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REPORT

OF THE

CRUISE OF THE U. S. REVENUE STEAMER

THOMAS CORWIN,

IN THE

ARCTIC OCEAN,

1881.

BY

CAPTAIN C. L. HOOPER, U. S. R. M.,  
COMMANDING.

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WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1884.



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LETTER

FROM

THE SECRETARY OF THE TREASURY,

TRANSMITTING,

*In response to Senate resolution of February 27, 1884, the report and papers of Capt. C. L. Hooper upon the second cruise of the revenue steamer Corwin.*

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JUNE 30, 1884.—Referred to the Committee on Commerce and ordered to be printed.

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TREASURY DEPARTMENT,

June 24, 1884.

SIR: Respectfully referring to the Senate resolution directing that the Secretary of the Treasury furnish to the Senate a copy of the report of Capt. C. L. Hooper, United States Revenue Marine, upon the second cruise of the revenue steamer Corwin in the Arctic Ocean, and its accompanying documents and illustrations, in possession of this Department, I have the honor to transmit herewith the report and papers mentioned.

Very respectfully,

H. F. FRENCH,  
*Acting Secretary.*

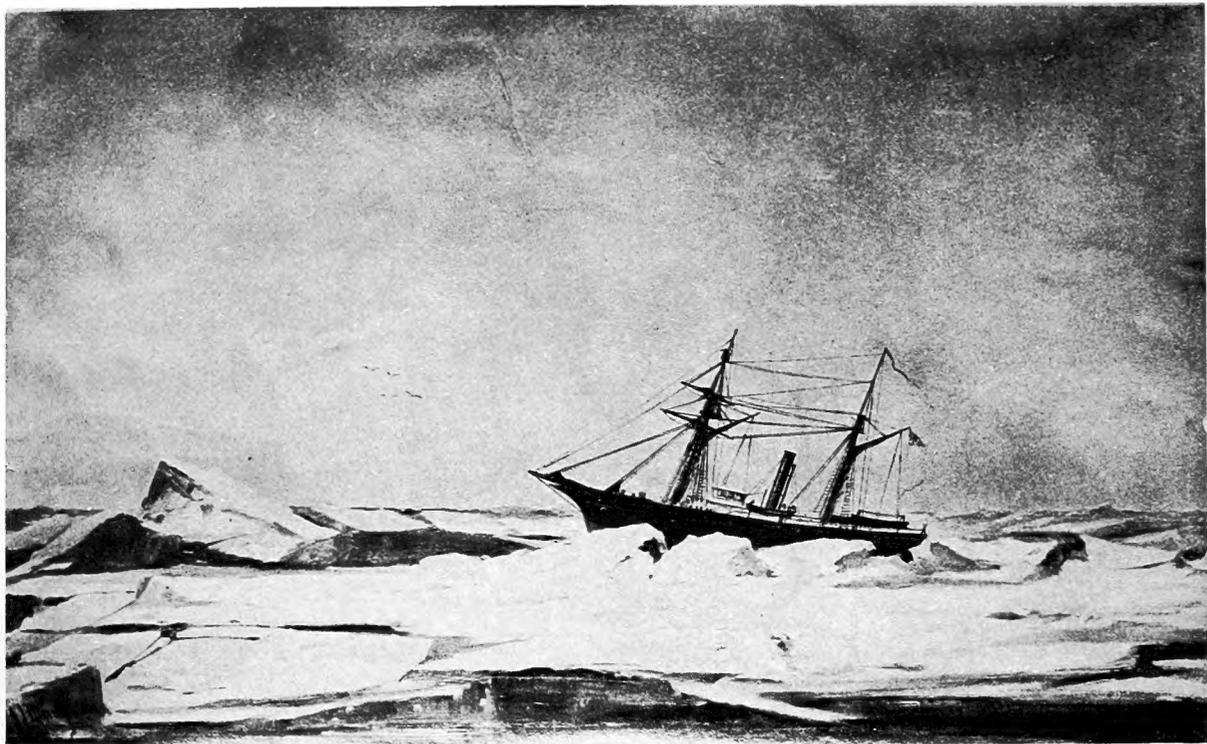
HON. GEORGE F. EDMUNDS,  
*President pro tempore of the United States Senate.*

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THE "CORWIN" IN 'A NIP.  
*Painted by G. J. Denny, from a sketch.*



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HELIOTYPE PRINTING CO., BOSTON.

THE "CORWIN" LANDING AT WRANGEL ISLAND.  
*Painted by G. J. Denny, from a sketch.*

# REPORT

OF THE

## SECOND CRUISE OF THE STEAMER CORWIN.

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The Corwin sailed from San Francisco on May 4, 1881, at 1 p. m., accompanied out of the harbor by the revenue steamers Rush and Hartley, and a number of vessels of the San Francisco yacht fleet, under command of Commodore Harrison.

Moderate weather prevailed until the 15th instant, when, within 50 miles of Ounalaska Island, heavy gales and snow storms were encountered.

On the morning of the 16th the island was seen bearing northwest, distant 40 miles. Soon after it began snowing and the weather became so thick that we were compelled to proceed with great caution, and did not reach the entrance of the pass between Ounalaska and Onalga Islands until noon, when, owing to the rough state of the sea caused by a strong current running against the northwest gale which was blowing, we were glad to turn back and run into Beaver Harbor, barely escaping the loss of our boats.

The Onalga Pass, although very rough at times and subject to strong currents, is in many respects preferable to either the Ouminak or Akoutan Pass, especially to vessels bound to Ounalaska. It contains no hidden dangers, and is safely navigable by all classes of vessels except as mentioned before, when a strong gale is blowing against the current. At such times the sea truly boils and foams, and it is advisable to wait until slack water before attempting to go through.

Beaver Harbor affords ample protection for a vessel under such conditions. Although the water is deep, several good anchorages may be found near the shore, where vessels can lie in safety.

On the 17th of May we arrived at Ounalaska and hauled the vessel on the beach to repair the oak sheathing which had started off in many places. The oak being very dry when put on and closely fitted, had bulged off upon becoming wet and swollen. After repairing it we took on board a supply of coal and water and nine months' extra provisions. The latter were purchased from the Alaska Commercial Company with the understanding that, if not used, they were to be returned without cost to the Government.

The past winter was reported to have been unusually mild, although at this time the weather was quite cold and the island covered with snow to the sea. The natives were suffering from an epidemic of pleuro-pneumonia, which proved fatal in a great many cases.

Ounalaska settlement, or Illuluck, has been so often described that a repetition is unnecessary, but to those who are not familiar with the subject the following reference to it by the late Capt. George W. Bailey, U. S. R. M., will be found of interest:

Ounalaska is the largest commercial port of the Aleutian Islands, and now a port of entry. \* \* \* It is also the principal depot of the two large trading companies, the Alaska Commercial Company and the Western Fur and Trading Company. There is a full priest resident at Ounalaska, and the church building presents a creditable appearance, church matters being conducted at this station on a seemingly more proper basis than in any other part

of the Territory. Upon the whole, the town, Illuluck, presents more of the appearance of civilization than any other west of Kodiak, excepting those of the seal islands. It has a population of 348, 8 being Americans, 118 Creoles, and 222 Aleuts. The American population includes a deputy collector and one of the United States Signal Service Corps, the others being agents and employes of the trading companies, with the exception of the Tyone or chief of the people and a few designated as church workers. The population are all sea-otter hunters. \* \* \* Of late years a few of the people have been taken by the Alaska Commercial Company to the seal islands as laborers, the seal islanders not caring to do anything outside of the regular business of taking seals. \* \* \* A portion of the women and youngsters are also given employment by the company in haymaking, getting a supply sufficient to feed the stock (consisting of 15 cows and 25 sheep) during the long winter when cattle cannot graze.



ILLULOOK, OUNALASKA ISLAND.

The pasturage during the summer is excellent, and the cows and sheep seem to be in fine condition. The grass grow luxuriantly in the valleys, but, owing to mists, fogs, and want of sun, it is found hard work to cure sufficient hay to keep the cattle through the winter. The priest, Father Shiesnakoff, and two creoles have each a small garden, where potatoes and turnips are raised. The turnips are excellent, but the potatoes are small and watery, the yield being hardly sufficient to preserve the seed. \* \* \* The principal food of the Aleutian people is fish, seal and sea-lion meat, and the meat and blubber of whales. \* \* \* There is located at Ounalaska a school, the teacher being one of the church officials. There seems to be no regular attendance of children, their parents not caring whether they attend or not, and the teachers are perhaps fully as indifferent, for if only a few children come, they adjourn until the next day, or until more are present. There is apparently no attempt to teach English, as it is not encouraged by the parents for some cause.

We sailed from Ounalaska at 4 a. m., on May 22, and arrived off the island of Saint George at 8 a. m. the following day. Although the fog was very dense, we found the island without difficulty by the great number of sea-birds with which the air in the vicinity was filled. The sea being quite rough we did not attempt to land, but kept on towards Saint Paul's, where we arrived about noon. Although the weather was still thick we succeeded, by means of the lead and the sound of the surf on the shore, in finding the anchorage. Soon after, the fog rolled away and the sun came out, affording us a fine view of the island.

The surf being too heavy for landing at the South West Bay, we got under way again and steamed around to the southeast side, where we found but little surf, and easily communicated with the shore.

Col. Harrison G. Otis, the special Treasury agent in charge of the islands, came on board, and after a consultation with him, it was decided unnecessary to detail an officer for duty on

Otter Island, as it was believed that the force on Saint Paul's would be ample to protect both islands.

Our stay at the Pribylov group was too brief to admit of a comprehensive description of the taking of the seals, and the preparation of their skins, even were such a thing desirable. The Department has been fully informed of the manner in which seals are taken and the skins cared for by the special Treasury agents who have been employed there from time to time. It is presumed that the fact of the existence of considerable drunkenness amongst the natives has also been reported, and the proper remedies suggested. Whether the existing laws are inadequate or imperfectly administered I am unable to state, but it is certain that drunkenness prevails to a lamentable extent, not only to the detriment of the people, but to the lessees of the islands and the Government, and some means should be devised to stop it. In my opinion, a simple and effective way to accomplish this would be to authorize the lessees to withhold the supply of flour and sugar from such natives as are known to brew quass, and even suspend the issue of it entirely, if necessary. At present they are required, under the terms of their contract, to furnish these and other articles, and have no authority to withhold them. If authorized, a due regard for their own interests would prompt them to keep a careful watch on the habits of the natives, all of whom may be regarded as the employes of the company. The interests of the Government, of the lessees of the islands, and of the natives are so closely identified in this matter that it appears to me the regulation of quass-brewing could be safely left in the hands of the Alaska Commercial Company.

The seals at this time (the last of May) were just beginning to arrive. A few old males had hauled out and taken possession of the ground upon which, on the arrival of the females, they would establish their harem.

At Saint Paul's, as at Ounalaska, the past winter was reported to have been a mild one. The thermometer had fallen below zero but once during the season, when for a short time it registered  $-2^{\circ}$  F. The snow had also been light most of the winter, compelling the natives to draw their sleds over bare ground in transporting their fuel. The health of all on the island had been unusually good up to this time, but subsequently, as we learned on our return, an epidemic, similar to that spoken of at Ounalaska, visited the island. It became quite general, and at one time threatened to be serious.

After securing our ice-breaker in place, rigging the crow's nest at the mast-head, and making other necessary preparations, we got under way at 8 p. m., and shaped our course for Saint Mathew's, an island about thirty miles long, just north of the sixtieth parallel of latitude, where it was the intention, unless prevented by ice, to examine the coasts for possible signs of human life, and to give all who desired an opportunity to hunt polar bears, reported to abound there. The weather record at Saint Paul's showed the prevailing wind for the thirty days past to have been from the northwest and moderate. This would tend to clear the western shore of ice.

Remembering our rough experience of last year in trying to get north along the east side of Bering Sea, we determined to keep, if possible, to the westward of the pack, and, if necessary, follow the land water along the Siberian coast, proceeding no faster than the ice should leave the shore. According to my experience, the west shore is navigable much earlier than the east. Both shores are, however, accessible nearly to Bering Strait, while the pack still holds possession of the middle of the sea, well down towards Saint Mathew's Island. This is probably due in part to the land breezes, which blow from each shore during the spring months, but principally to the offset from the rivers, which discharge into the sea from both continents. The water of these rivers is so tempered by the sun's rays and the warm banks through which it flows that it is not an unusual thing to find its temperature  $35^{\circ}$  to  $36^{\circ}$ , even when filled with ice. In one instance, at the outset of the north branch of the Yukon, we found a temperature of  $37^{\circ}$  when surrounded by ice so heavy as almost to stop our progress.

The ice in the rivers generally breaks up before that in the sea, and, coming down with the force of the current, carries everything before it, and forces its way through the sea-ice for miles. The effect of the breaking up of the ice on these great rivers is described by Dall and others who have witnessed it as something exceedingly grand. The mild weather at Ounalaska and the seal

islands during the past winter inspired the hope that further north an early breaking up of the ice would occur. On the morning of the 24th, in latitude  $58^{\circ} 43'$ , longitude  $171^{\circ} 26'$ , the temperature of the water fell to  $32^{\circ}$ , indicating the close proximity of ice; but none was seen until 2 p. m., when it was sighted from the deck on the starboard beam and ahead. Finding ice so far south, we gave up all hope of reaching Saint Mathew's Island, and shaped our course for Cape Thaddeus, Siberia, keeping south of the pack, which we saw occasionally.

On the 25th, we encountered a sharp southeast wind, with thick fog. Although the temperature of the water remained at  $32^{\circ}$  all day and the ice was very close, on account of the thick weather we saw none, but kept steadily on our course to the westward, with a sharp lookout for ice and sails, as we were now approaching the track of whalers bound towards the straits.

On the 26th (May), the wind changed to northeast, with snow. No ice being in sight, we hauled up to the northward under steam and sail. We again came up to it, however, and kept away to the westward, steaming through the loose drift until 8 p. m., when, after passing through a narrow belt of heavy ice, clear water was reached, with a swell from the northward, indicating an open sea in that direction for some distance. Taking in all sail, we hauled to the northward again, under steam, making during the night about 5 miles an hour against a strong northeast wind and blinding snow-storm. During the day, while steaming through the ice, we stopped twice to shoot seals, and succeeded in getting two, a small hair-seal (*Phoca vitulina*), and a saddle-back seal (*Phoca hystrius*). We ate some of each from a sense of duty, having determined to test the quality of all the articles of food made use of by the natives met with. Subsequently, however, this resolution was found to have been exceedingly rash, and a failure to observe it on all occasions was not regarded as an evidence of weakness. When offered by the natives the entrails of a seal, boiled just as taken from the animal, putrid walrus, and whale meat raw, or berries floating in rancid oil, our good resolutions failed. The sacrifice seemed too great, even in the cause of science; but while the nature of the food offered created a feeling of disgust and nausea, which nothing but dire necessity could have overcome, one cannot but be impressed with the generous nature of the natives in thus offering to divide their best, and in many cases all they have, without thought of reward. We found the seals very good eating; the meat is dark, but not tough, and has no unpleasant taste or odor.

