glacier from the head of McCormick Bay to the head of Bowdoin Bay—the site of the Peary headquarters.

But the sequel proved that our guide—the veteran Meeuh—had greatly underestimated the difficulties of travel at this unsettled season of the year, when neither the conditions of winter nor of summer prevailed. After an absence of four days, during which we encountered fog and storm and baffling "leads" of open water, our guide refused to accompany us further over the loose and rotten ice, and we were compelled to return to the ship. The day following our return the "Falcon" again attacked the ice, hoping to reach a "lead" which opened up in the desired direction. By means of continuous ramming and butting and the occasional use of blasting powder when the floes pressed us too closely, we finally reached open water, and, by following the narrow and tortuous passages between the ice fields, were able to advance about five miles up Inglefield Gulf, to the edge of the

unbroken winter floe. We were now in sight of the settlement of Karnah, whose inhabitants, old and young, straightway forsook all other pursuits and lost no time in reaching the wonderful "Oomiaksoak," where they were sure of a kind reception and a great feed at the hands of Larry Hackett, our kind-hearted steward. A reward had been offered by Mr. Peary for the first news of the ship's arrival, and the welcome tidings were first carried to "Anniversary Lodge" by two native couriers on the evening of July 31st. Lieutenant Peary dispatched Mr. Entrikin to the ship in company with the two enterprising Eskimos, the same evening, and thus it happened that early on the morning of August 1st the cry of "Kablunah" (white man) raised by the natives, brought me on deck in time to grasp the hand of Mr. Entrikin as he clambered over the ship's side.

Great was our regret to learn from him of the failure of Mr. Peary's sledge journey on the inland ice and the consequent postponement of its execution until the following year. After a very brief delay, Mr. Entrikin announced that he was ready to return to headquarters, and, accompanied by Mr. Diebitsch, and drawn by the two identical dog teams which had already twice made the thirty mile journey within twenty-four hours, we set out for "Anniversary Lodge." I doubt if anywhere on the globe there assembled that evening a happier company than the one which greeted our arrival at Falcon Harbor in front of "the Lodge." Lieutenant Peary was gratified to find his relief steamer reporting on time, Mrs. Peary delighted to find I had brought with me her brother, Mr. Emil Diebitsch, and the others glad to welcome new faces to their camp and to receive letters from family and friends. In due time, we were presented to the new member of the North Greenland Expedition, Miss Marie Anigheto Peary, whose little life had grown and blossomed into loveliness under the rays of the North Star as other children's lives had grown amid the comforts of more genial climes.

After a conference with Lieutenant Peary, it was decided to carry out the prearranged programme of the expedition and to visit Ellesmere Land to continue our search for traces of the lost Swedes and also to attempt the exploration of the north shore of



FROM THE GEOGRAPHICAL JOURNAL, 1893.

Jones Sound. Leaving Professor Chamberlin to pursue his studies of the glaciers about Bowdoin Bay, the Auxiliary Expedition, reinforced by the presence of Messrs. Astrup, Entrikin, Vincent, Carr, Davidson and Swain, of the Peary party, started on August 4th for Cape Faraday, Ellesmere Land. After thirty-six hours struggle with the ice in Murchison Sound, the open water of Baffin Bay was reached, and on August 7th we succeeded in pushing our way through the belt of ice which impinges the east coast of Ellesmere Land and succeeded in landing at Cape Faraday, being, as far as I can learn, the first party of white men to land on the west coast of Baffin Bay between Jones Sound and Smith Sound.[3] No trace of the lost explorers was found here, nor at Clarence Head—a bold headland to the south, where in company with Professor Libbey and Messrs. Astrup and Diebitsch I went ashore on August 8. Before returning to the ship, cairns were built on prominent points at both places in which records of our visit were placed. The assertion of the whaling captain that this west coast is unapproachable during ten months of the year, owing to the field of ice which extends twenty miles from shore, seemed to be verified by the experiences of our party. Although we arrived in the height of the Arctic summer we could not forcethe "Falcon" nearer than eight miles from shore and were compelled to make the remaining distance on foot at considerable risk over the shifting ice.

Had the unfortunate travelers ever succeeded in landing at Cape Faraday or Clarence Head their position would have been a desperate one. The entire coast line consists of a succession of precipitous headlands, crowned by the changeless snow-cap which discharges by numerous glaciers into the sea. No traces of

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3. Clements R. Markham, P. R. G. S. in an address before the Royal Geographical Society, on May 28th, 1894, (Geog. Journal, vol. iv, p. 14) referring to the possibilities for original research in Ellesmere Land remarked: "* * * Next to Northern Greenland, the most interesting part of the unknown region is the land on the western side of the north part of Baffin Bay, between Smith Sound and Jones Sound, and extending along Jones Sound to the west and north. It was named Ellesmere Land by Sir Edward Inglefield, who saw it from the deck of the Isabella in 1852. It is called Uming-Mak (the land of the musk oxen) by the Eskimos. No one, so far as we know, has ever landed between Jones Sound and Smith Sound."

game or of the recent presence of Eskimos were found,[4] and, on leaving these desolate shores, we had the sad satisfaction of establishing the fact that the young Swedes never succeeded in reaching the western mainland.

The exploration of Jones Sound, with all its possibilities of original geographical research, was now before us. Finding Glacier Strait icebound we made our course through the pack ice south of Coburg Island into the sound. For six hours we steamed onward through open water, and hopes ran high of reaching new lands beyond Inglefield's farthest of 1852.

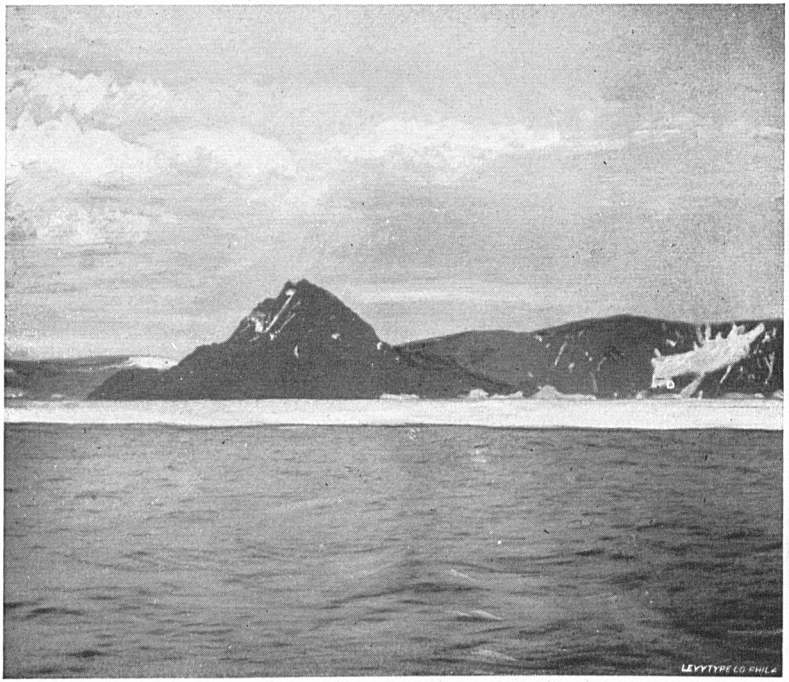
But after penetrating about forty miles the formidable unbroken ice of the previous winter rose up ahead, presenting an impassable barrier across the sound. It was a keen disappointment to be turned back thus on the threshold of the unknown; but, with no prospect of changed conditions, and with definite responsibilities ahead of us, protracted delay in these inland waters seemed unwarranted.

At noon on August 10th, observations showed our position to be: Lat. 76° 14′ 53″ N., Long. 81° 52′ 36″ W. Earlier in the day we had reached a point ten or fifteen miles west of this, where the solid floes extended across the sound. Holding our course to the northeast along the edge of the ice, we passed Cone Island at 4 P. M. This conspicuous landmark is apparently composed of red sandstone and rises in pyramidal outline directly from the ice-flecked waters of the sound.[5]

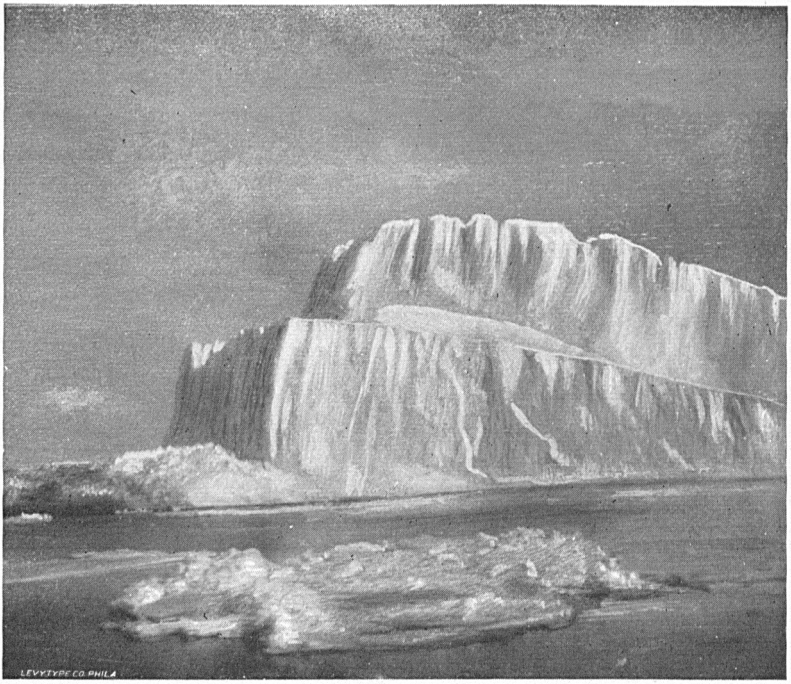
Wishing to again set foot on this land, which had promised such great rewards to our efforts, we steamed past Smith Island and headed our vessel towards a small bay on the adjacent north shore of the sound. After scrambling over the broken ice for two hours, we reached a smooth beach at the mouth of a small glacial valley. Rambling among the rocks where beds of scarlet

4. A few ancient Eskimo graves were found at Cape Faraday.

5. On August 17th, 1851, Lieutenant Sherrard Osborne in the "Pioneer" reached about the some position in Jones Sound and found like conditions prevailing, as he writes: "From a little beyond a conical shaped island on the north shore the sound was still barred with floes." Two of his officers landed on Cone Island and reported finding "numerous Esquimaux traces, though of very ancient date." (Stray leaves from an Arctic Journal, New York, 1852, p. 187.)



CONE ISLAND, NORTH SHORE OF JONES SOUND.



A MELVILLE BAY ICEBERG.

saxifrages smiled a welcome, we disturbed a few eider ducks feeding along the shore and sent two Arctic hares scampering up the hillsides. These were the only living things observed, although the skeletons of an ice bear and seal and numerous whale vertebrae were found imbedded in the sand near the beach. We were at a loss to account for the presence of these bones until the interesting discovery was made that we had lit upon the site of an Eskimo settlement. The foundations of eight igloos were found and a search amid the soil disclosed part of a bone sledge runner and the fragment of a lance head of the same material. These remains had every appearance of great age. The Eskimo hunter whom we had brought with us from Inglefield Gulf and who formed one of the landing party, vouchsafed no information regarding the former occupants of these moss-covered ruins.

This sheltered bay, being one of the few localities in this region adapted to the wants of a native settlement, may have afforded a temporary resting place to those Eskimos who wandering north eventually reached Grinnell Land and north Greenland. On the other hand, if we accept the statements of Bessels and Dr. Franz Boas[6] that a primitive tribe of Eskimos inhabit the southwestern part of Ellesmere Land, it would be reasonable to suppose that members of this tribe in times past had extended their travels along the north shore of Jones Sound, as far east as the camp site referred to.

Directly after the return of the landing party we bore off to the southeast and in due time steamed out of the sound and passing

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6. Dr. Franz Boas—The Central Eskimo. (An. Rep. Bu. Eth., 1884-85, p. 443.)—referring to the periodical journeys of one of the tribes of North Baffin Land, says: "The journeys of the Aggomuit are not at all confined tc Baffin Land. In favorable winters they cross Lancaster Sound, passing the small island Uglirn, and winter on the eastern half of Tudjan (North Devon). While here they keep up some intercourse with the inhabitants of Unmingman Nuna (Ellesmere Land). * * * * * Having reached Unmingman Nuna, the Eskimo who gave me this information affirm that they fell in with a small tribe who resided on this shore. Here they lived for some time, as there was an abundance of seals during the whole year. Further northwest is a large fjord. * * * * * The Eskimos do not visit the land on the other side of this fjord, as bears are said to be very numerous and large there. Though these migrations to Jones Sound do not occur very frequently, they have by no means been discontinued."

to the south of Cobourg Island made our course for Northumberland Island, where we arrived on the morning of August 13th.

Björling, in his record dated October 12, said that after the wreck of the "Ripple" he tried to reach Foulke Fiord to winter there, but "after reaching Northumberland Island, was compelled from several causes to give up this voyage and return to Cary Island." Thinking that possibly some traces of the presence of the Swedes might be found on this island, we skirted the south shore and landed at one point, but nothing was found to throw any further light on their movements.

After leaving Northumberland Island, we visited the native village of Netiulume, on the mainland to the southeast, where some hours were spent in securing ethnological specimens, after which we again started for "Anniversary Lodge,"75 miles distant. But our old enemy, the solid bay ice, which baffled us so often during the summer so delayed our advance that it was seven days later (August 20th) before we cast anchor in Falcon Harbor, in front of "the Lodge." The continued firmness of the ice in the sounds and bays of this region was quite unprecedented according to the Eskimos, and added immeasurably to our difficulties. During the fifty days passed within the Arctic Circle, we had but ten days of clear open sailing. For twelve days we were diverted more or less from our course by heavy floe ice. For twenty-two days the "Falcon" was in the heavy pack, making but slow progress at best and stopped for days by the thick, unbroken floe of the past winter. During the remaining six days we were beset, first off Cape York and later on in Murchison Sound.

After our return from a hunting expedition to Academy Bay, in which the combined parties took part, final preparations were made for departure. On August 26th Mr. Frank W. Stokes and Mr. E. B. Baldwin, the artist and meteorologist, respectively, of the Peary party, came on board. Their companions of the previous winter, Dr. E. Vincent and Messrs. Astrup, Entrikin, Clark, Carr and Swain, had accompanied us to Jones Sound and were already established in their contracted quarters on the "Falcon." Last of all, Mrs. Peary and her infant daughter and Mrs. Cross,

FACE OF THE TUKTOO GLACIER.

the nurse, came on board, together with "Miss Bill," a young Eskimo girl, whom it had been decided to bring to the United States. Hearty farewells were spoken to Mr. Hugh J. Lee, the member of Lieutenant Peary's party, who had volunteered to remain over another winter with him, and then our staunch old craft raised anchor and began her homeward voyage. Lieutenant Peary had decided to accompany us as far as Cape York, to superintend the shipping on board of a large meteorite, which had been located and examined by him on a sledge journey in the previous May. He is satisfied that this meteorite is identical with the historic "Souilic," or Iron Mountain referred to by the Arctic Highlanders who met Sir John Ross in 1818, as one of the two localities from which they obtained the iron for their knives.[7] Arriving at Cape York on the evening of August 27th, the ice in Melville Bay to the eastward, where the meteorite was located, was found to be intact, thus putting an end to all our hopes of securing the specimen.

To expedite the return of Lieutenant Peary to his headquarters the "Falcon" again turned northward and carried the explorer as far as the Petowik Glacier. Arriving here the Lieutenant bade farewell to his devoted wife and infant daughter and clambered down into the whale boat, which with its crew of Matt Henson, the colored servant, and four Eskimos, was awaiting him. Decked out in all her bunting, a salute from her gun proclaimed the farewell of the "Falcon."

Erect and resolute in the stern of his small boat, Lieutenant Peary, in answer to the parting cheers from the ship, waved a farewell as the favoring wind bore him from our sight. A strange parting this—under the cold, gray sky of the Arctic—with the great glacier in the background.

Keeping in the open water of Melville Bay, we set our course for Godhavn, on Disco Island; a southeasterly gale drove us many miles from our course and we did not arrive there until September 2nd. Here we parted with Dr. Axel Ohlin, the Swedish member of our party, who availed himself of the invita-

7. Arctic Manual, p. 325.

tion of Inspector Anderson, to take passage to Copenhagen on one of the vessels of the Royal Greenland trading Company. Our last stop in Greenland was made at Godthaab, the capital of South Greenland, where the Danish officials extended every courtesy to us and where, during our two days' sojourn, we enjoyed the opportunity of observing many phases in the life of this happy but isolated community. Leaving Godthaab on September 8th, an uneventful voyage of seven days brought us once again to the familiar harbor of St. Johns and into touch with the great world beyond.

I have not referred at any length, in the foregoing pages, to the scientific work of the expedition. This phase of our enterprise was ever prosecuted when opportunity presented and the results have proved interesting and important.

A complete set of meteorological observations was taken daily during the voyage north of St. Johns and an unexampled series of photographs was secured by Prof. William Libbey, Jr., illustrating different features of the journey. I submit with pleasure to those interested in glacial studies, the geological report of Prof. T. C. Chamberlin, which embodies the results of his trained observations in the virgin field of the far north. Dr. Axel Ohlin, our Swedish member, with Professor Libbey's assistance, secured a collection of marine fauna notable in its variety and extent, as may be seen by consulting his preliminary report herewith appended.

The list of plants collected by our surgeon, Dr. H. E. Wetherill, and subsequently determined at the Gray Herbarium, of Harvard University, contains the first specimens collected in Ellesmere Land, which region may be regarded as "the connecting link between Arctic North America and Greenland." The capable services of Mr. Emil Diebitsch, our civil engineer, were ever at the command of the party, and were frequently employed in connection with the astronomical work of the expedition.

Mr. H. L. Bridgman forsook his journalistic duties in Brooklyn to make the northern voyage and has published an interesting series of letters in connection therewith.

As Lieutenant Peary has himself written of the experiences of

Capt. Henry Bartlett. Chief Eng Fischer. 1st Officer Tracey Chief Steward Hackett.

OFFICERS AND CREW OF S. S. FALCON,
Lost at Sea October, 1894.

his own party during the winter of 1893-94 and the reasons for his want of success, I have not deemed it necessary to enter into these questions in this report.

