

GEOLOGICAL SURVEY OF CANADA

G. M. DAWSON, C.M.G., LL.D., F.R.S., DIRECTOR

REPORT

ON AN

EXPLORATION OF PART

OF THE

SOUTH SHORE OF HUDSON STRAIT

AND OF

UNGAVA BAY

BY

A. P. LOW, B.Ap.Sc.



OTTAWA

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UMIAK OR WOMEN'S BOAT, WAKEHAM BAY.



A. P. Low.—Photo. 1897.

ESKIMO IN KYAKS, WAKEHAM BAY.

G. M. DAWSON, C.M.G., LL.D., F.R.S.,

Director Geological Survey of Canada.

SIR,—I herewith beg to submit my report on the exploration in the summer of 1897, of a part of the south shore of Hudson Strait and of the west and south shores of Ungava Bay.

I have the honour to be, Sir,

Your obedient servant,

A. P. LOW.

OTTAWA, June 16th, 1898.

NOTE.—*The bearings in this report are all referred to the true meridian,
and the elevations to mean sea-level.*

REPORT

ON AN

EXPLORATION OF PART OF THE SOUTH SHORE OF HUDSON STRAIT AND OF UNGAVA BAY.

INTRODUCTORY.

This report is based on the observations made during July and August, 1897, on the geology and physical geography of the northern portion of the Labrador Peninsula bordering on Hudson Strait and of Ungava Bay. The area examined extended from Douglas Harbour, situated some 150 miles to the eastward of Cape Wolstenholme at the entrance of Hudson Bay, to George River in the south-east part of Ungava Bay, a distance by the coast of 750 miles. The work was chiefly confined to the coast, and except by a few trips extending a short distance inland, the interior was explored only along the lower portions of the larger rivers. Payne River was ascended thirty-five miles, Koksoak River thirty miles, Whale River ten miles and George River twenty-five miles. Mr. G. A. Young, B.Ap.Sc., who had acted as my assistant during the previous season, again took charge of the topographical work, and, in addition, kept daily meteorological observations and made a collection of plants found growing along the coast. He proved most efficient and materially assisted in the success of the exploration. The rest of the party consisted of D. Burgoyne sailing-master and carpenter, J. Lantz, cook, and J. Greenland, sailor, all of whom filled their positions in a satisfactory manner. It had been expected that an Eskimo interpreter would have been secured on the Labrador coast, so that advantage might have been taken of the local knowledge of the natives met with, but heavy pack-ice completely blocked the Atlantic coast on our way northward, and prevented the ship from calling at any place where such an interpreter might have been obtained. As a consequence, we were unable to communicate intelligibly with the natives and doubtless missed much valuable information.

Area included
in Report.

Members of
the party.

Acknowledgments are due to Mr. C. C. Chipman, Commissioner of the Hudson's Bay Company, for a circular letter to the officers in charge of the several posts visited, and to Mr. Mathewson, Fort Chimo,

Acknowledg-
ments.

Mr. John Ford, George River, and Mr. J. Edmunds, Whale River' officers of the Company, for kind hospitality and help ; also to Capt. A. Gray, of the Hudson's Bay Company's steamship *Erik*, for transporting the yacht and equipment to Nachvak and carefully storing it there for future use.

Investigations
in Hudson
Strait.

The Parliament of Canada, during the session of 1897, voted a sum of money to send a suitable ship to Hudson Strait in order to further test the period during which the strait is open to navigation. For this work the *Diana*, a Newfoundland sealing steamship, built specially for work in heavy ice, was chartered and placed under the command of Commander W. Wakeham, of the Department of Marine and Fisheries, the remainder of the officers and crew being natives of Newfoundland, accustomed to ice work. Advantage was taken of the transport afforded by the *Diana* to send two parties from the Geological Survey to explore the coast-line of both sides of the strait. Dr Bell was appointed in charge of the party on the north side, and to the writer was assigned the exploration of the southern shore. Two small yachts were built at Mahone Bay, Nova Scotia, for the use of the exploration parties. Their dimensions were similar, i.e., length 35 feet ; beam 10 feet ; extreme draught $3\frac{1}{2}$ feet ; thickness of planking 1 inch, white pine. They were decked over, except a large water-tight cockpit, and below deck had accommodation for two in a small cabin aft, while forward of a bulkhead was a store-room and a small galley, with close accommodation for four men in the bow. Sixty gallons of mineral oil was carried for fuel, in tanks under the seats of the cockpit, and a double burner Primus oil stove was used in the galley, answering its purpose admirably. The yachts were given a yawl rig, with a total sail area of 800 square-feet, sufficient to drive them along in light winds, and provided with wide reefs by which sail was easily reduced in heavy weather. A sixteen-foot skiff was towed as a tender, and was found very useful in landing along the coast. The yachts were found well adapted to the work, except that the pine planking was too soft and thin for rough usage amongst ice ; and if the boats are again employed for similar work it would be advisable to sheath them with copper protected by longitudinal battens of hardwood.

Yachts used
in explorations of Hud-
son Strait.

The yachts were placed on board the *Diana* at Halifax, securely lashed to the deck amidships, leaving only a narrow passage way between them, and were unfortunately the cause of much inconvenience, on board, especially when coal was being shifted from the main hatch to the bunkers.

The *Diana* sailed from Halifax on June 3rd, and passed through the Strait of Belle Isle, where the first heavy ice was encountered. On the way northward along the Atlantic coast, more or less delay was occasioned by the heavy pack drifting southward, and the eastern entrance of Hudson Strait was not reached until the 22nd of June. Further delays by ice, especially in the neighbourhood of Big Island, near the middle of the strait, prevented the *Diana* from passing into the open water of Hudson Bay until the 12th of July. Returning immediately, an attempt was made to land Dr. Bell's party in the vicinity of King Cape on the eastern side of the mouth of Fox Channel, but owing to the great quantity of heavy ice about Salisbury and Nottingham islands and to the northward, it was found impossible to do so, and the ship was headed east, to land my party at the first convenient place on the southern shore.

Passage from
Halifax to
Hudson
Strait.

Commander Wakeham, in his report of the voyage of the *Diana**, enters fully into the conditions and nature of the ice of Hudson Strait. My own observations and conclusions in regard to the ice coincide with those so ably set forth by him, and, consequently, it is unnecessary to allude further to them here.

PHYSICAL FEATURES OF THE SOUTH COAST OF HUDSON STRAIT.

Early on the morning of the 16th of July, the *Diana* reached the western entrance of King George Sound, and steamed slowly in between several islands and the mainland. The largest island is about six miles long by about three wide and had been poetically named the Maiden's Paps by some ancient navigator, from the outline of two rounded hills upon it; the other islands are much smaller, but all are high and rocky, the highest points on the large island being estimated at 700 feet above the sea. The mainland is also high, rocky and destitute of trees. It is broken by bold points into small irregular bays, with deep water close in shore, the only danger being due to the lumpy nature of the bottom, which in places rises into small islands, and in others to shoals indicated only by grounded ice. We anchored in a small cove on the west side of the mouth of a deep inlet, about five miles south of the western end of the Maiden's Paps, and a boat was sent to sound the channel into the inlet where a safer anchorage was sought, as the cove where the ship lay was open to the northward and full of ice drifting backward and forward with the tides. During the absence of the boat, preparations

King George
Sound.

* Report of the Expedition to Hudson Strait, etc., Marine and Fisheries Department, 1897, pp. 61-69.

were made for launching our yacht, and, owing to the absence of yards on the mainmast, considerably difficulty was experienced; but after two hours' work a successful launch was made and as the yacht took the water we named her the *Alle* after the hardy little auk.

The boat returned in the afternoon and reported a safe anchorage about five miles farther up the inlet, with the shallowest soundings of five fathoms at low-water on a bar at the entrance, and elsewhere from ten to fifteen fathoms. The ship then shifted to the inner harbour, towing the yacht with her, and a good holding ground of mud and boulders was found within a quarter of a mile of the shore on the west side of the bay. Four small rocky islands at the mouth of the inlet practically make the harbour land-locked. The best entrance is between the first and second islands from the west shore, and there is probably a sufficient depth of water for large ships between the other islands, but a narrow bar of large boulders, covered at high-water, extends from the western island to the mainland. The inlet was named Douglas Harbour by Commander Wakeham, and it was subsequently found to be seventeen miles long, being divided into two narrow arms nine miles above the entrance. The main body varies from half a mile to a mile across. High hills rise abruptly from the water almost everywhere, with an altitude of about 700 feet near the entrance, increasing to 1500 feet towards the head of the arms. The next day was employed in rigging the yacht and in stowing the provisions and outfit. Much annoyance was caused by large cakes of heavy ice drifting about on the tide, which required constant watch to keep them from fouling the yacht tied to the side of the *Diana*. In the evening Commander Wakeham handed me a letter containing instructions to be at Fort Chimo on September 15th, when the *Diana* would call there for our party and take us to St. John's, Newfoundland.

On Sunday July 18th, everything being properly stowed and the *Alle* completely rigged, we left the ship after breakfast and sailed with a strongly westerly breeze up the south-west arm. The *Diana* shortly after hoisted anchor and stood out of the harbour on her way to Big Island, where Dr. Bell's party was to be landed. We anchored at the head of the arm early in the afternoon and took a series of observation on the sun with the sextant and chronometer for latitude azimuth and time; later, the press was filled with arctic flowering plants which formed a brilliant carpet over the sandy and gravelly terraces in a continuation of the valley of the arm. A small river empties into the head of the arm, and at high-water its mouth was filled with trout from

Good ship
anchorage.

Douglas
Harbour.

Diana sails.



WEST ARM, DOUGLAS HARBOUR, HUDSON STRAIT.



A. P. Low.—Photo. 1897.

RAVINE ON BROOK AT HEAD OF WEST ARM DOUGLAS HARBOUR.

one to five pounds in weight. We had unfortunately omitted to bring Arctic Trout. a net, and as the fish were feeding on swarms of sand-shrimps they would not take other bait freely, so we caught only a few small ones. They proved to be the arctic trout or Hearn's salmon, quite distinct from the ordinary sea-trout of more southern waters. They are abundant in the tidal waters of all the rivers flowing into Hudson Strait and Ungava Bay. In the Koksoak River they have been taken up to fourteen pounds in weight, but ordinarily weigh from three to eight pounds. The bottom, in the shallow water at the head of the arm, was covered with numerous dead crabs of all sizes up to six inches diameter, which had been killed by the weight of heavy cakes of ice grounded there at high-water and left by the retreating tide.

Early the next morning an exploration of the country about the head of the arm was made. For a mile, our way led over a level terrace of sand and gravel, one hundred feet above sea level, to where the river divided into two equal branches. The valley of the stream from the sea to the forks varies from fifty to one hundred yards in width, and is cut into the terrace; its grade is steep and the stream in consequence is a continuous rapid over a winding, bouldery bed. The bank of the west branch was followed about half a mile, rising over terraces of thirty-seven and ten feet; crossing the stream further ascents of forty-five and one hundred and twenty feet brought us to the top of a well marked gravel terrace 313 feet above the sea, while behind it and flanking the steep rocky hills, were two other terraces at 375 feet and 506 feet respectively, above sea-level. These are not so clearly defined as the lower ones and are formed of coarser material with scattered boulders, but their tops appear to have been levelled by water, and they probably mark the extreme uplift of the land since the later-glacial subsidence. The stream has cleared the drift from its channel and rushes down a narrow rocky gulch in a beautiful cascade of 500 feet. Above this fall and below the next, there is a fine deep pool in which a number of large trout were seen, but having no means of catching them we could not tell the species, although they resembled the ordinary brook trout. From the pool, a steep climb of 850 feet over well glaciated, granitic rocks, led to a more gradual slope of the upper part of the hill, which was covered with innumerable boulders and blocks to its summit, 1,860 feet above the sea. The view from the summit is very desolate. Barren, rocky or boulder-covered hills on all sides, run in low rounded ridges separated from one another by small deep valleys filled with snow; the surface, wherever there is sufficient soil, was covered with lichens diversified with a few arctic flowers, but not in the beautiful abundance met with in the valleys. No trees and very little soil hide the bare rocks, scarred

Country about
Douglas
Harbour.

Brook Trout

Birds.

everywhere with huge blocks and boulders. A few birds, mostly snow buntings and Lapland longspurs were seen on the summit, evidently with young. Having examined the rocks and taken a number of photographs we returned to the yacht in time for a noon observation of the sun, and later on made observations for time to determine the rate of the chronometer. Towards evening it rained heavily and the weather remained dirty all night. The following morning we left the head of the arm and on the way down examined the rocks at several places on both sides. We then sailed to within a mile of the head of the south-east arm, where the water was only two fathoms deep at high-tide. The valley of this arm continues some miles beyond the sea, and is occupied by a large stream which has brought down the sand that forms the wide shoals at its mouth. An observation for latitude was taken at the edge of the shoal water, after which the whole afternoon was spent beating down the arm against a strong wind, the bay being covered with large cakes of ice blown into it by the wind. We anchored in a small cove on the west side, about a mile up the south-west arm, where there was good shelter from the ice. The hills about the head of the south-east arm appear to be higher than those ascended, the highest summits being probably about 2,000 feet above the sea.