On the morning of May 27 our reckoning placed us in the mouth of the Anadyr Gulf. The wind blowing hard from the northward and snowing, with a short, heavy sea running, at 4 a. m. we shaped a course for the south end of Saint Lawrence Island, and made fore and aft sail, intending, if possible to reach there, to visit the settlement on the southwest point of the island, a place at which the Corwin did not touch during her previous cruise in 1880. We stood to the north and eastward all day, but just before midnight again sighted the ice ahead and on the starboard beam, and hauling up more to the northward, followed the edge of the ice until 7 a. m. the following day, when we arrived off the settlement on the northwest point of Saint Lawrence and came to anchor. The island was still white with snow and almost surrounded by ice. Our arrival was hailed with demonstrations of joy by the natives, firing guns, shouting, &c.

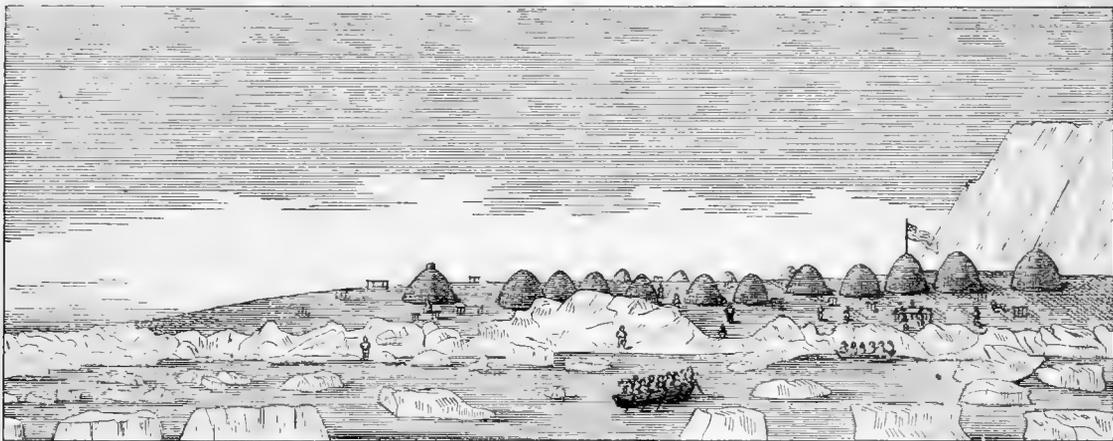
From the top of one of the houses an American flag was flying, the property of the schooner Lolita, which was wrecked on the north side of the island in the fall of 1880 while on the way to San Francisco, under seizure by the Corwin for violation of law in Alaska.

The natives came on board in large numbers. They were very friendly and seemed glad to see us, but inquired anxiously for "schooners." The weather during the past winter having been mild, they had experienced no difficulty in supplying themselves with food, and, in consequence, were looking much better than when we visited them on our former cruise. They had taken one whale (*Balaena mysticetus*), and as they had not yet been visited by whalers or traders, they still had the bone for sale. We bought some boots, mittens, walrus tusks, and white-fox skins, paying for them in ammunition, tobacco, flour, molasses, and drilling. We also bought a few reindeer skins, but as the natives are compelled to buy these from the Tehuktchis for their own use, they will barter them only when greatly in want of some article.

Saint Lawrence Island lies between the sixty-third and sixty-fourth parallels of north latitude and the one hundred and sixty-ninth and one hundred and seventy-second degrees of west longi-

tude, and is of volcanic formation. It was discovered by Bering on Saint Lawrence day, August 10, in the year 1728, and was at first supposed to be a group of small islands. Attention was first called to the wretched condition of its inhabitants by Capt. George W. Bailey, in his report of the cruise of the revenue steamer in 1879. A report of the natives had been brought to Ounaslaska by J. J. Nye, master of the trading schooner Pauline Collins. It being late in the season, Captain Bailey was unable to visit the island and learn the truth. On his return to San Francisco he reported all the facts to the Department, and I was ordered to investigate the matter during the cruise of the Corwin in 1880. This I did, visiting the island and making a personal examination of the deserted villages, but, as will be shown farther on, through lack of time and a fear of exaggerating the horror, I fell very far short of the truth.

After spending several hours at Saint Lawrence Island we got under way for Plover Bay, taking on board two families of natives, who appeared very anxious to reach the Siberian coast.



INNUIT SETTLEMENT, NORTHWEST END SAINT LAWRENCE ISLAND.

On the occasion of a subsequent visit to this island, this same party came alongside, having just returned from the Siberian coast, where we had landed them, and where it appears they had bought a supply of deer-skins.

We arrived off Plover Bay in the evening, but were unable to enter on account of the ice, which was still unbroken. The land as far as we could see in every direction was white with snow to the sea-level, and the shore lined with ice. Off Marcus Bay, a few miles northeast of Plover Bay, we spoke the whaling bark *Rainbow*, Captain Lapham, and delivered the mail, brought from San Francisco, for the whaling fleet. The barks *Abraham Barker* and *Hunter* were also in sight to the southwest.

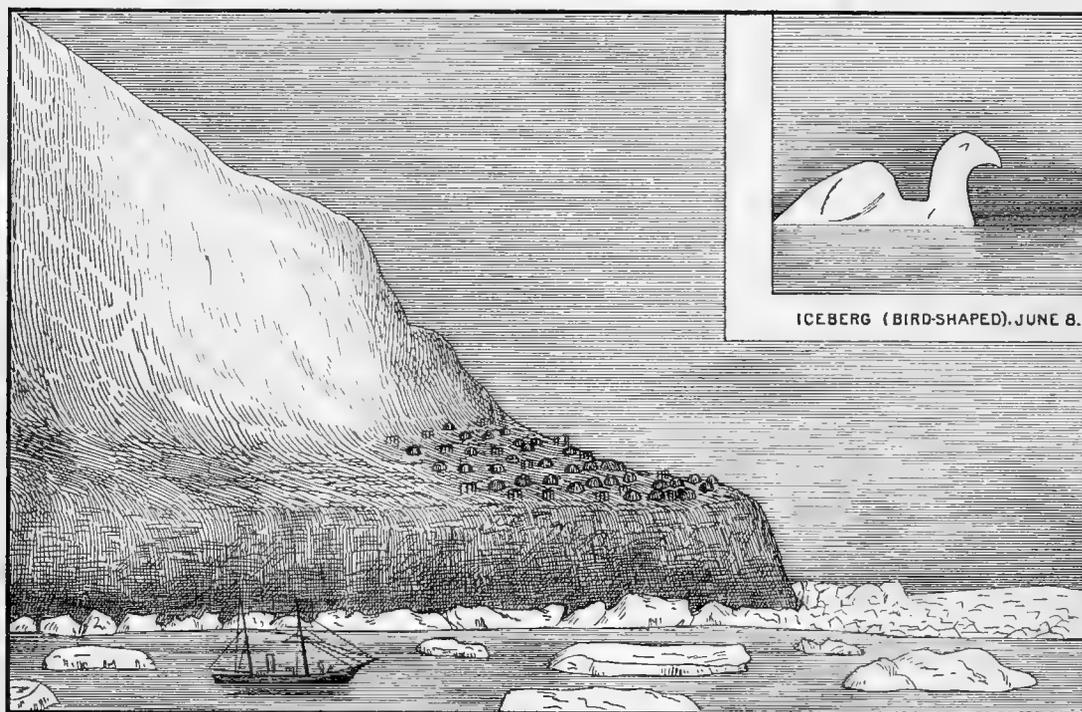
We learned from Captain Lapham that a report had reached the whale ships, through the natives at East Cape, and other places along the coast of Asia south of the straits, that a party of *Tchuktchis*, belonging to Cape Serdze, while sealing on the ice near that place, had discovered a wreck which was believed to be one of the missing whaling barks. Captain Lapham stated that the story had been related with a good deal of detail, and with but slight variations at the different places, and that the impression prevailed among the whaling captains that, notwithstanding the well-known mendacity of the natives in this vicinity, the report contained a ground work of truth. Considering this report of sufficient importance to justify a thorough investigation, I determined, as it would be impossible to visit the north coast with the vessel for some weeks, to dispatch a sledge party in that direction to learn all the facts as to the reported discovery of the wrecks and to make inquiries in relation to the *Jeannette*. After speaking the *Rainbow*, we stopped at Marcus Bay, where we engaged a native named Joe to accompany us as interpreter and dog driver and also secured a team of dogs.

The settlement at Marcus Bay consists of half a dozen houses of walrus hide stretched over a number of poles, the ends resting on the ground and curved so that the upper ends unite, giving the house the appearance of a huge umbrella of perhaps 25 feet in diameter by 12 or 15 feet high, the whole structure being held in place by a regular net-work of wire, the latter material being some of that left by the Western Union Telegraph Company upon the abandonment of the Bering Strait cable project. Inside the house are a number of square-shaped rooms about 6 feet in length and breadth and 5 feet high, called "pologs." These are made of reindeer skins drawn over a frame and suspended by thongs from the top of the house like an inverted box. The polog has no door and can only be entered by raising the edge and crawling under. They are almost entirely airtight and are warmed and lighted by a bit of moss, which is burned in a wooden or stone dish of oil. At first this method of heating sleeping apartments might seem unhealthy, but it does not appear that the natives suffer any ill-effects from it. The pologs looked warm and comfortable, and, what was most astonishing in view of the surrounding filth, they looked clean and had no bad smell.

Leaving Marcus Bay we proceeded north, steaming through drift ice, and passed Indian Point (Cape Tehaplin) just after midnight, when we shaped a course for Saint Lawrence Bay, where we arrived about noon (May 29) in a thick snow-storm and strong southeast wind. The inner bay was still filled with unbroken ice, and the north side of the outer bay so packed with drift ice that we could not make a landing there. A good anchorage was found on the south side of the bay off a small settlement, where we tried to procure more dogs either by purchase or hire. In this, however, we failed. The natives brought on board a number of walrus tusks and some sealskin boots, and because we would not purchase these at prices much above their value, refused to let us have dogs on any terms. They had heard the report of the wreck of the whalers and the discovery of the wrecks by the Cape Serdze natives. When asked to relate all they knew about it, one old man, seating himself on deck, after calling for a drink of water, became quite eloquent. He described the manner in which the wrecks (he claimed there were two) were discovered, and gave, with many violent gestures, a vivid description of their appearance, how the masts had been broken off by the ice, the boats stove, the bulwark crushed in, the hold and cabin filled with water, the decks and ice in the vicinity strewn with ghastly corpses, among which that of Captain Nye had been recognized, with many minor details, all of which were related in such an earnest and impressive manner that it would be difficult for any one unacquainted with Tehuktchi character to realize that the most of it was manufactured on the spot, for the sake of the reward which was expected to follow, as I soon became convinced was the case. However, at the bottom of all, after making due allowance for the effect of Tehuktchi imagination, there seemed to be a foundation of truth, and I became more than ever convinced that some discovery had been made by the natives to the north that would throw light on the fate of one at least of the missing vessels. This eloquent old man, called Jarucha, proved to be, according to the report of his compatriots, one of the worst old rascals in the country. His two sons who accompanied him were of the same general character as the father; they were the terror of the natives for miles around. When shown a chart and asked if he knew of the existence of Wrangel Land, he said, "Oh, yes; many white foxes there," and endeavored to give us the impression that the natives from the north shore went there regularly to procure them. But when pressed hard with questions he could not answer, he acknowledged that he had never known any one to cross there, but had heard such things in his youth.

Finding that we could get nothing but lies from the Saint Lawrence Bay natives, and the weather having cleared up a little, we got under way at midnight for the Diomedes. Soon after snow commenced to fall again and continued through the night, with a strong breeze from the southeast. At 6 a. m., May 30, we came to anchor off the west side of the west Diomede, close in shore, in ten fathoms of water, where we remained all day, quite comfortable, with large fields of drift ice passing by outside of us, setting to the northward about two knots per hour. The natives came on board in large numbers, and were very anxious to trade. One called for whisky, and, upon being told that we did not sell whisky, answered promptly, "I believe you lie." As soon as it became known to them that we wished to purchase dogs, a raid was made on all the aged female and useless dogs

of every description in the settlement, and boat load after boat load arrived, until we were almost compelled to use force to stop them from bringing the animals on board. With Joe's assistance, who passed judgment on them by saying, "That dog no good" or "This good," the required number of the best were selected, and the natives were informed that no more were wanted and that the rejected ones must be taken out of the ship. This last order Joe proceeded to carry out by



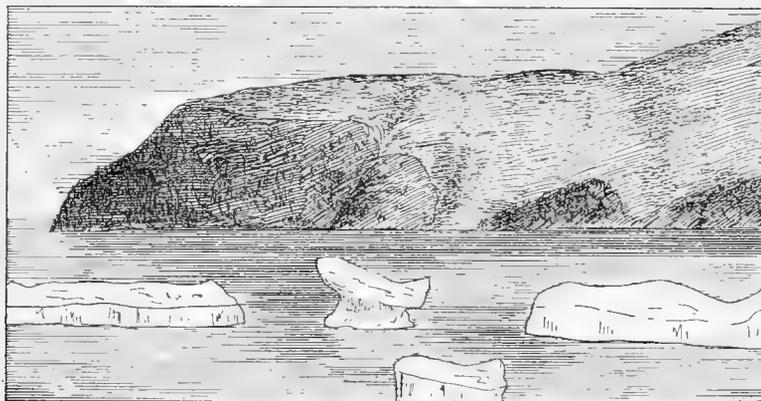
INNUIT SETTLEMENT ON WEST DIOMEDE ISLAND.

picking them up by the back and dropping them into the boats without regard to the howls and snarls of the dogs or the expostulations of their owners. We had succeeded in getting nineteen good dogs, with two sleds, paying, for all, twenty-one sacks of flour. We also bought some fur clothing, boots, and a few walrus tusks, paying for them in tobacco and ammunition.

We got under way in the evening, and after making a short stop at the settlement on the East Diomed we proceeded towards Cape Serdze Kamen. About midnight the weather cleared up a little and gave us a fine view of East Cape and hills to the northward. Although the sun in this latitude, at this season, sinks below the horizon at midnight, it is for a short time only, and when not cloudy it is as light as day throughout the night.