The best wishes of all who are interested in Arctic achievement will attend the expedition which is soon to start for North Greenland to effect the return of the explorer and his companions. We trust it will prosperously accomplish its mission and bring back Lieutenant Peary crowned with the success which his devoted courage and sacrifice have so fully merited.

In conclusion it only remains for me to allude to one other subject: I refer to the sad fate which befell the "Falcon." The past season was one of exceptional severity in the north and the members of the Auxiliary Expedition look back on their experience as an almost constant battle with ice and storm. But through all these trials the "Falcon" came uninjured. After her arrival in Philadelphia the vessel was the object of some rather severe criticism, as a rough, untidy craft unfit for decent people to live on. Far different from this she appeared to the members of our party, as oftentimes, returning from some excursion we recognized her familiar outlines amid the ice floes. Needless to say, this feeling of affection accompanied her when she sailed from Philadelphia for St. Johns on the 3d of October, 1894. Since then nothing has been heard of her, and it is surmised that she encountered the hurricane which prevailed off the southern coast of Newfoundland between the 9th and 11th of October, and went down with all on board. On her return voyage she was heavily loaded with a cargo of coal, but should have made the run to St. Johns in eight days. When days, weeks and months passed without any intelligence being received, we were ultimately compelled to abandon all hopes of the safety of the ship and her crew. This sad disaster came home to all of us with unaffected grief when we considered that we had so recently parted from those gallant sailors with hopes of long life and happiness before them. Captain Bartlett was far above the average Newfoundland "Skipper" in intelligence and education, and his death

and the loss of his fourteen shipmates will long be remembered with sorrow in St. Johns.

In a signal tower, built high on the cliff which guards the entrance to the harbor of St. Johns, for many weeks the faithful watchman gazed out to sea ready to signal to the townspeople below the approach of the "Falcon." Sad and wishful eyes looked for many days for the message which came not. To the stricken widows and fatherless ones in St. Johns the members of that little company, which shared the fortunes of the good ship during the past summer, send their message of sympathy and express their desire to be numbered among the mourners of the "Falcon."

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MR. HENRY G. BRYANT,

COMMANDER OF THE PEARY AUXILIARY

EXPEDITION OF 1894:

In cheerful compliance with your request, I have the pleasure of submitting herewith a synopsis of my observations as geologist to the Peary Auxiliary Expedition of 1894. Permit me to express my cordial appreciation of your hearty sympathy with my work, and your constant efforts to furnish all practicable facilities for it. Your solicitude and extreme care in everything pertaining to equipment and management contributed greatly to the safety and success of the investigations.

Very respectfully yours,

T. C. CHAMBERLIN.

University of Chicago, May 1, 1895.

APPENDIX A.

GEOLOGY.*

BY

PROF. T. C. CHAMBERLIN.

Typography of Greenland.

On our first approach to the coast of Greenland at Cape Desolation the rugose aspect of the coastal mountains arrested attention. The angularity of their sky-lines at once impressed itself, as well as the marked ruggedness of the whole topographic expression. Flowing contours were scarcely discernible in the general view. Here and there they might be found by search among the lower contours, but they contributed little to the general expression. In addition to the asperity of the profiles, it was observed that the dominant lines of sculpture lay in vertical planes. It was quite obvious that their fashioning was due to the familiar meteoric agencies that work vertically. These features would not have been remarkable on almost any other coast, but here they possessed special significance. It has been the view of some geologists that the former glaciation of the American mainland, which covered some three million square miles and reached southward approximately to the Ohio and Missouri Rivers, was but an extension of the present ice-cap of Greenland. If this were so, the interior ice of Greenland must once have pushed out to the coast across the border mountains and thence onward some 2000 or more miles. Such an extension would obviously have resulted in much horizontal rasping of the border mountains as the ice pushed across them. The unsubdued angularity they presented appeared to signify either that this hypothesis is en-

*For permission to reproduce the accompanying illustrations, the author acknowledges his indebtedness to the editor of the "Bulletin of the Geological Society of America."

tirely untrue, or that the advance of the ice was so ancient that the mountains have since recovered their angularity by meteoric degradation. The importance, therefore, of studying the entire coast line which we were to traverse, with a view to determining whether this angularity was a general feature or not, was fully appreciated, and observations were continued assiduously throughout the whole trip, going and coming, so far as the conditions of the voyage permitted. The interruptions due to fogs and darkness were considerable, but out of the something more than 1100 miles of coast skirted, a sufficient proportion was observed to justify drawing inferences with a fair degree of assurance.

It was found that the angularity was not a universal feature, but that it alternated with very considerable tracts of flowing outlines of glaciated aspect. All of the topography that was seen during the first and second days of our coasting was of the angular type. On the morning of the third day we found ourselves opposite a very pronounced transition. The coast southward was strongly serrate; that to the northward was as notably fluent. The latter type extended northward so far as could be seen during the forenoon of third day, but observation was much interrupted by fogs and was entirely cut off during the afternoon. So much of the coast as was seen during the following day, southward from Disco Island, was of a similar flowing type, in the main, but not altogether. The western projection of the Nurgsuak Peninsula is of the rounded type. From Svarten Huk to the Devil's Thumb, north of Upernavik, a portion of the contours are serrate, while other parts are subdued. There is no marked predominance of either class. The coast of Melville Bay is largely formed by the edge of the inland ice, which here comes down to the sea. The remainder is formed by promontories jutting out from the ice sheet like dormer windows, or by peaks projecting like islands through the great sheet of ice. The Devil's Thumb and Melville Monument are rather slender rock columns, standing but a few miles off the border of the present inland ice sheet.

From Cape York northward to Inglefield Gulf, subdued con-

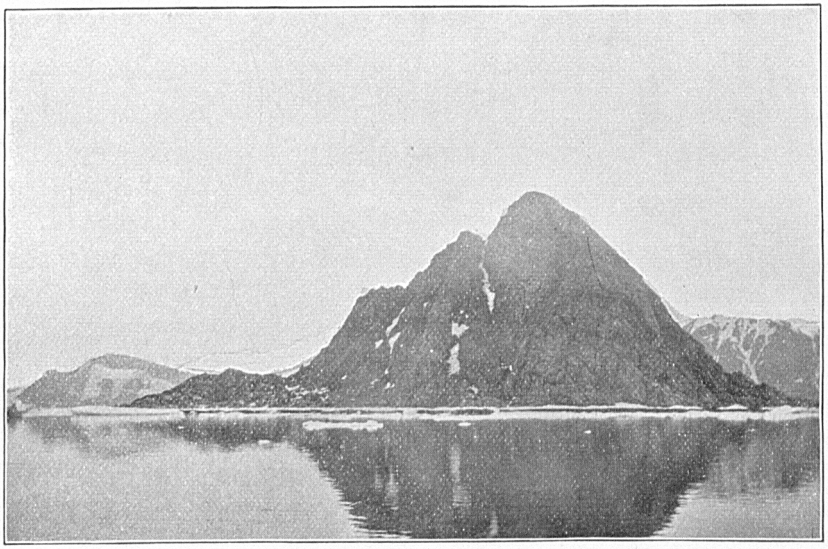

FIGURE 1.—DALRYMPLE ISLAND, NEAR THE GREENLAND COAST.

Showing unglaciated profile.

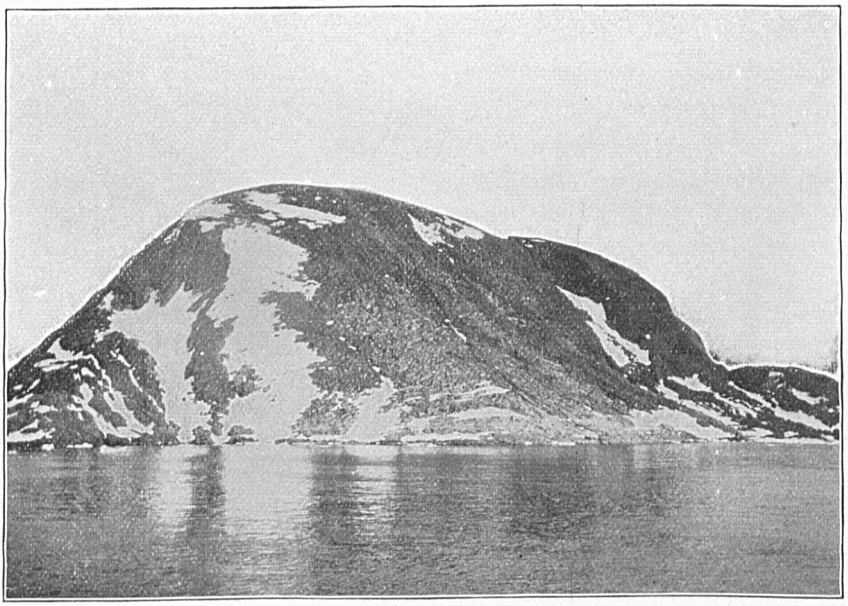

FIGURE 2.—SOUTHEASTERN CAREY ISLAND.

This island is about thirty miles west-northwest of Dalrymple island. The view shows glacial contour produced by movement from the north; not from adjacent coast of Greenland. The geologic structure of Dalrymple and Carey islands is almost identical, the difference in contours being apparently due wholly to glaciation.

The schooner "Ripple," belonging to the Swedish Travellers Björling and Kallstenius, was wrecked on this island August 17, 1892. From here the four surviving members of the party started, October 12, on the boat journey to Ellesmere Land, in the course of which they lost their lives.

DALRYMPLE AND CAREY ISLANDS.

tours prevail over rugged ones; the latter, however, are not entirely absent on the immediate line of the coast. Two very notable features are formed by Conical Island and Dalrymple Rock. Both of these are sharply conical masses of rock rising from the sea a short distance off the coast. Their steep sides are rugged and rise symmetrically to sharp peaks. They exhibit no evidences of horizontal rasping by glaciers. On the contrary, they seem to stand as conspicuous monuments of their absence. Dalrymple Rock is famous as the nesting place of eider-down ducks. Its selection by them is obviously due to the roughness of its surface, which affords appropriate niches for their nests. Quite in contrast with the rugose surfaces of Conical and Dalrymple Rocks are the Cary Islands, which lie in the midst of the bay, 30 or 40 miles from the coast. These present rounded contours which find a ready explanation in the glacial groovings on the summit of the southeastern island. The evidence of the striae is supported by erratics of limestone, sandstone and other clastic rocks found on the summits of the islands 500 feet above the sea, but yet altogether foreign. The striae show a glacial movement from the north, and this, together with the known distribution of Paleozoic rock similar to the erratics in that quarter, justifies inference that the glacier which rounded the contours of the Cary Islands, but left Dalrymple and Conical Rocks unaffected, came from Smith's Sound and beyond.

In summation it may be said that about one-half of the western coast of Greenland, between Cape Desolation and Inglefield Gulf, a stretch of some 17 degrees of latitude,presents angular and apparently unglaciated contours, while the remaining half presents subdued outlines apparently indicating former glaciation. This interpretation is supported by the observation that some of the rounded contours were actually glaciated, as shown by striae and erratics, and, on the other hand, by the fact that on Bowdoin Bay, a dependence of Inglefield Gulf, a small driftless area was found indicating that the former glaciation of Greenland was, there at least, very narrowly limited.

The impression has been very generally conveyed by writers upon Greenland that the coastal belt is mountainous. This is alto-

gether justified, so far as the territory south of Melville Bay is concerned, but it is quite worthy of special note, in view of its importance to glacial investigations, that north of Melville Bay the border tract is a plateau, only here and there accentuated in a mountainous fashion. In the region of Inglefield Gulf the plateau is very pronounced and nothing really mountainous is presented. This plateau is about 2000 feet in height, varying through a moderate range above and below this. The undulations of its summit rarely reach a thousand feet, and they have the characteristics of a rolling or hilly plain, rather than of mountainous corrugation. The rise from the sea level is in part precipitous, due doubtless to coastal encroachment, but in larger part perhaps it is sloping and traversible in almost all directions. Upon the plain of this plateau the interior ice spreads itself out with little interruption, except as valleys descending from the summit to the sea level draw out tongues from it. About half of these reach the water, while the other half terminate on the land.

It is very possible that this plateau is but the outer edge of a very extensive and elevated plain underlying the interior of Greenland. Many students of Greenlandic phenomena have suggested the existence of such a plateau in the interior on purely theoretical grounds. This view may fairly be thought to find support in the observation that in this northern region, along a tract of some hundreds of miles, such a plateau actually emerges from beneath the inland ice and forms the border of the island.

In addition to this upper plain, there is a lower one lying near the water's edge, which is worthy of attention, because of its historical significance, though it has but a meagre expression. It is very closely analogous to the plain skirting Norway and recently described by Dr. Reusch as constituting a new feature in the topography of that long-studied region.[1] The lower coastal plain of Greenland is well seen in the vicinity of Godthaab, the capital of the southern division. Here it constitutes an undulating peneplain abutting against a mountainous background. It descends gently toward Baffin Bay and its low undulations con-

1. Hans Reusch, Journal of Geology, May-June, 1894, pp. 347-349.

stitute the numerous small islands that fringe the coast. At many points it forms shoals and low islands, and is discernible even in the imperfect soundings shown on the coast charts of the region. Into this lower plain, the deeper channels along the coast, and the fiords in part, were excavated. The fiords, however, reach far back into the mountainous or upper plateau region.

Imperfect as my observations were necessarily, they seem to justify the suggestion that the history of the development of Greenland's topography embraced at least the following stages; quite possible it was much more complicated. The upper plateau appears to signify that at some former period, not very remote geologically, but certainly not very recent, the west coast of Greenland stood some 2000 feet lower than at present, and remained in that position during a period sufficiently long for the reduction of considerable tracts to a gradation plane, but apparently not long enough for the reduction of all the surface, for the bordering mountains of southern Greenland appear to be survivals. After this partial leveling of the island, it appears to have been elevated to an altitude not very different from the present and to have stood there long enough for the development of the coastal plain above described. Contemporaneously with this, the valleys doubtless extended themselves backward into the higher country. Later, a further elevation appears to have ensued to the extent of two or three thousand feet, during which the valleys were deepened and both the higher and lower plains considerably dissected upon their borders. Subsequent to this, the land sank to its present position, about which it is now obviously fluctuating, for there are evidences—among which are raised beaches and elevated shell deposits—that it has recently been elevated, and there are also evidences—among which are sunken ruins and forced migrations—that it has recently been sinking.

General Geology of the Region.

Subordinate to the main subject of study, the glaciation of the region, observations were made upon the preglacial geology as opportunity afforded. All that was seen in southern Greenland is but a confirmation of what has already become known through

the investigations of earlier observers. With the exception of the clastic and igneous deposits of the Disco province, the formations south of Cape York belong to an ancient crystalline series of the granitic or, more strictly, the gneissic type. These have usually been referred to the Archean age, and everything which I saw was confirmatory of the correctness of this reference, although, from the absence of any Paleozoic beds in contact with the series, the opinion rests chiefly upon the lithological character of the rocks themselves, their remote connections with the Paleozoic series of north Greenland and their general geographic relations to the terranes of the mainland.

In the region of Inglefield Gulf, the ancient crystalline rocks are bordered by sandstones and shales of unknown age. While the full extent of this clastic series could not be determined, even within the region visited, because it reached back under the ice cap, there were abundant grounds for the belief that it is but a narrow skirting belt. It was seen to be interrupted at frequent points by the coming of the crystalline series out to the shore. At other points, bays and valleys were observed to reach back across the clastic belt to the crystalline series behind. At other points where the clastic series occupies the whole coast and forms the front of the plateau, the glacial tongues brought crystalline rocks from beyond, and this is true in the case of Redcliffe Peninsula, whose ice cap is entirely separate from the inland ice and whose diameter is but about 15 miles. It is obvious from this and similar cases, that the crystalline rocks rise to the summit of the plateau within a few miles of the coast.

The clastic series embraces three distinguishable members. The lowest is a red sandstone which attains a thickness of perhaps 1000 to 1500 feet. Its beds possess moderate massiveness, lie at low inclinations, and rest unconformably upon the crystalline series. The discordance is very great and indicates that the crystalline terrane had assumed essentially its present attitude, had undergone very great erosion, and had approached its present topographic expression before the sandstone series was laid down upon it. If the sandstone were removed, the relief of the

topography would apparently not be less than it is now, and not very different from it in general aspect.

Lying conformably upon the red sandstone is a somewhat thicker series of pinkish gray sandstone. This has a quartzose constitution much the same as that below but somewhat exceeding it in hardness. While well indurated, it is unmetamorphosed. Under glacial action it manifests its endurance very markedly and constitutes, in favorable situations, a very notable constituent of the drift. Its thickness was roughly estimated at 1500 to 2000 feet.

Reposing conformably upon the pinkish gray sandstone lies a deep series of more thin-bedded sandstones and shales of reddish-brown and dark hues. The sandstones, which predominate over the shales, are less heavily bedded than the series below. They manifest a marked disposition to split up into thin slabs under exposure, and hence degradation proceeds with much facility. Interstratified with the sandstones there are shaly beds of kindred constitution which were obviously once only the more muddy sands of the accumulating sediments. Besides these sandy shales there is found on the south side of Redcliffe Peninsula a very notable horizon of finely leaved shales of dark color which disintegrate with great readiness into a soft talus of leaflets. These more pronounced shales do not, however, appear to be sharply differentiated from the common sandstone and shale series, but possibly a more thorough study of the region would find grounds for separation. The thickness of the whole series can only be vaguely estimated from such cursory observations as I was able to make, but I should judge that it exceeds rather than falls below the estimate of the preceding series. No careful measurements of the thickness of any of these series were made, and the figures given are general estimates that will be serviceable only in giving an approximate idea of the massiveness of these formations.

The conformity of the three sandstone series among themselves suggests that there may be no vital distinction between them and that they represent a consecutive sedimentation reaching a total thickness of four or five thousand feet perhaps.