Floating ice.

Ice in Strait.

It blew a gale during the night, and the wind continued so strong next day that we were unable to leave the anchorage, so Young and I climbed the prominent hill at the entrance to the arm. Its summit, by the aneroid, has an elevation of 1,600 feet, and consists of an immense dyke of rusty amphibolite. We experienced considerable difficulty in walking against the wind and several times had to take shelter behind large boulders during the more violent gusts. During the gale, a peculiar dark cloud remained stationary over the bay. A grand view of the entrance to Douglas Harbour was obtained from the summit, and also of the islands of King George Sound, while on the horizon Big Island was distinctly seen. Stringers of ice were observed in the sound, but beyond it clear water extended for fifteen miles, followed by loose pack to the horizon. On the way up and down the hill several new species of plants and three species of butterflies were added to the collection. Bird life is by no means abundant on the land the only species noted being the snow bunting, Lapland longspur, shore lark, a sparrow, raven and rock ptarmigan, the last still in about half-winter plumage.

On July 22nd, the wind moderated slightly towards morning, and we sailed for the mouth of the harbour under reefed jib only, and racing along with numerous small water-spouts soon reached the

islands at the entrance, where a landing was made. Outside the harbour the wind was steadier and lighter, gradually dying out and leaving us becalmed at noon near the western end of Prince of Wales Island. The distance between the mouths of Douglas Harbour and Fisher Bay is twenty-five miles, and the general trend is east-south-east. The coast between the bays is bold, and indented only by small coves, none of which afford harbours. The rocky shores rise abruptly, from 400 feet to 800 feet above the water, and are backed by higher hills that reach altitudes of 1,500 feet and more. The water appears to be deep close in shore, and only two small rocky islands were seen under the land. The islands to the eastward of the Maiden's Paps, four or five in number, extend in that direction about eight miles; they are much lower than the large island, and lie about ten miles off the coast. From the most easterly island there is an interval of eight miles to the west point of Prince of Wales Island. This island is about six miles long by three wide; it is high and rocky and lies diagonally to the coast, its south-west end being about four miles from the mainland. A smaller, high, rocky island lies immediately off the south-west point, and further eastward three rocky islands partly obstruct the channel between the large island and the mainland.

Coast between
Douglas Har-
bour and
Fisher Bay.

Fisher Bay is nine miles long and three miles wide at its mouth, being divided into two arms about half-way up. The bay opens to the north-east, and its western side is quite shallow, extensive boulder-covered flats being exposed at low-water on that side; but there is a good channel along the east side, which leads to a protected harbour behind two high islands near the head of the eastern arm, where we arrived at midnight. Prince of Wales Island is a favourite breeding ground for sea-pigeons, *Cephus mandtii*, thousands of which were about the yacht while we were becalmed off the island.

Fisher Bay.

The early part of the next morning was spent visiting the mainland and islands at the head of the bay. A small stream falls in from the eastward near the head of the bay, being the discharge of a beautifully clear lake lying between high hills, which the Eskimos report is well-stocked with trout. We ran several lines of soundings through the harbour and the approach to it, and found from five to eight fathoms at low-water.

Towards noon we sailed to the east point, where five families of Eskimos were encamped, engaged in harpooning white porpoises and seals for their winter's supply of oil. The encampment consisted of five seal-skin tents situated on the side of a rocky hill, covered in places with coarse shingle; the tents were erected among the boulders, and

Eskimo
encampment.

the only protection from the uneven rocky floor was a pile of hairy deerskins forming the bed in the back part of the tent. Blubber and meat were strewn about the tents indiscriminately, inside and out, and the smell of rancid oil and flesh was almost overpowering. The natives were all clothed in garments of deer-skin or seal-skin dressed with the hair on, and as most of them had apparently been worn a considerable time, they were far from clean. No articles of European manufacture were noticed, beyond guns, rifles, some iron in the spears and a few knives. Few of these people ever come in direct contact with the whites, as they send their winter hunt of furs by some picked men in the spring to Fort Chimo, the journey being made overland with dog-teams and occupying nearly three months. The skins of arctic foxes, bears and wolves are exchanged for guns, ammunition, needles and knives, while any credit remaining is used to purchase tobacco. The hunt had already gone to Fort Chimo before our arrival and as we did not want oil or sealskins, there was very little to trade with and what we did buy was all paid for in tobacco, of which these people are inordinately fond. We took several photographs of the group and also of the tents, and in exchange made a small present of tobacco to each man, woman and child. It was curious to see a mother take a short black pipe filled with rank, black tobacco, out of her mouth and pass it backwards to the small child in her hood; the youngster evidently relished it, as there was always a cry when the mother resumed her own smoke.

Coast between
Fisher and
Wakeham
bays.

Having taken a noon observation on the sun, we stood eastward along the coast to the next large inlet, called Wakeham Bay, and ascended it to its head, arriving there at 10 p.m. The distance, from the eastern side of Fisher Bay to the entrance of Wakeham Bay, is eight miles. The coast between these bays is more rugged and broken than to the westward, with a few small islands along shore but no shelter sufficient for the yacht. The land rises abruptly from the shore and increases in altitude as Wakeham Bay is approached, where, on the east side of the entrance, a rounded hill rises 1,800 feet directly from the water, and must be a prominent mark from far to seaward; the other hills along this part of the coast vary in altitude from 800 feet to 1,500 feet.

Wakeham
Bay.

Wakeham Bay is twenty miles long. At its mouth it is nearly two miles and a half wide, gradually narrowing to a little over a mile about three miles above the entrance. The water of the approach is deep, and the only obstructions to free navigation are two small islands, nearly covered at high-tide, one of which lies about two miles north-

east of the western head and the other about three miles due north of the eastern side of the entrance. There is plenty of room between them, and they should not be dangerous in approaching this, the safest and best harbour on the south coast of Hudson Strait. The eastern side of the entrance is formed by a rocky peninsula 600 feet high, joined to the mainland by a neck of sand and clay less than fifty feet high, with a small lake in the middle. Beyond the narrows the bay averages three miles in width for ten miles; the remainder of the upper end being less than a mile wide. A fine protected ship harbour, out of the run of the tide and consequently free from the danger of quickly moving ice, was found just inside the peninsula, with good anchorage in from fifteen to twenty-five fathoms opposite the low sandy neck. Of course when the bay is full of ice, a ship would be be-set here, but there is no current in the cove and consequently the ice-pressure would be due only to wind. Excellent ship harbour.

The highlands on the west side continue about ten miles up the bay to the wide valley of a small stream, beyond which the immediate hills vary from 200 feet to 500 feet until near the head of the inlet, when they reach heights of 1,200 or 1,500 feet. On the east side, the general altitude of the hills ranges from 800 feet to 1,000 feet, and there are numerous wide, drift-filled valleys below the 300 foot level.

On July 24th, the yacht remained at anchor all day, and we busied ourselves examining the country and rocks about the head of the bay. Head of Wakeham Bay. The main valley continues a long distance inland, and is occupied by a small unnavigable river. Other wide valleys parallel to that of the inlet make the country more broken, but lower than that described about the head of Douglas Harbour. The hills are from 1,000 feet to 1,500 feet high, and being formed from diabase and schists are more abrupt in outline than those of the granite region to the westward. In the afternoon we examined the lower stretches of the river with the small boat, and later dredged from the yacht, securing a number of crabs and shrimps, which, with other dredgings taken later were preserved in alcohol, and given to Commander Wakeham. Dredgings. Two of the men went hunting, and although they saw many tracks of caribou, they did not come across any of the animals.

The next morning we beat down the inlet against a light head wind and reached the anchorage behind the peninsula at 1.30 p.m. The last five miles was made through large cakes of heavy ice, which the wind was rapidly drifting into the bay. This was exciting and somewhat dangerous work, as our boat with its inch planking would not

stand many hard knocks or pinches, and several times we had to force passages between large pans. From the summit of the peninsula the coast was found to be tightly packed with ice, while a constant heavy stream of it was pressing through the narrows into the bay. As the cove in which the yacht was anchored still remained free from ice we determined to remain there. Later in the evening a family of Eskimos was found encamped on a point outside the bay.

Delayed by
ice.

On July 26th, the wind continued from the north-east, causing the stream of ice to rapidly fill the bay with each flood tide, while little if any went out with the ebb; a circumstance probably due to the large body of ice outside preventing the rapidly flowing tide from carrying out the ice brought in on the preceding floods. In the morning we sounded the bottom of the open cove, where we were hemmed in, with the results previously stated; and then dredged, obtaining several species of shells, crabs, sea-urchin, shrimps, sponge, rock-cod and a sculpin. As the ice was encroaching on the yacht we beached her near high-water mark on a bed of gravel out of reach of the heavy cakes of ice which took the ground in much deeper water outside. In the afternoon we climbed the hills on the east side of the bay and obtained the barometric elevations of the terraces on the peninsula. We gave the Eskimo a rifle and sent him for caribou which he says are plentiful not far away. The following day the conditions remained the same, the ice pouring into the bay with the north-east wind. On the 28th the bay was full of ice, and fearing that a change of wind might block us in the cove for days we took the yacht in tow of the small boat and succeeded in moving her along shore about a mile, to the point at the narrows, where we were caught in the ice moving in contrary directions with the current and eddies and only with great good luck escaped serious damage. Being unable to pass the point we returned to our former anchorage, where we remained until the evening of the next day, when we again tried to tow out of the bay and succeeded in passing the point on the slack water at high-tide, and then took the yacht into a small cove on the outer side of the neck where we were icebound until August 1st. During our enforced delay, the time was employed examining the surrounding country and rocks and in painting and cleaning the yacht. On the last day we were visited by a large party of Eskimos in three umiaks and seven kyaks. They were on their way from Stupart Bay to some place on the coast to the westward where they go inland to hunt caribou for their winter's supply of clothing. I took several photographs of the boats and people and made to all the customary present of a small piece of tobacco.

Eskimo
visitors.

We started as soon as the yacht floated on August 1st and had considerable difficulty working out of the cove between the large pans of ice aground; when outside a light west wind carried us past Cape Prince of Wales to Stupart Bay where we anchored for the night. The course all the way was through loose ice, sufficiently open to allow the yacht to pass with little danger.

The distance from Wakeham Bay to Cape Prince of Wales is twenty-four miles and the course is nearly east. A large island, which we called Doctor Island, lies about three miles off the coast, with its western end about fifteen miles from Wakeham Bay. Doctor Island is about five miles long and appears to be triangular in shape; it is much lower than the large islands to the westward, and from outside might be taken for a portion of the mainland. The coast is more indented than to the westward, but all the bays are wide and afford no shelter from northerly winds. The hills, for ten miles beyond Wakeham Bay, rise about 800 feet directly from the sea; they then become lower and less abrupt, and are broken by wide valleys, in which the drift is terraced to about 300 feet above the present sea-level. As Cape Prince of Wales is approached the hills gradually die out and about the cape do not exceed 300 feet in elevation. With the decrease in the height of the land there is a corresponding shallowing of the water, and to the eastward of Doctor Island there are numerous shoals, some of which are bare at low water and others marked by heavy ice grounded upon them.

Wakeham
Bay to Cape
Prince of
Wales.

Shallow water.

From Cape Prince of Wales, the course was south for five miles, to the entrance of Stupart Bay, where one of the government observation stations was situated in 1885-86. We found the dwelling-house still standing and in good repair, the other buildings having been broken up by the Eskimos. The house was closed with large blocks of cement from the pillars for the magnetic instruments. The inside of the house is used by the natives as a store-house for oil and the floor was covered with sealskins full of oil, the stench of which was overpowering. One room had been left locked by Mr. Payne, the observer, and the natives had never entered it, as we found, among other things, on forcing the door, a small mirror, two tin pails and some boots, all of which were of great value to these people. This is a proof that the Eskimos of the south side of Hudson Strait have not the thieving proclivities reported of the natives in other parts of the Arctic, and our own experience was wholly corroborative, for although no watch was kept of them while aboard the yacht none of the small articles lying about were ever missed.

Old observa-
tion station at
Stupart Bay.

Joy Bay.

We left Stupart Bay early next morning with a light south wind, that freshened to a strong breeze, and sailed across Joy Bay to the south of Stupart Bay and up its south shore into very shallow water, with eight feet about a mile from the shore at high-tide. The head of the bay is blocked with sand brought down by the small river emptying into it. We were unable to enter the river on account of the sandy flats at its mouth, but it appeared larger than any stream yet passed, and the deep valley in which it flowed was flanked by sand terraces up to 200 feet.