About 4 a. m., May 31, we fell in with and boarded the whaling bark *Helen Mar*, Captain Bauldry, who reported the ice well broken to the north; that he had taken four whales, and had been north to latitude 68°. Cape Serdze was seen about noon, after feeling our way in through thick fog and heavy drift ice for several hours. Following the coast to the westward until 4 p. m., we came to a settlement of Tchuktchis behind an island called by the natives Tapkan. The island is about one-half mile long, one fourth of a mile wide, and is a mile from shore. Along the coast we found a rim of ice from 5 to 30 feet high, and extending from 2 to 10 miles off shore. At our landing place it was quite narrow, but so rough and hummocky that it seemed to us impassable, and we were about to give up the attempt and return to the ship, when we discovered some natives on the ice a mile farther north, apparently going towards the vessel. Rowing to a point opposite them, we got upon the ice and waited for them to approach, which they did with some caution, as if not quite sure what our intentions might be. A few words from Joe and a present of some tobacco soon quieted their fears and established friendly relations between us.

At first they denied all knowledge of the reported discovery of the wreck, but subsequently, having acknowledged that they had heard of the wreck being seen west of Koliatchin Bay, they told so many wonderful and improbable tales in relation to it as almost to shake our faith in all of them. They were a good-natured, careless lot, and when told of the object of our visit, and asked



EAST CAPE, SOUTHWEST, DISTANCE 6 MILES.

if one of their number would go with us, they laughed heartily and said, "What is the use of looking for them if they have been there so long?" pointing to the north. "They must all be dead." After some persuasion and promises of liberal rewards, two of them consented to accompany us if we would shoot walrus for their families to subsist upon during their absence. This we readily promised, provided we could find the walrus, but as we were convinced that this was only an excuse, we offered them a few pounds of tobacco, which was readily accepted. One of them proved to be such a great talker that Joe, who was a man of very few words, said, after listening to him awhile, "I think it is more better we don't take this fellow—too much talk," and in deference to Joe's wishes the loquacious Tapkanian was left behind. The other, a large, quiet, good natured fellow, accompanied us, and was found useful, although not altogether truthful. He seemed to think we were in search of information which it was in his special province to supply, and some of the flights of imagination he indulged in were truly surprising. We also bought from these people a very fine sled. Having signified a desire to visit the settlement, we were invited to ride there upon the dog sleds, about a dozen of which, with from five to eight dogs attached to each, were found after climbing over the rough hummocky ice for perhaps half a mile. Although the undertaking seemed one of great hazard, we determined to venture, and, taking seats on the sleds as directed, we succeeded either in holding on or falling in such a way as to avoid having our bones broken when thrown off until we reached the settlement, where we were kindly received. Deerskins were spread on the ground for us to rest on, and a pair of mittens of peculiar make presented to each. The houses have the same general appearance as those at Marcus Bay, but, being built on sandy soil, were drier and more comfortable looking. The settlement is near the wintering place of the Vega in 1878-'79. In one of the houses we were shown a silver fork and spoon which had been presented to one of the old men by Professor Nordenskjold, for whom they all seemed to entertain a friendly feeling and who was called by them Captain Enshall.

At first they denied all knowledge of the Vega, as in the case of the wreck, but a number of leading questions disclosed the fact that they remembered her very distinctly. Whether their reticence on this point arose from defective memory, failure to understand the original questions, or that lying is a part of their nature, it is impossible to tell. I am inclined to think the latter comes nearest the true cause. They are great liars naturally, and their association with white men has not improved them. They are so accustomed to being lied to by the whisky traders that they take it for granted that all white men are untruthful until they receive proof to the contrary. Their suspicious nature is well illustrated in an instance that came under the notice of Lieutenant Herring during his sledge journey along the Siberian coast. Some letters were given the chief at the Koliatchin settlement to be delivered to any vessel or party of white men that might visit the coast.

On the return trip of Lieutenant Herring these letters were handed back to him by the chief, who declined to have anything further to do with them, saying he was afraid they might contain "bad marks" against him, although he had been very friendly and given Lieutenant Herring and party all the assistance in his power. After completing our visit to Tapkan, and declining several pressing invitations to partake of boiled seal, entrails included, we returned to the vessel by the same rugged pathway, and, thanks to the skillful management of the native driver, arrived without accident.

It is truly astonishing over what rough ice these people can travel with their loaded sleds. The driver runs alongside, assists in pulling with the dogs when ascending the hummocks, holds back in descending, steadies the sled at all times, by the handle or bale which is bent over the center of the sled, and when on a level, no matter for how short a distance, jumps on the sled and rides, urging on the dogs by shouting and rattling some rings attached to the end of a stick. The whip is used very little by the Tchuktehis. When struck, the dog immediately turns and bites his nearest neighbor, who treats the next in the same way, and so on until a general fight ensues, which results in such a mixing up of the dogs that it is often found necessary to unharness them before they can be extricated.

Leaving Tapkan at 9 p. m., we steamed to the westward, following the shore ice. The blink of the pack being in sight to the northward, showing that we were in a lead, although the pack itself was beneath the horizon, I was anxious to land the party as far west as possible. The season being so far advanced, the snow was rapidly melting and the surface of the ice becoming soft, would render traveling by sledges exceedingly difficult.

On the following day (June 1) at 5.30 p. m., in latitude  $68^{\circ} 28' N.$ , longitude  $175^{\circ} 10' W.$ , we came to solid ice ahead and on the starboard bow, showing that we had reached the end of the lead. Owing to a thick snow-storm, we had not seen the land since early morning, and could form no definite idea of our distance from it. Although I was very anxious to get our sledge party started, I did not consider it prudent to embark them on the ice until we could get sight of the land. The wind freshening up from the northward, we crossed over to the weather side of the lead and hove to under sail, waiting for the weather to clear up, trusting to the vessel to drift fast enough to avoid getting caught in the end of the lead, which we found to be rapidly closing. We continued under sail, holding on to the weather side of the lead, and, when necessary to avoid getting entirely surrounded by the heavy ice, running off before the wind to clear it.

At midnight the wind had increased to a moderate gale and the snow fell so thick that the ice could not be seen more than the length of the vessel. Shortly after midnight we found ourselves entirely surrounded by heavy ice, and were compelled to use the engine to work out of it. In doing so the rudder was broken and unshipped, every pintle being carried away. The situation was anything but pleasant, caught in the end of a rapidly closing lead, 120 miles from open water in a howling gale and driving snow-storm and without a rudder. It at first appeared as if the destruction of the vessel was inevitable. However, after several hours of hard work, steering the vessel as best we could by means of the sails, and giving her a great many hard bumps and nips, we succeeded in getting into the open lead again, and by 6 o'clock we had prepared a jury rudder, using the swinging booms and studding sail boom. They were lashed side by side and weighted with pig-iron, so that one edge would sink. When ready it was put in the water, and, one end being drawn up to the stern-post, was held in place by guys; a couple of guys from the after end of the jury rudder were rove in through leading blocks secured to the ends of spars rigged out on each quarter, and taken forward to the barrels of the steam-windlass, one end over and one under, these guys having "hard over" and "midship" stops put on, for the guidance of the man who worked the windlass. It was pronounced all ready. The bell was struck to go ahead, and I waited with some anxiety to see how the improvised apparatus would function. It was found to answer admirably, and although very much slower than before in answering the helm, the vessel was now controlled without difficulty. It was readily worked by one man, the lever being moved in obedience to a wave of the hand by the officer conning. As the wind was still blowing fresh from the northward, and the lead still closing, we determined to work down towards the end of it, and unless we could get hold of the land during the day so as to start our sledge party, to run out of the lead entirely and wait for a change in the weather. Should the northerly wind continue

I believed it to be only a question of a few hours before the northern pack would rest against the shore as far south as Cape Serdze, and to be fairly caught between the pack and shore ice would be certain destruction for any vessel, no matter how strongly built. We steamed slowly to the south and east during the day, sighting ice on both sides, as the weather cleared a little from time to time, enabling us to see a distance of four or five miles.

At 4 p. m. it stopped snowing entirely for a few minutes and gave us a view of Koliatchin Island. I had just sent for the interpreters and asked them if they considered the ice passable in such weather. John, the Tapkan native, was scanning it carefully, and although apparently in some doubt as to the chances, he evidently preferred to make the attempt than endure a repetition of our experience of the past twenty-four hours. Suddenly his face brightened, and pointing to the southwest, he said one word, "Koliatchy." I looked in the direction indicated, and to my great delight saw Koliatchin Island, apparently not more than 5 miles away, although it proved to be more than double that distance. I again asked if they considered the ice passable. A short consultation between the natives resulted in a grunt from the Tapkanian, which Joe interpreted to mean, "He thinks it pretty good." I waited to hear no more, but passed the order for the sledge party to embark, and an hour later they were on the ice, where they were met by a party of native seal hunters, who rendered them valuable assistance in getting their heavily-loaded sledges over the rough ice.

The party consisted of First Lieutenant Herring, Third Lieutenant Reynolds, Coxswain Gessler, and the two natives. Their outfit consisted of twenty-five dogs, four sleds, and one skin boat, one tent, one coal-oil stove and furniture, with 5 gallons of oil. Five skin coats, 3 pairs skin trousers, 6 pairs seal-skin boots, 2 deer-skins, and 2 rubber blankets, an aneroid barometer, thermometer, marine glass, boat compass, lead and line, &c., 1 hatchet, sail needles and twine, 15 yards cotton canvas, a quantity of seal-skin line for securing loads to the sledges, 140 pounds of bread, 10 pounds coffee, 10 pounds sugar, 50 pounds dried potatoes, 80 pounds pemmican, 3 rifles, 3 revolvers and a shot-gun, with an abundance of ammunition, completed the outfit. Instructions were given Lieutenant Herring to proceed along the coast as far as practicable, communicating with the natives at each settlement, and, if possible, to find the parties who were said to have discovered the wreck, and gather all facts in connection with it that could in any way throw light on the fate of the missing whalers or the Jeannette. In regard to rejoining the vessel when this task had been completed, they were instructed as follows:

The Corwin will be at Tapkan June 15, June 20, and July 15. If you do not meet the vessel at any of these dates proceed to East Cape, leave letters at all settlements stopped at, both going and coming. In case the vessel does not reach East Cape by the 15th of August, go to Plover Bay; on the way stop at Saint Lawrence Bay, and leave letters with the natives to be put on board whaling vessels or to be delivered to the Corwin, giving information of date of passing, &c. Inform all natives met with of the object of your visit, and request them to assist any parties of white men that may at any time appear on their coast, and assure them that any services rendered will be well rewarded.

These instructions were written out early in the afternoon before land had been seen, and with the expectation that we would be compelled to return to Tapkan before embarking them, and in the event of their being unable to cross Koliatchin Bay, they were to return to Tapkan, where we would pick them up on the 15th, and make another attempt to land them west of the bay, as I had no doubt we would be able to do by that time without difficulty. After seeing our sledge party fairly started on their way, we ran south and east under sail, intending to go to Plover Bay and repair our rudder. Fortunately, we had been able to save the broken parts, and hoped to be able to scarf them so that the rudder could be used by lashing it to the rudder-post. On the following morning we passed Cape Serdze, which we caught sight of at intervals between the snow squalls. During the afternoon the wind moderated and the weather cleared a little.

Just north of East Cape, we saw eight whalers, six of them "boiling out." Several reported having taken as high as eleven whales, a remarkable catch so early in the season.

A bright ice-blink had been in sight, to the eastward, all the afternoon, and about 8 p. m. the ice was raised on the port beam and ahead. We soon discovered the straits to be entirely filled with ice, coming through from Bering Sea, compelling us to lay by until morning. During the night the set of the current, after careful observation, was found to be about one knot per hour to

the northward. On the following morning, the ice setting off shore from East Cape, we steamed out past and shaped a course for Plover Bay. A number of natives coming on board off East Cape, urged us to come in and anchor and trade with them. We bought a few pair of skin boots, paying for them in tobacco. These natives confirmed the previous report of an unusually mild winter.



DIOMEDE ISLANDS, SOUTH BY EAST (MAGNETIC).

They told us the story of the wrecks, with the usual variations, although the main points remained the same. As many of the old maps, and even some of the more modern ones, are so erroneous as to give but an imperfect knowledge of Bering Strait and the adjacent coasts and islands, a brief description may not be out of place.

The strait, which is about 45 miles wide, has an average depth of 26 fathoms, and hard, regular bottom. Nearly midway of the straits are two islands, generally called the Diomedes. The larger and most western is about 3 miles long by 1 wide, is probably 800 feet high, with nearly perpendicular cliffs. It was named by Captain Beechey, R. N., "Ratmanoff." The native name is "Noo-nor-book." On its southwest side is a large settlement. The natives are Innuits, but are so situated that they are thrown in contact with the Tchuktchis, and consequently possess many of their characteristics in habit and language; but the Inuit is without doubt their native tongue. The eastern island is nearly the same height, but less than one-third the area of the western. It was named by Beechey after Admiral Krusenstern, and is called by the natives Ignalook. This island has also a settlement on its southwest side. Like those on the larger island, the natives are Innuits, but possess many of the characteristics of the Tchuktchis. The natives of both settlements are great traders, and each summer cross over to the American side and meet the natives that assemble in numbers at Hotham Inlet, for the purpose of trading. They are very skillful at killing whales, walrus, and seals. The boundary line between Asia and America passes between the Diomedes. The reference to the boundary in the treaty is in the following language:

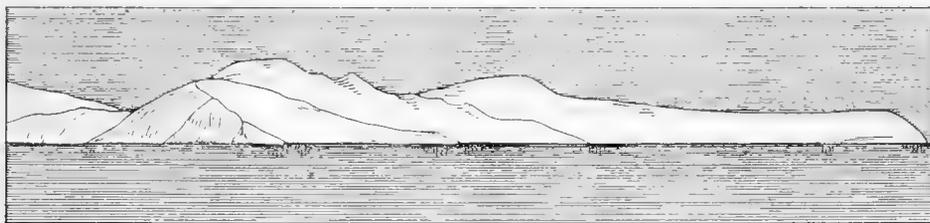
The western limit, within which the territories and dominion conveyed are contained, passes through a point in Bering Straits on the parallel of sixty-five degrees and thirty minutes north latitude at its intersection by the meridian which passes midway between the island of Krusenstern or Ignalook and the island of Ratmanoff or Noo-nor-book, and proceeds due north without limitation into the same frozen ocean.