Unfortunately the series is extremely barren of fossils. The absence of these cannot be charged to any catastrophe which the series has undergone, for, while it is faulted in some places and gently tilted generally, it is not crumpled nor folded and shows no signs of destructive metamorphic changes. While it is by no means safe to assume the entire absence of fossils; while, indeed it is perhaps safer to assume their presence, they are very rare, or else circumscribed in their distribution within the region studied, for, though attention was chiefly absorbed by the glacial phenomena, it was incidentally necessary to traverse much territory occupied by the sedimentary rocks, and their exposure is so ample as to afford great facilities for observation. The vegetation is so scattered as to offer practically no concealment of the surface. The intense frost has split the surface beds into innumerable slabs which lie in the greatest profusion over the surface. At the same time there has been very little disintegration of rock into soil, or else it has been washed away, and hence almost no concealment from that source. While in some parts drift from the crystalline series interposes some concealment, the extent of this is limited. The importance of finding a sufficient number of fossils to identify the formations was fully realized, and a fairly constant outlook for them was maintained, but without result. All others who have visited the region have been, so far as I can learn, equally unsuccessful. There remain, however, grounds for hope that sufficient fossils will ultimately be found to determine the age or the ages of the series. The whole group has usually been referred, with doubt, to the Tertiary age, because of the presence of rocks of that age with a similar constitution in the Disco region.

Igneous dykes traverse the series and the adjacent crystalline terranes. These are obviously later than the rocks traversed by them, but not necessarily later than all of the clastic series. Horizontal sheets of igneous rock were seen in a few cases, but whether they were intruded or outpoured on the surface was not determined.

Glacio-Natant Phenomena.

Under this convenient term may be embraced all forms of floating ice and all kinds of geological action arising from such ice. The convenience of grouping these together lies in the frequent need of distinguishing them from land ice, glaciers in particular.

ICE FLOES. The simplest kind of natant ice encountered was that which was formed by the freezing of the sea surface during the preceding winter. This we met in more than its usual extent and thickness in Melville Bay and Inglefield Gulf. As it presented, however, no wide departure from the oft-described characteristics of such ice, it need not detain us. On the immediate coast it is obviously a geological agency of some moment, particularly where the tides are strong. In such situations the ice rises and falls semi-diurnally, and so is caused to work effectively upon the shore with which it is in contact. To a considerable extent, however, the shore is protected by a fringe of stationary ice which acts as a buffer against the tide-actuated ice. As the summer advances, however, this skirting ice yields and becomes itself an instrument of the tide. The geological effect lies chiefly in the grinding of the shore material. There is a limited amount of transportation of the material backward from the shore by reason of its attachment to the ice. When it is considered that the ice during a large portion of the year acts as a protection to the shore, it may be an open question whether the eroding and transporting activity is at all increased by the agency of the ice when the yearly average is taken. The action takes a different form and is interesting and important from that point of view.

Closely allied to the relatively thin floes—rarely more than five or six feet—formed unquestionably by the freezing of a single season are the sheets that are retained from year to year and given additional thickness. There is little of this formed in Baffin Bay, although the ice is not entirely cleared away each season. As a result the Baffin floes are relatively thin, lie low in the water and have a flat surface, except as crushed up at the edges by mutual encounters.

The ice floes borne by the east Greenland current are notably different from these. It is very widely known that an Arctic current sweeps down the east side of Greenland and thence along the coast of Labrador and the easterern border of our own country. It is not so widely known, although indicated on the charts of the region, that this current curves about the southern extremity of Greenland and sweeps to the northward for several degrees, whence it turns about to the west side of Baffin Bay and descends the Labrador coast. In passing this current, which bore a dense pack, admirable opportunities were afforded for observing the wasted forms of the thick variety of ice floes. While no measurements were made, it seemed within safe limits to estimate the thickness at fifteen or twenty feet quite commonly. Probably in some cases it was nearer twice that. That this great thickness was the result of the combined work of several seasons, as already hinted, rather than the deeper freezing of a colder district, seems to be supported by the studies of numerous Arctic explorers, and by the inherent probabilities of the case; but whether it was due simply to the freezing of the sea water, or to the accumulation and consolidation of snow on the surface of the floes, or to other agencies, seems a much more open question. The gradual change of form which these thick masses undergo during their transportation forms an interesting subject of study, but as this has slight geological importance, and has been elsewhere described,[2] it may here be passed by. It is worthy of passing note, however, that extremely little rock debris of any kind was observed attached to these floes. While they may be a limited source of geological transportation, they cannot be regarded as being an efficient agency.

We encountered in the northern part of Baffin Bay a few "paleocrystic floes" of fine proportions, but only enough of their nature was seen to intensify interest in the problem which these remarkable forms present. Their breadth and flatness, the fine horizontality of their surfaces and their puzzling thickness, so great for sea ice, so small for land ice, make them an exceedingly attractive enigma.

2. Journal of Geology, No. 7, November-December, 1894, pp. 653-655.

ICEBERGS. Observations on icebergs were made as opportunity was afforded, but were not a primary object of study. A few were noted on the east and south coast of Newfoundland in the latter days of June and the first of July. On the trip from St. Johns to the southern coast of Greenland, I saw only three small masses which might by a measure of courtesy be called icebergs. The number would no doubt have been greater had there been less interference from fog, though this was not unusually prevalent. When this scantiness is compared with the much larger amount of ice reported along the coast of Labrador and Newfoundland by observers on other vessels, and with the greater amount seen on our return voyage near that coast, there seems warrant for the inference that the berg-bearing current is comparatively narrow and hugs the mainland somewhat closely. This is concordant with the narrowness of the Greenland current observed by us off Cape Desolation, and with the fact that it is flexed to the northward at the mouth of Baffin Bay. A very broad, strong current could scarcely be influenced so markedly by a coastal feature of no greater magnitude. It seems to me not impossible that owing to the narrowness of this stream and the concentration of the bergs along the coast, where they are most liable to observation, there has been some unconscious exaggeration of their numbers. Certainly my own observations, so far as they went, gave occasion for reconsidering the impression I had formed from previous reading as to the total quantity of icebergs sent forth from Greenland. The observations of a single trip, however, are obviously to be accepted with caution.

Comparatively few icebergs were observed in crossing the east Greenland current, nor were many seen along the southern portion of the Greenland coast. It was only as we approached Disco Island that we encountered them in striking numbers. There we passed a grand procession moving southwesterly from Disco Bay. But even there, the beauty and picturesqueness of the icebergs and the stateliness of their slow movement were more impressive than their numbers, as determined by cold, unsentimental count. Only thirty that could be classed as bergs were in sight even when we were in the midst of the procession,

and we appear to have passed it at the height of the discharging season. In Disco Bay, however, the numbers mounted up into the hundreds; indeed at the time of our first visit, in the middle of July, the surface of the bay, forty miles in width, was plentifully studded with the singularly varied and beautiful bergs for which the Jacobshaven Glacier is famous. The majority of these, however, were not very massive, though some of gigantic size towered above the great white fleet. As the inland ice crowds through the Jacobshaven conduit with unusual force and rapidity, it is greatly crevassed, and the numbers and picturesqueness of the discharged masses is but an expression of the intensity of the fracturing that precedes and attends the birth of the bergs.

North of Disco Island we encountered a still more magnificent procession of icebergs emanating from the Umanak Fiord. These were much larger and more tabular than those derived from the Jacobshaven Glacier. Thirty or forty of the larger order were in view at once, attended by perhaps an equal number of smaller ones that might fall within the limit of bergs, as distinguished from mere blocks resulting from the breakage of bergs or the minor products of the original discharge. The large members of this procession were truly massive, and if the magnificent proportions of the train were maintained for any long period, the total output must indeed be large. There could scarcely be said to be a trace of it, however, when we passed its track on our return in early September. The larger part of these bergs probably came from the Great Karaiak Glacier. A more scattered procession moved parallel to this on the north, which appeared to come from the straits between Ubekyendt Island and the Svarten Huk Peninsula.

In Melville Bay a very considerable number of icebergs were seen, some of which had escaped from the fixed ice along the shore and made their way considerable distances out into the moving ice. By reason of the fact that the ice in Melville Bay remains during a large part of the year—and indeed, the coastal belt of ice which embraces the larger number of icebergs, frequently remains, it is said, from season to season—it is difficult to form an impression whether the discharge of ice is really

active or not. It is quite evident that an exaggerated impression may easily be gained by simply observing the numbers of the icebergs that are held in the fixed belt of ice along the shore. Many of the icebergs which we observed in the bay immediately east of Cape York, on the upward trip, were still there when we returned, and are doubtless there yet.

Very large icebergs in considerable numbers were seen off the Crimson Cliffs, but the head of Baffin Bay north of Wolstenholme Sound contained relatively few. In Murchison Sound and its dependencies a scattered fleet of moderate dimensions was being held by the sea ice awaiting their discharge through its breaking up. In Inglefield Gulf a very notable cluster, embracing some hundreds, were grounded upon the shoals south of Redcliffe Peninsula. In the inner reaches of the gulf, a considerable number of quite large tabular masses, derived from the Heilprin and adjacent glaciers, were observed. It is not to be overlooked that in Inglefield Gulf all that had been discharged since the preceding summer, together with such as had been held over from former years were still retained, as none found escape before August. The total iceberg product of the Gulf region, while large, is after all not very impressive when compared with the 200 or more miles of ice border (embracing that on land) by which the gulf is surrounded.

The foregoing statements relative to icebergs have something of indefiniteness because opportunity was not afforded for systematic estimates of their numbers or masses. They can only have a slight and very general value.

Glaciers.

Aside from the great sheet of inland ice which covers the interior of Greenland, there are numerous local ice-caps as well as true Alpine glaciers. The distinction between the last two classes is perhaps worthy of passing note. In the one the snows accumulate upon limited plateaus which are but dissevered portions of the main plateau of Greenland. In the other, the snows collect on the slopes or in the gulches or amphitheatres of the higher

mountains. In the former case, a nearly horizontal sheet is formed which spreads outwards and gives rise to tongues when the expanding border encounters valleys leading down from the little plateau to the lower lands or the sea. Thus the tongues radiate from the parent mass. The motion is centrifugal. In the other case, the snows and ice gather from the amphitheatres and gulches into a common trunk, much as the water of a collecting area gathers into a river. The movement is concentrative. The upper ice streams gather into a lower trunk stream. In some respects, therefore, the habit of the true Alpine glacier is the opposite of that of the local ice-cap. Notwithstanding this notable difference, the two forms grade toward each other, and may possibly grade into each other. Where several Alpine glaciers collect on the several sides of a mountain, they jointly have a radiant movement. If their amphitheatres are conjoined, they approach the type of the ice-cap. If the summit of the mountain is broad and smooth, so as to permit a general snow covering, there may be a graduation of the one type into the other.

The frequency of occurrence of local ice-caps on little plateaus between the inland ice and the sea is quite notable, and is not without importance as a factor in glacial study, for these local ice-caps define more sharply than the great inland sheet, the limitations of glacial accumulation. They enable us to observe quite accurately what elevations (combined with other conditions) are adequate to produce glaciation, and where the limit of adequacy is reached. So also, elevations being equated, they furnish the means for estimating the influence of meteoric conditions. In the case of the great ice-cap it is difficult to determine how far the protrusion of the ice upon the borderlands is due to local conditions, and how far to influences derived from the distant interior.

USE OF TERMS. The prevalence of ice-caps in Greenland has led to a special usage of glacial terms. The title glacier is usually applied simply to the ice tongues that protrude from the inland ice or from some local ice-cap. It is also applied to distinct portions of the border of the ice-cap, particularly such as come down to the sea, even though they protrude but little, or

none at all. The ice sheet with which these tongues or sea walls are connected and which really makes up the great mass of the glacier is usually spoken of under the phrase ice-cap. If the great ice-cap is meant the common term is the inland ice. In Alpine regions the term glacier includes the entire stream of ice, though especially applied to the trunk stream to which the upper portions are tributary.

DISTRIBUTION OF WORK ON GLACIERS. Acceding to this convenient use of terms, it may be serviceable to indicate at this point the distribution of my studies, as it will be impracticable in this synoptical report to describe the glaciers in detail. On the Island of Disco three glaciers were examined. They arise from a small ice-cap which occupies the plateau of the southwestern portion of Disco Island. From this they descend into Blaese Dael, but do not reach the sea. They have been elsewhere designated the Lower, the Middle and the Upper Blaese Dael Glaciers,[3] respectively, according to their position in the valley. In the Inglefield Gulf region, my examinations embraced fourteen glaciers, the border of the main ice-cap and of the ice-cap of Redcliffe Peninsula. Of the fourteen glaciers, the Igloodahomyne, the Bowdoin, the Tuktoo, the East Branch, the Mirror, the Gable, the Hubbard and the Leidy Glaciers originate in the main ice-cap, indeed they are mere short tongues or lobes of it. Of these, the Bowdoin, the Hubbard and the Leidy reach the sea; the others do not. The Fan, the Bryant, the South Point, the Gnome and the Krakokta Glaciers radiate from the ice-cap of Redcliffe Peninsula. None of these reach the sea level. The first two flow southward, the next two eastward and the last northward, affording opportunities for a study of the meridional aspects of glaciers of a common source and similar dimensions, and these I was able to compare with the observations of Lieutenant Peary on those which descend on the west side. The East glacier, though immediately adjacent to the border of the inland ice, appears to have an ice-cap of its own on the summit of a small dissevered portion of the plateau. Glacial geologists

3. Journal of Geology, November-December, 1894, pp. 775 to 788.

will appreciate the advantages of selecting so large a proportion of glaciers that terminated on the land, in a study whose chief object was light upon glacial deposits, rather than upon glacial physics, and also of selecting short lobes of the inland ice, which were practically the border of the ice-cap itself, and more favorably exposed for study. The border of the inland ice between lobes was also studied. Lieutenant Peary was kind enough to conduct me out upon the inland ice far enough to afford a perfectly typical impression of its characteristics. Being entirely free from rock debris (except atmospherical dust) it did not call for prolonged study.

In addition to the immediate study of these glaciers, the general aspects of very many others were seen to greater or less advantage, by the aid of an excellent field glass, as we coasted past them, or were otherwise brought into their proximity. A very exceptional opportunity of observing the frontal contours of the inland ice was offered during the inner passage of Melville Bay in the course of which we skirted its remarkable frontage through almost its entire distance.

As the limits of this report preclude detailed description, it may be convenient to throw the seventeen glaciers visited into two classes, which may be designated the southern type and the northern type.

THE SOUTHERN GLACIAL TYPE. It is well known to all students of the subject that the glaciers of southern latitudes end in a slope of moderate declivity. The glacier disappears by a rapid thinning at its edge, due chiefly to progressive surface melting. This habit was found to prevail with all glaciers seen on Disco Island, not simply those which were visited, but the others which were seen at greater or less distances. The same was true of those seen distantly farther south, and generally true even of those seen somewhat farther north.

THE NORTHERN GLACIAL TYPE. But in Inglefield Gulf, between the latitudes of 77 and 78 degrees, the prevailing habit is a marked departure from this. The glaciers end in ab-

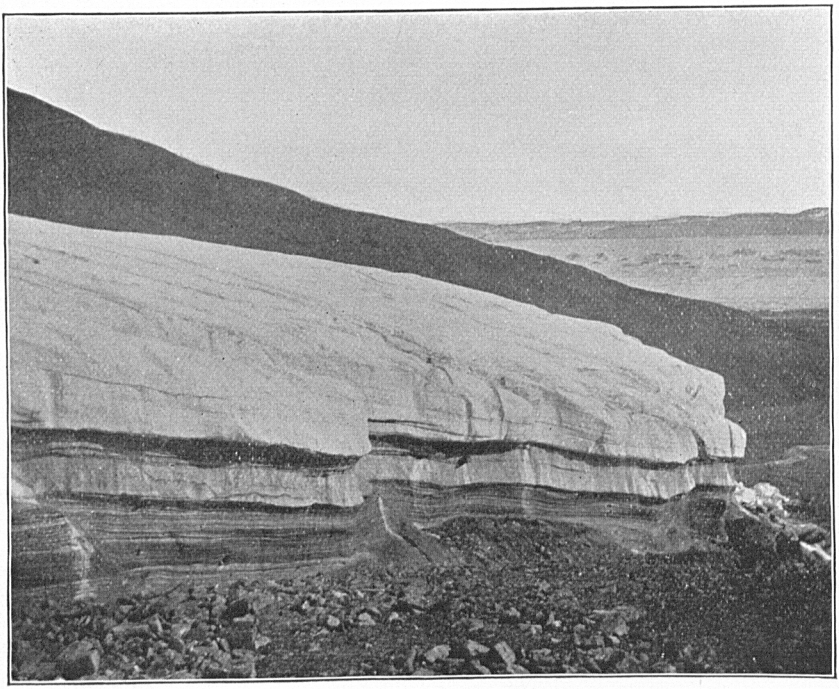

FIGURE 3.—WEST FACE OF BRYANT GLACIER.

Showing vertical wall and stratification of the ice. The amount of debris is made to appear much greater than it really is by surface wash.

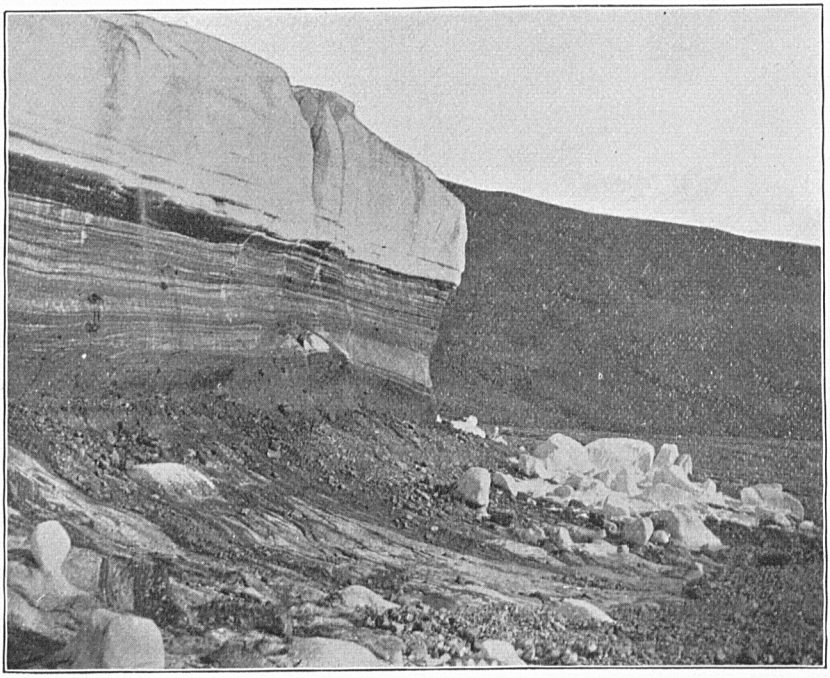

FIGURE 4.—FRONT OF BRYANT GLACIER.