This is probably the river in which the Eskimos are reported to have caught salmon and trout for the observation station. From the bottom of Joy Bay we beat out to near the end of the point separating it from Whitley Bay, and came to anchor in a good boat-harbour behind an island, being unable to proceed further on account of thick fog, rain and loose ice.

Joy Bay is nine miles wide and about the same in depth. Its shores are generally low, and greatly broken by rocky points, forming shallow irregular coves; a number of rocky islands are dotted over its surface. The water is nowhere deep and the bottom is irregular, so that it would be dangerous to enter with a vessel. The country in rear is broken, and the hills vary in altitude from 300 feet to 700 feet, but they rise more gradually than those along the coast to the westward, and appear to run in ridges parallel to the strike of the rocks, or north-west and south-east, with abrupt cliffs towards the south-west.

Whitley Bay.

The rain and fog continued until 3 p.m. the next day, when a light southerly breeze enabled us to get into Whitley Bay, where we grounded for two hours, and finally made a harbour at dark in the upper end of the bay some eight miles from the point, and just outside a narrows between high rocky cliffs where the tide rushed through at a rate of seven or eight knots an hour. Whitley Bay is even more shallow than the last, and like it completely dry at low-tide, when the bottom shows as mud-flats covered with many great boulders. Eider ducks in thousands feed on these shoals.

The following morning we landed Young on the west side of the narrows to sketch the adjacent coast from the summit of the hill, which he found to be 700 feet high. We then sailed through the narrows on the rising tide which caused a heavy rapid with a fall of three feet in fifty. Beyond the narrows, the bay widens to about a mile across and continues with this width for two miles, to its head, where a small river flows in through a deep narrow valley. On our way out we had considerable difficulty in stemming the rapid with a strong fair wind, and only



A. P. Low.—Photo. 1897.

GROUP OF ESKIMO AT WAKEHAM BAY.

succeeded in doing so by crossing from side to side and so taking advantage of small eddies. Picking up Young at the point, we sailed into the next small bay, which is navigable only at high-tide ; and remained there examining the rocks until after the noon observation for latitude.

We then ran eastward along the coast behind a large island and past several small bays open to the north and north-east, and anchored in a deep narrow inlet about three miles long, with a small river flowing in at its head, thirty miles from Whitley Bay. This is an excellent Last ice seen. boat-harbour, but very deep, there being seven fathoms of water within a hundred feet of the shore. We saw only a few strings of loose ice about ten miles off shore.

After passing the large island, five miles long, at the mouth of Whitley Bay, the coast again becomes bold, with deep water close in shore and with only a few small islands under the land. The hills rise abruptly from 400 feet to 1,000 feet above the sea, and there are only small areas of terraced drift at the heads of the bays and coves and in the valleys between the hills ; elsewhere only bare rock is seen.

On August 5th, we made only eleven miles on account of calms and very light winds. The coast passed was more rugged, with the hills rising directly from the water to heights varying from 700 to 1,000 feet. No good harbours were seen, but the coast is indented with small coves, all open to the sea, and without islands or points with shelter behind them. There are drift terraces in all the bays, and we measured a series of eight on the flank of a conspicuous headland called Dyke Head. No ice was seen during the day, but there was an ice-blink to the north-east and a patch of fog to the eastward. The next day we had no wind until evening, when we ran until dark in search of a harbour, and found only an indifferent one behind a point near the head of a bay, open to the north-east, twelve miles east of our last anchorage. The coast passed was broken by three bays, the first being broad and the last two about five miles long and from one to two miles wide, with deep water to their heads and no safe anchorage from northerly wind. The coast continues bold, with sharp headlands about 1,000 feet high jutting out between the bays. Coast east of Whitley Bay.

We remained at anchor for the next two days, riding out a heavy north-east gale in a partly exposed position, where the yacht was subjected to the force of the heavy swell heaving into the bay from outside. Gale.

On August 9th we left this anchorage, and taking advantage of a strong north-west wind, soon passed eight miles of the same high broken coast, to the mouth of Diana Bay, which is sixteen miles wide Diana Bay.

and nearly twenty-five miles long. The western shore is high and rocky, but about the head of the bay and along the east side, the country is much lower, the highest hills not having an elevation of more than 200 feet; in the south-east corner, the general level is below 100 feet. The mouth of the bay is blocked by a high island about eight miles wide and extending eleven miles up the bay; good shelter for ships could be found among several other large islands that lie between the big island and the west shore. The head and eastern part of the bay are shallow with a lumpy bottom of rock and boulders.

Errors of the
Chart.

This portion of the coast is not accurately mapped on the chart, there being two large islands marked at the entrance to Ungava Bay and no bay like the one here described. As the coast on the chart was laid down from observations made on ships sailing through the strait, it is very likely that the large island in the bay is the inside island shown on the chart, and that the point forming the east side of the bay is represented by the outer island, the land at the head of the bay being below the horizon of a ship passing through the strait. We anchored for the night in a small cove on the east side near the entrance to the bay.

Cape Hopes
Advance

The next morning we sailed four miles, with a light wind from the north-east, to Cape Hopes Advance or Prince Henry Foreland, rounding which we proceeded south-east through a labyrinth of small rocky islands with shallow water between them, until we were stopped by thick fog at 3.30 p. m., when we had to feel our way to a harbour, being guided by the lead and by the noise of the breakers. Cape Hopes Advance is about 300 feet high and rises boldly from the water, but beyond it the coast is much lower and the irregular hills rarely exceed 200 feet in altitude. The islands were called the Eider Islands on account of the great numbers of these ducks found nesting upon them.

Thick fog covered the sea all next day, with light winds from south-east to north-west and consequently we were unable to sail. The fog appears to hang nearly constantly about Cape Hopes Advance, a circumstance caused perhaps by warmer currents of water and air from Ungava Bay meeting the colder currents of the strait. There was little fog inland, so we landed and took a series of observations for latitude and azimuth, and later, dredged between the islands, adding to our collection three new small fishes, a sponge, an anemone, a shrimp, some corals, and a few shells. Great quantities of kelp on the bottom seriously interfered with the dredging by blocking up the mouth of the dredge.

On August 12th, we started early and sailed south-southeast Shallow water. eleven miles, between low rocky islands that form a fringe about four miles wide along the coast. The water between the islands is very shallow, so that at low-tide many of them are joined together and to the mainland. Shallow water with shoals appears to extend outside the islands for several miles, rendering an approach with large vessels dangerous. The course was then changed to south-west, and we continued in that direction for twenty-eight miles, and were then forced to ground the yacht at high tide in a small rocky cove at the head of a wide shallow bay, in order to escape the dirty weather brewing with a north-east wind and a very low barometer. The islands gradually die out along this course after about ten miles, but the shallow water continues and the bottom being uneven is very dangerous on account of the great blocks and boulders scattered over it. The coast is low and broken only by detached, irregular hills never over 200 feet high. The country is covered with drift to a considerable extent and the flats are dotted with many small ponds, the breeding place of ducks and wading birds. There are no large streams, the ponds being drained by a network of brooks.

During the night, the wind increased to a gale which continued until Stormy weather. the following evening, when it shifted to north-west and the weather cleared. The yacht remained on the beach and we passed the day making excursions over the peaty plains, passing over a hill 200 feet high, faced on both sides with boulders forming a ridge running nearly west inland to another hill about three miles away. The appearance of the bay at low-tide was startling. The bottom was entirely exposed for about three miles outside high-water mark and was formed of low rocky ridges with mud flats between them, while everywhere boulders of all sizes were strewn about.

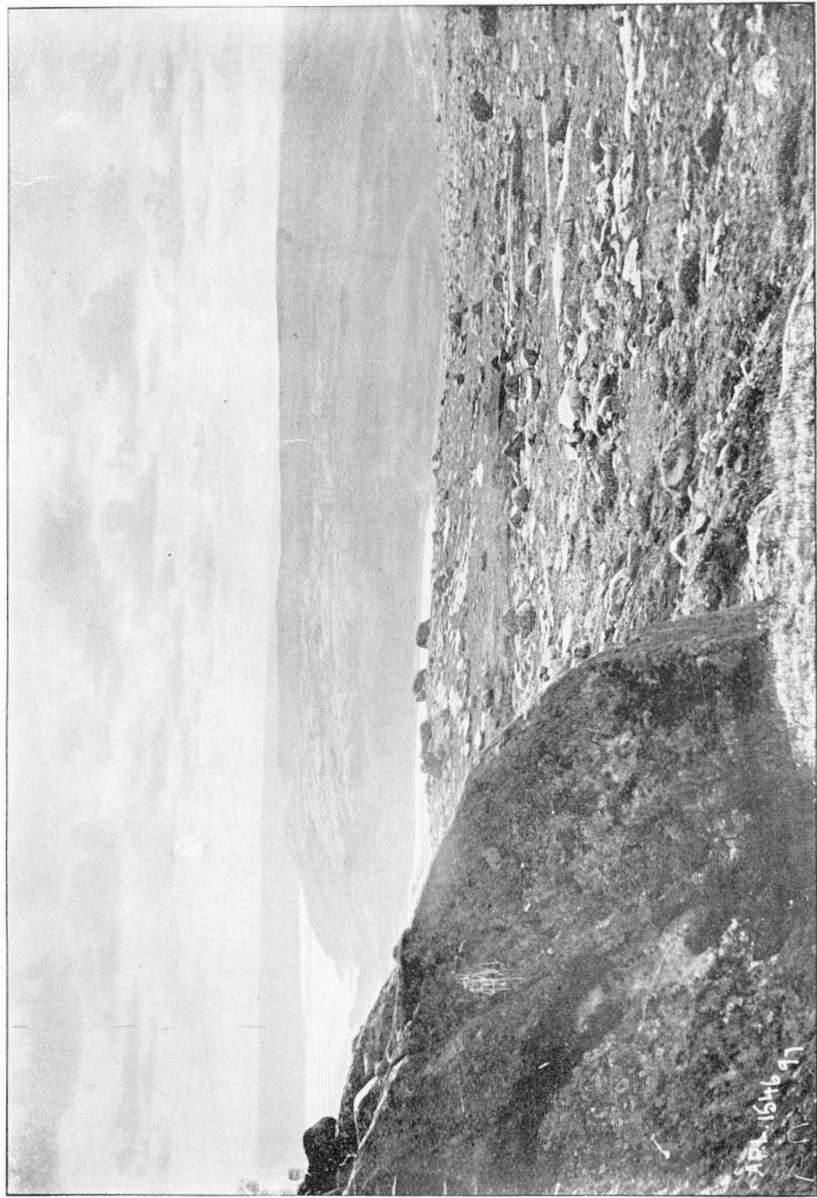
The next morning, at high-tide, we towed the yacht out of the bay, Great rise and fall of tide. but made no headway until afternoon, when we sailed southward about five miles with a very light south-east wind, and then searched for upwards of an hour for a sufficient depth of water to anchor in. We finally found a hole between a number of small drift-covered islands with forty feet of water at high-tide. At half-tide the current between the islands was so strong that the yacht surged to and fro with the helm lashed hard over and we were in danger of breaking adrift, or dashing against the hummocks of boulders which formed the sides of the hole. Fortunately, as the tide became low, the shallows about became dry and the current slackened, so that when the yacht grounded for upwards of an hour it was in quiet water. This is an example of

the great rise and fall of the tide in Ungava Bay, and of the danger in navigating its shallow waters, where the tide falls an inch a minute, and where, in consequence, if a boat grounds in falling tide it is impossible to release her until the water rises again. We named the islands in the neighbourhood the Plover Islands, on account of the great flocks of these birds met with here, together with thousands of gulls, sea-pigeons and eider ducks. The coast in the vicinity is low and flat like that previously described, and the shallow water extends several miles out from shore. We saw the loom of a large island some twenty miles to the eastward which we subsequently learned from the Eskimo was the western end of Akpatok Island. This changes the west end of the island thirty miles to the north of its position on the chart, making it conform with the position of the northern and eastern parts as laid down by the *Diana*.

Eskimos at
Payne River.

On August 15th we continued southward for twenty miles, passing among low islands formed of rock and drift, separated from one another and from the low shores by shallow water, and arrived at a rocky headland called Tuvalik, on the north side of Payne Bay. A band of Eskimos in four tents, was found at Tuvalik, and from these people we learned that a large river flowed into the bay. We sailed five miles up the bay, passing with shallow water over muddy flats, and anchored in a deeper channel, off the point at the entrance to a bay stretching to the northward, where it was thought the river might flow in. The coast passed during the day was very similar to that already described, being generally low and flat, broken only by occasional ridges of rocky hills never more than 300 feet high. These have an east-and-west trend, and thus come out to the shore in rocky points. The hills have the aspect of the Cambrian hills of the Koksoak River, and are formed of stratified rocks, the direction of the ridges conforming with the strike of the rocks, which dip northward at low angles and correspond to the hill-slopes in that direction, while towards the south the hills generally have abrupt cliffs.