The longitude being dependent on that of both Diomedes, was omitted from the treaty on account of its uncertainty. It has since been determined by Acting Assistant W. H. Dall, United States Coast and Geodetic Survey, to be  $168^{\circ} 58' 05''.38$ . Between the Diomedes is a good clear channel of 2 miles in width, and having 20 fathoms of water. The bottom is very hard and regular. Good anchorage may be had off the settlement on the west Diomede in 15 fathoms of water close in shore. About 10 miles south of Krusenstern is a high sheer-looking rock, to which Beechey gave the name of Fairway Rock. Its native name is Ooghuak. Although the passage from Siberia to America and back is made many times each year by the natives in their skin boats, and is not considered by them to be attended with any unusual amount of danger, I could not learn that it is ever made over the ice during the winter. The natives say the ice is always broken and subjected to great and sudden changes, rendering any attempts to cross it extremely hazardous. It is said that open spaces occur from time to time throughout the winter, which

contain numbers of whales, but that owing to the sudden changes which take place their capture is not attempted. Cape Prince of Wales, the northwestern portion of the continent of America, forms the east side of the straits. It is a high, rugged promontory, rising to a height of 2,500 feet. On the south side the mountain is steep to the sea, but on the north slopes away gradually, terminating in a strip of low land several miles in width. Off the end of the cape a dangerous shoal extends in a northerly direction, having at a distance of 8 miles 5 fathoms of water, and at 15 miles 7 fathoms. On the west side the shoal is abrupt, going from 5 fathoms to 25 in a distance of two or three ships' lengths. On the east side the change is more gradual, 9 fathoms, which was carried close up to the cape inside of the shoal, being the greatest depth found. This shoal is dangerous, from the fact that the whalers in leaving the Arctic late in the fall are often compelled to pass near to avoid the ice which accumulates in the west side of the straits after the northeast winds begin to blow. There are two native settlements at the extremity of the cape, one being on the beach and the other on the side of the hill.

The natives are the worst on the coast, being generally feared by all with whom they come in contact. When no one else is at hand they are said to fight with each other. Their disastrous encounter with the crew of the trading brig W. H. Allen, of Honolulu, was referred to in my former report. The lesson taught them at that time seems to have had a beneficial effect, as they have not attempted to molest white men since.

East Cape, called by Nordenskjöld Daschner, which forms the west side of the strait, is a bold promontory connected to the mainland by a low neck. Like Cape Prince of Wales, it has at a distance the appearance of an island. It is the most eastern point of the continent of Asia, and also of what is generally termed the Tchuktchi Peninsula. It has two native settlements, one on the north side and one on the south side. The natives are Tchuktchis, but owing to their long intercourse with the Innuits have acquired many of their habits. A few Inuit words are also in use among them, as well as Kanaka and English, and occasionally they put in a few adjectives in Portuguese. The effect of this general mixture is extremely ludicrous. After passing East Cape we steamed to the southward until 10 o'clock p. m., when we came up to an immense field of ice, closely packed and extending east and west as far as we could see from the mast-head. Following its edge for a distance of 20 miles without finding its eastern limit or any indication of a lead through it, and the wind freshening, with indications of approaching bad weather, we hauled up for Saint Lawrence Bay, not caring to encounter a gale at sea in our crippled condition. We reached the north side of the bay at 7.30 a. m., and came to anchor in 7 fathoms of water off the mouth of a fresh-water stream, upon the east bank of which is a small native settlement. The ice in the inner bay was still unbroken. The natives came on board and we tried



CAPE KRELONGOUNE, BEARING WEST, MAGNETIC DISTANCE 10 MILES. (SOUTH HEAD OF SAINT LAWRENCE BAY.)

to buy some reindeer-skins, but did not succeed. Formerly large herds of reindeer were owned and kept at this place, but for some cause they have been taken away. One large herd owned by a former resident of Saint Lawrence Bay, by the name of Omniscott, is now kept at Mechigone Bay, about 30 miles to the south and west. The owner, a modest, dignified old man, who talked but little, made us a visit, having come from the "Southlead," about 10 miles, where he had a son living, whom he was visiting at the time of our arrival. Although evidently disappointed when told that we were not there for the purpose of trading, and had no whisky, he was very

friendly, and invited us to visit his place, promising to sell us all the deer skins we needed if we would do so. We bought some walrus tusks, and paid him in tobacco, of which he was entirely out. His son, about twenty-five years of age, who spoke some English, offered to accompany us to Plover Bay, and act as interpreter. Thinking he might be of some use, and being desirous of obliging the father, who appeared anxious to have his son visit Plover Bay, I consented to take him. Although of some use as an interpreter, I had cause before long to regret having done so. He became insane, and made a desperate attempt to commit suicide, and gave us a great deal of trouble in many ways. The wind continued to increase till noon, when it was blowing a strong gale. During the afternoon the bark Francis Palmer came in and anchored near us, and later in the evening the brig Hidalgo came in and attempted to anchor, but her chain parting, she stood off to the eastward again under short sail. The gale lasted until the evening of the 6th, when it moderated, and we were enabled to clear the decks of the Tehuktchis. Several boat loads had come on board as soon as we arrived, and the rapidly increasing gale had prevented their return to the shore. We were glad enough to see them depart, as they are great beggars, and of course, under the circumstances, we could not refuse them food. We gave them a lesson in civilization by insisting upon their dividing everything given them with the women.

On the morning of the 7th we got under way early for Plover Bay, which we hoped to reach that night. We were, however, again doomed to disappointment, for a field of ice extended from Indian Point to Saint Lawrence Island, probably the same we had encountered before, having been driven south by the gale of the last three days. Being unable to reach Plover Bay, we steered for Saint Lawrence Island through heavy fields of drift-ice, arriving at midnight, and anchoring off the northwest end, we had a strong northeast current during the day (east-northeast true 30 miles). On the following day the wind was moderate, southwest, and the weather thick and snowing. Large quantities of drift-ice passed to the northward along the west side of the island, at times going at the rate of 2 miles an hour and then slacking its speed until its motion was hardly perceptible.

On the 8th we made an attempt to find the wreck of the schooner Lolito, reported by the natives to be on the beach a few miles to the eastward of our anchorage. We hoped to be able to utilize her rudder pintles. After searching several hours without finding the wreck we gave it up, on account of the ice and thick fog, and returned to our anchorage.

On the 9th the wind was still southwest and snowing, with large quantities of ice drifting past to the northward. Occasionally a portion of the drift would swing around the point near our anchorage, once coming so close as to necessitate our moving nearer in-shore to avoid it. The weather being thick most of the time, a sharp lookout was kept on the movements of the ice, heavy banked fires kept, and the chains on the windlass all ready for getting under way at a moment's notice. On the morning of the 10th, at about 4 o'clock, a large floe came directly towards the vessel. It was snowing hard and very thick at the time, so that the ice could not be seen until it was less than a cable's length distant from the vessel. It came in like a solid wall, drifting directly towards the shore and extended each way as far as we could see and looming up through the blinding snow-storm, growing higher and more distinct as it came nearer until it seemed all ready to fall on and crush us. On the other side the perpendicular cliffs of the island seemed almost directly overhead and the discordant notes of the sea-birds perched on the rocks were becoming more and more distinct each moment as the narrow belt of open water between the boulder-lined shore and the incoming wall of ice grew gradually less. To be caught under such circumstances meant certain destruction, and but one way of escape seemed possible, namely, to force the vessel into the floe and take the chances of the nip in the ice, which was sure to follow. No time was to be lost and whatever was to be done must be done promptly, as the vessel was being forced steadily towards the rocks. The floe presented such a solid front and our jury rudder acted so imperfectly that we had difficulty in getting into it. After repeated failures to enter the ice head on, the jury rudder was broken and had to be triced up across the stem. By backing full speed we succeeded in forcing the vessel several lengths into the pack, the ice of which was so high as to endanger our boats hanging to the cranes. Happily we received no other damage than the breaking of the jury rudder, which was easily repaired. After several hours we were released. The ice setting off-shore again and the weather having cleared, we steamed to the eastward

along shore in search of the wreck of the *Lolito*, which was discovered about noon well up on the shore. Anchoring about a mile outside in four fathoms of water, we found the wreck embedded in the shore ice, which at this place was still unbroken. The hull appeared to be but little injured, but the wreck had been stripped of everything movable by the natives. A party of men in charge of an officer landed and commenced cutting ice away from around the stern. Unfortunately, after several hours' hard work, it was discovered that the rudder and pintles were broken. We got some bolts and bands and a part of a wire backstay, all of which were useful. We also took on board two barrels of oil which were found on the beach. These were subsequently sold at San Francisco, and the proceeds used for the benefit of the vessel. Judging by the quantity of drift-ice in the sea that we would not be able to get the vessel on the beach in Plover Bay for some time, and realizing our helpless condition in the ice or in a gale at sea, it was decided not to wait until the vessel could be put on a beach, but to repair the damage at once as best we could. The rudder having already been scarfed and bolted, a lower pintle was made of a piece of 1½-inch iron bolt, fitted by sawing into the strap of the old metal pintle, and held in place by two iron strips fitted over it and bolted through the rudder. A middle pintle was made of a spare 200-pound anchor, the shank of which was cut off 18 inches from the crown, and was driven into the rudder, a hole of suitable size having been bored for the purpose. The arms being left about 6 inches long, one was let into the rudder by sawing into the metal straps as in the first case, and the other arm serving as the pintle was fitted into the socket. This done, we shipped the rudder, and in place of the upper pintle, figure-of-eight lashing of wire rope was passed through a hole previously cut for the purpose in the rudder and around the rudder post. The rudder head, owing to its having been shortened by the scarf, could not be connected with the screw steering gear. The wheel ropes running to the pilot-house were rove off and got in readiness for connecting up when needed. An extra pair of wheel ropes connected with the preventer tiller through leading blocks on each quarter, and running outside the monkey rail were rove off and connected with the pilot-house wheel in order to relieve the scarf as much as possible. The latter were used most of the time. I hoped by putting the vessel on the beach to get a lashing on well down to support the heel. Although unable to do so, we had made it quite strong and had no fears of its giving way, unless struck by a heavy blow near the heel.

On the following morning, June 11, we made an early start and after working to the northward several hours, through heavy drift-ice, we came to spaces of open water and shaped a course for Plover Bay, where we hoped to take in some coal. After working through heavy drift-ice all day, about midnight we came to the sound spit, which forms a natural breakwater in the only place where anchorage can be found in the bay on account of the great depth of the water. As I had feared, the ice was found unbroken inside the spit, and we could only be made fast to its edge, a distance of a mile and a half from the coal pile. The following day we tried to cut a dock in the ice by blasting with powder, but the charges, which were exploded under the ice in tin cans, had no other effect than to break a hole of a few feet in diameter and send a column of water into the air 15 or 20 feet without cracking the surrounding ice. The ice, which was melting rapidly, was soft and spongy and had not that brittleness which it has in cold weather.

On the morning of the 13th, all hands were turned to coaling ship. We had constructed two large sleds which would carry about half a ton each, and dividing the crew into three parts, one part was put at the coal pile to fill coal into sacks, while the other two were drawing it to the ship on the sleds. The distance from the coal pile to the vessel in a direct line was about a mile and a half, and the rapidly melting ice was very soft on the surface and covered with deep pools of water. Notwithstanding the long distance and the unfavorable conditions, with the assistance of the natives we succeeded in taking in about nine tons a day. The natives used their sleds and dogs and assisted our men at the drag-ropes of the large sleds. The Plover Bay natives are not fond of work, and when employed require constant urging. They are Tchuktchis and were once powerful and wealthy, having large herds of reindeer. Now only a few poor miserable wretches remain, and but one small herd of deer. Contact with civilization has wrought the change. I saw among them a very pretty half-breed girl named Pelurza, about five years of age, with bright clear blue eyes and light curly hair. Her history, as told by the natives, is as follows: Two white men coming to Plover Bay in a trading-vessel were left on shore with a stock of liquor

to trade to the natives and each took a native wife. The wife of the younger, and mother of the child, died in giving her birth. According to native belief the white man was responsible for her death and, in pursuance of their doctrine of blood for blood, must be killed. Accordingly, one night an attack was made on them, in which the father was killed and the other driven off. The child has since been cared for by a relative of the mother. The natives were very reluctant to speak of the matter, fearing trouble to themselves, and it is possible that the story as told by them may not be entirely true. However that may be, the main facts remain the same. This beautiful little child is growing up in ignorance, surrounded by filth and vice in their worst forms, and unless some friendly hand is stretched forth to save her, her fate is easily foretold. Although so far away she is easily reached. Almost any of the whaling captains would take her on board their vessel and carry her to San Francisco, if assured that she would be provided with a good home and properly cared for.

On the afternoon of the 13th a sail was reported entering the bay, and soon after the whaling bark Thomas Pope, Capt. M. V. B. Millard, made fast to the ice near the Corwin, being homeward bound with a full cargo of bone and oil, and having called into Plover Bay for fuel and water.

On the 14th we worked all day, drawing coal on the sleds, assisted by the natives and two sleds with three dogs each, but the rapidly melting ice made it very tedious. On the 15th we continued work, although the softness of the ice compelled us to reduce the loads to one-half their former size. About 4 p. m. a slight roll of the vessel was perceptible, indicating a swell coming in from the outside. At the same time a slight undulating motion of the ice was observed. This was followed by cracks in the ice running in every direction, and we had barely time to take in our ice anchors, call our men on board, and take the Thomas Pope in tow before the ice was all broken and in motion and rapidly drifting toward the mouth of the bay. At first it looked as if we might have to go to sea to avoid it. The wind by this time was blowing fresh from the north-east with a thick snow-storm, and, judging from the roll coming into the bay, a heavy sea must be running. Added to this was the fact of the sea being filled with large fields of heavy drift ice, making the prospect anything but a pleasing one. After lying off outside the ice for an hour or two, and just when it seemed as if our only hope was in putting to sea, Captain Millard reported from the mast-head that the whole body of ice had started off-shore, and that if we could get in through it we could find good anchorage in clear water. Although the ice was pitching and rolling badly, it was well broken up, and we determined to make the attempt, and succeeded better than I had anticipated, and about midnight we came out into clear water, and anchored near the shore in 12 fathoms, the Thomas Pope coming to just outside of us in 20 fathoms. During the night the wind moderated, and the flood-tide brought much of the ice back into the bay, so that in the morning we were again entirely surrounded by it, and the boats sent away to fill water being unable to return to the vessel, we were compelled to get under way and pick them up. We succeeded in getting on board a supply of water during the day, and as the bay was so filled with drift ice that we could do nothing coaling, we got under way early on the morning of the 17th, and, taking the Thomas Pope in tow, worked out through the drift ice and down past the sand spit. At the entrance of the bay we found a small field of heavy sea ice. A heavy swell rolling in from seaward made the ice tumble in such formidable manner that I did not care to venture into it with a vessel in tow; so just before reaching the edge of the floe we rounded to, sending our mail-bag on board the whaler. Wishing her good-by and a pleasant passage, each entered the ice on his own account. After tumbling and bumping along in it for an hour or more we came out into clear water, none the worse for our experience, the whaler shaping a course for the Oonimak Pass and the Corwin for Norton Sound.