Showing vertical wall and stratification of the ice.

BRYANT GLACIER.

rupt terminal walls, which rise to heights of 50 to 150 feet.[4] Not only are the ends of the glacial tongues vertical, but in most instances the sides are so likewise. To some extent the edge of the ice-cap itself is vertical, though here a remarkable wind-drift border introduces a notable variation. The vertical walls face all points of the compass. It can scarcely be said that they do this indifferently, as only a few glaciers facing the north were visited; but these possessed a verticality altogether comparable to that of those which faced the east or west or south. There is little doubt that the cause of this is the low inclination of the sun's rays, and the fact that these are directed against the ice from all points of the compass in turn. Rays of low slant strike the back of the glacier at a very acute angle, and hence glance away with great facility and little effect. On the edge of the glacier, however, they strike much more normally and effectively, while in low latitudes the opposite is true. In addition to this, the slanting rays of the sun striking the surrounding earth's surface at low angles glance slightly upward and impinge upon the edge of the ice. In lower latitudes the rays strike the surrounding earth in a more nearly vertical direction and are thrown more directly back toward the sky. There are some instances in Inglefield Gulf where this verticality of margin does not obtain, but these are altogether subordinate in number and importance to the mural habit. In the report of Lieutenant Greely these vertical faces are not inaptly likened to the Chinese Wall.

The general phenomena observed in connection with the Disco glaciers and others of the southern type were in no way markedly different from the familiar phenomena of southern glaciers generally. There was little debris upon the surface. In the lower portion of the ice considerable rock material was embraced, and this to some extent appeared on the frontal slope at the extreme margin of the ice. It extended for a few rods back from the extreme edge, but did not in any notable way affect the upper surface of even the glacial tongues. No debris at all, except atmospheric deposits, was seen upon the ice-caps proper, either

4. It is scarcely necessary to say that I am here speaking of glaciers that end upon the land. Obviously those which reach the sea terminate in vertical walls through the breaking away of the ends.

north or south. Without therefore dwelling in detail upon the less unfamiliar features of the glaciers of the southern order,[5] we may pass to the special characteristics exhibited by the northern type, as shown by the glaciers in the environs of Inglefield Gulf.

STRATIFICATION. The most impressive feature displayed by these glaciers is the pronounced stratification of the ice. The stratification of glaciers is not at all new, but the remarkable extent, definiteness and peculiar characteristics of the stratification displayed in the vertical walls of these northern glaciers amounts practically to a revelation. The ice is almost as distinctly bedded as sedimentary rock. On the vertical face there are usually presented two notable divisions, an upper one of nearly white ice, whose laminations are not conspicuous from lack of differential coloration, and a lower one discolored by debris, which gives great distinctness to the bedded structure. The lower division is divided by very numerous partings, along which are distributed rocky debris, embracing not only sand and silt, but rubble and bowlders. Often the amount of this interspread debris is so slight as to constitute the merest film, while at other times it reaches a thickness of an inch or two, and sometimes it is distributed throughout several feet. In the last case, there is usually an intermixture of rock, rubbish and ice, but, in general, the rocky debris is arranged in very definite and limited horizons, leaving the ice above and below as clean and pure as any other. It is very notable and significant that the ice next the debris layers is the firmest and most perfect ice which the glacier affords. It fractures in a peculiarly vitreous fashion, and sends forth beautiful iridescent reflections from between the fracture faces. The coarser debris is arranged in the same horizons with the fine silt and clay. Often fragments several times as thick as the average silt layer will be centered upon it, projecting upwards and downwards into the ice on either hand. Where the ice is well laminated, as it very commonly is, the laminations bend under and over the embedded bowlders, just as

5. These have been given in the Journal of Geology, November-December, 1894, pp. 768-788.

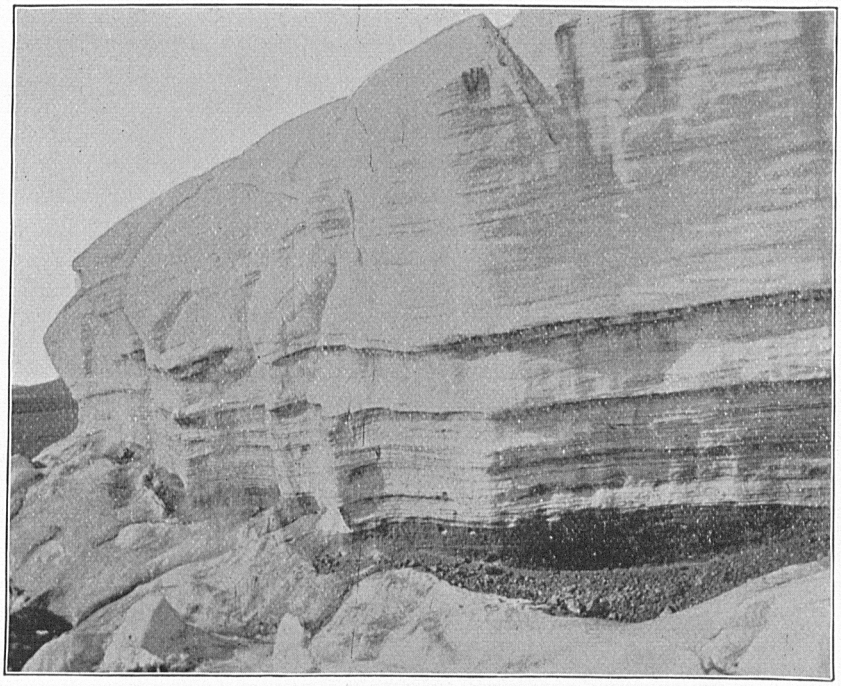

FIGURE 5.—EAST FACE OF BRYANT GLACIER.

Showing vertical wall and stratification of the ice.

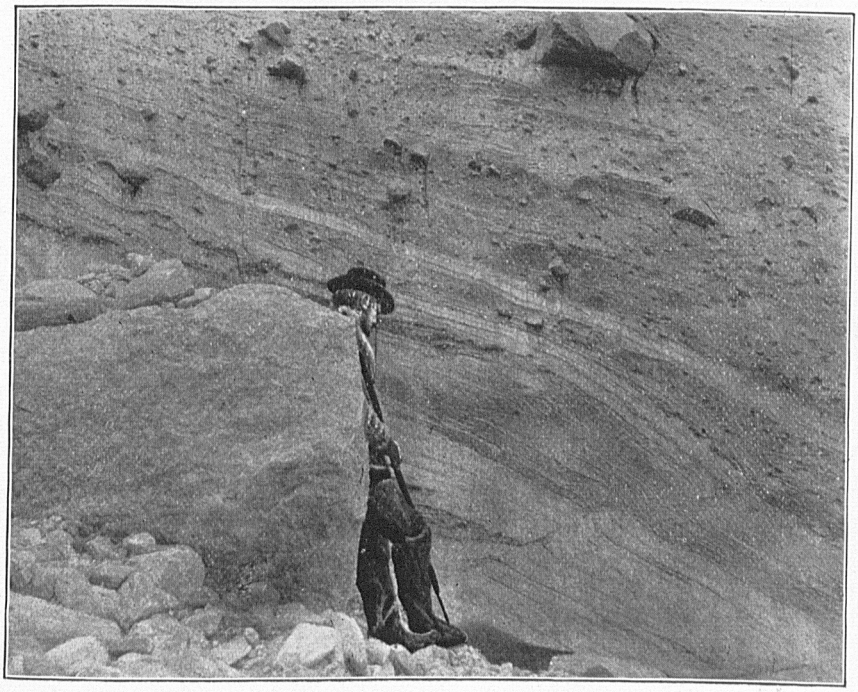

FIGURE 6.—LOWER PART OF VERTICAL WALL OF GABLE GLACIER.

Showing inset debris, lamination, faulting and drag.

BRYANT AND GABLE GLACIERS.

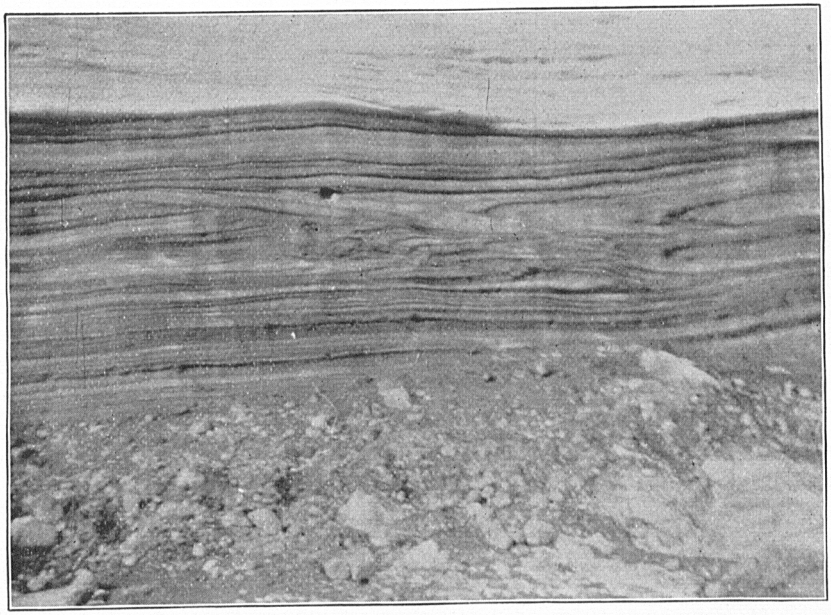

FIGURE 7.—LOWER PART OF PORTION OF EAST WALL OF BOWDOIN GLACIER.
Showing lamination, faulting, drag and overjutting of layers.

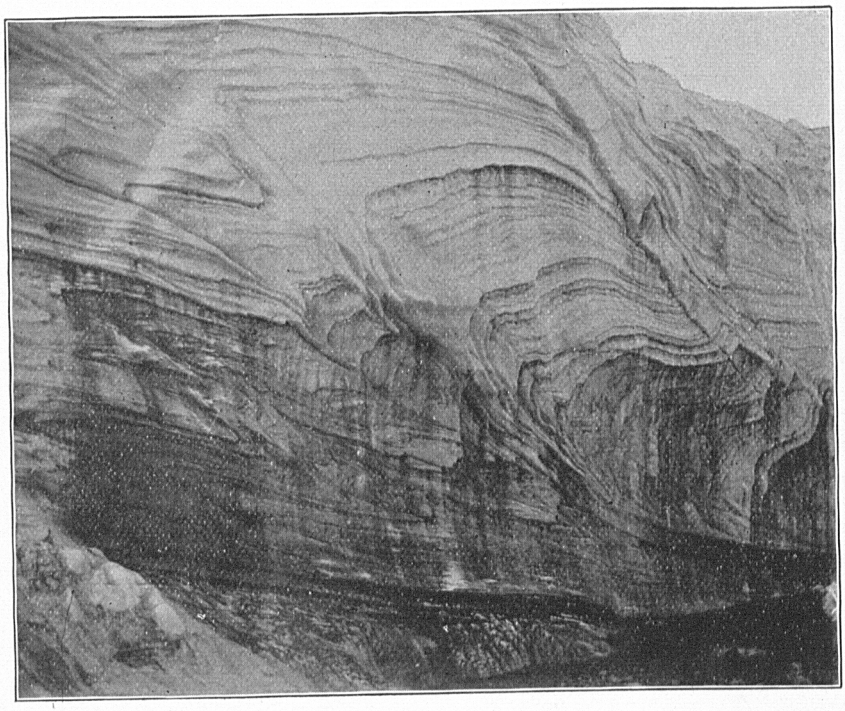

FIGURE 8.—A PORTION OF EAST FACE OF BOWDOIN GLACIER.
Showing an oblique upward thrust and distortion of laminæ.

BOWDOIN GLACIER.

silt laminations are often seen to do in the case of embedded rock masses. This seems to indicate that the embedded bowlders do not descend through the ice by virtue of superior gravity, but are retained in the original position given them by the embedding process. The extent to which the basal portion of the ice is laminated is quite remarkable. In selected cases as many as twenty laminations might be counted to the inch. These laminae are sometimes very symmetrical, straight and parallel. At other times they are undulatory in varying degrees, while in some instances they are greatly curved and even contorted in an intricate fashion.

HEIGHT OF THE EMBEDDED DEBRIS IN THE GLACIAL BASE. In view of opinions that have prevailed to some extent relative to the rise of rocky material through a glacier, it is important to note the heights to which the embedded rock was found in the ice, and its behavior at the glacier's margin. The debris-bearing layers are found to be essentially parallel to the base of the glacier. This is very notably true in the larger view. Locally the layers rise and fall. Sometimes in the presence of obstacles they are thrust very notably upwards, and again in the lee of embossments they curve rapidly downwards and even in some instances are seen to be doubled upon themselves. On the whole, however, the ups and downs nearly balance each other, and the rocky material remains confined to the lower part of the glacier. In the main, debris is limited to the lower 50 or 75 feet. Sometimes the dirty layers prevail up to 100 feet and rarely beyond. I think that 150 feet might be named as a rather extreme limit. Even at the border of the glacier the clean, white layer of ice above the debris-bearing stratum usually constitutes one-third or more of the section. The view that the debris habitually works up to the surface and forms a layer upon it as it nears the border of the glacier is without support.

INTRODUCTION OF THE DEBRIS. The question of the method of introduction of the debris obviously becomes one of prime importance, not only on account of its interest in connection with the glaciers under study, but because of its appli-

cation to the elucidation of the drift phenomena of the ice age of America and Europe. Unless I misinterpret, I was fortunate enough to observe the process of introduction in progress. On the north side of a short lobe of the great ice-cap, which has been called from the peculiarity of its terminal face, the Gable Glacier, there was found a large embossment of rock over which the ice was forced to pass, and in so doing to rise in a dome-like fashion. One side of the ice dome was melted away, revealing the operations at its base. Here it was observed that trains of rock rubbish, apparently scraped from the surface of the embossment, were being carried out into the ice in its lee. Some of these trains were short, while others extended several rods into the ice. They were somewhat inclined downward, but the slope of the glacier being greater they passed obliquely into its base, instead of following closely its bottom. On close observation it might be seen that the tongues of debris thus thrust in were really layers, or perhaps rather laminae, of ice doubled back upon themselves. The doubling of such layers upon themselves was observed in several instances in connection with different glaciers. Combining a considerable number of observations, whose import was more or less distinct, the following interpretation of the process was derived. The bottom layer of the ice in passing over the crest of the embossment would be pressed with exceptional force upon it, and would, as a result, be specially liable to detach fragments from it and imbed them within itself. If debris was being pushed or dragged along between the ice and the rock surface beneath, it would be pressed into the ice and the ice compacted about it with exceptional force. As any given portion of the basal layer passed beyond the crest of the embossment, the vertical pressure would tend to cause it to follow down the lee slope, while the horizontal thrust of the moving ice would tend to force it straight forward. If any given portion yielded to the first and passed down the slope, it would produce a curve in the hardened basal layer of ice. As a result of this, the horizontal thrust, instead of continuing to act along the disadvantageous curved line, and against the superior friction of the bottom, would be disposed to cause the layer to buckle at the bend. The

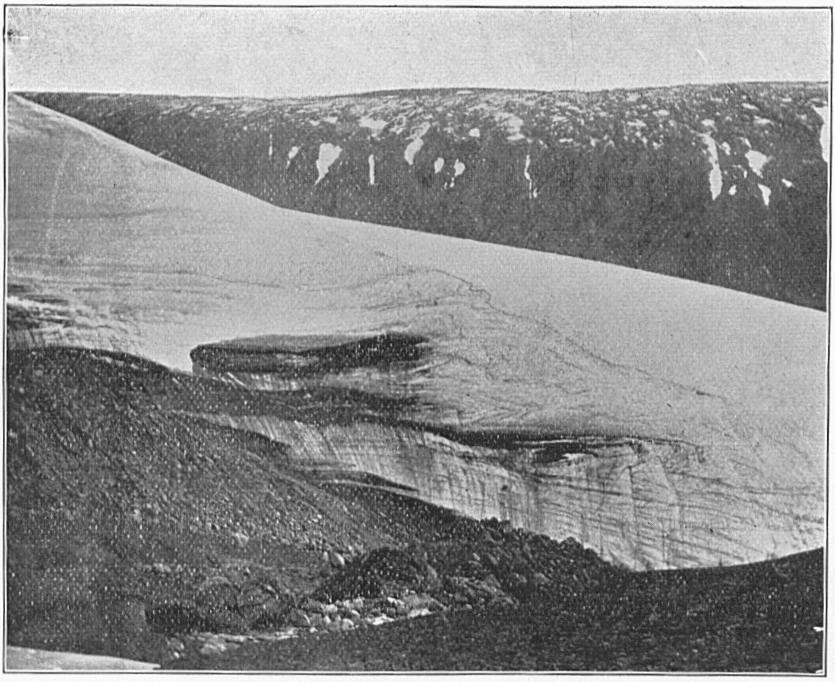

FIGURE 9.—PORTION OF NORTH SIDE OF GABLE GLACIER.

The view is near junction with main ice-cap and shows method of inthrust of debris-layers.