The next morning we sailed to the head of the northern bay, but there found only a small stream discharging a lake some ten miles long, that lay in a wide valley to the northward. Some time was spent examining the rocks on the mainland and islands, which were found to contain large quantities of iron-ore. In the afternoon we worked out of the bay, (nearly dry at low tide), and anchored for three hours between the islands at its mouth, awaiting the flood-tide to enter the river. In the evening the river was ascended about six miles, on a very strong current, and the yacht was brought to anchor under the



A. P. Low. — Photo, 1897.

VIEW OF PAYNE RIVER, THIRTY MILES ABOVE ITS MOUTH.

north shore in thirteen fathoms of water. After dark we were joined by a number of Eskimos in an umiak and seven kyaks, who pitched three tents on the shore opposite the yacht.

The following morning we visited the encampment and arranged with two men to pilot us up the river. We started on the rising tide under treble reefs and raced up stream ahead of a gale, making over twenty-five miles in less than three hours. There were tremendous tide-rips at an island about fifteen miles up, which we successfully passed through and arrived at a second rapid, where the river is obstructed by a bar of huge boulders stretching diagonally across the stream near the head of tide-water. Beyond this obstruction the river was unnavigable for the yacht. In the afternoon I sent the Eskimos to kill a barren-ground caribou, these animals being plentiful about here, and with Young ascended the hills on the north side of the river, and took several photographs from the summit.

The country on both sides of the river is rough and rocky, with hills rising about 600 feet above the stream, and divided into ridges by deep valleys containing small tributaries. The valleys and sides of the hills are generally mantled with clay up to an elevation of 300 feet, while above that there is little fine drift, but plenty of scattered blocks and boulders. The hills are composed of granites, and consequently have the usual rounded aspect due to glaciated masses of this rock in the Laurentian country. The river stretches far to the westward, and about ten miles above the limit of tide the stream divides into two nearly equal branches, each with a deeply cut valley. The climate seems to be less rigorous than along the coast, as the willows grow to bushes several feet high, instead of only rising an inch or two from the ground as on the sea-shore.

The following morning an attempt was made to catch salmon and trout with a fly at the foot of the rapid, but without success, although a number of large trout were seen swimming about in the eddies. The Eskimos returned at noon with a part of a very large buck, which had been killed the previous evening; and on their arrival we started down stream. When the island was reached where the heavy tide-rips had been noticed on the previous day, we found that a ledge of rock extended from the island to both shores, causing a rapid with about six feet fall in two hundred yards. It was rather exciting to sail down with the yacht with only sufficient wind for steerage, but we got through safely and continued down stream eight miles, until met by the rising tide, when the anchor was dropped until the next ebb.

We got under way at three o'clock next morning and drifted down to the Eskimo encampment, where we paid off our pilots and

landed to photograph the natives. We bought a number of Arctic trout which had been taken in a net, and were informed that the Atlantic salmon were also abundant in the river. The natives were on their way to the caribou-hunting grounds, some fifty miles above where we turned back on the river. They would remain there for a few weeks spearing the barren-ground caribou as they crossed the river in great bands during the autumn migration southwards to the edge of the wooded region.

Barren-ground
caribou.

In the afternoon we continued down the river and along the south shore of the bay, coming to anchor among some islands nine miles beyond the south point of the bay.

Payne Bay.

Across its entrance, from Tuvalik to the south point, Payne Bay is fourteen miles wide. It gradually narrows to about three miles at the mouth of the river, which is eleven miles to the westward of Tuvalik. The bay is generally shallow and dotted with islands and bouldery shoals. There appear to be two deep channels leading from the mouth of the river towards the sea, one on either side of a group of five islands about three miles off the mouth. The deep water extends beyond the islands, but outside, in line with the capes, there appeared to be a number of low bars and shoals which practically block the entrance to the river for large vessels.

The river at its mouth is nearly three miles wide, but decreases rapidly to a point projecting from the south shore, three miles up stream, where it is about two-thirds of a mile across. Above the point it again widens, and varies from three-quarters of a mile to a mile and a half, for fifteen miles, to where it takes a sharp bend to the northward, two miles below the first rapid. The bend is a mile long, when the river again flows from the westward for six miles from the head-of-tide rapid. On the lower course the bays are shallow and are generally dry at low tide, presenting mud-flats covered with boulders, these being particularly thick along the outer margin of the flats where they have been shoved up by the ice. A number of shoal points and bars stretch out from both shores and there are also shoals dividing the deep channel of the lower part of the river. These bars and shoals are covered at high-tide and are then very dangerous owing to the large boulders scattered over them. As has been already mentioned, there is a reef of rock extending from shore to shore at the island above the bend, the heavy rapid caused by it is not more than ten feet deep and forms a practical bar to further navigation.

Dangerous
entrance to
Payne River.

Above the island, the channel appears to be uniformly of good depth for the next six miles, to the second rapid, where a line of boulders

stretches diagonally across the river and at low-tide causes a fall of about six feet over and between the boulders. The Eskimos report shallow water above this rapid, navigable only with small boats and very rapid everywhere, but without any direct fall. The river forks about ten miles above the rapid, and some distance further up the main branch again divides. The middle branch flows out of Payne Lake about a hundred miles to the westward of the mouth of the river, and it is near the outlet of the lake that the Eskimos go for caribou. The volume of the river is estimated to equal that of the Gatineau at Ottawa. The banks above high-water mark are generally rocky, except in the bays, where the drift terraces are faced with dry walls of boulders. The hills on both sides of the valley are continuous except where broken by the valleys of small tributaries; they gradually increase in height from the coast inland, being from 200 feet to 300 feet near the bay and about 600 feet at the upper rapid. There are considerable deposits of clay overlain by sand in the valleys, and these are terraced up to 300 feet above sea-level.

Payne River is the only important stream flowing into Hudson Strait between its mouth and King George Sound, none of the other rivers being sufficiently large to drain an area extending fifty miles inland. From this it would appear that the area along the coast must be higher than the interior portion of northern Labrador, and that the streams flowing into Hudson Strait and the northern part of Ungava Bay only drain a relatively narrow outer slope of coastal hills, the main drainage flowing first southward and then east or west into Ungava and Hudson bays. This is borne out by the description of the interior given by the Eskimos, who say that the country far inland from Payne River and southward is lower and flatter than the highlands of the coast, and that the extensive plains are dotted with lakes and covered with a much better growth of vegetation, affording excellent feeding-grounds for immense herds of caribou.

Drainage of
the northern
interior.

On August 20th, we started at 3 a.m. with a light south-west wind and sailed southward along a low flat coast, being gradually forced off shore by the shallowness of the water, which never exceeded five fathoms and at times was less than three fathoms. For twenty miles we passed between a number of low rocky islands, lying from five to ten miles off the mainland, and arrived opposite a deep bay, about ten miles wide, with a long low point dividing it into two channels each about three miles wide. Highlands were seen about twenty-five miles to the westward, probably near the coast at the head of the bay. Eight miles south of this bay we landed for an observation on a rocky shore, having

Low shores
and shallow
water.

isolated hills 200 feet high, but generally low and flat. From there the course was south-southeast for seventeen miles to Cone Island, only 140 feet high, but very conspicuous among the surrounding low islands. We anchored in deep water behind some small islands six miles to the south-east of Cone Island, arriving there at dark.

During the afternoon we followed the low shore on which we had landed for the observation, and were about eight miles off it at Cone Island, from the top of which a large bay with high shores was seen running north-west for about fifteen miles. While looking for a harbour we entered this bay and found it very shallow; it has a couple of smaller bays running northward from its upper end. The Eskimos at Fort Chimo say that this bay connects with the bays passed in the morning, the whole forming Hopes Advance Bay, which is consequently about twenty-fives mile wide at its mouth and about twenty miles deep; this being much less than the length given on the chart. The mouth of the bay is blocked by large islands with shallow channels between them, through which the tides rush in and out with great violence, rendering the bay quite unnavigable for large ships. A river nearly as large as Payne River is reported to flow into the head of Hopes Advance Bay.

Hopes Advan-
ce Bay.

Gale.

We passed an uncomfortable night, owing to the strong tide between the islands keeping the yacht broadside to the heavy sea. The wind was fresh in the morning and was accompanied with fog, while the barometer fell steadily and we decided to look for a more sheltered harbour. This was found between the islands and the mainland, but with the tide rushing through the channel like a mill-race. The wind increased to a gale in the afternoon and changed to the northward, forcing us to put out the second anchor. It blew very hard during the next night with heavy squalls of rain, changing to snow during the following afternoon, the hills becoming white while there was about six inches of snow on the deck. In the evening the wind shifted to north-west, and the weather partly cleared. On the morning of August 23rd, we worked for two hours getting up the anchors which had become fouled under boulders by the swinging of the yacht. We then sailed eight miles southward, through a labyrinth of islands which were named Gyrfalcon Islands from the number of those birds seen.

Gyrfalcon
Islands.

The islands are formed by broken ridges of stratified rocks; the ridges lie south-east and north-west with which the length of the islands conform. They vary in height from 50 feet to 200 feet, and have cliffs facing the south-west, with more gentle slopes in the opposite direction conforming to the dip of the rocks. The water in

the channels between the ridges is deep, but in the cross channels it is liable to sudden changes and is often shallow. The mainland has the same character as the islands and is so broken by bays that it is very difficult to distinguish coast from islands.

From the southern limit of the islands we crossed a bay. This is called Leaf River Bay, and is about eight miles wide at its mouth, but narrows to three miles across some ten miles up. This we learned was the entrance to Leaf Lake, a body of salt water divided from the bay by a deep narrow strait walled in by high rocky cliffs. A small vessel called the *Fox* is sent annually by the Hudson's Bay Company from Fort Chimo to kill white porpoises in the lake. The captain of the *Fox* estimates the lake to be nearly fifty miles long and about ten miles wide. Its longer axis runs about north-northwest, and the outlet is situated about half-way up the lake. The Leaf River flows in on the west side almost opposite the outlet, and is a considerable stream having a volume about equal to Payne River, according to the estimate of the Eskimos. Salmon are not known to enter this river. Barren-ground caribou are always plentiful on the plains inland along the course of the stream, where willows and arctic birches grow abundantly as large bushes and are the only trees of the region, the northern limit of the spruce and larch being still further south.

Leaf River Bay.

Porpoise fishery

We sailed eastward along the south shore of the bay for twelve miles to Stony Point, where we were obliged to anchor behind a rocky islet in a heavy swell, owing to the wind dying out. The south side of the bay being formed of granitic rock, is totally different in character from the north shore; there is an absence of islands and the water is shallower gradually deepening to about five fathoms a mile off shore. The shores are generally rocky at the small points, and elsewhere boulder-strewn, while the country behind gradually rises into long rounded hills never more than 200 feet high. A thick mantle of drift covers the slopes and fills the valleys, but owing to the gentle slopes the terraces are not well marked and were only indistinctly seen from the yacht. Stony Point is a rocky hill about 200 feet high, with a number of rocky knolls outside, which become islands at high-tide, with huge masses of rock scattered everywhere. The water is very shallow for two miles outside the point, and for five miles beyond the sea breaks upon a number of boulder shoals.

Coast south of Leaf River Bay.

On August 24th, we started at 4 a.m. and sailed south-southeast for thirty-five miles along a low and almost unbroken shore to the mouth of the Koksoak or Ungava River. This part of the coast is low, with only three or four islands of shingle close to the shore and separated

Coast north of Koksoak River.

Arrival at
Fort Chimo.

from the mainland by shallow channels dry at low-tide. The water deepens slowly to about five fathoms a mile off shore, and there appears to be very few shoals outside that limit except towards the mouth of the river, where a number of rocky islands and shoals extend outwards from the north point for more than a mile. Other shallow places in the mouth of the river render an entrance hazardous without the aid of a pilot. We stopped at the mouth of the river until 1 p.m., awaiting the rising tide which carried us to Fort Chimo, thirty miles up, where we arrived at 5.30 p.m. and found the Hudson's Bay Company's steamship *Erik* at anchor opposite the fort. She had arrived on August 20th from Churchill, this being the earliest arrival on record.

We remained at Fort Chimo until August 27th, making necessary repairs to the yacht and equipment, and then left for George River which empties into the south-east part of Ungava Bay about 100 miles to the eastward of the mouth of the Koksoak. Before leaving, arrangements were made with Captain Gray for the transport on the *Erik* of the yacht and equipment from Fort Chimo to Nachvak on the eastern Labrador coast, where the yacht would be available for another season's work in the Strait or Hudson Bay. This would not have been the case if the yacht had been laid up at Fort Chimo, owing to the impossibility of reaching that place until the end of August, too late for any effective work.

Islands off
Whale River.