On the afternoon the weather became foggy, necessitating a constant use of the lead. At 8 p. m. we were off the northwest end of Saint Lawrence Island, as shown by the soundings, which are here very regular and an excellent guide to the passage between Saint Lawrence Island and the mainland. These soundings are very correctly shown on the American Hydrographic chart of Bering Sea and the Arctic Ocean.

On the morning of the 18th the weather cleared, and we steamed to the eastward all day, with clear, pleasant weather. This was the first fine day we had experienced since sighting the Aleutian Islands, and almost the first without a snow-storm. All enjoyed the change very much. The

atmosphere was unusually clear, making objects visible a long distance. The high hills on the north side of Norton Sound were raised up by refraction, and their white snow-clad peaks gleaming in the mirage produced many very beautiful effects, at times coming clearly into view and assuming a thousand fantastic forms, then as suddenly passing from sight only to reappear a moment later apparently nearer and clearer than before. During the night of the 18th we passed several small patches of ice, but nothing to interfere with our progress, and on the following morning we arrived at Saint Michael's. During our passage through Norton Sound we noticed a large quantity of drift-wood, also a great deal of reddish-colored water, with a temperature of 38° and 40°. This is a portion of the water discharged from the northern mouth of the Yukon, which crosses Norton Sound and striking its northern coast is deflected to the westward, and passing Cape Prince of Wales enters the Arctic Ocean. This fresh water does not mix readily with the sea water and in calm weather its western edge may often be traced for miles both by its color and temperature. In the spring, when the water in the rivers is high, large quantities of drift-wood are brought down, much of which is deposited on the north shore of Norton Sound between Cape Nome and Cape Prince of Wales; the beach is thickly covered with it, and it is found in smaller quantities to the eastern limit of the bay. This stream of fresh water, however, is only superficial; being lighter than the sea water, it remains on the surface until agitated by wind or current, when it loses itself in the sea water. Captain Beechey, while sailing along the coast between Point Hope and Kotzebue Sound in *H. M. S. Blossom*, in 1826, found a current with a velocity, at times, of three knots. By means of the patent log, however, he learned that this current was confined to a depth of between 9 and 12 feet, the specific gravity varying from 1.02502 to 1.0173, with a temperature of 58°. This water discharged from the rivers emptying into Hotham Inlet and Eschschooltz Bay and a few smaller streams discharging into the bay of Good Hope (as the head of Kotzebue Sound is sometimes called) is like that from the Yukon, and does not mix readily until agitated by wind or current.

On the morning of June 19 we reached Saint Michael's, and, to our great delight, found the weather fine. The snow was all gone, the hills bright with beautiful, fragrant flowers, and the air filled with song-birds. The change from the ice, snow, fog, and wind with which we had been struggling for the last month was so very great, that it was difficult to realize that we were barely outside of the Arctic Circle. One of the most remarkable and interesting features of the Arctic climate is the rapid, almost magical, change of seasons from the ice, snow, cold, darkness, and desolation of winter to the warm, bright sunshine, sweet flowers, and merry singing-birds of the summer. There is no lingering spring or autumn in the Arctic regions. Summer and winter follow one another so closely that it may be fairly said that there are but two seasons. On our arrival in Norton Sound one year ago this date we were stopped by the ice about 16 miles from the settlement, and the country in all directions was white with snow. A few days later (7th of July), after a short cruise into the Arctic, we again returned to Saint Michael's, and found the ice and snow gone and the grass springing up, flowers in bloom, and the air so filled with mosquitoes that it was with great difficulty that observations could be taken on account of thousands of these little pests covering the lenses of the instruments. Our arrival at Saint Michael's was hailed by a salute of two guns from each of the two trading companies located there, which we returned. Soon after our arrival a small trading steamer belonging to the Western Fur and Trading Company arrived from the Upper Yukon, bringing some of the company's traders and the furs purchased by them during the past winter. They reported a mild winter, and a light fall of snow, not exceeding two feet at any time. A good deal of complaint is made by the traders of the conduct of the Indians, which, they allege, is growing worse each year. It is said they demand credit, and when goods are obtained in this way they refuse payment and make their own terms with the traders, often compelling them to pay more for the furs than they receive from the companies. By allowing them their own way during the past year the traders have avoided many serious quarrels. But it is believed that unless some action be taken by the Government serious trouble is sure to come before many years, and it is not unlikely that it will result in an expensive war. Of the tribes on the Yukon and its tributaries, as many as could be concentrated would participate in case of an Indian war. The causes that have led to this are various. One is that several perpetrators of cold-blooded murders are now running at large in the Territory, with no effort being made for their apprehension. I re-

ported the facts of some of these murders last year, and recommended that some official action be taken to bring the murderers to justice. I now respectfully renew the recommendation. Another prolific cause of trouble has been the treatment of the natives by the traders in times past, there being great opposition between the traders of the two companies. Each, in order to gain the goodwill of the natives long enough to secure their furs, would take the worst men of the tribe, they having generally the most influence with the others, and make them presents and show them other marks of distinction. Then, neither side hesitated to encourage the Indians to cheat the other side by refusing to pay their debts. At the stores they ask and receive credit for food and other articles until such times as they can pay, and when they come in with a supply of furs, instead of paying their just debts, they not unfrequently take them to the opposition store, where they are readily bought, notwithstanding the indebtedness may be well known. Then, to avoid an outbreak, the traders do not hesitate to tell them each year that troops or Government aid in some form will be sure to arrive when the boats return from the mouth of the river the following season. At first this had the desired effect, but they have seen the boats return so many times with only the traders that now they have lost all faith, and say openly they do not believe any aid will be sent.

As a specimen of the treatment of criminals by the traders in the past, it may be mentioned that Larriown, the murderer of Lieutenant Barnard, R. N., for many years before his death, which occurred about three years ago, made annual visits to the trading posts at Saint Michael's, where he was treated with the greatest consideration by the traders, presents made him, &c. The murder of this gallant young Englishman was one of the most barbarous and uncalled for ever committed in the Territory. He was an officer on board H. B. M. ship *Enterprise*, Captain Collinson, which fitted out from England, and in company with the Investigator sailed for Bering Strait for the purpose of prosecuting in that direction the search for tidings of the expedition under Franklin. Both vessels arrived at the straits in the summer of 1850, but the *Enterprise*, being a slow sailer, did not arrive until too late to pass Point Barrow that season, so turned back and wintered at Hong-Kong, and returned to the Arctic the following year. Hearing rumors of white men having been seen on the Upper Yukon, and believing it possible that it might be some of the Franklin expedition making south in that direction, Lieutenant Barnard asked for and obtained permission to remain at Saint Michael's, or Michaelofski Redoubt, as it was called by the Russians, and make a trip up the river. He arrived at Niolates the following spring, and while there the Koyukuns, a neighboring tribe, became offended, at some imaginary insult, and, to avenge themselves, attacked the Niolates people, and massacred almost the entire tribe. Lieutenant Barnard, who was in bed ill at the time, was attacked in his room. He seized his gun, which was near him, and fired two shots, but without effect; the gun being struck up, the balls lodged in the ceiling. He was stabbed in the abdomen by Larriown, after being seized and disarmed. Barnard died after several days of suffering. The massacre was a most atrocious affair, and the mention of it now only serves to show what these people are capable of.

This country, which at present produces nothing but furs, the majority of which go to the two large trading companies located at Saint Michael's, is believed to be rich in minerals. In its rivers are an abundance of the finest salmon in the world. In a few years undoubtedly these interests will be developed, bringing in a large number of white men, and, unless some action is taken to prevent it, serious complications may occur. A trail is now being cut from the Yukon to the headwaters of the Chilkat, and it is not unlikely that some of the miners from Southeastern Alaska will find their way through there the present season.

The traders from the interior report that, owing to the light fall of snow in the Yukon country, the Indians were unable to kill moose enough for food, and in consequence a number of them died of starvation. In many settlements they suffered severely. They hunt moose on snow-shoes, the deep snow enabling them to approach the game, which they kill with bows and arrows.

The schooner *Flying Mist*, being in port at Saint Michael's, was thoroughly examined. She had on board 25 gallons of whisky, with a permit to carry the same from the San Francisco custom-house. The *Flying Mist* was in the hands of the same parties who had charge of the schooner *Leo*, which was seized by this vessel last year. (R. C. Walker, master, and C. L. Lieninski, agent.) The schooner was fitted out for taking seals, having on board seal-clubs for killing them, and salt for preserving the skins, and was apparently bound on a predatory cruise around the seal islands

later in the season. On the arrival of the steamer *St. Paul*, from the seal islands, I received a letter from Col. Harrison G. Otis, special agent in charge at that place, which contained the following :

On the night of the 8th instant, a schooner, supposed from her suspicious movements to be on a predatory mission in these waters, was sighted off the east side of the island bearing in a northerly direction, and next morning at 2 o'clock she was discovered by the lookout at Northeast Point, standing close in shore. Late in the morning, after the men on shore commenced moving about, she stood out to sea.

As parties on board the *Flying Mist* acknowledged to having been in the vicinity of the seal islands, she was undoubtedly the vessel referred to by Colonel Otis, and our suspicions as to their intentions were confirmed. She had probably been frightened off by seeing the men on shore, and would return later in the season when the nights were longer, and endeavor to take seals during the night and stand off shore before daylight.

Our stay at Saint Michael's had been enjoyed by all. Professor Muir took long rambles on shore, studying botany, collecting specimens, etc. Some necessary work on the boiler and engine and taking in a supply of coal detained us until the evening of the 21st, when we got under way and proceeded direct to Saint Lawrence Island. Mr. E. W. Nelson, naturalist in the employ of the United States Signal Service, accompanied us for the purpose of taking notes on the natural history of the country, and making an ethnological collection at the deserted native settlements on Saint Lawrence Island and other places.

We arrived off one of the deserted villages on the morning of the 23d, and stood in for an anchorage, but a northwesterly gale coming on compelled us to change our plans and haul off shore. In carrying sail hard to get off the lee shore and clear the northwest point of the island the weather-jib guy parted, carrying away the jib-boom. Fortunately we had taken on board the jib-boom of the wrecked schooner *Lolita*, which made a very good substitute. After clearing the point of the island we stood in on the west side and came to anchor close in shore, but the wind backing to the north-northwest during the night, drew on shore and made our berth very uncomfortable.

On the morning of the 24th we ran down to the south side of the island and anchored off a deserted village. The sea was quite smooth, although the wind blew down off the high cliffs in terrific gusts. Owing to the strength of the gale we were unable to visit the shore and make an examination, but it is probable that this was one of the villages depopulated in the terrible famine which visited the island in the winter of 1878-79. We were informed by the natives at the Northwest Cape that at a settlement on the south side a few of the natives were still alive, and, as we saw no signs of life at this place, although the shore was constantly scanned, I concluded that there must be another settlement farther along the coast to the eastward. The wind moderating a little towards night, we got under way, and steaming slowly to the eastward, with the lead going, and keeping a sharp lookout on the shore with the glasses, we were at length rewarded by the sight of two houses, which appeared to be occupied, situated on the top of a small hill. Hauling in for them, we came to anchor near the shore in six fathoms of water. The location of these houses on top of a hill at first caused some surprise, as it was contrary to their usual custom of establishing themselves near the shore. For greater convenience in using their skin boats, they build at the point nearest to their place of landing, where the snow does not drift. A landing place is selected with a view to two things, namely, a sloping bank for the convenience of launching and hauling out their boats and game, and water sufficiently deep near the shore to enable them to land without much difficulty the walrus and whales captured. Landing and making an examination, the cause of the singular location of their houses was apparent. The original settlement had been near the water, on a slightly elevated flat, protected from all winds except southeast, but during the famine all the inhabitants had died, with the exception of those now occupying the two houses on the hill, about sixteen in number, and as their blanched corpses were now lying on the ground in the immediate vicinity of their former houses, and even inside the houses, so that it was almost impossible to get around without stepping over them, the survivors had withdrawn to the hill to avoid the ghastly sight.

From the report of the natives on the north side of the island last year, I estimated the number who had died at this place to be 75. This I find is very much below the truth. Professor Muir,

who carefully examined the houses and ground in the vicinity, places the number at 200. While lying here the natives visited the vessel several times and we had a good opportunity of inquiring into their condition, which is truly a wretched one. They were, however, well supplied with seal meat and fish, and seemed in no danger of immediate want. Near one of the houses I counted eight empty whisky casks. Mr. Nelson took some photographs of the houses and people; the latter, however, not without some difficulty. They showed great dread of the camera and evidently believed it was "bad medicine." At one time, after repeated failures, on account of a high wind, to photograph some women and children, Mr. Nelson shook his head and said, "No good," and started to take the camera away, when one old native approached and asked if they would "all die now." Upon being assured that the camera was not gifted with such extraordinary powers as he supposed, he asked, with much disgust, "What is the use of it, if it won't tell us that much?" Saint Lawrence is a great resort for emperor geese, of which we saw many large flocks while in the vicinity of the island. As a rule they were flying away from the land in a southwest direction, but as they flew very low it is not improbable that they were merely changing to the lee side of the island on account of the rough water to windward. While at anchor off this settlement, waiting for the gale to abate, an unfortunate incident occurred, which came near ending the life of the young native taken on board at Saint Lawrence Bay. He had been acting strangely for some time, but being naturally a great coward, we attributed his strange actions to fear. Being refused permission to visit the shore, he made a desperate attempt to commit suicide, first stabbing himself in the left lung and then jumping overboard. He was taken out of the water and after receiving such medical treatment as his case demanded was placed under guard. We got under way soon after the occurrence and proceeded to Plover Bay. I hoped to get the lunatic home before he died, or at least to get him among the natives who were acquainted with him, so that the facts in his case might be understood by them, fearing that if not taken back alive his father would make it a pretext to refuse to sell us deer skins unless we made him large presents. I was also afraid that they might believe that he had been killed by some one on board, and kill a white man by way of revenge at the first opportunity. We reached Plover Bay early the following morning and anchored near the coal pits. The would-be suicide, although still wandering in his mind, was gaining strength and seemed likely to recover. He yet had a constant fear of my shooting him, and was in great misery whenever I came in his sight. Owing to his critical condition, and the uncertainty of his living until we could reach Saint Lawrence Bay, I determined to leave him with the natives at Plover Bay, a plan which seemed to be to his liking, for he was anxious to get out of the vessel. Before allowing him to go on shore, I consulted with two or three of the most intelligent natives of the settlement; stated his condition, the attempt at taking his own life, etc., and asked if they were willing to take charge of him, which finally they agreed to do, and came with a boat and took him away. Returning to Plover Bay a month later and inquiring whether the "crazy," as the natives termed him, had got well, they said, "Oh, yes; small well; gone home," and upon questioning them we learned that a few days after our departure from the bay he had started to walk to his home at Saint Lawrence, a distance of one hundred and fifty miles. It was subsequently learned that he had reached there safely, and, as a proof of the continuance of his delusion, he reported that "the captain" had stabbed him and thrown him overboard.