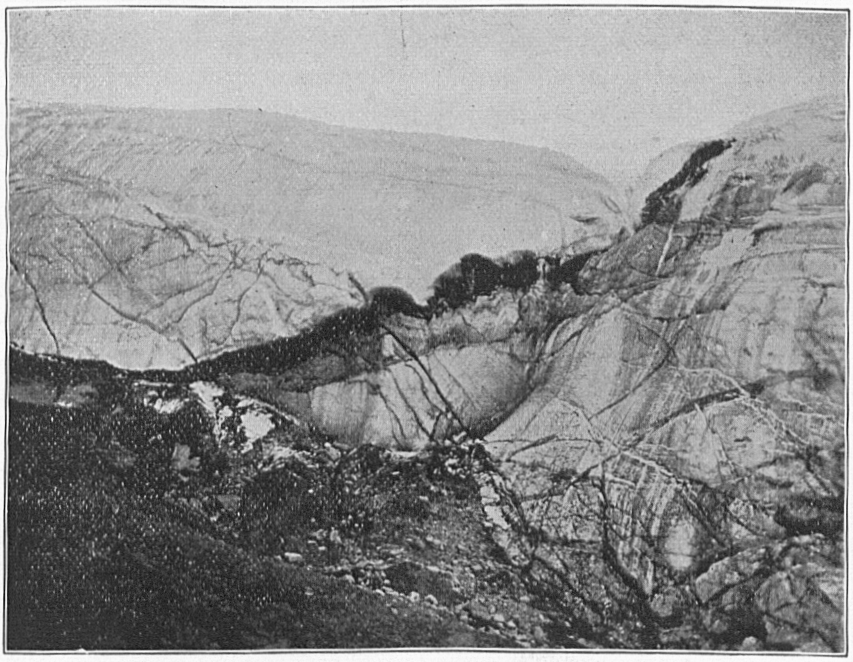

FIGURE 10.—PORTION OF NORTH SIDE OF GABLE GLACIER.

The view is taken below the one above, and shows an overthrust with debris along the plane of contact; ice much veined.

GABLE GLACIER.

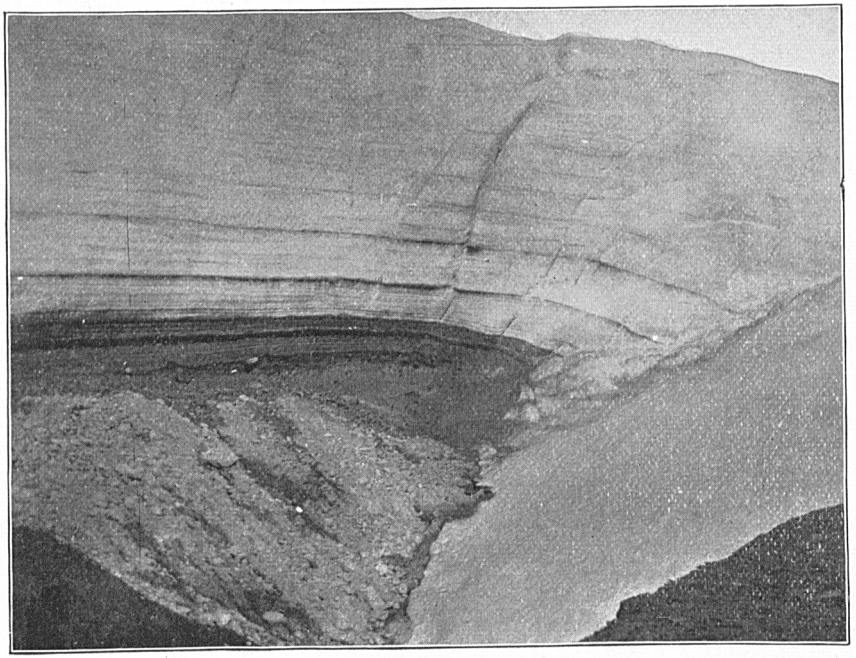

FIGURE 11.—PORTION OF EAST SIDE OF FAN GLACIER.

Showing behavior of the ice in passing over a low embossment of rock and drift. This figure shows only the upper portion, the next only the lower portion; the central part, of about equal length, not shown. Motion from right to left.

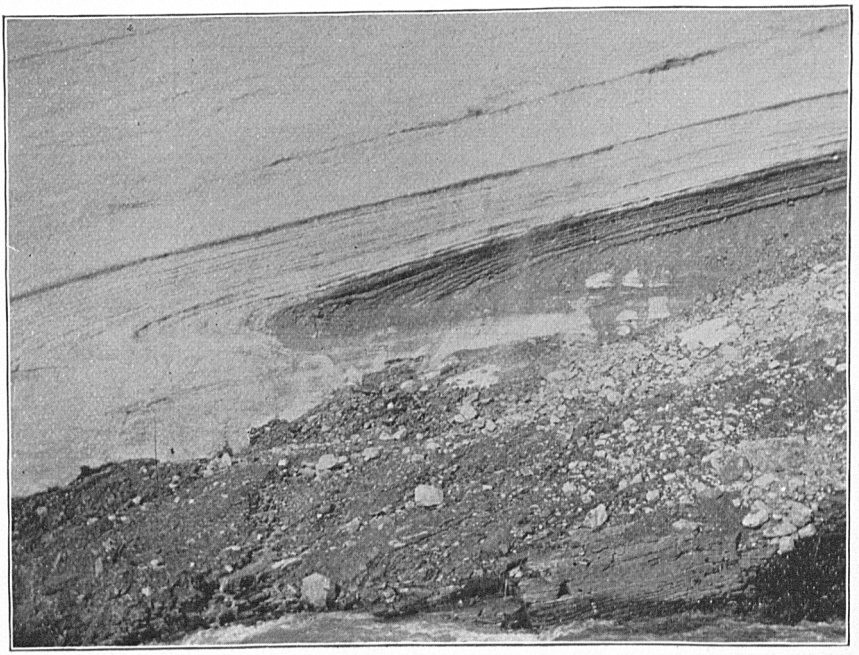

FIGURE 12.—PORTION OF EAST SIDE OF FAN GLACIER BELOW THE ABOVE.

Showing the curving down and bending back of the laminæ in the lee of the embossment. The prominent dark line in the center turns back with a sharp curve a short distance beyond the limits of the view, and is apparently continuous with one of the bands shown very obscurely in the lower left-hand portion of the picture.

fold so formed would be elongated and appressed by the continuation of the process and become a layer. The ice, beneath, however, would gradually yield, and the debris layer would settle down out of the line of maximum thrust and the conditions for a new fold would be induced. There were several such appressed folds or inthrusts on the slope of the embossment in question. In several cases in connection with other glaciers, very open folds were formed by the debris layers passing directly out into the ice in the lee of the embossment, and then gradually curving down and becoming reversed, apparently because the ice in the lee moved slower than that above. In some of these cases it was clear that the layer was formed by rubbing across the embossment or some protruding part of it, and that the folding was subsequent. So also there were cases of true faulting and overthrust, rocky debris being carried along the fault plane. The particular mode of inthrust seems therefore to vary somewhat, but the general method is essentially the same. It is practically a process of overthrust, dependent on inequalities at the base of the ice.

METHOD OF MOVEMENT. The structure of the ice, as already described, appears to imply that the layers moved as units. The sharp definition between the clean ice and the debris layers, which was the common fact, indicates the absence, in the main, of that heterogeneous admixture of rock-rubbish and ice which might be expected if the ice moved as a liquid. The distribution of the dirt through the ice was very different from that of dirt through water when it is roiled by motion.

Several other considerations support the interpretation that the ice moved by layers, in part at least. On almost every one of the vertical faces certain layers were seen to jut out sharply above those beneath. Sometimes there were six, eight or ten of these projections one above another on the same face, the overset ranging from a few inches to a foot or two. In rare cases the overjutting reached ten or fifteen feet. At first sight this seemed a clear proof of the overthrust of the upper layer, but upon more critical study it was seen that there was usually earthy matter in the upper part of the under layer, or at the junc-

tion of the two, and it appeared possible that this, by catching the sunlight and melting back faster than the pure ice above, might explain some part or all of the phenomena, and suspicion arose that the inference of overthrust might be illusive. In following a given projection laterally it was seen sometimes to terminate where the earthy material ceased. To be sure, it might be supposed, with good reason, that the shearing of the ice and the inthrusting of material were companion phenomena, and should naturally begin and end together. But none the less there was ground for hesitancy in trusting this class of evidence. In casting about for means of avoiding this possible source of error, the suggestion arose that pieces of rock lying at the junction of the layers would produce grooves or flutings if the upper layer were thrust forward faster than the lower one, and search was made for such groovings. It was found that the under surfaces of many of the projecting layers were fluted, and this, at first sight, seemed abundant confirmation of the hypothesis of overthrust. But here again, a more careful study made it quite certain that some of this fluting, indeed, much of it, as it was actually observed, was due to water trickling down the face of the overlying layer, which, instead of dropping freely away when it reached the edge of the projection, turned under and followed the lower surface backward, and in so doing fluted it. It may be that the fluting had been initiated by shearing, and was merely further developed by this backward running of the water, but in most cases I could not tell whether this was certainly so or not. Most of the projections were too high to be reached and critically examined. In searching for flutings that could not be attributed to water action, I found instances where the junction plane between the layers was marked by a layer of debris which was itself fluted. The earthy material was like a corrugated sheet passing backward from the edge between the layers of ice, the upper one of which projected over the lower.

Another class of evidence was derived from blocks of the stratified ice which had fallen from the face of the glaciers and had entered upon the initial stages of disintegration sufficiently to disclose the intimate nature of their mass. Glaciers are for

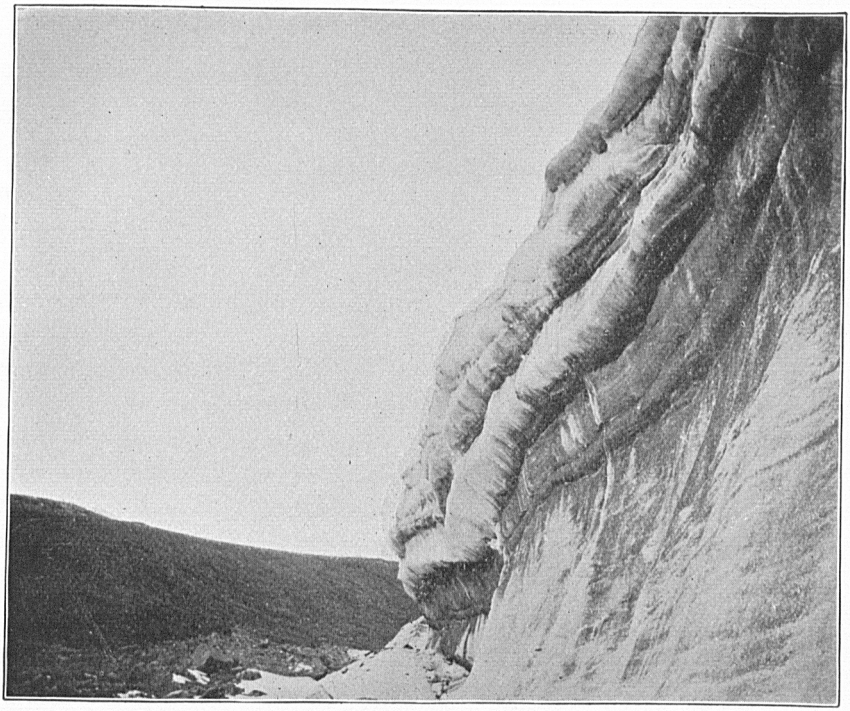

FIGURE 13.—PORTION OF SOUTHEAST FACE OF TUKTOO GLACIER.
Showing projection of the upper layers, apparently due to overthrust.

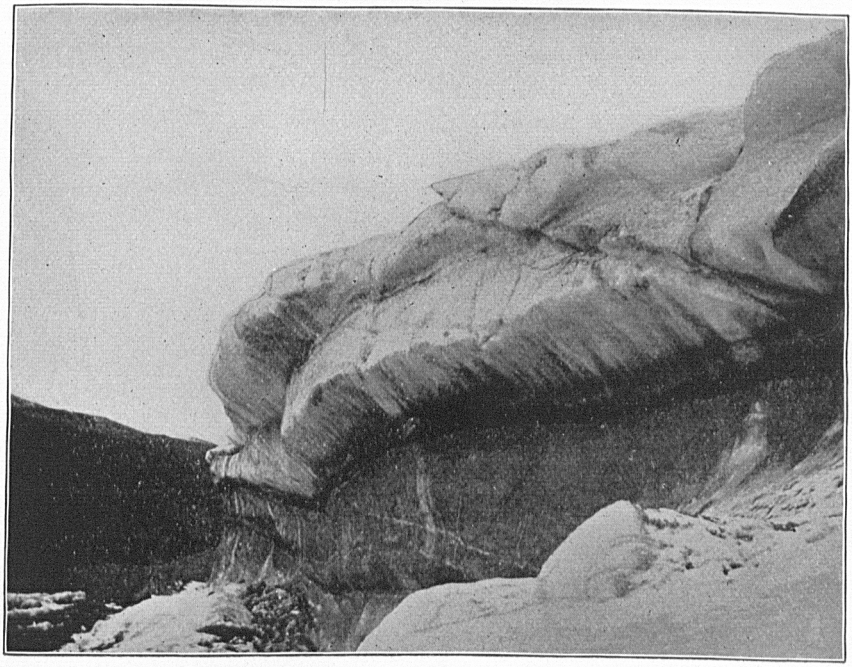

FIGURE 14.—PORTION OF SOUTHEAST FACE OF TUKTOO GLACIER.
Showing projection of the upper layers and the fluting of their under surfaces.

TUKTOO GLACIER.

the greater part made up of coarse granules of ice intimately interlocked. When these begin to undergo disintegration, the granules commence to separate from each other and the structure declares itself. Now in these fallen blocks it was observed that definite planes of parting were developed between some of the layers, while intermediate between these partings the interlocked granules held the crumbling mass together even after decay had made considerable progress. These partings were sometimes observed even when the layers were not separated by any earthy filament, the ice on both sides being white and pure. The plane of parting between the layers was often slightly gaping at the surface of the block, giving the impression that the two layers were peeling apart, though the effect was probably due in reality to superior melting along the junction plane. I found it easy by a moderate stroke of the spike of my alpenstock to split the blocks along these partings. The separated faces were smooth and strongly suggested an analogy to slicensides. That there had been motion of the one layer upon the other seemed practically beyond question. Between these partings the ice was so far bound together by the interlocking granules that an attempt to cleave the mass resulted in a fracture of the most ragged and irregular sort.

When we combine these evidences with what has already been stated regarding the intrusion and interstratification of the earthy material (and the inferences which this interstratification force upon us cannot lightly be escaped), it seems scarcely less than demonstrated that the glaciers move, in some notable part at least, by the sliding of one layer upon another. The bearing which this has upon fundamental theories respecting glacial movement is beyond the province of this report, but is obviously important.

RELATION OF THE GLACIERS TO THEIR DEBRIS. The northern glaciers afford little that is new respecting lateral and medial moraines and they may be neglected. It has already been seen that much basal material is carried in the lower layers of the ice. It was also a matter of frequent observation that debris lies under the ice. Apparently the ice sometimes pushes

this along and sometimes slides over it. At the end of the glacier the debris within the ice is freed by melting and accumulates as a talus slope. This sometimes protects the basal layers from melting and they become at length buried in the growing accumulation. Their subsequent melting gives rise to one form of kettle-holes, but only one form. It appeared from the stages presented by the several glaciers that where a lobe is slowly advancing the talus-slope gradually grows forward and constitutes an embankment upon which the glacier advances. It thereby grades up its own pathway in advance. On seeing this process one is at no loss to understand how ice can advance over fields of sand or soil without in any way disrupting them. It buries them before it advances upon them. A large number of the glaciers of the Inglefield region rest upon embankments or pedestals of this kind. Some that have recently retreated have left these causeways exposed to observation.

When the frontal material accumulates in a large mass, it opposes such a degree of resistance to the ice that its layers are curved upward on the inner slope, and if the glacier subsequently advances, the ice rides up over the moraine. Several such instances were observed, but none were seen where the ice showed any competency to push even its own debris, in notable quantity, in front of it. The ice is weaker than its moraines, as a whole.

WIND-DRIFT BORDER. There is a very notable wind-drift phenomenon connected with the border of the great ice-field of north Greenland, to which Lieutenant Peary was the first, I think, to call attention. The winds of the great ice-cap flow chiefly down its slopes as though by direct control of gravity. They carry great quantities of snow, and this lodges in the lee of the terminal moraine. The breadth of the fringing-drift thus formed reaches 2000 or 3000 feet in some cases and its slope rises from 100 to 250 feet, though a portion of this elevation is doubtless due to a slope of the earth's surface below. This snow remains from year to year and becomes solidified after the fashion of a glacier; indeed, it is little short of a peripheral ribbon-like glacier skirting the border of the great ice-cap. Between this and the ice-cap, as a narrow line of division, lies the termi-

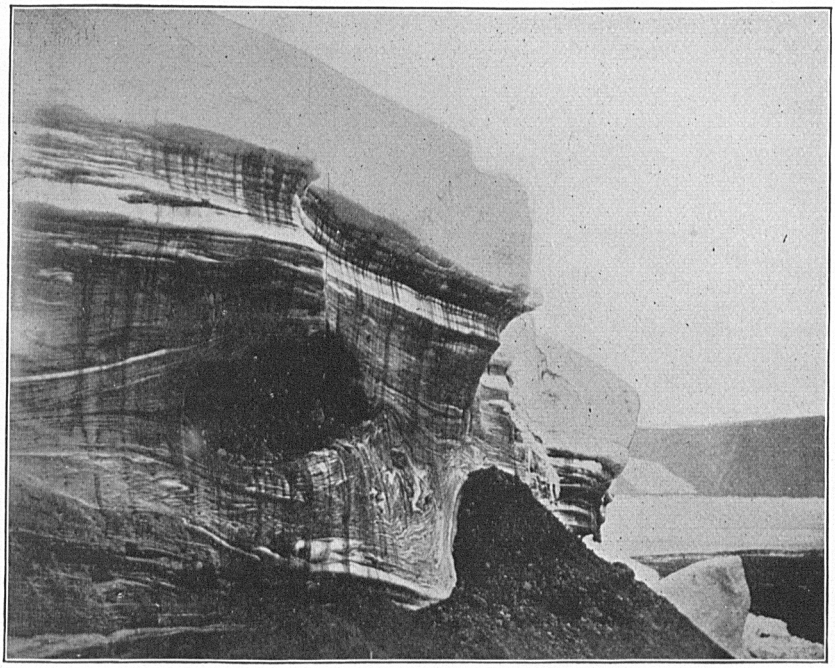

FIGURE 15.—PORTION OF LATERAL FACE OF EAST GLACIER.

Showing the perching of the glacier on its own debris, and the gneiss-like contortion of the laminæ, due to the resistance of the mound of debris in front. The overjutting of certain of the upper layers is also shown. Bowdoin bay seen in the distance.