We dropped down the river and anchored in a small cove on the south side near the mouth, where we waited for the next morning tide, which carried us eastward fifteen miles, past a number of low shoals of rock and boulders stretching nearly ten miles off the south point, until we finally brought up against a line of reefs, bare at low tide, that extends northward from the islands at the mouth of Whale River to and beyond a large island called Saiglorsok, that lies sixteen miles outside. This island is surrounded by a cluster of smaller ones, all high and rocky and forming good marks in steering for the Koksoak River. Saiglorsok is about five miles long and should be kept well to the southward as the reefs continue some miles beyond it.

Whale River.

We turned south along the west side of the shoals and with the rising tide soon reached the channel between Big Island (Whale River) and the mainland. The channel narrows from a width of three miles at its entrance to less than a mile at the upper end of the island, seven miles farther up, where a sharp bend of a mile to the eastward leads to the true mouth of Whale River. The deep part of the channel is quite narrow and is bounded by extensive mud-flats on both sides

that are bare at low-tide. The current in the channel is very swift, and at several places breaks into rapids and tide-rips. At the bend we picked up an Eskimo, who was engaged setting salmon nets for the Hudson's Bay Company, and with him as guide reached the Hudson's Bay post, situated on the east bank eight miles above the mouth of the river, arriving there after dark. The channel up to the post varies from a mile to a mile and a half in width and is full to the banks at high-tide, but at low-tide, bare mud-flats occupy over two-thirds of the width, with the deep channel considerably below their level. The post is situated at the head of navigation, there being shallow rapids only a short distance above it, where the influence of the tide ceases. The river has a volume about equal to that of Payne River and drains a large area of country to the southward, between the drainage-areas of the Koksoak and George rivers. It rises in large lakes about 200 miles inland, on one of which the Hudson's Bay Company formerly had an outpost, mentioned as Erlandson's Lake post in McLean's narrative.* The post at Whale River is merely a fishing establishment and small trading station for the natives in the vicinity, consisting of three small buildings. The salmon fishery in the lower part of the river was formerly a paying industry, but has been gradually decreasing and this year (1897) was almost a total failure, as were the fisheries in the Koksoak and George rivers.

Hudson's Bay
Company's
post.

The banks of the river are generally low, with terraced drift behind and highlands in rear of the post, where the hills rise about 500 feet and are partly wooded with small black spruce and larch, the woods extending nearly to the mouth of the river.

The coast between the mouths of the Koksoak and Whale rivers is generally low, with a range of hills extending from the mouth of the former stream south-east about the head of False River Bay to the mouth of Whale River. There is a shallow bay on the south side of the mouth of the Koksoak, between these hills and the end of a low bouldery point five miles to the north-east of them. Rounding this point, the coast trends to the south of east for ten miles, to the mouth of False River Bay, so called on account of having been often mistaken for the mouth of the Koksoak. This bay is several miles long and about three miles wide at its mouth, but is so shallow that it cannot be navigated even by small craft. A low point separates False River Bay from the west channel to Whale River which has been already described.

Coast between
Koksoak and
Whale rivers

* Notes of a Twenty-five years service in the Hudson's Bay Territory, London, 1849,

Coast east of
Whale River.

Next morning we left the post on the top of high-water and sailed out by the channel to the east of Big Island which can only be used by small craft at high-tide. Then, with a fair wind, we continued north-east along the coast for forty-five miles and anchored at dark in a small rocky cove quite open to the sea. The coast passed is generally low with an occasional rocky point. The water is very shallow everywhere for two or three miles off, and we were obliged to keep that distance out to avoid striking. There are a few rocky islands scattered along the shore, but they are surrounded by water too shallow to afford harbours behind them. Two long bays were passed, which extend inland between the high hills that rise behind the low margin along shore. The natives say that three small rivers empty into the heads of these bays, one stream flowing into the western bay and two into the eastern. These bays are very shallow and at low-tide are nearly dry and quite unapproachable. The margin of low land varies from one to five miles in width; beyond it the country consists of rocky hills rising to altitudes varying from 500 to 1000 feet; the hills are broken by the deep valleys of the rivers mentioned and those of minor streams.

We got under way at four o'clock next morning and arrived at 7 a.m., at Beacon Island on the west side of the mouth of George River, seventeen miles from the starting point. The wind freshened to half a gale, blowing directly out of the river, and in consequence we only made six miles more by 11 o'clock when we were forced to anchor behind a large rocky island on the east side to await the next rising tide. This was the strongest wind in which we had sailed during the season and the tide against the wind raised a heavy short sea. The yacht behaved splendidly, however, working to windward with treble-reefed mainsail and reefed fore-staysail without straining and dry except for the flying spray. We remained behind the island until 4 p.m., and then made about six miles before dark, when we anchored under a point about two miles below the George River Narrows.

The coast from last night's anchorage to Beacon Island is higher and more rocky than to the westward; it is greatly broken by irregular rocky points, and is fringed with islands. The water unfortunately remains shallow.

We started early on August 31st, and succeeded in getting within a mile of the cove where the Hudson's Bay Company's post is situated before the change of tide. There we anchored until evening, when we worked the yacht into the cove.

The cove is on the east side of the river twenty-three miles from Beacon Island. The post consists of the usual three or four small houses, built on the side of a hill that rises about 700 feet above it. The opposite side of the cove is bounded by a similar hill, and the situation is very desolate, especially at low-tide when the bottom of slimy mud and boulders is bare out to the river a mile away. A few stunted trees grow along the banks of a large brook which flows into the upper part of the cove. The post is kept up chiefly for the salmon fishery and for the trade with about twenty families of Eskimos living along the eastern shore of Ungava Bay.

Hudson's Bay
Company's
post at George
River.

The George River is a large stream second only to the Koksoak ; it drains a wide area of country to the southward, extending from the western slopes of the Atlantic range to the Whale and Koksoak drainage-areas on the west. It rises in large lakes of central Labrador, in the vicinity of the fifty-fifth parallel of north latitude, close to the head-waters of the North-west and Hamilton rivers which flow eastward into Hamilton Inlet. Beacon Island is the largest of a group lying off the western point at the mouth of the river, and is situated about two miles from Gull Island, which is connected with the shore at low-tide. From Gull Island to the large islands on the east side, the distance is three miles, and this constitutes the width of the main channel, as the channels between those islands and the east shore are dry at low-tide. Eleven miles above Beacon Island, the river takes a sharp bend to the east and contracts to about a mile across, with a small rocky island in mid-channel, just below it, the north channel is obstructed by a ledge of rock projecting some distance from shore and causing heavy rapids and whirlpools. The eastern bend is two miles long, and above it the river again flows from the south for ten miles from Post Cove, above which its course is from the south-west. Above the narrows the width varies from one mile to two miles, with a long shallow cove on the east side four miles below Post Cove. There is a large rocky island opposite the post, with only a narrow channel separating it from the west shore.

Mouth of
river.

The *Erik* anchors between the island and the northern point of the cove, lying about half a mile from shore, or within one hundred yards of the muddy flats extending from the point. All the goods are landed with boats at the post more than a mile away, and as this can only be done when the tide is more than half in, the ship always tries to be at George River near the time of highest tides. There is a great difference in the appearance of the river at high and low tide. When the tide is high the water reaches to the foot of the bold rocky shores

Difficulty of
landing goods
at post.

Surrounding
country.

generally without a beach, while at low-tide a wide margin of boulder-strewn mud intervenes between the channel and the rocky banks. Below the narrows are a number of shoals bare at low-tide, especially along the east side. The hills about the mouth of the river range in altitude from 100 feet to 400 feet. As the river is ascended there is a gradual increase in the general elevation, so that above the narrows the hills are from 500 to 1,000 feet high, and the general level of the country is close on 500 feet. Drift lies in considerable thickness in the valleys between the ranges of hills, and along the river, terraces are seen up to 300 feet above the present water-level. Small spruce trees are first seen a short distance above the eastern bend, and the forest becomes quite thick and continuous in the river valley about ten miles above the post.

The influence of the tide extends to a rapid some ten miles beyond the post, and above it the river varies from a quarter of a mile to a mile in width and is very swift, flowing in a shallow channel with nearly continuous rapids but no actual falls. It is navigable with boats for about forty miles above the post.

Return to
Fort Chimo.

On the 1st of September we left the post and reached Beacon Island on the falling tide, where we remained until next morning, when we laid a course for Saiglorsoak Island, and anchored, in a calm, about nine miles off the south point at the mouth of the Koksoak River. Owing to calm weather we did not reach Fort Chimo until the afternoon of the 4th. The next few days were occupied in stripping the yacht and loading it aboard the *Erik* which left for George River on September 8th. From the 8th until the 17th we remained at Fort Chimo, anxiously awaiting the arrival of the *Diana*, which on the latter date steamed up the river in a heavy snow-storm. Fort Chimo was finally left on the 19th and after a quick passage we were safely landed at St. John's, Newfoundland, on the 25th. From St. John's, passage was taken in the *Ceylon* a tramp steamer partly loaded with iron ore, and after a very rough voyage we reached Halifax on the 30th, where the members of the party separated and I returned to Ottawa on the 2nd of October.

Return to
Ottawa.

GEOLOGY.

General Observations.

General
geological
observations.

The rocks along the south coast of Hudson Strait and the west and south shores of Ungava Bay, present many interesting and complex problems. The occurrence of numerous quartz veins in the bedded rocks near to their contact with intrusive masses of greenstone and

granite are important, as such conditions are favourable to the pre-
 sence of the more valuable minerals, and although no such minerals
 were found during the exploration, there is no reason why they should
 not be found with more detailed search, as many of the veins carry
 large quantities of pyrites. Bedded iron-ores were found, and
 although those examined were not of a very high grade, better bodies
 of ore might doubtless be found in the extensive areas of this iron-
 bearing series of rocks seen at a number of localities on the coast.

Mineralized.
quartz veins.

Bedded iron
ores.

The long line of coast explored in the limited time at the disposal
 of the expedition, together with the difficulties of navigation in the
 shallow waters along the greater part of the coast, where the difference
 between high and low tide varied from twenty-five to forty feet, only
 allowed of a hurried examination each day of a few points on the
 shore, at considerable intervals, so that a thorough examination of the
 rocks was impossible, and consequently only such relations as could be
 made out from these isolated observations are here given. These
 northern coasts are ideal places for geological investigation, owing to
 the absence of trees and often of all vegetation, which leaves the rocks
 almost continuously bare; while below the 300-foot level the shores, as
 they have risen from the post-glacial subsidence, have been smoothed
 and polished by the pounding of floating ice, which has removed nearly
 all the drift from the points, leaving the solid fresh rock always
 exposed.

Difficulties of
detailed inves-
tigations,

The rocks met with are all of great antiquity, and all are more or less
 altered by pressure, induced by intrusions of igneous masses which has
 folded the bedded series and have produced foliation in much of the
 otherwise massive granites, gabbros, diabases and other greenstones.
 The foliation of the granites shows that the pressure was exerted from
 a direction varying from west to south-west. Where massive beds of
 cherts and quartzite have resisted the folding action, they, with their
 associated beds of softer shales or slates, have been shoved into ridges
 by over-thrust faults, giving the hills cliff-faces inland, while their
 seaward slopes conform closely with the dip of the beds.

Ancient rocks.

Biotite-granite or granitite and biotite-gneiss, especially the latter,
 together occupy fully three-quarters of the coastal area. The granite
 and gneiss have commonly a medium texture, and vary in colour from
 light-pink to flesh-red, the light coloured varieties predominating.
 These rocks are usually very quartzose and often grade into impure
 quartzites, and in the gneissic rocks dark-red garnets are usually present.
 Masses of hornblende-biotite-granite are associated with the biotite-
 granite and in places appear to represent only more basic portions of

Predominance
of granite and
gneiss.

the same magma. The gneisses seem to be metamorphic products of several rocks of different age and origin. Some of them are very ancient and probably represent part of the original Archæan complex. Others may represent granites of a somewhat later date, injected into the first, but still long anterior to the time of deposition of those sedimentary beds of Labrador that have been provisionally classed as Cambrian. A considerable part of the gneisses has, however, been formed from the alteration and quartzose infiltration of the bedded series of the Cambrian near the contacts of these rocks with great intrusions of later granites; and, finally, some of the gneisses are foliated parts of these later granitic intrusions. All these gneisses of different origin are very similar in appearance and composition, and often could not be distinguished from one another in the hurried examination given them, except in a few places where the contacts were clearly seen. These places are mentioned later in the detailed account of the exposures examined. Owing to the difficulty or impossibility of differentiating these gneisses of several ages and origins, they have all been classed together and no attempt is made to separate the so-called Cambrian bedded rocks from an older basement complex, except to state that in a number of places the bedded rocks appeared to rest unconformably upon rounded bosses of gneiss, which may represent an older series partly composed of clastic rocks, or may be masses of granite intruded below the newer bedded series, as, owing to the highly metamorphic condition of the newer rocks and their frequent intrusion by later granites it is exceedingly difficult to tell when a contact other than an intrusive one was found.