Taking on board fifty-four tons of coal we left the same evening, intending to stop at Saint Lawrence Bay, proceed north, and touch at Tapkan to learn whether our sledge party had returned to that place. About midnight we passed Indian Point (Cape Tchaplín), where a large number of Tchuktchis, coming off in their oomiacs, called to us to stop and trade, but being anxious to meet our party, no stop was made. The following morning (June 27), having arrived at the south head of Saint Lawrence Bay and anchored, natives soon came on board, and upon one of them offering to pilot us to the "durman's" place, we got under way and steamed westward to the mouth of Mechigme Bay, which, to our great disappointment, we found still filled with ice. Communicating with several native settlements in the vicinity, and leaving word for the durman of our intention to reach his place later in the season, we proceeded north. The natives encountered in the vicinity of Mechigme Bay, a very inferior looking set, are remarkable for having the worst looking faces of any natives seen by us on either continent, even worse than those of Saint Lawrence Bay,

whom they very much resemble in appearance and character. They are reported to fight among themselves and steal from each other whenever opportunity offers, and numerous scars of knife and bullet which we noticed bore silent testimony to the many desperate encounters in which these natives had engaged. Passing Cape Krelougoune in the evening, the course was shaped for the west Diomedé island, which was reached on the following morning, after steaming through a succession of fog banks all night, at times having clear, bright weather, and at other times fogs so dense that it was impossible to see the length of the vessel. Anchoring close in shore, the natives, as usual, soon came on board. Wishing to leave a boat's crew on this island to take current observations, I selected two of the natives who appeared to be looked upon as leaders, and making known to them my plan, asked if they would render the crew any assistance they might need, and see that they were not annoyed by the other natives. They said if the men were placed in their charge they would assist them in every way possible and see that no harm came to them.

The only fear I had was that they might be annoyed by thieves. Our interpreter, a Saint Michael's half-breed, claimed to have heard the natives planning to rob our men after the vessel left, but considering this only an invention on his part, got up to avoid remaining, which it was evident he did not want to do, I gave the matter no serious attention. Dick, one of the natives to whom I had spoken in relation to the boat's crew, said he would take them to his own house and see that nothing was stolen from them. This was the same man who on a former visit so promptly told me I lied when I assured him we had no whisky to sell. He seemed quite proud of the trust reposed in him, and ordered the other natives around with an air of great importance.

A small anchor with a line and buoy attached was dropped well outside the eddies to serve as a boat mooring; the crew was supplied with instruments for making current and meteorological observations. Two commissioned officers being already absent from the vessel, I placed the boatswain in charge of the boat. The party consisted of the boatswain, one quartermaster, one seaman, and the interpreter. Having giving them the necessary instructions in relation to taking observations and cautioned them to avoid all trouble with the natives, we sent them on shore and got under way, shaping a course for Cape Serdze Kamen. We passed near East Cape with the intention of communicating with the natives, but were prevented by a fresh northeast wind which, blowing directly on, made a heavy surf on the shore. Steaming to the northward during the night, on the following morning we arrived off Tapkan settlement and anchored outside a rim of ice which extended two or three miles from the shore, the wind blowing fresh from the northward and quite a heavy sea running. Soon after dropping anchor, the American flag was seen flying from the top of a tent that looked smaller and whiter than the surrounding ones, and we knew that our sledge party had returned. As soon as this became known, speculation ran high throughout the ship as to what success they had met with. Had they found the Jeannette or learned anything of the fate of the missing whalers, how far had they been, &c.? It was not long before it was noticed that they were breaking camp, and soon after a general movement was made towards the ice, and when near enough to be seen distinctly we could distinguish the skin boat and saw that an attempt was to be made to cross over the ice. Although quite rough near the edge where the motion of the sea was felt, the feat was accomplished without accident. Before reaching the edge of the ice two boats were sent to assist, which they did by throwing a line to the skin boat and watching a favorable opportunity; both boats succeeded in reaching clear water, although not without a good deal of difficulty and danger. The wind had been increasing since morning and the broken ice along the edge of the pack was pitching and tossing furiously. The Tapkan dog-driver having come on board with our men to be paid for the work he had done, and the sea now being too rough to think of sending a boat to the ice again, he was asked whether he could get back from East Cape if put on shore there. Upon his assurance that he could walk home in three days we got under way and proceeded towards the straits. Lieutenant Herring and party reported having been as far west as Cape Wankarem, latitude  $67^{\circ} 50'$ , longitude  $176^{\circ} 50'$ . They had succeeded in finding the discoverers of the wreck, and had procured from them the following-named articles: One pair marine glasses, one pair silver-bowed spectacles in a tin case, a harpoon with the letters B. K. O. stamped on it in letters about five-eighths of an inch long, and the name "Macy," supposed to be that of the maker; two common black-handled table knives, one marked

with a letter "V" on the handle; a number of other articles, principally carpenter's tools and cooking utensils, were seen, but, having no marks by which they could be identified, were not taken away.

After leaving the vessel on the afternoon of June 2, the party made the best of their way to the ice, where they experienced some difficulty in embarking on account of the strong breeze, which raised a sea; but, fortunately, three natives who were sealing on the ice observed their approach and directed them to a lee, where they embarked in safety, at a place supposed to be about 5 miles northeast of Kolintchin Island, but as snow was again falling, the island, which had been in view but a few minutes, was again hidden. The dogs were very anxious to reach the shore after having been on board ship a week, and some time before they arrived at the ice several of them jumped overboard in their eagerness, and they had some difficulty in catching and harnessing them after all were landed. Sledges were packed and everything made ready for the start. Before this was completed, however, the Corwin steamed away and soon disappeared in the thick snow-storm. The sled upon which the skin-boat and some other things were secured broke down soon after starting, and, although it was repaired, would carry nothing but the boat, as the ice was very rough. It was a rather discouraging situation for sailors. Left on the ice in a blinding snow-storm, with a broken sled, not knowing the distance to the land, they found the native seal hunters, by whom they had been met, of great assistance; they helped our people carry their loads, and guided them to the settlement. The second start proved more successful, although the ice was very hummocky and the progress necessarily slow with such heavily loaded sleds; but the novelty of the situation, and the grotesque appearance of the party, clad in furs, soon put them in good humor, and, as the sledging grew better, the first 10 or 12 miles were passed without difficulty, when they found rough ice again, and frequent halts were necessary to give the dogs a rest. During these halts, natives would run away a short distance and scrape away the snow from certain places, where there were air-holes and nets in which seals are caught. They took a number in this way, and claimed the admiration of the party by the wonderful instinct with which they found these nets, for, although to all appearance there was nothing to mark their position, they found no difficulty in going straight to them. To set the nets, which are made of seal-skin, five holes are cut in the ice, one at each corner and one in the center of a square of about 10 feet. The center hole being much larger, the net is lowered down through this and the corners hauled up through the outer holes and fastened. When the seal comes to the large hole to breathe he becomes entangled in the net, and, being unable to rise to the surface, is drowned. To get the seal, a long pole, with a hook on the end, is put down through the center hole and part of the net hauled up; then they slack away the corners and haul seal and net upon the ice. Many seals were taken in this way, which the natives kindly buried in the snow in order to assist the sledge party to the village. The snow-storm soon abated enough to render the island visible, and it then appeared about 10 miles off. Two of the party were obliged to run along side the boat to prevent its capsizing and to ease the sled over rough places. The natives constantly shouted, "Ooh! Ooh!" at the dogs to urge them to greater speed, and as this seemed to be necessary to a skillful dog-driver, all soon learned the exclamation. About 9 o'clock the party stopped for a short rest. Not being accustomed to this method of traveling, it was at first extremely tiresome, and all would have been glad at this time to have pitched the tent and camped for the night, but as the settlement was only 10 miles away they pushed on after taking a short rest and a bite to eat. The ice still continued very rough, and as there were many holes, into which they often slipped, all were quite wet and exceedingly uncomfortable. In some places it was almost impossible to get the boat along, and more than once it was necessary to cut a passage between large hummocks to allow it to pass. They reached the settlement shortly after midnight, and were received by the whole population. The distance from the place of landing to this village was probably about 15 miles, in a direct line, but the sledge party were obliged to travel over 25 miles, owing to the condition of the ice, which they made in a little more than seven hours—very rapid traveling, considering all things. There are twenty-six huts and three hundred people in Kolintchen village. The chief received the travelers kindly, and gave them permission to pitch the tent, which was done in short order, the natives assisting or rather endeavoring to assist, for doubtless they were willing enough, though greatly in the way. Shortly after landing, our people were invited to the chief's hut, where Russian tea had

been prepared, the kettle belonging to the party having been borrowed in which to brew the tea. The chief's hut was crowded with curious people. A small box covered with a piece of checkered cloth served as a table. The tea service consisted of four decorated china cups and saucers which had been brought from some Russian trading post. The tea-drinking lasted fully two hours, the chief drinking one cup after another without ever appearing satisfied. He produced a small pouch in which he kept a few pieces of cube sugar, which was very much prized by him; occasionally he would bite a lump of sugar into several pieces and place a piece in each cup with an air of great satisfaction. After tea our people made a pot of coffee, which, being something new to the natives, they did not appear to like at first, but having decided that it was made to drink the chief plied himself with cup after cup for two hours. A feast of venison was next prepared, to which all were invited, but only one of the party remained to enjoy it, the others preferring to rest in the clean tent. It was not until 4 o'clock in the morning that any sleep was obtained, but as the weather in the morning was exceedingly stormy, rendering travel not only disagreeable but unsafe, the day was spent in camp. The islanders were very annoying by their curiosity, but it could not be wondered at, since "Joe," the interpreter, declared that many of them had never before seen white men. During the afternoon the island was explored. From the highest point, 1,200 feet above the level of the sea, open water could be seen twenty miles away. The mainland could also be seen at intervals as the weather cleared, about eight miles distant. Late in the afternoon the weather cleared up and the following day proved much pleasanter. Sea fowls and eggs were procured from the young natives for a small present of tobacco. The snow proving too soft for traveling, it was decided to wait until evening before making another start. However, the tent was struck and every thing made ready. Several of the dogs having accompanied a party of seal hunters did not return until late, which caused some delay. Before leaving all were invited by the chief's wife to partake of some fresh fish. They proved to be small cod, and if properly cooked would have been excellent eating. Two letters were left with the chief, one for the Corwin and one for the Rodgers should either vessel visit the place before the return of the party. The most searching inquiries failed to elicit any information regarding the object of the search. At 7 p. m. the start for the mainland was finally made, but the sleds being heavily loaded it took some time to get the dogs down to work. For a few miles the traveling was good, but afterwards the ice became rough, and the snow being soft and deep between the hummocks made progress slow and tedious. Two men were obliged to run beside the sled containing the boat, in snow and sludge up to the waist in many places. They were also obliged to assist the driving sled, as the dogs would frequently get stalled. The work seemed quite discouraging, especially since the only prospect was for warmer weather, which would render the snow more impassable each day, and even now it was found necessary to travel mostly by night. About midnight a short halt was made to eat supper and rest the dogs. The air was clear and a splendid view was had of the midnight sun. The snow was becoming very soft, and unless the ice, which in some places was very rough, could be followed, it was feared the sleds and boats would have to be abandoned. At 2.30 a. m. the village called Unatapekan was reached. This is the summer dwelling-place of the people of Koliatchin. During the winter the natives cross to the island, pitch their tents, and hunt seals, but when summer comes they return to the mainland. They leave all their boats at the village of Unatapekan, as they are not used in the winter. A short delay was made here to examine the places. There were a number of boat-frames resting on scaffolds and fishing and hunting implements scattered about, which spoke well for the natives' honesty, since this village is on a sort of highway. The members of the sledge party found these people very honest; every little article left accidentally within their reach was promptly returned. The dogs began to show signs of fatigue and hunger also, but as nothing could be procured at the settlement they could not be fed, and after a short rest they pushed ahead again. Plenty of drift-wood lined the beach, and whenever a halt was made a fire was built to dry clothing and warm the tired and stiffened limbs of the travelers. On account of the bad condition of the ice, it was necessary to make a circuit of 25 miles from the island to the mainland, although the distance is only about 8 miles. The journey was continued until 7 o'clock the next morning, when a camp was made for the day and breakfast eaten with a relish; pemmican and granulated potatoes steamed together, making a very palatable dish. It was at this time a matter of congratulation that there were no natives near, and a quiet day was expected, but in a few minutes four teams



FLOVER BAY. TCHUKTCHI TENT. (YARANGA.)



MECHIGME BAY. TCHUKTCHI WOMAN.



S. EX. 204, I, 48.

INDIAN PT. SIB. (CAPE TCHAPLIN.)  
TCHUKTCHIS TRADING.



HELIOTYPE PRINTING CO., BOSTON.

TCHUKTCHIS FROM CAPE NORTH, COAST OF ASIA.  
MET AT CAPE PRINCE OF WALES.