FIGURE 16.—PORTION OF EDGE OF THE ICE-CAP.

Showing upward curving of basal debris-bearing layers, due to the resistance of accumulations in front.

EAST GLACIER AND EDGE OF ICE-CAP.

nal moraine. The three or four sections across this which were open to observation made it apparent that the moraine was formed by the basal layers of the ice-cap curving upward on encountering the resistance of the wind-drift border in front. The upward movement may have been initiated by a concealed moraine below, but superficially, at least, it would appear that even solidified snow in great mass is sufficient to deflect the advancing layers of ice, paradoxical as this certainly seems.

RATE OF MOVEMENT OF THE ICE. Though I went equipped with a full instrumental outfit for measuring glacial movements, the condition of the gulf ice made it necessary for me to leave this part of my equipment with the "Falcon" when I parted from it to go to Lieutenant Peary's headquarters. This would have been a subject of much greater regret had not Lieutenant Peary already commenced a series of observations upon the movements of glaciers of the Inglefield region, both by instruments and by photographs taken at intervals. It may not be inappropriate to quote for purposes of comparison a single result from his measurements. He found the daily movement of the Bowdoin Glacier, the most active in the vicinity of his headquarters, during the month of July to be four-tenths of a foot at the slowest point near the east border, and 2.78 feet at the fastest point near the centre, while the average for the whole breadth of the glacier was 1.89 feet. The movement of the majority of the glaciers of that region, particularly those that fail to reach the sea level is very much slower, indeed, in most cases, it is obviously exceedingly slow. While not permitted to make instrumental measurements, I took note of the ordinary signs of movement. In many cases these were found to be almost entirely absent. For instance, in front of the Fan Glacier there are cones of granular ice brought down by the streams which run upon the surface of the glacier. In addition to these, there are embankments of old snow soiled with earth, granulated, and half solidified into ice, as though at least a year old. These were found banked against the end of the glacier without any signs of movement on its part since their formation. As they leaned up against the terminal face to heights of thirty to forty feet, at least,

it is obvious that there had been no melting of the base at the extremity to counteract the effects of an advance had there been any. At the extremities of several other glaciers, phenomena of similar import were observed. The very firm impression was given by such physical signs that the average rate of movement of the glaciers of the region was very slow. At the head of the gulf, however, there are a few glaciers, among them notably the Heilprin, which produce large icebergs and which must therefore be wide departures from the prevailing slowness of motion. The difference in the rates of motion of different parts of the edge of the great ice-sheet are remarkable and must be carefully considered in forming an opinion respecting the average rate.

GLACIAL DRIFT ON ABANDONED TERRITORY. The amount of drift on the territory once occupied, but now free from ice, is notable much more for its scantiness than its abundance. On Disco Island it was found to be very limited, except along the immediate fronts of the present glaciers. In the Inglefield district there are at some points very considerable accumulations of drift within a mile or two of the present ice-front, but at the same time much of the territory between the ice-front and the sea bears a very scant covering of drift. No great moraines were seen, nor any thick mantles of drift. The valleys in front of the glaciers are well floored with glacial wash, but even here the rock occasionally appears. Considerable delta-fans project into the gulf, but none of them exceed half a mile in depth.

Consonant with this scantiness of drift, the topography of the border-land shows only moderate evidence of glacial subjugation. It is mildly rounded, but not greatly molded.

DISCOVERY OF A DRIFTLESS AREA. Quite to my surprise, I found upon the east side of Bowdoin Bay a driftless area lying immediately adjoining the present great ice-cap. The driftlessness of the area is firmly attested by several lines of observation. There was an absence of transported material upon it. The surface was notable for the exceedingly angular, ragged disintegration of the harder belts of rock that protruded above the average contours. It was also notable for the deep disintegration of the gneiss between these protruding ragged portions.

Deep gullies and ravines revealed the fact that the disintegration of the gneiss had extended to very considerable depths and had rendered it a soft, rotten mass which was not only easily crumbled, but was, to a considerable extent, even pliant and waxy under the fingers. It was possible to descend steep slopes by simply thrusting the heels deep into the softened mass. The coloration of the disintegrated material of this driftless tract was in harmony with its origin and in contrast with that of the drift-covered region about. The combined weight of all this evidence left no question whatsoever as to the verity of the driftlessness of the tract. The area was small, not exceeding three or four miles in maximum diameter. It lay between the edges of the ice-cap and Bowdoin Bay, and on ground whose average altitude was less than that of the glacier. A photograph taken from the moraine at the edge of the glacier and looking across the driftless area shows the ice of Bowdoin Bay in the perspective. It is clear, therefore, that its immunity from glaciation was not due to special elevation. It can only be attributed to the agencies inherently concerned in the growth and wastage of the glacier.

FORMER EXTENT OF GLACIATION. It is evident that the occurrence of even a small driftless area on the border of the widest stretch of the Greenland ice-sheet is extremely significant respecting its former extension. Attention has already been called to the angular topography that characterizes perhaps one-half of the western coast of Greenland. Some of the coastal islands are notably ragged, examples of which have already been mentioned in Conical Rock and Dalrymple Island. Some relatively slender residual columns, as the Devil's Thumb and Melville Monument, stand on or near the coast. The combined testimony of these seems to amount practically to a demonstration that, while the ice of Greenland formerly extended somewhat beyond its present border, it has never had any great amplification, at least in a westerly direction. This conclusion is subject to the bare possibility that there was a more extensive glaciation at a date so ancient as to permit the development of angular contours since, as well as the destruction of the drift and the deep disin-

tegration of the gneiss of the driftless area. But this supposition seems highly improbable.

ARE THE GLACIERS ADVANCING OR RETREATING? Several glaciers on Herbert and Northumberland Islands showed evidences of retreat; the terrace-like pedestals which they had formerly built being in part abandoned. Some of the glacial lobes of the ice-caps showed, by fresh abandoned ground, a small retreat. Other glaciers showed by the presence of old moraines immediately in front that in the past they had been more extended than at present. These moraines may be a few hundred years old, but they offered no evidence of very great antiquity. One glacier was seen overriding its terminal moraine in one portion, while lying within it at another. This, taken in connection with the massiveness of the moraine, probably indicates that it has stood practically stationary for a considerable period.

Other glaciers were building sharp talus slopes in front, which probably means that they are very slowly advancing. But in one of the most marked cases of this kind, the South Point Glacier, it was clear that the border had been slightly more advanced in very recent times. The general inference was drawn that the fluctuations of the ice edge were as slight as the ice movement was slow.

APPENDIX B.

ZOÖLOGY.

Preliminary Report

BY

DR. AXEL OHLIN.

In the following brief notes I desire to enumerate the mammals and birds observed by the members of the expedition, and to give a brief account of the results of the work with the dredge and surface net. When the fishes and invertebrate animals collected by these methods are worked up, I hope to be able to contribute with a number of species to the knowledge of the fauna of Baffin Bay and Smith Sound—localities hitherto so little known.

As the main events of the expedition have already been fully described in the preceding pages of this report, I do not deem it necessary to make further reference to the objects or itinerary of our summer cruise in the Arctic. An intelligent understanding of our movements may be gained by consulting the accompanying maps (pages 13, 18), on which the route of our party is given.

Although no new species of mammals or birds were observed, it will be of interest, in connection with the subject of geographical distribution, to mention those observed in Davis Strait and Baffin Bay.

MAMMALS.

1. VULPES LAGOPUS.—Only one specimen of the Arctic fox was shot; this was secured at Academy Bay. From all we could learn, however, these foxes seem to be fairly numerous where the conditions are favorable for their existence, along the whole coast from Cape York to Humboldt Glacier.

2. URSUS MARITIMUS.—On our northward trip three specimens were obtained on July 19th, just beyond Sanderson's Hope, when we were approaching the pack-ice of Melville Bay. All were males.

The biggest one measured 8 feet 9 inches in length. The following day another was seen; but we were unable to shoot it. In the floe-ice off Clarence Head, we succeeded in securing two polar-bears, and here, as well as at the entrance to Jones Sound, we observed several others. On our return, one old female and two cubs were shot from the vessel, not far from Cape York, on August 27th. In Inglefield Gulf the polar-bear is very rare; no specimen was killed here during Peary's two expeditions. According to former observations it seems to be most common among the vast pack-ice fields of Melville Bay, and on the western side of the "northwater" of Baffin Bay. It is difficult to understand why it should be so rare on the Greenland coast north of Cape York, and it is difficult to give a satisfactory explanation of this fact, the supply of seals being here as good, or, perhaps, better than on the coast of Ellesmere Land. Probably, the Eskimos, whose remains are still to be seen at so many places along the whole coast of Grinnell and Ellesmere Land from the 82d degree of latitude to Lancaster Sound, have abandoned their old "igloos" on this shore just because the seals are less numerous here than on the east side of Smith Sound. One might expect that the polar-bear, whose food is mainly the same as that of the natives, would follow their example and move eastward; but such does not seem to be the case.

3. PHOCA HISPIDA.—Although only one specimen was brought on board for examination, I have no doubt that this seal is the most common in Smith Sound and its northern continuation, and also that it is the most numerous species from Cape York to Cape Union, where it was observed during the Nares Expedition. Probably the seal called "pooshi" by the natives around Inglefield Gulf is identical with this species. In regard to the seals, it was unfortunate that we could procure but comparatively few specimens, although numbers of them were shot. The reason being that they sink immediately in the water when struck severely or killed by the ball. Even if met with on the ice and wounded, they were generally quick enough to jump into one of their blow-holes and disappear. In most cases, I was thus compelled to base the determination of the seals on the description I received from the members of Peary's Expedition, or from the Eskimos, as it was almost impossible to decide with any great degree of certainty to what species a seal head belonged which appeared for a few minutes above the water, and was observed at a considerable distance.

Therefore, my notes in reference to these animals are open to some

little criticism. Yet I am convinced that the seal most common in Inglefield Gulf next to the one just described is:

4. PHOCA BARBATA.—We did not obtain any specimen of these big and characteristic seals during our short summer trip, although they appeared frequently near the ship and at least one fine specimen was shot and nearly landed by a member of our party. We learned, however, that the bearded seal or "oogsook," as the natives call it, is not uncommon along the east side of this part of Baffin Bay and Smith Sound. Many individuals were killed last winter in Inglefield Gulf by Peary's companions. Here, as well as in the pack-ice off Cape York, we observed many seals which I am quite sure belonged to this species.

The third form of the genus Phoca which I consider quite common in Baffin Bay is

5. PHOCA GRŒNLANDICA.—The Greenland seal prefers, in these regions as well as in other seas which it frequents, the vast pack-ice fields far from the coast. On our northward trip in Melville Bay, and on our passage to Cary Islands, we saw many great herds of a seal belonging, without doubt, to the Jaen Mayen seal. We also met with the "harp seal," as this species is called by the Newfoundland sailors, in the pack-ice along the coast of Ellesmere Land from Cape Faraday into Jones Sound as far as we penetrated, *i. e.*, some few miles west from Cone Island in lat. 76° 14′ 53″ N. and long. 81° 52′ 36″ W.

6. CYSTOPHORA CRISTATA.—Although this large seal does not frequent Baffin Bay or Smith Sound, I mention it, because, on our northern trip to Disco, we killed five specimens, all of them being old males. We encountered the hooded seal in considerable numbers in the east Greenland ice or "stor-is," as it is termed by the Danes, which, as it is well known, floats with the cold Arctic current along the east Greenland coast through Denmark Strait, round Cape Farewell as far north as Holsteinsborg, in lat. 67° N. We entered this ice on July 12th, soon after sighting the Greenland coast, off Cape Desolation, in lat. 60° 23′ N., some miles northward from Cape Farewell. In this ice we steamed for two days, not very far from the coast, and everywhere we saw the "klapmyds" of the Norwegian whalers sleeping in the bright sunshine on the heavy ice-floes.

The question naturally suggests itself: How are these animals able to climb the high, steep walls of this ice, whose abrupt sides often rise six or seven feet from the surface of the sea? While on a Norwe-

gian whaler in the vicinity of Jaen Mayen in 1891, I sought in vain for a solution of this problem, a satisfactory explanation of which yet remains to be given.

7. ODOBŒNUS ROSMARUS.—Walruses were seen by us in several places: as in Melville Bay in lat. 75° 50′ N. July 21st, and in the "northwater" of Baffin Bay on our passage from Wolstenholme Sound to Cary Islands July 24th, but in greatest number they were observed among the floe-ice in a little bay west of Cape Faraday. Here the vessel was accompanied by walrus-herds, each containing ten or twenty. It was a matter of some regret that the exigencies of the time did not permit us to capture any of these animals. The bottom of this bay was sandy and had a luxuriant vegetation of big *Laminaria* and *Fucus*, and I obtained here, in five fathoms water, *Mya* and *Glyptonotus* in considerable quantities. We were informed that the walrus or "awik" (Esk.) is very abundant in some favorable places in Inglefield Gulf, where it finds a rich supply of food in the shallow water. The winter food of the Eskimo dogs is, mainly, walrus meat and Lieutenant Peary provisioned his stock of dogs from the same source.

8. LEPUS GLACIALIS.—The Arctic hare is, besides the lemming, the terrestrial mammal which goes farthest north, its traces having been observed during Greely's Expedition, by Lockwood, in lat. 83° 24′ N. It was found by us at many places, *e. g.*, on the south coast of Ellesmere Land, at a cape opposite Smith Island, where we landed August 10th, and on Northumberland Island, where five individuals were shot. In some valleys around Inglefield Gulf its tracks were seen. The specimens killed were all quite white, except the tips of the ears, which had a black stripe about one inch long, and the under-side of the feet, the hairs of which had turned reddish-brown through rubbing.

9. RANGIFER TARANDUS.—The reindeer is very common in the valleys and high plateaus around Inglefield Gulf, and a sure proof of this is the fact that no less than 200 odd were killed last year by Lieutenant Peary's party, the expedition thus being supplied during the whole winter with fresh meat. Before starting south the "*Falcon*" visited the head of Inglefield Gulf, for the purpose of securing some reindeer meat and skins for Lieutenant Peary. Unfortunately, we only obtained four or five. The favorite feeding-places are valleys and the slopes of the mountains, which it ascends 1000 feet or more. I learned from Lieutenant Peary's companions that they had killed reindeers on

small "nunataks," situated some miles from the border of the inland-ice, this animal not hesitating to cross glaciers.

10. OVIBOS MOSCHATUS.—Although we did not meet with any of these interesting mammals, I put the musk-oxen on this list, seeing that several bones of it have been found in the neighborhood of Inglefield Gulf. As is well known, its geographical distribution is highly interesting; I do not think it is necessary to enter fully into this matter here. For further information I refer to the accounts of the Nares and Greely Expeditions. It is evident, however, that there is one problem in regard to the present range of the musk-ox which has not yet been fully explained. Its occurrence on the east coast of Greenland, first noted by the German expedition (1869–1870), and, recently, mentioned again by the Danes, is not strange, in view of the latest information from north Greenland. Peary and Astrup, on their sledge-journey, in 1892, to Independence Bay, in lat. 81° 37′ N., and long. 34° 5′ W., observed about twenty, some of which were killed. Thus, the way the musk-ox has taken to reach east Greenland is clear: From Grinnell Land, across Kennedy or Robeson Channel, he has wandered along the northern coast of Greenland, in the valleys of which he has found good feeding-places, as a comparatively rich vegetation covers the slopes of the mountains of Independence Bay, at the border of the inland-ice. R. Brown's opinion, that Greenland must end somewhere in lat. 82° or 83° N., was thus verified by Peary's important discovery. Still, we cannot, in a satisfactory way, account for the disappearance of the musk-ox along the whole east side of Smith Sound, from lat. 82° N., as far south as Wolstenholme Sound, on which coast his bones have been found by Nares' and Peary's Expeditions. Feilden,[1] the naturalist on board the "*Alert*," one of Nares' ships, believes that the Eskimos exterminated them; "for, I imagine, few animals are less fitted to elude the wiles of the hunter."[2] Still, he says on the next page: "When thoroughly frightened they take to the hills, ascending precipitous slopes, and scaling rocks with great agility." This seems to be somewhat contradictory. Other travelers refer to the danger of hunting the musk-ox, and tell how furiously the old bulls attack the hunter if he fires at the herd. It is difficult to determine the

[1] G. S. Nares. "A Narrative of a Voyage to the Polar Sea," etc. London, 1878. Vol. II, p. 199.

[2] Ib., p. 200.

facts in the case, but I venture to say that the Eskimos cannot kill the musk-oxen easier than they do the reindeer. The latter animals are very numerous, although they have been hunted by the Eskimos for many years in the same localities where the musk-ox has now totally disappeared. Perhaps the disappearance of the musk-ox can be accounted for by its competition with the reindeer for the scarce vegetation, which is barely sufficient to supply ONE large herbivorous animal with food. The explanation of the fact is, in any case, very difficult, and in trying to solve this problem, as well as the one I mentioned regarding the polar-bear, I think we have to count with factors not yet appreciated by former authors, and still fully unknown.

11. BALŒNOPTERA MUSCULUS.—During our stay at Godhavn on the northward trip, the Eskimos sighted far out to sea the floating body of a big whale. Then "*Falcon*" steamed out and brought the carcass into the harbor. It belonged to the above species. North from Disco Island I did not observe any right, or fin-whales, but on my return to Denmark, I saw fin-whales several times; the determination of the species being impossible, it is unnecessary to enumerate the localities.

12. HYPEROODON ROSTRATUS.—When cruising in the east Greenland pack-ice off Fredrikshaab I saw some bottlenoses among the ice. As I have intimated once before,[3] this whale and, probably, all the others except a very few, are not dependent in their distribution on the temperature of the water, as formerly was believed by many authors. In Baffin Bay or Smith Sound we did not observe the bottlenose.

13. BELUGA LEUCAS. "Kaja-gaktoo" (Esk.).—The white whales seem to be very numerous in Inglefield Gulf and on the Greenland side of Baffin Bay. Many times, when trying to get through the ice in Murchison Sound and Bowdoin Bay, we had the opportunity to observe great schools, containing sometimes as many as a hundred individuals, swimming and blowing quite near the vessel. The weather being fine, I observed during one week of August nearly every evening the "white fishes" approaching the shore. Young and old were always going in the same school. I never heard any sounds from it, a characteristic noted by some authors.