Probable
different
origins of
gneiss.

Alteration of
bedded series
due to granite
intrusions.

The bedded series occurs at intervals along the coast from Fisher Bay to the mouth of George River; its degree of alteration depending largely on its proximity to masses of newer granite and gneisses, which near the contact have broken, squeezed and metamorphosed the beds into highly crystalline schist, and gneisses.

Resemblance
to rocks of the
interior.

There appears to have been an orogenic movement subsequent to the granitic intrusions, which has further altered the bedded series, throwing the beds into folds, or into repetitions of the series by a number of over-thrust faults. The rocks when least altered bear a close resemblance to portions of the unaltered series of bedded rocks classed as Cambrian and found in the interior of Labrador along the Hamilton and Koksoak rivers and also on the east coast of Hudson Bay.* They consist largely of black bituminous or graphitic shales, generally bearing considerable pyrite; gray micaceous slates, dark

* Annual Report, Geol. Surv. Can., vol. VIII. (N.S.), pp. 261-282 L.

hornblendic slate, impure dark ferruginous chert, and dark siliceous ferruginous dolomite, the two last often carrying large masses of magnetic iron-ore. The great thickness of light-coloured, siliceous, dolomite found elsewhere with the series, was not seen along the coast. The rocks bear a close resemblance to that part of the Cambrian series found along the lower reaches of the Kaniapiskau and Larch branches of the Koksoak; and the presence of great sills or laccolites of gabbro, together with a peculiar light-green diabase and other greenstones, is a further point of resemblance to the rocks of the Koksoak. Sills of gabbro.

The intrusion of the granite appears to have greatly affected these clastic rocks, changing them into gneisses and schists, so that, for a considerable distance from the contact they resemble lithologically, the Grenville series of the Laurentian. The granites appear not only to have produced the schistosity, but to have caused infiltrations of heated waters carrying silica and silicates in solution depositing large quantities of quartz and felspar between the laminae of the mica and hornblende-schists, changing these into typical gneisses, which, as well as the schists, usually carry large quantities of garnet often in very large crystals. When associated with gabbros, diabases and their decomposition-products, the bedded rocks are often ramified with quartz veins, generally holding considerable pyrite, these veins are most abundant near contacts with newer granites. Several samples from such veins have been assayed for gold with negative results, but as already explained these cannot be accepted as in any sense conclusive. Infiltrations of quartz.
Negative assays.

DETAILS OF ROCK EXPOSURES EXAMINED ALONG THE SOUTH COAST OF HUDSON STRAIT.

Douglas Harbour.

At the head of the South-west Arm, biotite-gneiss alone occurs in the hills forming the walls of the valley. The direction of the foliation varies from S. to S. 70° W. Similar biotite-gneisses were met with on both sides of the arm to within a mile of its mouth, where, on the north side, the rocks are coarse to fine, pink and red, very felspathic mica-gneiss. The fine-grained variety is usually pink in colour, the coarse-grained has in places an augen-gneiss structure and is red in colour. These gneisses are in contact with a mass of basic rock, about 200 feet thick, composed chiefly of very coarse-textured amphibolite, bearing considerable quantities of dark-red garnet and some light-green decomposed plagioclase. The dark mass has South-west arm.

Amphibolite.

the appearance of an ancient dyke injected into the gneiss before the foliation and tilting occurred, and was probably altered to its present condition by the same agencies that caused the foliation of the surrounding gneisses. The amphibolite is cut by veins of very quartzose pegmatite, resembling a graphic granite, composed of light-pink felspar, bluish quartz and scales of silvery biotite. In one of these veins near the contact of the gneiss and amphibolite, the lining of the vein next to the hornblende rock was made up of small crystals of dog-tooth spar and rusty-weathering rhombic dolomite, probably derived from the decomposition of the bisilicates of the amphibolite.

On the summit of the hill on the north side of the entrance to the South-west Arm, there are several large dyke-like masses of rock which vary in texture from very coarse massive amphibolite to fine-grained, well foliated hornblende-schist. These rocks seem to have been dykes cutting garnet-bearing biotite-gneiss; pressure on the thinner portions of the dykes having changed them into the foliated hornblende-schist. The massive rock is largely composed of coarsely crystalline black hornblende with many crystals of reddish-brown sphene and small spots of greenish-white plagioclase. A finer grained variety is almost wholly composed of black hornblende with little biotite, sphene and plagioclase. The foliated rock is chiefly composed of needle-like crystals of hornblende along with thin plates of greenish plagioclase and occasionally small red garnets. The adjacent biotite-gneiss is largely discoloured by iron rust from the decomposition of the dyke rock.

Garnet-bearing gneiss.

At the end of the point between the arms, pink and light-gray, fine-to medium-grained biotite-gneiss was seen, holding in many bands small red garnets, and including broken bands of blackish hornblende-mica-schist, evidently formed from ancient squeezed dykes greatly fractured; dip of gneiss S. 85° W. $<70^{\circ}$.

On the western island at the mouth of the harbour, the rock is chiefly medium-textured, hornblende-mica-gneiss, very quartzose and weathering rusty. It is associated with finer grained, garnet-bearing, pink mica-gneiss, which appears to have been cut by the other. Both are cut by a dark basic dyke, one hundred feet wide, running N. 25° W. and seen cutting similar gneisses on the west shore of the bay. The dyke is very fine-grained near its contact with the gneiss and has only a medium texture in the middle. It is largely composed of hornblende with some sphene, many small garnets and some decomposed plagioclase. A number of very large dykes were seen cutting the gneisses in the hills along the coast between Douglas Harbour and Fisher Bay, but no stop was made to examine them.

The islands inside Prince of Wales Island are formed of rusty-weathering, greenish hornblende-mica-gneiss, very quartzose and holding broken bands of hornblende-mica-schist, all being cut by many dykes of pegmatite. Prince of
Wales Island

Fisher Bay.

The rocks forming the high islands at the harbour near the head of the east arm of Fisher Bay, are medium- to coarse-textured, pink and yellowish mica-gneisses and mica-hornblende-gneiss usually very quartzose and holding shattered bands of dark hornblende-mica-schist. The pink hornblende-mica-gneiss is evidently an intrusion cutting the yellowish biotite-gneiss and dark bands of schist. All these rocks are cut by numerous dykes of red pegmatite. The general strike of the foliation is N. 30° E.

The point between the east and west arms shows a section, a quarter of a mile long, of dark schists and fine-grained biotite-gneisses. Mica-schist predominates and is usually dark in colour, the lighter coloured variety shading into a mica-gneiss with frequent partings of quartz. Hornblende-schists are interfoliated with the mica-gneiss and schist, and all the schists are very garnetiferous, with crystals varying from a quarter of an inch to one inch in diameter. Strike S. 80° E. A large vein of white pegmatite cuts across the bedding of the schists, and there are numerous veins of quartz, generally parallel to the foliation, the quartz being also garnet bearing. These rocks are probably altered clastics and associated dyke rocks, the clastics being represented by the mica-schists and gneisses and perhaps in part by the hornblende-schists, although most of the latter appear to have been dykes. The hornblende-mica-gneiss, previously described on the islands, appears to have been the cause of the metamorphism of the schists, and these appear to have been a patch of ancient sedimentary crust caught up by a granitic intrusion which occupies both shores of Fisher Bay. Bedded series

The rocks along the coast between Fisher Bay and Wakeham Bay appeared from a distance to be largely granite-gneisses cut by large dykes, but no close examination was made of them.

Wakeham Bay.

The rocks forming the shores of Wakeham Bay seem to be largely foliated granite, and it is impossible to state with the data to hand whether or not all the granite is newer than the series of metamorphic clastics found there. From the hurried examinations made about the Different age
of granites.

bay, it seems probable that there are two foliated granites of different age both alike to the eye. One of these cuts and alters the bedded rocks and their associated irruptives, while the other is cut by the irruptives associated with the clastic rocks.

Metamorphic
schists.

At the head of the bay, the rocks on the east side are well banded, dark-coloured mica-schists and hornblende-schists often full of garnets. The mica-schists are often rusty, owing to the decomposition of contained pyrite. Associated with the schists are beds of yellowish-white quartzite, from one to four feet thick, containing silvery mica in small scales along partings of the bedding. To the east of a small gully and about four hundred yards from the exposure of schists, the shore rises in abrupt cliffs of more or less squeezed and foliated decomposed diabase, much of which still shows the original diabase structure. These rocks extend for half a mile up the small river flowing into the head of the bay. No beds of mica-schist or other altered clastics were found associated with them. Hornblende-schist is most abundant and shades into a diorite-gneiss, and from that into a massive hornblende-rock with a diabase structure, there being little or none of the original augite remaining in the rock. Numerous small veins of quartz cut these rocks, and in a number of places small cavities and cracks were found filled with calcite probably from the decomposition of the bisilicates.

Granite.

The dark-coloured irruptives occupy the east shores of the upper part of Wakeham Bay for nearly ten miles, to the end of the narrow portion, except at one point about two miles below the head of the bay, where a mass of granite is protruded from the west shore and evidently cuts into the basic rocks. The west shore is all granite, from the schists at the head of the bay to the wide valley five miles below the narrows, beyond which the darker schistose rocks appear to be folded up with granite to the mouth of the bay. The irruptive granite is represented by coarse pink and gray biotite-gneiss, often of the character of an augen-gneiss and sometimes inclosing bands of mica-schist and mica-hornblende-schist, while hornblende is at times a constituent of the gneiss. At the small island near the mouth of the narrows, these gneisses were found associated with a finer grained mica-gneiss free from garnet and seemingly different from the garnet-bearing schists and gneisses.

On the peninsula on the east side of the mouth of Wakeham Bay, the rock is largely a medium-grained, gray mica-hornblende-gneiss with coarser red and dark schistose bands, in which mica and hornblende predominate. These rocks are generally very schistose. There is a

very prominent line of fault that crosses the peninsula diagonally and is continued in the cliff beyond the harbour to the eastward. The fault is marked by a trench, from ten to fifty feet wide and from five to twenty feet deep, filled with angular fragments of rock which near the fault has been greatly shattered with a development of chlorite and serpentine filling small cracks. Prominent fault.

Along the east side of the outer cove between the peninsula and the mainland, pink and red usually coarse-grained granitite-gneiss predominates. It is associated with gray, finer-grained, very quartzose mica-gneiss, usually holding small garnets, and with darker mica-schists. These appear to represent a bedded series and they are cut and twisted by the coarser red granitite-gneisses and also by many large dykes of red pegmatite. The pegmatite is chiefly orthoclase, with a good deal of quartz, and contains occasionally small crystals of biotite, magnetite, garnet and in one place a light-green crystal probably of beryl. Near the head of the cove the granitic rocks are cut by a large dyke of white pegmatite, which runs at a low angle up hill to the southward and directly across the strike of the foliation. The rocks along the shore are much contorted and faulted, the strike frequently changing abruptly. Contorted strata.

On the summit of the hill forming the point at the mouth of the cove, there is a huge dyke, from one hundred to four hundred feet wide, running nearly north-and-south. It cuts light-gray mica-gneiss which has a strike of S. 40° E. Both the gneiss and dyke rock are cut by red pegmatite which often holds fragments of the dyke. The dyke is formed of dark-coloured rock composed chiefly of hornblende, biotite and plagioclase, with many small garnets. The texture varies from medium in the interior to fine-grained and schistose near the edges of the dyke, where the direction of the foliation coincides closely with that of the walls. Great dyke,

Coast between Wakeham Bay and Stupart Bay.

From Wakeham Bay to the vicinity of Cape Prince of Wales, the rocks along the coast are very similar to those last described; the coarse granitites appear to predominate, but as the cape is approached the granitites give place to the bedded series and their associated basic irruptives. A landing was made on a small island about half way to Cape Prince of Wales, where the rocks were found to be chiefly coarse, red granitite-gneiss cutting and inclosing bands of gray, fine-grained, very quartzose, garnet-bearing mica-gneiss; both gneisses being in turn cut by large dykes of red pegmatite.

At Cape Prince of Wales, light-pink garnet-mica-gneiss is associated with bands of hornblende-schist which is also garnet-bearing in places. The schists are cut by small veins of white pegmatite which hardly penetrate the gneiss. The bedding is very regular, with the strike S. 10° W. Near the old station at Stupart Bay, gray and pink mica-gneiss is cut by red pegmatite. Some of the bands of gneiss hold a few small garnets.

Joy and Whitley Bays.