*Photo. by Nelson.*



came in sight, and four natives from Tapkan were soon in camp. From them meat was obtained for the dogs for a few pieces of tobacco, which more than compensated for the loss of rest caused by their arrival. Breakfast was also shared with them. After breakfast all sought the rest they so much needed, having dragged sleds, without sleep or rest, for twenty-eight hours. The country thus far seems to have been entirely barren of game, none being seen, although search for it had been made many times. At 5.30 p. m. arrangements were made for another start, but the ground being covered with newly-fallen snow, through which the sleds cut at every step, it was impossible to proceed until it had frozen; so they waited until 1.30 a. m., June 6, before starting, when the track was quite good, although the ice in all directions showed signs of breaking up, and was covered with water, and as the dogs invariably refuse to go into water unless beaten, it was necessary to wade through with them to prevent their turning back. These dogs, which we had picked up at different places, had never before worked together, or it would not have been so difficult to drive. There were nine dogs attached to the large sled, and the leader, a dog belonging to Joe's team, constantly watched the others and would occasionally, when he found them shirking, turn and give them a sharp bite. As they were great shirks, this would have been extremely gratifying, but by so doing he caused such a commotion among them and got them so entangled in their harness that it was often necessary to stop and clear them, and as the harness is so constructed that the dog has little difficulty in getting away, the escape of several under such circumstances is no unusual thing. As they are very rapid runners after becoming frightened they are not easily caught, and it can only be accomplished by strategem. The native entices runaway dogs within reach in a way which is both novel and effective, but disgusting in its character. On the 6th a large number of reindeer were met. They were being driven down the coast in search of good grazing ground. One of the dogs had just freed himself from his harness and defied recapture. Fearing that he would chase the deer and cause them to stampede, which might result in trouble with the owners of the herd, the dog was shot. The next village reached was Onman, at the cape of that name, which is a double one, there being a small beach between the two points. This settlement consists of only five huts and about sixty inhabitants. It was decided to rest here for a day or two, and as soon as the tent was pitched the chief sent deer-skins for beds and food for the dogs. The people all seemed very hospitable and kindly disposed. As usual along this coast, no game was found. From the top of the cape open water could be seen about 10 miles off shore. The cape is a precipitous rock about 1,000 feet high. On the top are sharp, flinty stones, covered with lichens. Off the northern point of the cape are several detached rocks, rising perpendicularly more than a hundred feet, and resembling huge monuments. About 12 miles south of Cape Onman there is a smaller point, not as bold or rocky as Cape Onman, with low land intervening. All of these cliffs give a fine echo. Whenever natives were met inquiries were made in regard to the missing vessel, and at this settlement (Onman) they were told that a broken vessel (wreck) had been seen by the people off Oncanina (Wankerem), a few miles farther up the coast. Accordingly our party pushed along the coast as fast as the poor condition of the traveling would permit. The snow was becoming softer each day, and many streams of water formed by the melting snow were encountered, which made traveling exceedingly difficult. About 5 miles northwest from Cape Onman a small settlement, called by the natives Euelpau, was passed, but no delay was made there. Notwithstanding the bad condition of the traveling, good progress was made, and the party reached Wankerem at 8.15 p. m. Wankerem is a small settlement of twelve huts and seventy-five inhabitants, situated on the west side of the Wankerem River. Our party was kindly received, and after giving the natives presents of coffee and tobacco made known the object of their visit. All the information in their possession was freely given. Three men belonging to the village had seen and boarded the wreck, bringing a number of articles from it. The men were sent for, and brought the articles with them, which were inspected, but the closest examination failed to show any marks by which they could be identified by our party as belonging to any vessel or person, with the exception of one knife which had the letter V carved on the handle, probably the initial of "Vigilant." The three natives said: Last fall, when the new ice was making, they were out sealing near Concarpio, an island off Cape Wankerem, and saw a wrecked vessel drifting down towards the island. The wind was from the northward at the time, and they went on board the wreck, which was half full of water. The three masts had been cut off near the decks, no boats could be seen, and the bul-

warks were gone in many places. The jib-boom was the only spar remaining in place, and on its end were a pair of deer's horns. Four corpses, three in berths and one floating in the water, were seen in the cabin. They had no beards, and their skin was dried up, black, and drawn tightly over the bones. Being afraid to stay long on board, they gathered a few articles and left the ship, leaving all papers and books, such things being of no use to them. The following night the wind changed to southwest, and the wreck, drifting off-shore, was seen no more.

The articles in possession of these people were one whaling-iron (Moy's make) marked "B. K. O.," two wood-saws, one ax, one marline-spike, one carving-knife, one jack-knife (Rodgers), two table-knives, one chisel, one saw-file, one soup-ladle (K. N. M. No. 10), one chopping-knife, one pair marine glasses, one bottle laudanum, three spades, one pump-handle, one shovel, two stove-pans, made in Philadelphia, one razor, one pair silver-mounted spectacles and case, one sailor's ditty-bag, containing needles, thread, &c., one linen jumper, one truss, one brace and bitt, one tack-hammer, one pair bullet-molds, one drawing-knife, one small lamp, one meat-saw, two pennies and one five-cent piece, two pieces of two-inch manila rope, one square lantern painted green, one adze, and one tin candlestick.

From the nature of these articles it is evident that the wrecked vessel was a whaler, and that the natives got into the galley and carpenter-shop. The absence of the boats and the fact that but four men were seen on the wreck would indicate that possibly a part of the crew tried to escape by taking to the boats. The masts had probably been cut away for fuel. The *Vigilant* had, when last seen, a pair of deer-horns on her jib-boom, as no other vessel in the fleet had, so far as known—a fact which goes far towards establishing her identity with the wreck. The natives were willing to part with any or all of these articles, but only those were selected which would be most likely to be identified, which were paid for with bread and tobacco. Having learned all the facts in regard to the discovery of the wreck, and having, through traveling parties of natives who had come from the vicinity of Cape Yakan, learned that no white man had been seen or heard of in that direction, it was deemed by our party useless to proceed farther to the west so late in the season, as they could not hope to extend their search as far along the coast, as they had already heard through the traveling parties, and, rightly judging that their services would be more valuable on board the vessel, they did not attempt to go farther, but started on their return trip.

The coast between Cape Wankerem and Onman is very low, but about 10 miles west of Cape Onman and 5 miles from the coast a mountain rises abruptly from the level tundra, presenting a splendid landmark. At this season the sun remained above the horizon throughout the twenty-four hours, and although its heat was not great, yet it shed warmth enough to prevent the snow becoming hard. An almost daily fall of snow or rain put fresh difficulties in the way of the travelers. At 8 a. m. the following day they reached Cape Onman, traveling 52 miles in twenty-four hours. On the morning of the 9th a start was made, but a severe snow-storm prevailing rendered traveling impracticable. The dogs were very hungry, but no food could be found for them at Onman. A boat belonging to the natives was nearly destroyed, the poor half-famished animals eating the cover and lashings in many places. The owner was pacified by a present of bread and tobacco, and about mid-day traveling was again undertaken. The new snow, which was well packed, had improved the traveling, and progress was quite satisfactory, a strong wind also being favorable. Late in the afternoon the herd of reindeer which had been seen a few days previously was overtaken. As usual, some trouble ensued with the dogs, but fortunately no more were lost. The west shore of Koliatchin Bay was followed, and the party were anxious to reach the eastern shore of the bay before camping. A number of seals were seen on the ice, but could not be approached near enough for a shot. During the morning the party met the Koliatchin chief, who returned the letters left with him, which he declined to keep any longer, as he was afraid they might contain unfavorable accounts of him. At noon Pelouin was reached; it is a settlement of three huts on the east side of Koliatchin Bay. Up to this time at least 65 miles had been traveled without camping, and, as all the party were much fatigued, it was decided to remain here for a long rest. The people were found to be as eager for presents of bread and tobacco and as curious in regard to the white men as all the others which had been met. Here the interpreter, Joe, succeeded in killing three ducks, the first which had been seen since the start. In the evening a start was made, and the morning of June 12, the snow falling and sleighing being very bad, camp was made near a fine stream, where

there was plenty of drift-wood, and the luxury of a warm fire and rest was thoroughly enjoyed after a hard night's traveling. Plenty of ducks were seen, but only one was killed. At night the journey was again commenced, in the midst of rain and snow, the sleighing being very bad and everything as uncomfortable as possible. Occasionally the sun came out from the dense clouds, and his warm rays were indeed cheering to the cold, wet, and discouraged travelers. In crossing one of the numerous small streams of water formed by the melting snow one of the sleds upset, and they barely escaped losing a large part of their provisions. At 4.30 on the 12th, after another fatiguing all-night march, tents were pitched and a short rest taken. Two of the party went upon a hill back of camp, from which could be seen mountains some distance inland and open water about 10 miles off-shore. In the evening a start was made, but it was impossible, on account of the rough character of the ice pack, to round a small cape, and they were compelled to draw the sleds up a steep hill 300 feet high and over about 2 miles of almost bare ground. Just to the eastward of this cape is the village of Youngilla (Iintliu), of six huts, where food for the dogs was procured and the journey continued. No one, unless accustomed to traveling in Arctic regions, can imagine the dreary monotony of each day's journey, when the traveler is assailed by blinding snow-storms or drenched with chilling rains, with no variety in the scenery to interest him. During a greater part of the time the landmarks are obscured by mists and snow, and when, as occasionally happens, the clouds lift and the sun appears, there is little to be seen but the lonely snow-clad hills, swept by the fierce winds from the north, or the ice pack extending out to sea. The next camp was made at 2.30 p. m., June 12, at the old winter quarters of the Vega (Pittle Keg). Some difficulty was here experienced in getting wood enough for fire, it having been used by Nordenskjöld's party, and but little having drifted ashore since. About 2 o'clock the next morning two men with dog teams came from Tapkan, having learned that the party were on the way with heavy sleds and but few dogs. They had traveled a long distance to lend assistance, not expecting or asking any pay for their services. After transferring a portion of the equipments to the sleds of these natives the journey was continued. The next settlement reached was Rarajtnoup, consisting of only two huts, and two hours later another, also of two huts, called Irgunnuk, was passed. Next came the settlement of Noskon, where there are twenty-two houses. In this way the journey was continued without any occurrence of importance until the place was reached where the party were to await the Corwin.

At the time of starting it was expected that venison, birds, and fish could be procured on the way. The country was found very destitute of game, however, and the travelers were obliged to subsist almost entirely upon their rations. The coast traveled over by them was low and sandy, excepting at the capes, which are usually several hundred feet high and descend precipitously into the sea. High land and mountains were seen some distance back from the coast. The ground, where not covered by snow, is wet and uneven, and covered with a spongy moss, which makes traveling very difficult. About 15 miles below Cape Onman there is a salt-water lagoon several miles in extent, which is connected with the sea by a small opening in the low beach.

Just back of the village of Yinllin there is a lake which, according to the natives, contains fresh water. Near Naskau, several miles west of Tapkan, there is a large indentation in the coast. Tapkan itself is situated on a long and narrow cape or sand spit, the end of which is near Cape Serdze.

The water to the southward of the cape is very shallow and less than a mile in length. Whenever natives were met inquiries were made as to wrecked vessels. They reported that vessels seldom came that way, the Vega being the only one ever seen, and that no shipwrecked crews had been seen or heard of. These men travel all along the coast, and would be very likely to meet or hear of any stranger who might come.

While waiting for the Corwin to return, numerous attempts were made to catch seal, but without success. Unless they are instantly killed, they escape through air-holes near which they lie, and if they are shot in the water do not float. The skin boat was used to make several visits to the island which lies off the village. This island is not laid down, and is about 1 mile from shore, and nearly half a mile in length and half of that in width, and is nearly 100 feet high, and precipitous, except upon the south side. The water is deep all around it. The natives encountered during the journey were Tehuktchis. The men shave the top of the head, leaving the hair about

3 inches long all around, but the women wear their hair in two long plaits and have it cut short over the eyes, after the manner of our ladies in more civilized quarters. All dress in furs, and the women usually uncover the right arm and breast when at work or waiting upon the men. They are apparently not affected in the least by exposure to the cold. They are good natured and very honest. They are persistent beggars, especially for tobacco, which they prize very highly and for which they will trade anything, being perfect slaves to it. All use it, even the children, mothers often taking tobacco from the mouth and giving it to the children just learning to walk. The young children are sewed up in furs, nothing but a small part of the face being visible, which gives them an odd appearance, and it appeared wonderful that they were able to walk at all.

They have no form of worship, and no Sunday, holiday, or day of rest. They keep no record of time except by moons, and cannot tell their ages. They live principally upon the meat of the seal, and of course the men become very expert in catching these animals. The patience they show in hunting the seal is wonderful. A native sometimes crawls half a mile upon hands and knees through pools of water to approach near enough to strike one with a harpoon, and after all this trouble the seal will often escape. The women skin the animals and prepare the meat for eating. They are very expert with the knife, handling it with a dexterity which would do credit to any market butcher. Many parts of the seal are eaten raw, and none is cooked much. The eyes are considered a great delicacy, and are given to the men, who usually stand by while the dissection is going on, with whips to keep away the dogs. Often one more cunning than the rest evades the watchers and steals a piece of meat, with which he makes off, followed closely by the rest of the pack, and a rough and tumble fight ensues.

The walrus is also an important article of food, but there are only certain times of the year when it can be caught. The killing of the first walrus of the season is an important event, and is celebrated by a peculiar ceremony, which was witnessed at Tapkan. Walrus being seen in the offing, all the male population of the village went out in their boats to capture them, and after a long chase they were successful, having caught three. As all the people were concerned in the capture, the animals were divided among them, the owners of the boats being entitled to the head and skin in addition to their share of the meat. After the division the people gathered in the chief's hut, the walrus head was placed in the center, and the chief's youngest son took three pieces of reindeer meat and the same of fat and seal meat, and placing these in the mouth of the walrus, he took three other pieces and threw them in different directions. After this the chief made a speech, and took five pieces each of the fat and meat, and going to the place where their winter supply is stored, threw four of the pieces in different directions, while the fifth was thrown in the center of the storehouse. All were then given a piece of fat and meat to eat.

The milk of the deer is cooked and eaten. They have no bread and no substitute for it, but in the spring the bulbous root of a small plant is cooked and eaten. It is something like the potato. Eggs and birds are also used for food.

These people are very inquisitive, and travelers must be constantly on the watch to keep them from sticking their fingers, which are never clean, in the food, to sample it.

They have no written language, and cannot understand the use of letters, expressing much astonishment at seeing members of the party making notes with pencil and papers, which, however, they tried to imitate. The young girls often indulge in a dance, which consists of various contortions of the body, and is accompanied by a deep, hard-breathing noise. The young men and boys do not dance. They seem to think it inconsistent with the dignity of a man.

Each village has a chief or headman, though he appears to have no privilege which is denied to others, except that presents of meat and skin are made to him once a year, sometimes oftener if they are very successful in hunting. Upon the death of the chief his oldest son inherits the title. In case he has no son, the oldest son of his oldest brother inherits the title.

Their marriage ceremony is very simple. The parties go through the usual form of love-making, the girl showing her preference for the man by working for him. The man then makes known his wishes to the girl's parents, who decide upon the price he must give for the daughter, which usually consists of a number of deer-skins or walrus-hides. When all is arranged satisfactorily the people of the village are notified, and they gather at a certain place where the ceremony is to

take place. When all are assembled the bride runs away and the groom follows her. If he succeeds in catching her, which is usually the case, the marriage ceremony is complete, and they are afterwards considered husband and wife.

When a Tchuktchi dies he is lashed to a long pole and carried to a distance from the village; he is then stripped and his clothes laid on the ground, also his weapons and other articles belonging to him, while the body is exposed to the birds and beasts.