14. MONODON MONOCEROS. "Kell-el-looah" (Esk.).—I believe the narwhal is also very abundant in Smith Sound and the "north-

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[3] Ohlin. "Some Remarks on the Bottlenose Whale (Hyperoodon)," in Kongl. Fysiografiska Sällskapets i Lund Handlingar, Bd. 4, Lund, 1893, p. 6.

water" of Baffin Bay, as we procured narwhal tusks in every Eskimo settlement we visited from Cape York to Inglefield Gulf. Several evenings in August I saw companies of this remarkable whale coming close to the ship showing but their marbled backs, but never their horns above the water. Yet the schools did not contain so great a number as those of the "beluga," and they seemed to keep more apart from each other. Like the white whales they were always to be seen in the clear strips of water or "leads" between the ice-floes. Farther south we did not meet with any. The narwhal, white whale and Greenland whale are probably the only real circumpolar whales. The natives when asked about the function of the tusks, had no explanation to give, and none of the views hitherto expressed can be accepted as entirely satisfactory on this point.

BIRDS.

Before enumerating the birds observed on the expedition, it may be well to remark that the small number of land birds observed may be accounted for by the rare opportunities we had to land, as we were almost continually on board the vessel or making excursions on the ice. We learned, however, that a few small birds of the orders *Passeres* and *Grallatores* were found living in the vicinity of Inglefield Gulf. However, I was not able to identify them from these descriptions; therefore I have enumerated here only the birds observed by myself; excluding those seen south of Cape Farewell, as they belong to the Atlantic Ocean.

1. FALCO CANDICANS.—I had an opportunity to see this magnificent bird only in Godhavn during the first week of September, when waiting for the Danish vessel. Lieutenant Peary's companions affirmed that they observed the Greenland falcon several times in Bowdoin Bay.

2. PLECTROPHANES NIVALIS.—When we arrived at Lieutenant Peary's headquarters, August 19th, I saw small flights of snow-buntings among the hills and rocks, which were covered with a scant vegetation of minute specimens of *Papaver nudicaule*, *Potentilla*, *Silene*, *Pyrola* and other plants. In Godhavn this little bird was very common.

3. SAXICOLA ŒNANTHE.—This bird I observed only once; it was in Godhavn, when stopping there on our northward trip.

4. CORVUS CORAX.—We shot one raven, July 24th, at Dalrymple Island, situated in the mouth of Wolstenholme Sound. At the

end of August also I observed some others at the entrance to Bowdoin Bay.

5. LAGOPUS RUPESTRIS is very common everywhere in Danish Greenland. Farther north I did not see any, but was informed by the natives that the ptarmigan frequents the coast of Inglefield Gulf.

6. STERNA ARCTICA.—Some specimens were observed in Murchison Sound and other parts of Inglefield Gulf. I do not think the Arctic tern is found breeding in great numbers in this region, as we saw but few of this species.

7. PAGOPHILA EBURNEA.—The ivory-gull I met with first during the journey, July 21st, in the pack-ice off Melville Bay. The only specimen obtained on our expedition was shot in Murchison Sound, July 26th. I did not see any others in Inglefield Gulf and I think it is rather rare here. During our stop off Clarence Head I saw three or four ; but nowhere else on the coast of Ellesmere Land.

If one must consider the ivory-gull as very scarce in Baffin Bay, I suppose

8. RISSA TRIDACTYLA is the most common gull here as everywhere in the Arctic and north Atlantic seas. On our passages through Davis Strait and Baffin Bay, the ship was nearly always accompanied by the kittiwake, although I am rather inclined to believe, according to observations made by former expeditions, that it decreases in number the farther north one proceeds in Smith Sound.

9. LARUS GLAUCUS.—This big gull occurred nearly everywhere in Baffin Bay and Smith Sound. On Southeast Cary Island we found the glaucous gull breeding, but only a few pairs. It did not appear to be so numerous here as in Nova Zembla, Spitzbergen and other parts of the Arctic Ocean.

10. LESTRIS PARASITICUS.—The skua was to be seen on both sides of Baffin Bay and several times on our passages through Davis Strait, but never in great numbers.

11. PROCELLARIA GLACIALIS.—From the date of my leaving St. Johns, July 7th, until I came, on my return voyage, into the North Sea, lat. 58° 24′ N. and long. 2° 5′ E., I saw the fulmar nearly every day whilst sailing in open water. On the contrary, when the ship was nipped in the pack-ice of Melville Bay or Inglefield Gulf the fulmar was not to be observed at all or only represented by a few individuals. I noted the same fact in 1891 in the east Greenland ice around Jaen Mayen. The "mallemuck" does not seem to advance

any distance into the pack-ice fields as it always disappears on their borders.

12. MORMOU ARCTICUS.—This bird I saw only once in Davis Strait and Baffin Bay ; it was on our northward trip off Upernavik.

13. MERGULUS ALLE.—The little auk is very abundant among the ice-floes of Melville Bay and Baffin Bay. Never before have I seen this little bird in such countless numbers as here or in Inglefield Gulf. It would be difficult to estimate the number of thousands seen in one day only. The natives are very skillful in catching them. The flesh is a delicacy and the skins, with the feathers turned inwards, forms the winter undergarment of the Eskimos.

14. URIA GRYLLE.—The black guillemot or "sea-pigeon," as our sailors called this bird, was found nearly everywhere in the pack-ice of Baffin Bay and Smith Sound, although, of course, it did not equal in number the little auk or the following species.

15. ALCA BRUENICHII is very common on both sides of Baffin Bay. In the pack-ice of Melville Bay and Inglefield Gulf we had many chances to shoot the loons which frequented these waters in considerable quantities.

16. SOMATERIA MOLLISSIMA.—The eider-duck may be regarded as one of the most common birds along the whole coast from Disco Island to Inglefield Gulf. We shot it several times during the journey ; most successful were our hunters on our northward trip at Dalrymple Island, at the entrance to Wolstenholme Sound, where they killed eighty-seven, all females, in an hour and a half. I found a great many nests of this bird on Cary Islands and at many places in Inglefield Gulf. On the coast of Ellesmere Land the eider-duck was also to be found.

In regard to invertebrate animals I may remark, at the outset, that I had no opportunity to collect insects or spiders. Our botanist, Dr. Wetherill, surgeon of the expedition, had opportunities on his excursions to secure a few insects. These have been roughly classified by an American entomologist as follows—One *Bombus hyperboreus*, three *Tipula arctica*, four *Pediculi*, four spiders, one species of *Diptera*, two cocoons and three larvæ of *Bombycidæ*.

The entire collection of marine fauna was brought by me to Sweden, and, having just finished a rough classification of the collection, it may be well to say a little by way of preliminary concerning it. Most of the marine animals were obtained by the dredge or the surface-net in Inglefield Gulf. I much regretted that I had no oppor-

tunity of dredging at other places, except in the harbor of Godhavn, and at Cape Faraday, the chief reason being that weather or ice did not permit it. Aside from the two above-mentioned stations, I had opportunities to dredge only in *five* places in Inglefield Gulf and Murchison Sound. On the map (pages 13, 18). I have marked these stations, together with the depths of the sea and the nature of the bottom.

As will appear on examination, I dredged in no water deeper than 50–60 fathoms. Therefore, we cannot expect to find true deep-sea forms among the collection; yet the result may be considered eminently satisfactory when the limited opportunities for work are considered.

On the whole, Inglefield Gulf must be considered very rich in animal life, which is, as I believe, to be accounted for, chiefly, by the great variety of the bottom within short distances. Especially favorable for highly interesting and numerous forms I found the bottom in front of the glaciers. In Murchison Sound I once used the little hand-dredge on muddy bottom in twenty-five fathoms of water—just where a river from a recedent glacier was flowing into the sea, the water being here for a considerable distance from the shore very brackish. I am convinced that the dredging on this occasion was the most successful one on the expedition, as regards both the number of the species and the individuals. In great quantities I obtained here four or five species of *amphipods*, *Mysis*, *Arcturus*, three or four of *palæmonids*, and some other crustaceans, three or four of *ophiurids*, *Antedon*, probably *A. Eschrichti*, *sea-stars*, some *gastropods* and *bivalves*, as *Leda* and *Yoldia*, *chætopods*, and other specimens not yet worked up. Rocky bottom, mixed with mud or sand, also proved to be very good. Among the crustaceans which here, as everywhere in the Arctic Sea, play a very important part in the animal life, three or four species of *crangonids* and some *palæmonids* were very numerous; besides these, *amphipods* came up in great numbers of species and individuals. *Fishes* were also caught in the dredge, mainly slow bottom-fishes, as *cottids* and *blenniids*. In no less number were dredged on this bottom *ascidians* and *polyzoa*, some characteristic *gastropods* and *bivalves*, *Strongylocentrotus Droebachiensis*, *ophiurids* and *Antedon*. More rarely occurred *Waldheimia*, a little *cephalopod*, probably *Rossia*, two *pycnogonids*, a *caprellid*, a few *sea-stars*, a big *lucernarid*, some *hydroids*, *Cyclopterus*, a *nemertin*, *Piscicola*, and *Myzostoma* on Antedon.

The only locality on the coast of Ellesmere Land where I had a chance to dredge was Cape Faraday. In five to seven fathoms water, and from a sandy bottom covered with a rich vegetation of *Laminaria* and *Fucus*, I obtained a few animals not before met with on the Greenland coast of Smith Sound: *e. g.* an *idotheid*, probably *Glyptonotus Sabinii*, two or three species of *gammarids*, and *Liparis*. On our northward trip I also took the opportunity to dredge in the harbor of Godhavn. The result was very poor, and the few forms obtained have, no doubt, already been described.

I used the surface-net at *six* stations during the voyage: in Davis Strait, off Fredrikshaab, in lat. 62° 30′ N., July 13th; off Tasiusak, the most northern "udliggersted" of Danish Greenland, some miles north of Upernavik, July 19th; at Dalrymple Island, July 24th, and three times at different places in Inglefield Gulf. The result of the surface-gatherings off Tasiusak and Dalrymple Island was next to nothing; only some *dinoflagellats*, *diatoms*, *copepods* and other *entomostraca* were secured. On the contrary, off Fredrikshaab, the net was filled with *Limacina*, *copepods* and *ostracods*, *Zoea-* and *Mysis*-stages *of decapods* in great quantities. Not so numerous were small *Clione*, *Cydippe*, *craspedote medusæ*, *Salpa*, a *hyperid*, *Ceratium* and *Appendicularia*.

The "plankton" of Inglefield Gulf was very rich. I found the evening to be the best time for using the surface-net; at that time and, probably, during the whole night, if I may use such a word for that part of the day when the sun is lowest on the horizon, innumerable masses of exquisite animals rise to the surface. We learned to expect the richest life near the places where the thousands of little auks were feeding on these organisms. In greatest profusion were *Clione* and *Limacina*, *copepods* and *ostracods*, four or five species of *ctenophors*, five of *craspedote medusæ*, one *hyperid*, two or three other *amphipods* and some larvæ of *decapods*. More seldom I observed in the plankton *Sagitta*, *palæmonids*, *schizopods*, a *polychæt*, two small *fishes*, *hydroids* on floating seaweed and *Ceratium*. Unfortunately I had no good opportunity on board the vessel to preserve the fine cœlenterats. Thus most of them are now much contracted and, of course, without their beautiful colors, which interfere with a sure determination. Nor had I time to describe or picture them alive.

Although the collection secured through these few dredgings and surface-gatherings is not yet worked up, I judge it will be interesting to note the following list of the animals brought up in the dredge. By

a very rough selection and examination I have been able to make up the following preliminary account of species accurately distinguished. To this list there will be added many more when all the classes and the pelagic forms are worked up by specialists. Thus I have obtained from the dredging material :

Pisces,		10	species (at least)
Crustacea :	*Decapoda,*	10	" "
	Schizopoda,	2	" "
	Cumacea,	2	" "
	Isopoda,	5	" "
	Amphipoda,	20	" "
Pycnogonida,		2	" "
Mollusca :	*Cephalopoda,*	1	" "
	Gastropoda,	15	" "
	Lamellibranchiata,	11	" "
Tunicata,		6	" "
Brachiopoda,		1	" "
Vermes,		15	" "
Echinodermata :	*Crinoidea,*	2	" "
	Asteroidea,	4	" "
	Ophiuroidea,	10	" "
	Echinoidea,	1	" "
		Total, 115	species (at least)

Polyzoa, hydrozoa and *spongiæ* are to be added to this list, besides all animals obtained with the surface-net and in some fresh-water pools at Godhavn, which I found to contain great numbers of *Branchippus, Apus, copepods, ostracods* and other organisms not yet examined.

If the number of species already classified (which will be considerably increased after a more careful and detailed examination of the whole material), is compared with a list of the collection brought home by the Nares' Expedition of 1875–1876, the result will be somewhat surprising when we find that our material, obtained in a few dredgings and almost exclusively at one station, viz., in Inglefield Gulf, will, probably, exceed that collection in number both of species and individuals. It is true that the Nares' collection was obtained farther north from lat. 78° to 83° N., within an area where one might possibly expect the fauna to be poorer on account of the geographical position in higher latitude. Nevertheless, considering the great number of dredgings and the extensive circuit within which they were carried on, the difference in regard to number of species and individuals secured during both expeditions is a remarkable one. It would be

interesting, therefore, for future naturalists visiting these regions to determine whether the fauna is actually so much poorer at localities situated at 2–3 degrees farther north. For the sake of comparison it will be of interest to examine Nares' list : [4]

Pisces,		10 species (including 3 fresh-water forms)
Crustacea :	*Decapoda,*	9 " (1 with ?)
	Schizopoda,	1 "
	Isopoda,	5 "
	Amphipoda,	12 "
Pycnogonida,		2 (3) species
Mollusca :	*Gastropoda,*	19 " (1 with ?)
	Lamellibranchiata,	16 " (2 " ?)
Brachiopoda,		1 "
Vermes,		23 "
Echinodermata :	*Crinoidea,*	2 "
	Asteroidea,	8 "
	Ophiuroidea,	8 (7) "
	Echinoidea,	1 "
	Holothurioidea,	1 "
		Total, 118 (110) species

Other classes are also enumerated in the Nares' list, but not having as yet the material of the corresponding groups separated, I cannot give here, even provisionally, a parallel series. No doubt the material brought home by the Nares' Expedition was the most complete collection of marine fauna from Baffin Bay and Smith Sound, or, perhaps, the only one. Since that time Greely's Expedition is the only one that visited those regions before Peary ; Greely's expedition and the first of the Peary expeditions did not bring home any collections of marine fauna, as no dredgings were carried on. I have thought it proper to publish this preliminary report to show how rich is the animal life in those waters, and to draw attention to the fact that so little is known of the fauna, and to indicate what a fertile field for further zoölogical explorations is presented by these seas which have hitherto been sounded so few times.

The material will be worked up by specialists as soon as possible, and I hope then to be able to publish a full account of all forms obtained during the expedition.

Lund, Sweden, December 10, 1894.

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[4] l. c. Vol. 2, Appendix.

APPENDIX C.

BOTANY.

List of Plants Obtained on the Peary Auxiliary Expedition of 1894.

COLLECTED BY

DR. H. EMERSON WETHERILL.

DETERMINED AT THE

Herbarium of Harvard University.

NOTE.—Determinations of the species of THALLOPHYTA and BRYOPHYTA by DR. W. G. FARLOW; of the CARYOPHYLLACEÆ and the genus COCHLEARIA by DR. B. L. ROBINSON. Determinations of the remainder of the collection by MR. M. L. FERNALD, with the exception of the genus SALIX, which was referred to MR. M. S. BEBB, of Rockford, Ill.

Ranunculus pygmæus, Wahl. Cape Faraday, Ellesmere Land (No. 152).

Ranunculus nivalis, L. On cliffs, northwest side of Disco Island (No. 78); north side of Jones Sound (No. 162); Northumberland Island (No. 187).

Papaver nudicaule, L., var. **arcticum**, Elkan. Abundant, Godthaab (No. 15); Cape York (No. 73); on cliffs, northwest side of Disco Island (No. 84); near Cape Acland, Inglefield Gulf (No. 130); Fan Glacier, Inglefield Gulf (No. 145); Cape Faraday (No. 156); north side of Jones Sound (No. 163). A white-flowered form comes from Bowdoin Bay, Inglefield Gulf (No. 44), and from the Glacier Valley north of the promontory to the west of Robertson's Bay (No. 108). It is said that the pistils are eaten, probably for the opium which they may contain.

Lesquerella arctica, Watson. Fan Glacier, Inglefield Gulf (No. 196).

The species of the arctic genus **Cochlearia** are in a state of considerable confusion, which renders the exact identification of specimens at present almost impossible. The difficulties presented arise on the one hand from the inherent variability of the species and the obscurity of their characteristics, especially as shown in dried specimens; on the other, in the uncertainty which prevails still among European botanists as to the

exact application of the Linnæan descriptions relating to members of the genus. The present collections contain specimens of **Cochlearia** collected in two localities, and to be referred doubtfully to the following species:

Cochlearia Grœnlandica, L. The spreading stems 3–4 inches in length; the central one much shorter: radical and lowest cauline leaves on long, slender petioles, ovate, cordate, entire, marcescent; the middle cauline oblong, narrowed at the base to more or less distinct petioles, entire or nearly so; the uppermost sessile, often inconspicuously auriculate: flowers crowded at the ends of the stems, relatively large: the obovate, white petals nearly two lines in length: fruit, when young, globose; at maturity, ovoid; valves scarcely reticulated.—Cape York, N. W. Greenland (No. 189). This plant appears to be a form of **C. Grœnlandica**, near var. **oblongifolia**, Lange (Conspect. Fl. Grœnl. 35). The stems and petioles, and to some extent the leaves, possess a noteworthy viscidity, shown by the clinging of grains of sand, seeds, etc.

Cochlearia fenestrata, R. Br. Dwarf; central stem short, erect; the lateral an inch or two long, spreading: leaves small, the radical as in the preceding, the cauline narrowly oblong, entire, contracted at the base: flowers smaller than in the preceding: capsule ellipsoidal or even somewhat pointed at apex and base, more or less distinctly reticulated; septum often fenestrate.—Cape Faraday, Ellesmere Land (No. 199).