On the end of the long point in Joy Bay, dark-red, coarse-grained augen-gneiss, composed chiefly of biotite and red felspar in imperfect crystals or lumps, is interfoliated with thin bands of red pegmatite holding a little magnetite and brown sphene. Fine-grained pink mica-gneiss, holding a few garnets, occurs in thin bands with the above rocks. About five miles inside the south point of Joy Bay, a dyke from one hundred and fifty to two hundred feet wide runs N. 40° W. up the side of the hill and sharply cuts the gneisses. It ends abruptly at a line of fault on the summit, where the rocks are greatly twisted and the contorted gneisses inclose fragments of the dyke. The dyke is a decomposed diabase, now made up largely of green hornblende, biotite, chlorite and a little plagioclase, and for about three feet from the contact with the gneiss the dyke rock is schistose, the foliation forming a small angle with the walls. The gneiss is a more or less schistose, red and gray mica-gneiss holding considerable silvery biotite. On the summit it is much contorted and mixed with pegmatite and coarser light-gray, mica-gneiss, while at the foot of the hill the strike is regular and the fine-grained gneisses are interbanded with very quartzose layers and hornblende-mica-schists; strike N. 85° E.

Near the end of the point there is a prominent knob of rock that rises abruptly about one hundred feet above the surrounding hills. It is of a dark basic material consisting chiefly of dark-green hornblende, biotite and plagioclase, with a number of quartzose bands that contain a considerable quantity of magnetite in grains and patches forming a magnetite-gneiss very similar to that found on the Stillwater and Manicougan rivers in Labrador. The whole is cut by small veins of bluish opalescent quartz. A number of similar knobs were seen stretching to the westward along the strike of the gneisses, and the iron-bearing beds and their associated altered basic rocks probably continue for a considerable distance. On the point there is a large quantity of fine-grained diorite, together with quartz-mica-diorite and pink granitite-gneiss; the last-mentioned cuts and incloses masses of the

more basic rocks. The diorites often contain large masses of coarsely crystalline green hornblende associated with garnet and also small segregations of yellow-weathering dolomite and dog-tooth spar. The iron ores were not noticed in these masses. The foliation of the diorite-gneiss coincides with that of the granite-gneiss, and the granite-gneiss appears to penetrate the more basic masses of diorite.

On the end of a small point four miles up Whitley Bay, well banded schists are seen, with light and dark mica-schists predominating. Some of the bands are charged with pyrite and in consequence weather Pyrites. rusty. The mica-schists are associated with bands of hornblende-schist and sericite-schist. All the bands contain garnets, most plentifully in the dark hornblende-schist and mica-schist, where the crystals are often very large, varying from one to two inches in diameter. Numerous quartz veins penetrate the schists, but generally run parallel to the foliation. The quartz is usually smoky and holds much garnet and yellow-weathering dolomite together with plates of light-green sericite and some pyrite. Large garnets.

On the low island lying off the point that divides the head of Whitley Bay into two arms, similar garnet-bearing dark mica-schists and hornblende-schists occur, with a very regular dip of N. 45° W. <10° to 20°. In the northern arm of Whitley Bay, the dark, garnet-bearing schists appear to rest upon domes of medium-grained, pink granite-gneiss. In the south arm the rocks are all pink and gray granite-gneiss and the coast appears to be largely composed of similar gneisses for the next six miles to the west point of Bourgoyne Bay, where schists are again seen intensely crumpled and folded. In this exposure black mica-schist with large garnets is most abundant, then Contact between schists and granite. follows a black carbonaceous schist full of small plates of graphite and containing small rhombs of dark-brown ankerite and a good deal of silica, the rock passing with excess of silica into a very fine-grained carbonaceous chert holding ankerite. The other schists are, gray siliceous mica-schist passing into a dark-gray quartzite, rusty-weathering mica-schist containing pyrite in minute grains, and dark-green chlorite-schists and hornblende-schists. A short distance up the bay from the point, the schists are less disturbed and appear to rest upon domes of light-gray granite-gneiss. On the point in the middle of the bay, only the light-gray, medium to coarse granite-gneiss is seen, with a strike of N. 35° E., but along the east side of the bay the schists again cap domes of gneiss, and within a quarter of a mile of the point a great fault drops the gneisses below the water-line leaving only schists on the point, where dark-gray, pearly mica-schist, greatly crumpled and faulted, holds much disseminated pyrites.

*Coast between Whitley Bay and Cape Hopes Advance.*Rocks largely
granites.

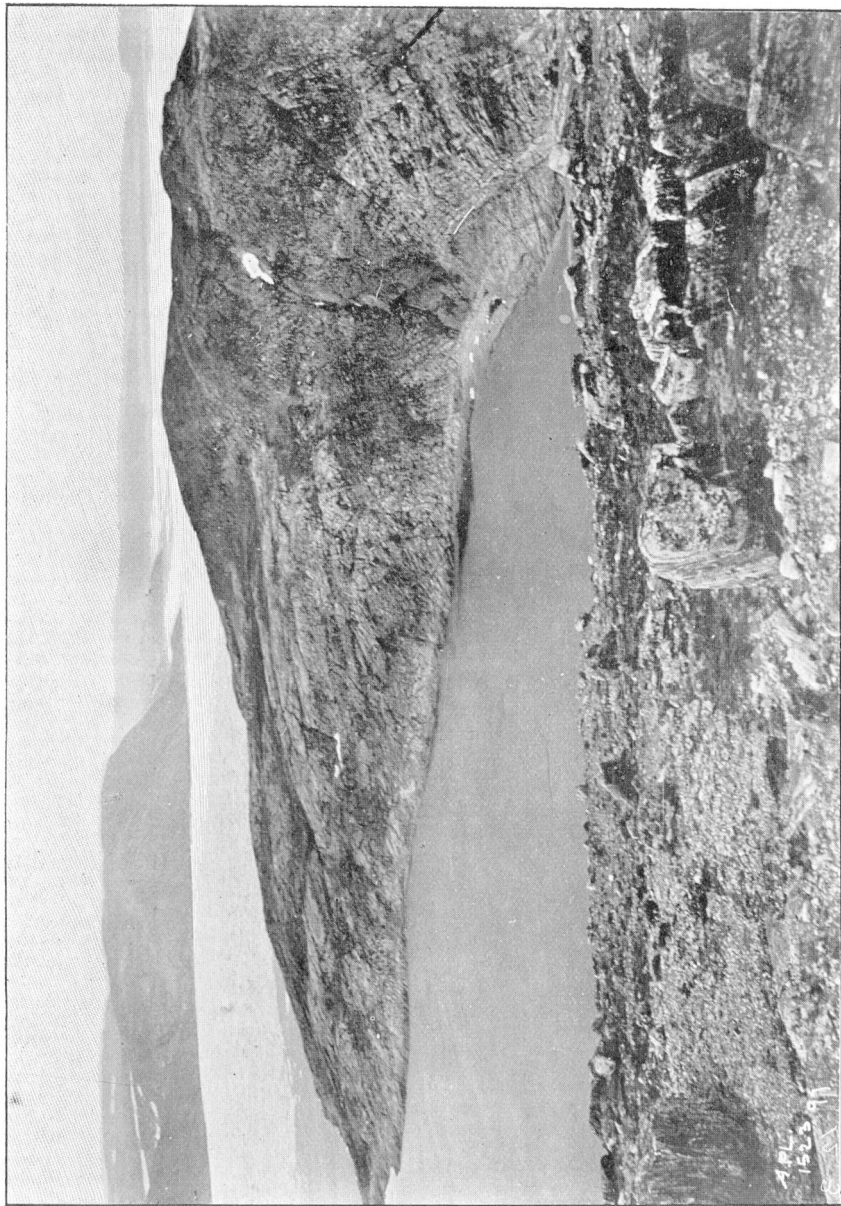
For more than sixty miles to the eastward of Whitley Bay, or to the east side of Diana Bay, the rocks along the coast are chiefly granitite-gneiss which varies in texture from fine-grained schistose to coarse-grained massive, and often appears as augen-gneiss, with the strike of the foliation nearly parallel to the general trend of the coast, or east-and-west, and the dip toward the sea. Many large dykes of diabase and gabbro, more or less decomposed, cut these rocks and appear to have been greatly squeezed since their injection, as they change to chloritic and hornblende schists wherever the dykes thin out. In many places the gneisses are very quartzose and in a number of the bold headlands the rocks are broken into huge rectangular fragments resembling blocks of thick-bedded sandstone.

Dark schists.

On the islands and along the east shore of Diana Bay, the dark mica-schists and mica-hornblende-schists are again found associated with the granitite-gneiss, which cuts and incloses masses of the schists; these latter predominate along the east shore of the bay and largely occupy the low land forming the wide point between Diana Bay and Ungava Bay. At Cape Hopes Advance and on the islands in the vicinity, coarse, red mica-augen-gneisses and mica-hornblende-gneisses are associated with bands and masses of finer grained similar rocks. All of these cut gray and pink, schistose mica-gneiss, in one place changing the strike from S. 80° W. to N. 40° W., and they also send off red pegmatite dykes, generally along the lines of foliation, into the schistose gneisses.

*Cape Hopes Advance to Payne River.*Relations
between
intruded
granite and
gneisses.

Ten miles south of the Cape, on one of the Eider Islands, the masses of intruded, red hornblende-mica-gneiss were carefully traced, and were found generally to conform with the foliation of the light-coloured granitite-gneisses; but when followed along the contact, the red gneiss was found crossing the foliation in places and turning the laminae of the light-coloured gneiss close to the contact, as if by the flow of the intrusion. In many places there is a gradual passage from one variety of gneiss to the other. The interrupted masses when followed along the foliation were seen to pinch out at both ends and have evidently been intruded from below. In texture, the hornblende-mica-gneiss varies from fine-grained to a coarse pegmatitic rock, distinct from later pegmatites which cut all the rocks and hold crystals of tourmaline, biotite and hornblende. Most of the light-coloured granitite-gneisses are very quartzose and are interbanded with darker, more basic gneiss, made up



A. P. Low.—Photo. 1897.

MOUTH OF WAKEHAM BAY, FILLED WITH ICE

largely of chlorite and decomposed hornblende with greenish plagioclase and bluish opalescent quartz, very similar to that found in the squeezed diabase previously mentioned. This rock is taken to be such an altered diabase, rendered acidic by the accretion of quartz between the laminæ of the bisilicates.

Ten miles south of this exposure, the rocks are dark-gray, mica-schist and hornblende-schist associated with coarser light-gray granitite-gneiss and coarse red granite. Dip. N. 10° E. $< 70^{\circ}$. Five miles further south, the intrusive granite predominates and incloses broken bands of finer-grained garnet-gneiss. The next examination was made twenty miles further on, at the north side of Dry Bay where there is a prominent hill composed largely of light-gray granitoid-gneiss with interbanded medium- to coarse-grained, red granitite-gneiss and also bands of mica-schist and mica-hornblende-schist, usually thin and broken. At the south point of Dry Bay the rock is all gray and pink gneiss, varying from medium- to coarse-grained and at times having an augen structure. Strike N. 25° W. From there to the entrance of Payne River Bay, the same gneisses prevail, with an occasional large dyke, altered to hornblende-schist, and at times considerable areas of the mica-schists and mica-hornblende-schists.

At the north point of Payne River Bay, the rock is a coarse, red granitite-gneiss with little foliation. This rock continues about five miles up the bay, when a change is made to a metamorphosed series of clastic rocks which forms the hills and islands of the upper part of the bay and lower portion of the river. The following section was measured across the hills forming the outer point of the bay, on the north side of the river, five miles from its mouth; starting from gray granitoid-gneiss cut by pegmatite and pink granitite, the sequence is as follows, in descending order:—

Intrusive granite.

Section of rocks on north side of Payne Bay.

	Feet.
Light-grayish mica-schist often very quartzose passing into dark-gray quartzite with partings of mica.....	500
Light, yellow-weathering, blotched with brown, fine granular quartzite, with patches of ankerite and some lime. This rock towards the top shades to a dark, bluish-gray, from the presence of large quantities of magnetite in small grains, mixed with quartz, and at times occurring in larger crystalline masses	70
Dark-bluish, slaty quartzite, holding considerable magnetite, and shading upwards into barren, dark quartzite containing a small percentage of lime and lumps and veins of dark chert.....	350
Dark-gray arenaceous slate.....	35
Dark, massive, quartzite with a few partings of slate..	40

	Feet.
Dark mica-schist.....	20
Light mica-schist.....	10
Dark mica-hornblende-schist holding garnets and probably a squeezed dyke.....	8
Light-gray, schistose, biotite-gneiss.....	500

General dip of beds S. 80° E. < 30° to 60°.

The small islands in the north bay are formed of dark-gray, siliceous mica-schist, that weathers rusty from the decomposition of disseminated pyrite. At the mouth of the small river flowing into the bay, there is exposed, in the hillside to the east of the river, one hundred feet of light-blue, finely crystalline, siliceous limestone, greatly shattered and recemented by networks of small quartz veins, so that the rock closely resembles the siliceous limestones of other Cambrian areas of Labrador. The limestone is overlain by about a thousand feet of silicious, calcareous rock containing large patches of brown ferruginous dolomite interlaminated with black chert and also containing masses and veins of that mineral. The rock decays unevenly, leaving cavities where the carbonates have weathered away. Interbedded with these cherty rocks are bands containing much actinolite in large crystals radiating through a siliceous rock. The actinolite is light-coloured in the rock-mass, but there are veins containing dark steel-gray hornblende in masses of radiating crystals and others containing quartz and dolomite with sericite along the walls. The overlying rock is a rusty-weathering mica-schist similar to that met with on the islands of the bay, and it probably occupies the interval of swampy land between this hill and the range where the previous section was obtained. The islands at the mouth of Payne River belong to the same series, which is readily identified by the yellow-weathering dolomitic beds.

Hornblendic
cherts.

Sheets of
decomposed
gabbro.

These rocks occupy both sides of the river for about ten miles above its mouth, when they give place to granite-gneiss. Along the river the clastic series is largely displaced by sheets of diabase, gabbro and hornblendic, chloritic and sericitic schists, which appear to have burst up between the bedding planes of the clastics like the great interflows of diabase and gabbro near the forks of the Kaniapiskau and Larch branches of the Koksoak River,* the only difference being that the pressure and metamorphism appear to have been greater about Payne River.

The rocks of the upper part of the river are mostly pink and gray biotite-gneiss cut by many large dykes of diabase which are seen in the bare walls on both sides of the valley.

* Annual Report, Geol. Surv. Can., vol. IX. (N.S.), p. 33-34 L

Payne River to Gyr Falcon Islands.

To the southward of the mouth of the river the coast is chiefly occupied by light-coloured gneisses. At a stopping place fifteen miles from the river, there is an immense mass of amphibolite, at times containing violet plagioclase and cut by large veins of violet pegmatite. Owing to shallow water, no landing was made for thirty miles from here, to the large islands in the mouth of Hopes Advance Bay, where light- and dark-gray, very quartzose mica-gneisses are interbanded with garnet-bearing hornblende-schist. Dip N. 50 E. $< 20^{\circ}$ to 45° . These are cut by huge dykes of red pegmatite, and on the west side are cut off by a mass of coarse, dark, decomposed gabbro or diorite. Amphibolite,
mass.

On Cone Island of the Gyr Falcon group, the rocks are somewhat contorted and dip eastward; they consist chiefly of impure quartzite holding in places a good deal of garnet and small scales of biotite, and shade into a quartzose biotite-gneiss. Dark mica-diorite-gneiss, sometimes holding garnets, occurs with them, apparently interbedded. The Gyr Falcon Islands are arranged in a series of chains running north-west and south-east parallel to the strike of the rocks, and appear to have been formed by a series of thrust-faults, which have pushed the rocks into sharp ridges with perpendicular faces towards the south-east and gentler slopes in the opposite direction corresponding to the dip of the bedding of the rocks. Quartzites and very quartzose mica-gneisses predominate and are associated with a highly felspathic mica-diorite-gneiss which often resembles a decomposed crushed anorthosite. All the rocks contain more or less garnet. A few bands of rusty-weathering quartzite hold patches of ankerite and probably represent a more highly metamorphic phase of the rock met with at the mouth of Payne River. Crushed
anorthosite.

Gyr Falcon Island to Koksoak River.

The rocks forming a small island on the south side of Leaf Bay, are chiefly dark-green amphibolite and hornblende-schist, together with bands of quartzose, schistose mica-gneiss cut by large dykes of light-pink pegmatite and coarse red granitoid-gneiss. The amphibolite is very coarse in texture near its contact with the pegmatite and granite. From this island to Stony Point, the shore is largely formed of light-coloured granite and gneiss. On the small islands off the point, a medium-grained, light-pink granitoid-gneiss predominates, and holds broken bands of light-gray biotite-gneiss often containing small garnets; both the granite and the gneiss are cut by red pegmatite. The coast from Stony Point to the mouth of the Koksoak is low, with few rock-exposures, all of which appear to be similar to that last described. Amphibolite.

The rocks along the Koksoak to Fort Chimo have been described in a previous Report.* They consist of a bedded series of mica-schists hornblende-schists and gneisses cut by hornblende-granite and large veins of pegmatite, the irruptives predominating towards the mouth of the river.

Koksoak River to George River.

Gneisses and
granites.

The coast between the Koksoak and Whale River is very low, with shallow water extending far out and quite unapproachable with the yacht until the channel on the west side of Big Island is reached, where the shores become higher and give an almost continuous rock exposure up Whale River to the Hudson's Bay post.

The rocks are all light-coloured gneisses and granites, being made up largely of irruptives containing shattered bands of a highly metamorphosed bedded series, now forming very quartzose, garnet-bearing biotite-gneiss and schist, with less hornblende-schist than to the northward. Between the mouths of Whale and George rivers, the wide flats and boulder-ridges which extend far out from the low shores rendered close examination of the rocks impossible, and only a few landings were made on islands and rocky points. Wherever an examination was made, however, gray biotite-gneiss with mica-schist and hornblende-schist were found, cut and shattered by red granites and pegmatite.

The same rocks occur on the islands along the east side of the mouth of George River and up that stream to the Hudson's Bay post. At Gull Island and along the west shore for ten miles above it, there are large exposures of dark basic rock, now chiefly diorite-gneiss, and evidently representing large masses of gabbro or diabase corresponding to the basic irruptives met with in the bedded series as previously described.

GLACIAL GEOLOGY.

Extent of ice
sheet.

The entire coast visited has at one time been covered by an ice-sheet sufficiently thick to over-ride the highest hills, and the movement of this ice caused the removal of the loose material leaving only large blocks and boulders strewn over the rocky surface of the rounded hills, which is everywhere grooved and striated by ice action. Little or no fine drift remains on any of the hills more than 400 feet high, and in the valleys between the higher hills there is

* Annual Report, Geol. Surv. Can., vol. VIII. (N.S.) p. 221 L.

usually not much fine material, the débris being mostly boulders and broken rock.

The list of glacial striæ given below, shows that the general motion of the ice was from the interior radially towards the coast, so that, as a rule, the striæ on the hills run nearly at right angles to the general trend of the coast. The direction of the ice-flow was, however, modified by that of deep valleys along the coast, the ice-stream accommodating itself to the valleys and pouring down these into the sea. The striæ are not well marked on the exposed points and islands along the coast below the 400-foot level, having been obliterated by the pounding of floating ice during the uplift subsequent to the main period of glaciation.

List of Glacial Striæ.

		Radial flow of ice.
Douglas Harbour, on hills at head of S.W. Arm.....	N. 75° E.	List of glacial striæ.
" " at point between the arms.....	N.	
" " 2 miles from point, W. side S. W. Arm..	N. 25° E.	
Fisher Bay, on top of island at anchorage.....	N. 50° E.	
" " on side " ".....	N. 10° E.	
Wakeham Bay, on island at mouth of narrows.....	N. 80° E.	
" " on summit of the peninsula.....	N. 50° E.	
" " on summit of east side at mouth.....	N. 25° E.	
" " " ".....	N. 30° E.	
Cape Prince of Wales, on end of cape.....	N. 35° E.	
Joy Bay, 5 miles from S. point on summit of hill 500 ft. high.	N. 85° E.	
" on end of south point.....	N. 80° E.	
Whitley Bay, on the long low island in the bay....	N. 40° W.	
10 miles east of Whitley Bay, on summit.....	N. 55° E.	
25 " " ".....	N. 25° E.	
Diana Bay, south-west point of the large island.....	N. 40° W.	
Cape Hopes Advance.....	N. 60° E.	
Eider Islands.....	N. 25° E.	
" ".....	N. 40° E.	
" ".....	N. 40° E.	
Flat Bay, summit of hill on north side.....	N. 40° E.	
" south point.....	N. 75° E.	
Plover Islands.....	N. 65° E.	
12 miles north of Payne River Bay.....	N. 45° E.	
On summit of hills at end of exploration, Payne River.....	N. 40° E.	
10 miles south of Payne River Bay.....	N. 20° E.	
Cone Island Gyrfacon Islands.....	N. 35° E.	
Mainland at Gyrfacon Islands.....	N. 30° E.	
Leaf River Bay, small island on south side.....	N. 35° E.	
15 miles west of mouth of George River.....	N. 5° W.	
Island on the east side of " ".....	N.	

Marine Terraces.

The greatest depth of submergence and the periods of rest during the uplift of the land toward the close of the glacial period, are marked

Terraces
marking
limits of
subsidence of
the land.

Highest
terraces.

by a series of terraces cut into the drift occupying recesses between the rocky hills of the bold coast, or, in the lower country along the west side of Ungava Bay by flat plains that rise in steps from the present sea-level. The terraces were seen wherever sufficient drift material remained to form them, and their heights were estimated by eye, or, where convenient, their altitudes were obtained by means of the aneroid barometer. The highest terraces measured were found at the head of the south-west arm of Douglas Harbour, and near Dyke Head, some thirty miles east of Whitley Bay, or more than one hundred miles east of Douglas Harbour. In both places the barometric height of the highest terrace was 405 feet and the tops were evidently an ancient shore-line under a rocky cliff, the surfaces being made up of moderately large, rounded boulders. This upper terrace is taken to represent the greatest depression of the land in this part of the Labrador Peninsula at this time, and is considerably less than that of the western portion, where the marine terraces are found to an elevation of more than 700 feet above sea-level in the vicinity of Richmond Gulf on Hudson Bay.* The amount of uplift along this part of Hudson Strait appears to have been constant, from the levels of the terraces cited above, and in Ungava Bay it seems to be somewhat less. Unfortunately no definite highest-level terrace was found there south of Payne River, where the highest terrace seen is only 325 feet above the sea. Those about the mouths of the Koksoak and George rivers are not higher. Along the Koksoak River the highest-level terrace is about 300 feet above the river near its mouth, and as the stream is ascended the terrace also rises so that at Stillwater Lake, 175 miles south-west of the mouth of the river and 520 feet above sea-level the upper terrace is 200 feet above the surface of the lake. This highest terrace is a well marked feature of the river-valley and is continuous from the mouth to Stillwater Lake. It is accompanied by marine stratified clays, so that its marine origin is undoubted.

Unequal
uplift of
Northern
Labrador.

From the foregoing facts, it would appear that there has been an unequal uplift of the northern portion of Labrador, the maximum, more than 700 feet, having occurred along the coast of Hudson Bay in the vicinity of Richmond Gulf; and that this region of maximum uplift was continued inland, eastward, more than half way across to Ungava Bay; while from Stillwater Lake a gradual decrease occurs to about the southern part of Ungava Bay, where the uplift is only about 300 feet. Passing northward, however, the uplift again becomes greater, so that at the mouth of Payne River it reaches 325 feet and along the southern shore of Hudson Strait 405 feet.

* Annual Report, Geol. Surv. Can., vol. IX. (N.S.), p. 41 L.

At Douglas Harbour, terraces below the upper level were noted at 275, 212, 91, 46 and 37 feet. On the peninsula at the mouth of Wakeham Bay, well marked terraces occur at 180, 165, 150, and 65 feet, and at the head of the bay there is a broad terrace 90 feet high. About Cape Prince of Wales the lower terraces are persistent, and at the mouth of the river flowing into Joy Bay the drift deposits are terraced to above 300 feet. On the points of Joy and Whitley bays there is a continuous terrace at an elevation of 65 feet. The terraces at Dyke Head, lie in a small valley at the bottom of a cove facing the strait and afforded one of the best examples of terraced beaches seen on the coast, the heights being 405, 330, 275, 255, 220, 175, 90 and 85 feet, any lower terraces being lost by the scouring away of the drift from the rock. Between Cape Hopes Advance and the mouth of Payne River, the country is generally low and drift-covered, and is made up of flat-topped plains that rise in low terraced steps, as only isolated rocky ridges have an elevation above 200 feet, high-level terraces are not frequently seen. At Cape Hopes Advance there is one at 190 feet, and on the side of a rocky hill near the Plover Islands there are two beaches at 200 and 75 feet respectively. At the mouth of Payne River, the drift between the hills shows terraces at 323, 314, 304 and 184 feet besides others at lower levels. Along the river the valleys between the hills are filled with terraced drift up to 325 feet, the lower terraces are cut from stratified clay which rises about 150 feet above the level of the river, and is overlain by stratified sand nearly to the level of the highest terrace.

From Payne River to the mouth of the Koksoak, the low shores and slowly rising country in rear, gave only low terraces, seldom exceeding an elevation of 100 feet. The coast between the mouths of the Koksoak and George rivers is also low, and terraces are only seen along the flanks of the hills several miles inland. They appear to be continuous, with the highest estimated to be about 300 feet above the sea. Along the lower reaches of the George River to the Hudson's Bay post, the gullies and banks where drift is lodged are terraced to about 300 feet above the present level of the river, and the stratified clay appears to rise upwards of 100 feet above the water and is capped with stratified sand.