Although these forms from their fruiting characters are apparently to be referred as above, it may be noted that the relative size of the flowers is just opposite that indicated by Professor Lange in the place cited.

Draba alpina, L. Glacier Valley, north of promontory to the west of Robertson's Bay (No. 191); near Cape Acland, Inglefield Gulf (No. 192); Fan Glacier, Inglefield Gulf (No. 195); north side of Jones Sound (Nos. 200, 202).

Draba Fladnizensis, Wulf. Fan Glacier, Inglefield Gulf (Nos. 197, 198); near Cape Acland, Inglefield Gulf (No. 201); Glacier Valley, north of promontory to the west of Robertson's Bay (No. 204); north side of Jones Sound (No. 227).

Draba incana, L. Godthaab (No. 16); Netiulume, Whale Sound (No. 203).

Arabis alpina, L. Cliff, northwest side of Disco Island (No. 77).

Raphanus Raphanistrum, L. Disco (No. 13). Apparently this is the first time this common European weed has been collected in Greenland.

Silene acaulis, L. Abundant, Godthaab (No. 34); Cape York (No. 71); on cliffs, northwest side of Disco Island (No. 83); Glacier Valley, north of promontory to the west of Robertson's Bay (No. 107); near Cape Acland, Inglefield Gulf (No. 129); Fan Glacier, Inglefield Gulf (No. 147).

Lychnis apetala, L. Near Cape Acland, Inglefield Gulf (No. 131); Fan Glacier, Inglefield Gulf (No. 134); north side of Jones Sound (No. 159).

Lychnis triflora, R. Br. Godthaab (No. 35); Bowdoin Bay, Inglefield Gulf (No. 45); Netiulume, Whale Sound (Nos. 180, 183).

Arenaria verna, L. Fan Glacier, Inglefield Gulf (No. 193).

Arenaria ciliata, L., var. (?) **humifusa**, Hornem. Fan Glacier, Inglefield Gulf (No. 194).

Arenaria peploides, L. Cape York (No. 72).

Stellaria media, Cyrillo. Disco (No. 14).

Stellaria humifusa, Rottb. On cliffs, Dalrymple Island (No. 47).

Stellaria longipes, Goldie, var. **Edwardsii**, Watson. Godthaab (No. 33); Netiulume, Whale Sound (No. 172); Northumberland Island (No. 186). No. 133 from Fan Glacier, Inglefield Gulf, is sterile, but probably goes here.

Cerastium alpinum, L. Godthaab (No. 46); Cape York (No. 74); cliffs, northwest side of Disco Island (No. 76); Southeast Cary Island (No. 98); Glacier Valley, north of promontory to the west of Robertson's Bay (No. 102); near Cape Acland, Inglefield Gulf (No. 132); Fan Glacier, Inglefield Gulf (No. 135); Cape Faraday (Nos. 150, 151); Clarence Head, North Lincoln (No. 157); north side of Jones Sound (No. 158); Netiulume, Whale Sound (No. 181). An extremely variable species.

Montia fontana, L. Near Cape Acland, Inglefield Gulf (No. 125).

Dryas octopetala, L., var. **integrifolia**, C. & S. Abundant, Godthaab (No. 17); Cape York (No. 69); cliff, northwest side of Disco Island (No. 81); Glacier Valley, north of promontory to the west of Robertson's Bay (No. 109); near Cape Acland, Inglefield Gulf (No. 128); Fan Glacier, Inglefield Gulf (No. 149); north side of Jones Sound (No. 166).

Potentilla emarginata, Pursh. Fan Glacier, Inglefield Gulf (No. 144); north side of Jones Sound (No. 160).

Potentilla nivea, L. Godthaab (No. 18); Netiulume, Whale Sound (No. 174). A form equaling **P. Vahliana**, Lehm., from Cape York (No. 70); cliffs, northwest side of Disco Island (No. 82); Southeast Cary Island (No. 100).

Potentilla frigida, Vill.? No. 43 from Bowdoin Bay, Inglefield Gulf, has been referred here, though it may be a very depauperate form of **emarginata**, Pursh.

Sibbaldia procumbens, L. Disco (No. 12).

Saxifraga nivalis, L. North side of Jones Sound (No. 161).

Saxifraga cernua, L. Near Cape Acland, Inglefield Gulf (No. 124); Cape Faraday (No. 155); north side of Jones Sound (No. 164); Northumberland Island (No. 184).

Saxifraga cæspitosa, L. Cape York (No. 67); on cliffs, northwest side of Disco Island (No. 79).

Saxifraga tricuspidata, Retz. Godthaab (No. 24); Bowdoin Bay, Inglefield Gulf (No. 40); Cape York (No. 66); Northumberland Island (No. 185).

Saxifraga oppositifolia, L. Abundant, Cape York (No. 68); cliffs, northwest side of Disco Island (No. 80); Southeast Cary Island (No.

99); Glacier Valley, north of promontory to the west of Robertson's Bay (No. 110); near Cape Acland, Inglefield Gulf (No. 126); Fan Glacier, Inglefield Gulf (No. 148); Cape Faraday (No. 154); north side of Jones Sound (No. 165).

Epilobium angustifolium, L. Collected at Disco (No. 1) early in September with immature buds.

Epilobium latifolium, L. Godthaab (No. 25); near Cape Acland, Inglefield Gulf (No. 127); Fan Glacier, Inglefield Gulf (No. 146).

Antennaria alpina, Gærtn. Godthaab (No. 20).

Arnica alpina, Olin. On cliffs, northwest side of Disco Island (No. 85); Fan Glacier, Inglefield Gulf (No. 141).

Taraxacum officinale, Weber. Disco (No. 11), one of the specimens approaching var. **lividum**, Koch.

Taraxacum officinale, var. **lividum**, Koch. Netiulume, Whale Sound (No. 175).

Vaccinium uliginosum, L., var. **mucronatum**, Herder. Abundant, Godthaab (No. 23); Cape York (No. 61); cliffs, northwest side of Disco Island (No. 89); near Cape Acland, Inglefield Gulf (No. 121); Fan Glacier, Inglefield Gulf (No. 142). One branch of No. 121 has leaves fully as large as in the type.

Cassiope tetragona, Don. Godthaab (No 21); Bowdoin Bay, Inglefield Gulf (No. 41); Cape York (No. 62); cliffs, northwest side of Disco Island (No. 87); Glacier Valley, north of promontory to the west of Robertson's Bay (No. 106); near Cape Acland, Inglefield Gulf (No. 123); north side of Jones Sound (No. 168).

Bryanthus taxifolius, Gray. Cliffs, northwest side of Disco Island (No. 90).

Rhododendron Lapponicum, Wahl. Cape York (No. 64); cliffs, northwest side of Disco Island (No. 88).

Pyrola rotundifolia, L., var. **pumila**, Hook. Abundant, Disco (No. 10); Godthaab (No. 22); Bowdoin Bay, Inglefield Gulf (No. 42); Cape York (No. 63); cliffs, northwest side of Disco Island (No. 86).

Diapensia Lapponica, L. Godthaab (No. 127); Cape York (No. 60).

Armeria vulgaris, Willd. Not very abundant, Cape York (No. 65); near Cape Acland, Inglefield Gulf (No. 122); Fan Glacier, Inglefield Gulf (No. 143); Netiulume, Whale Sound (No. 176).

Mertensia maritima, Don. Not very abundant, Cape York (No. 59).

Bartsia alpina, L. Cape York (No. 55).

Pedicularis flammea, L. Quite abundant in low ground at Cape York (No. 58).

Pedicularis hirsuta, L. Cape York (No. 56); cliffs, northwest side of Disco Island (No. 92); north side of Jones Sound (No. 167).

Pedicularis Langsdorffii, Fisch., var. **lanata**, Gray. Cape York (No. 57); on route to ice-cap, Blaese Dael and Red River (No. 75); cliffs, northwest side of Disco Island (No. 91).

Pedicularis Lapponica, L. Cliffs, northwest side of Disco Island (No. 93).

Polygonum viviparum, L. Disco (No. 9); Godthaab (No. 26); cliffs, northwest side of Disco Island (No. 95); near Cape Acland, Inglefield Gulf (No. 120).

Oxyria digyna, Hill. Godthaab (No. 19); cliffs, northwest side of Disco Island (No. 94); Glacier Valley, north of promontory to the west of Robertson's Bay (No. 105); near Cape Acland, Inglefield Gulf (No. 119); Fan Glacier, Inglefield Gulf (No. 140); north side of Jones Sound (No. 169); Netiulume, Whale Sound (No. 177); Northumberland Island (No. 188).

Betula nana, L. Disco (No. 8); Cape York (No. 54).

Salix Brownii, Bebb. (**S. arctica**, R. Br. non Pal.). Disco (No. 206); Godthaab (No. 207); Bowdoin Bay, Inglefield Gulf (No. 208); Cape York (No. 212); Southeast Cary Island (No. 216); Glacier Valley, north of promontory to the west of Robertson's Bay (No. 217); Fan Glacier, Inglefield Gulf (No. 220); north side of Jones Sound (Nos. 223, 224, 225). Variations from the type are shown in No. 205 from Disco, No. 221 from Fan Glacier, Inglefield Gulf, and in No. 226 from Netiulume, Whale Sound. No. 219, from Cape Acland, Mr. Bebb considers near the next species.

Salix glauca, L. Cape York (Nos. 209, 210, 211, 213); Fan Glacier, Inglefield Gulf (No. 222). No. 215 from the northwest side of Disco Island is intermediate between this and the last species.

Empetrum nigrum, L. Disco (No. 7); Godthaab (No. 39); Cape York (No. 53).

Tofieldia palustris, Huds. Near Cape Acland, Inglefield Gulf (No. 118).

Luzula arcuata, Meyer. Glacier Valley, north of promontory to the west of Robertson's Bay (No. 103); Fan Glacier, Inglefield Gulf (No. 139); north side of Jones Sound (No. 170).

Eriophorum Scheuchzeri, Hoppe. Disco (No. 6); Godthaab (No. 29); near Cape Acland, Inglefield Gulf (No. 117); Fan Glacier, Inglefield Gulf (No. 138).

Eriophorum polystachyon, L. Near Cape Acland, Inglefield Gulf (No. 116); Fan Glacier, Inglefield Gulf (No. 137).

Carex rigida, Gooden., var. **Goodenovii**, Bailey. Godthaab (No. 28); near Cape Acland, Inglefield Gulf (No. 114); Fan Glacier, Inglefield Gulf (No. 136).

Carex misandra, R. Br. Near Cape Acland, Inglefield Gulf (No. 115).

Carex scirpoidea, Michx. Cape York (No. 51).

Carex nardina, Fries. Glacier Valley, north of promontory to the west of Robertson's Bay (No. 104).

Alopecurus alpinus, Sm. On cliffs, Dalrymple Island (No. 48); abundant about the settlement, Cape York (No. 49), where it was called "Blue Grass;" Cape Faraday, Ellesmere Land (No. 153); north side of Jones Sound (No. 171); Netiulume, Whale Sound (No. 178).

Hierochloë alpina, R. & S Disco (No. 5); Godthaab (No. 30); Bowdoin Bay, Inglefield Gulf (No. 38); north side of Jones Sound (No. 172).

Calamagrostis phragmitoides, Hartm. Disco (No. 4).

Deschampsia brevifolia, R. Br. Near Cape Acland, Inglefield Gulf (No. 111).

Deschampsia alpina, R. & S. ? Cliffs, northwest side of Disco Island (No. 96).

Trisetum subspicatum, Beauv. Disco (No. 3).

Phippsia algida, R. Br. Southeast Cary Island (No. 101).

Arctagrostis latifolium, Ledeb. Near Cape Acland, Inglefield Gulf (No. 113).

Poa abbreviata, R. Br. Netiulume, Whale Sound (No. 179).

Poa alpina, L. North side of Jones Sound (No. 173).

Poa cenisea, All. Near Cape Acland, Inglefield Gulf (No. 112).

Festuca ovina, L., var. **brevifolia**, Watson. Disco (No. 2).

Equisetum arvense, L. Cape York (No. 52).

Aspidium spinulosum, Swz., var. **dilatatum**, Hook. Godthaab (No. 32).

Aspidium fragrans, Swartz. Bowdoin Bay, Inglefield Gulf (No. 37).

Cystopteris fragilis, Bernh. Godthaab (No. 31); Bowdoin Bay, Inglefield Gulf (No. 36); cliffs, northwest side of Disco Island (No. 97).

Lycopodium Selago, L. Cape York (No. 50).

Ceratodon purpureus (L.) Brid. North side of Jones Sound (227).

Racomitrium lanuginosum, Brid. Southeast Cary Island (228); Fan Glacier, Inglefield Gulf (229).

Aulacomnium turgidum (Wahlb.) Schwaegr. North side of Jones Sound (230); Fan Glacier, Inglefield Gulf (231).

Jungermannia minuta, Crantz. North side of Jones Sound (232).

Besides the above named **Bryophyta** there were specimens from several localities of members of the genus **Bryum** in a sterile condition, **Polytrichum juniperinum** (Hedw.), Willd., **Hypnum uncinatum**, Hedw., and fragments of other **Hypna**.

Alectoria ochroleuca (Ehrh.) Nyl. Cape York (233); cliffs northwest side of Disco Island (234); Glacier Valley (235); northwest side of Jones Sound (236); Northumberland Island (237).

Dactylina arctica (Hook.) Nyl. Northumberland Island (238).

Cetraria nivalis (L.) Ach. On cliffs, Dalrymple Island (239); Cape York (240); Southeast Cary Island (241); Glacier Valley (242); northwest side of Jones Sound (243); Netiulume, Whale Sound (244).

Parmelia saxatilis (L.) Fr. Glacier Valley (245); Fan Glacier, Inglefield Gulf (246).

Parmelia lanata (L.) Wallr. Cape York (247).

Nephroma arcticum (L.) Fr. Disco (248); Glazier Valley (249).

Umbilicaria proboscidea (L.) Stenh., var. **arctica**, Ach. On cliffs, Dalrymple Island (250), where it was the most common species found; Cape York (251); Southeast Cary Island (252); Glacier Valley (253); Fan Glacier (254); Netiulume, Whale Sound (255).

Umbilicaria anthracina (Wulf.) Schaer. ?

Two small specimens were collected at Glacier Valley (256), which may be referred to this species with some doubt. The thallus is small, cinereous, with lacerate and fringed margins and fibrillose beneath, especially near the margin. The orbicular apothecia are for the most part simple but are, in some cases, aggregated but not at all plicate. The specimens cannot well be referred to **Gyrophora Wenckii**, J. Müller, nor is the thallus that of the typical **U. anthracina**. In the latter respect it agrees better with **U. cylindrica** (L.) Delis., and it may perhaps be a form of that species in which the apothecia have not become plicate.

Placadium elegans (Lk.) DC. Cape York (257); Southeast Cary Island (258); Glacier Valley (259); Netiulume, Whale Sound (260).

Lecanora rubina, Ach. On cliffs, Dalrymple Island (261).

Rinodina turfacea (Whl.) Nyl. Godthaab (262); Southeast Cary Island (263).

Stereocaulon tomentosum, Fr., var. **alpinum**, Th. Fr. Cape York (264).

Cladonia cornucopioides (L.) Fr. Netiulume, Whale Sound (265).

Buellia geographica (L.) Tuck. Glacier Valley (266).

Sphaerophoron fragile (L.) Pers. Glacier Valley (267).

Desmarestia aculeata (L.) Lamour. Near Cape Acland, Inglefield Gulf (268).

Fucus sp.

Imperfect specimens of a species of **Fucus** were collected near Cape Acland and one specimen also from Cape York, which are interesting from the locality in which they occurred. The specimens are about four inches long, with a prominent midrib, but no air-bladders. Unfortunately the conceptacles are very young, and it is not possible to say whether the species is diœcious or not. The general habit is that of the group of **F. vesiculosus** rather than **F. evanescens** as limited by J. Agardh.

The only fungus collected was a single specimen of a **Lycoperdon**, of which the basal portion only was preserved, and it is only possible to say that the species is probably **L. cœlatum**. The locality is Cape York. There were besides some fragments of dead plants, which could not be identified, on which was a fungus which agreed well with **Pyrenophora chrysospora** (Niessl.) Sacc.

The following species were collected only at Godthaab or on Disco Island; *i. e.*, south of latitude 70°:

Arabis alpina, L.
Raphanus Raphanistrum, L.
Stellaria media, Cyrillo.
Sibbaldia procumbens, L.
Epilobium angustifolium, L.
Antennaria alpina, Gærtn.
Bryanthus taxifolius, Gray.
Pedicularis Lapponica, L.
Calamagrostis phragmitoides, Hartm.
Trisetum subspicatum, Beauv.
Festuca ovina, L., var. brevifolia, Watson.
Aspidium spinulosum, Swartz, var. dilatatum, Hook.

The following species were collected only at Cape York, on the north side of Jones Sound or northward; *i. e.*, north of latitude 75°:

Ranunculus pygmæus, Wahl.
Lesquerella arctica, Watson.
Cochlearia Grœnlandica, L.
Cochlearia fenestrata, R. Br.
Draba alpina, L.
Draba Fladnizensis, Wulf.
Lychnis apetala, L.
Arenaria verna, L.
Arenaria ciliata, L., var. (?) humifusa, Hornem.
Arenaria peploides, L.
Montia fontana, L.
Potentilla emarginata, Pursh.
Saxifraga nivalis, L.
Saxifraga cernua, L.
Armeria vulgaris, Willd.
Mertensia maritima, Don.
Bartsia alpina, L.
Pedicularis flammea, L.
Salix glauca, L. (typical form).
Tofieldia palustris, Huds.
Luzula arcuata, Meyer.
Eriophorum polystachyon, L.
Carex misandra, R. Br.
Carex scirpoidea, Michx.
Carex nardina, Fries.
Alopecurus alpinus, Sm.
Deschampsia brevifolia, R. Br.
Phippsia algida, R. Br.
Arctagrostis latifolium, Ledeb.
Poa abbreviata, R. Br.
Poa alpina, L.
Poa cenisea, All.
Equisetum arvense, L.
Aspidium fragrans, Swartz.
Lycopodium Selago, L.

The remaining species were collected at various points from Godthaab northward, and appear to be of general distribution.