These people display a great deal of ingenuity in making their nets and implements. The fish and bird spears are tipped with ivory; the seal-spears have a small piece of iron on the end. Their war-spears and those used in hunting bears are made of steel, with a handle about 6 feet in length. The blade is kept very sharp and highly polished. These weapons are often beautifully inlaid with brass ornamented figures, and are purchased from the Russian traders at Gazhaga. The women make the thread which they use in making clothes, nets, boots, &c., from the sinews of the reindeer. The operation is very slow and tedious, but they never seem to be tired, and will sit for hours in one position, twisting the thread by hand. The men make the nets, but this also is a slow process. They refuse any offers of assistance, and will not adopt other methods of working, seeming to think it presumptuous on the part of white men to try to teach them to make articles they have always used.

On the morning of the 29th the Corwin steamed up the coast, and immediately everything was excitement on shore; the whole population of the village gathered on the beach, with much talking and shouting. The question of how to get the party on board was a serious one. The water was clear from the mainland to the island, but outside of that was about 2 miles of pack-ice. The natives took dogs, sleds, and other articles in their oomiacs, and tried to reach the vessel. The rifles and ammunition were taken, but the dogs, sleds, &c., were left on shore. As it was impossible for the boats to penetrate the pack ice outside the island, only a few things were taken in the skin boat, which was lashed to a sled. It was found very difficult to get over the ice, even with this small equipment, for some of the small floes were so far apart that it was frequently necessary to launch the boat and paddle across. After several narrow escapes the party finally, with the assistance of the boats sent to their aid, reached the vessel in safety.

The Tapkan native John, who had been put in a very good humor by a present of a musket and some ammunition and other small things, in pursuance of his original plan of constantly furnishing news, told many wonderful tales, at times bringing them entire from the depths of his imagination, and at others, apparently by a mighty effort, reproducing them from a rapidly-fading memory. Of this latter class was an account given us of the boarding of the Jeannette off Cape Serdze settlement, on her way north, in 1879, by a party of walrus hunters who were out on the ice near where she passed. They described her as a steamer with three masts, and having on board two Nekourucks, the name by which they designate the Innuits, and whom they recognized as such by the labrets in their lips. They also spoke of the large number of dogs and sleds seen on her decks. The two Innuits were those taken on board by Captain De Long at Saint Michael's, Alexan and Amrequin. This information, although not later than what we have already received from the whalers, goes to show that the natives are observing, and take notice of everything that passes near the coast. Had a vessel or party of white men visited the coast since that time the natives would have known it, and accounts would have reached us.

Running southward during the night, before a gale of wind, a short breaking sea occasionally fell on board and washed all loose articles around the decks in a lively manner. East Cape was passed the following morning, and as the sea was too rough to land at the Diomedes, where we were desirous of stopping to pick up the boat and crew left to make current observations, we hauled in for the anchorage off the south side of the cape. We also wished to land the Tapkan native, for, after our experience with the Saint Lawrence Bay lunatic, we were not anxious to have any of them on board longer than was necessary. The gale continued all day, coming down off the hills in whirls, which caught the water and carried it higher than the masthead, so that communication between the ship and the shore was impossible. On the following morning (July 1) the wind moderated, and the natives came on board in large numbers. Professor Muir and Mr. Nelson went on shore for a ramble over the hills, the former to make a botanical collection and study the geological features of the remarkable headland, and the latter to make ethnological notes, and, if

possible, collect a few specimens. In this he was unsuccessful, owing to the fact that while in the vicinity of the burying ground he was closely watched by the natives. The burying ground is located on the side hill, about 180 feet above the level of the sea. It is a short distance above and in plain sight of the settlement.

About noon we got under way for the Diomedes, and arrived in the evening. As I had feared, we found that, owing to high winds, our party had not been able to launch their boat, and the sea had been so rough on the shore that they could form no idea of the amount of rise and fall of the tide. After getting the boat's crew on board again my first inquiry was in relation to the treatment they had received from the natives during the absence of the vessel, although the smiling, confident expression on Dick's face, as he came forward to shake hands with me, bore evidence that he considered his friendship for the whites an established fact, and one which was likely to be fully recognized and liberally rewarded. Boatswain Hallahan's account confirmed the impression made by Dick's happy smile. He stated that upon landing they had been assisted to haul up the boat to a place of safety above the reach of the sea, and that Dick had insisted, as a precautionary measure, upon all articles belonging to them being taken to his house, and had furnished all necessary assistance for making the transfer. Everything arrived in safety except one brass rowlock, which could not at first be found. Upon being informed of the loss Dick drew his knife, and, after exhausting his stock of profanity, went forth to recover the lost property. It was not long before he returned, proudly swinging the rowlock by the lanyard. It was found in the path by which they had ascended the hill to the settlement, probably dropped there accidentally; but if it had been otherwise, the sight of Dick's knife would have been likely to overcome any desire the thief might have had to retain the missing article. Nothing more was lost, and the party were treated with the greatest kindness during their stay.

Having rewarded the natives liberally for their assistance, and assured them that their kindness and honesty should be made known to all white men whom we met, we steamed away to the southward, our effort at taking current observations having resulted in nothing but the loss of a boat, anchor, and several days' services of the men engaged in the work. During the night we steamed to the southward, through heavy banks of fog, similar to those noticed in this vicinity on our way north.

On the morning of the 2d the fog cleared away and the sun came out bright and warm, with a perfectly clear atmosphere, such as I believe is not found except in high latitudes, giving us a fine view of the Siberian coast range of mountains from Cape Krelongoune to Plover Bay. The dynamic effects of glacial action on this range were so distinctly visible that Professor Muir declared this sight alone to be well worth a trip to the polar regions. The whole range is beautifully molded by glacial force. The coast line from East Cape, and including Plover Bay, is a system of glacial fiords similar to those described on the Greenland coast. They are smaller but not less clearly defined. The glaciers have long since passed away, but the general direction of the drift, the size of the main trunk, and the number and size of the tributaries are clearly shown by these deep fiords, and by the deposits of moraine matter.

At meridian, July 2, we arrived off Cape Tchaplín, and the natives coming off in large numbers, we stopped to communicate with them. On approaching near enough to be heard, from one of the boats came the hail "Ship ahoy," to which we replied "Hello," and the answer came back, as one of the sailors expressed it, in good *nautical English*, "Say, captain, why in hell don't you anchor?" This, of course, created a laugh, and supposing that the speaker would be able to converse in English, I had him brought to me when the boats came alongside, and to my astonishment found that the sentence quoted, and one or two others of a similar nature, exhausted his knowledge of English.

They brought large quantities of whalebone and walrus tusks, also white-fox skins, which they were very anxious to trade, as they said no schooner had visited them for two years, and they were entirely out of many articles, such as tobacco, ammunition, and drilling. We bought some white-fox skins, some walrus tusks, and a very fine Arctic brown-bear skin, but could get no reindeer skins or fur clothing. They claimed to have plenty on shore, but would not bring them off unless we would come close in shore and anchor. This we could not spare the time to do. Besides we had no confidence in their statements, which were believed to be Tchuktchi diplomacy to induce

us to anchor, and grant them an opportunity to lounge around the vessel, as they are very fond of doing. These people have not a very good character among the whalers and traders, and it is but seldom that any vessel comes to anchor there, although they generally have a good supply of whalebone and ivory for sale. Whalers, in trading with them, lay with the topsail to the mast, ready to fill away at any time, and when trade gets dull the master orders "brace forward," and the natives understanding that to mean that the vessel is about to leave, trade becomes more active for a while; and when it slacks the same thing is repeated. I believe, as a rule, the whalers do not sell them whisky. At East Cape and Saint Lawrence Bay they told us they had bought some from the bark Francis Palmer, from their description. I judge that it was put up in square cans similar to those used for coal-oil; empty cans of this description were seen on shore among the natives. So far as I could learn, they have never molested white men in any way, and my opinion is that the dread of them arises more from their large numbers and boisterous manners than anything else. They would probably steal anything left in their way, but I think fear of the consequences would prevent them from doing anything worse.

When ready to start ahead, Joe was told to inform the natives that we were about to start, and that they must leave the vessel. Over a hundred of them were on deck, but not one started. Seeing that talking had no effect, the bell was struck and the engine started ahead; then a long blast of the whistle was given, which caused a general rush for the boats, each native yelling at the top of his voice, and bunches of whalebone, ivory, and fox-skins were thrown into their boats indiscriminately. After getting them fairly started, the engine was stopped long enough to permit them to get away from the side in safety.

From Cape Tchaplín we proceeded to Marcus Bay, where we landed Joe. From Marcus Bay we proceeded to Saint Lawrence Island, where we arrived the following morning, and spent half a day examining the deserted villages on the north side and making a collection for the National Museum, consisting of human skulls, hunting and fishing implements, parts of suits of armor, &c. Fragments of these suits were found at various places, but notably at Saint Lawrence Island, East Cape, and the Diomedes. Many of them were made of bone and walrus ivory, and had the appearance of being very old, but some on Saint Lawrence Island were made of iron, probably heavy cask-hoops, and did not appear to be many years old. They were all made in the same way, being composed of pieces about 6 inches in length by 1 in width, and one-quarter of an inch in thickness in the center and one-eighth at the edges, where they overlap like fish-scales. The whole is fastened by seal-skin thongs, and would, no doubt, be a safe protection against a knife, arrow, or even a light spear, but would offer but slight resistance to a bullet from the Remington and Sharps rifles now in use among them, or even a Winchester, and it is not probable that they are used much at the present time. We saw no entire suits at any place, although we offered liberal prices for them, Mr. Nelson being very anxious to secure one for the National Museum.

The day being unusually fine and the atmosphere clear, we were favored with a fine view of Saint Lawrence Island nearly its entire length. The island is of volcanic formation. From our anchorage at North Cape I counted thirty perfectly formed volcanic cones, each with an extinct crater, many of them so recent that no sign of vegetation had begun to appear on them, notwithstanding its rapid growth in these latitudes. The beds of the streams of lava which had run their zigzag course from the crater to the sea were plainly visible. These streams also exhibit no signs of weathering, so recently were they formed. In addition to the larger cones and lava streams, innumerable little cones or mud volcanoes dotted the valleys and hillsides. The sight was a very interesting one from a geological point of view.

After completing the ethnological collection, Mr. Nelson returning to the ship, we got under way for Saint Michael's with a fresh southwest wind and fair weather. In the evening a fog set in and necessitated slowing down a little, but as the fog lay in banks with clear spaces between, we kept up a fair rate of speed, and on the following afternoon (July 4) we anchored at Saint Michael's, where we found the Alaska Commercial Company's steamer in port, to our great satisfaction, as we hoped to send mail by her. All the employes of the Alaska Commercial Company were hard at work under the direction of Captain Erskine and Chief Engineer Cox, of the *St. Paul*, putting up a small steamer for the use of the up-river traders, to take the place of a smaller one which, worn out

in service, had been crushed by ice and sunk during the past winter. The new steamer, built at San Francisco, with boiler and engine and everything complete, being too small to make the sea voyage, had been taken apart and shipped to Saint Michael's by the St. Paul, and now only required to be put up and fastened (everything being fitted), and the boiler and engine put in place. The work was being rapidly pushed forward and it was expected that the hull would be ready to launch in a few days. These small steamers, owned by each of the two trading companies, are used by them in transporting goods to the different trading posts on the Yukon and its tributaries, and in bringing down the furs purchased during the winter. They come down when the ice breaks up and return as soon as they can transfer the furs to the company which they represent and take in a new stock of goods. These furs and trade goods are not taken on board the steamer, but each trader has a large boat in which he carries his supplies and the boats are towed by the steamer. Formerly immense skin-covered boats were used, but they gave a good deal of trouble on account of the necessity of taking them out of the water to dry every three or four days. Unless dried and oiled occasionally, they become so soft and stretched that they are likely to spread out if the least sea is encountered. A number of the traders now have fine large clinker-built boats brought up from San Francisco.

The trip up the river against the current is a long, tedious one, and, without the assistance of steam, would be one of great labor; but the descent is readily made without any other assistance than the current, which will carry a boat sixty or seventy miles a day.

A number of Indians from the interior having come down with the traders, as they are accustomed to do each year, they were invited on board, and several shells were fired from the broadside guns for their benefit. They seemed very much astonished at the size of the shell, and also at the second explosion. One old chief, after considerable urging and many assurances that the operation was entirely safe, consented to pull the lock-string and fire one of the guns, although evidently in great doubt as to the result. This old fellow, whose name is Sa-mah-tu, is chief of the Yukons, and is said to be the only hereditary chief remaining on the river. According to report he is also distinguished for more acts of conspicuous bravery and pure Indian viciousness than any Indian in that section of the country, circumstances which furnish material for the many stories told of him by the traders. It is related that at one time, having a desire for revenge against a neighboring tribe for some slight offense, he pretended great friendship and invited them to a dance. Before the dance began, Sa-mah-tu made a speech, in which he expressed the warmest friendship for his neighbors, and to convince them of the genuineness of his professions, he threw away his knife and directed his men to do the same, after which he invited the visitors to follow their example, saying that being entirely unarmed would prevent the possibility of trouble during the excitement of the dance. The request, under the circumstances, seemed so reasonable to his guests that it was readily complied with. But the old rascal had taken the precaution to have his men wear two knives, and no sooner were their visitors entirely unarmed than, drawing their second knives, Sa-mah-tu and his men attacked and killed every one of them. So far as I know, he has never molested the whites, from motives of policy probably, believing that it pays better to be friendly with them. I have often noticed this peculiarity of Indian character: those that are worst and most dreaded among their own people, are most anxious to secure the friendship of the whites. Other stories told of Sa-mah-tu illustrate his vicious and vindictive character; how he robs other men of their wives, and shoots them down if they resist; how he enforces trades on his own terms, &c. Physically, Sa-mah-tu is a fine specimen of a man, and, notwithstanding his treacherous manner of dealing with his enemies, is brave as a lion, and has never been known to decline an open fight with any one when it became necessary. He prefers to dispose of his enemies by strategy if possible, not because he dreads a fight, but because, to the Indian mind, bravery and treachery are synonymous. Indians that will willingly face an armed man on an equal footing, if necessary, will resort to the greatest cunning and treachery to kill an unarmed one, if it can be accomplished in that way.

I learned from Captain Erskine, of the steamer St. Paul, that after his departure from the Seal Islands on the return trip but one special agent would remain, and in view of the information contained in the letter of Special Agent Otis on the occasion of our former visit to this place, and

my own belief that the schooner Flying Mist would make an attempt to take seals from the island later in the season, I detailed Lieutenant Doty with two seamen to return by the St. Paul to the Seal Islands, and remain on Otter Island until the departure of the seals in the fall.

We remained at Saint Michael's four days, cleaning boiler, coaling ship, &c., and all enjoyed the visit very much. The air of industry imparted by the sound of ax and hammer in hands of busy workmen; the sight of the half completed steamer on the ways; the piles of merchandise in front of the storehouses, laid out in readiness for the traders; the surrounding tundra covered with its carpet of verdure, and the songs of the birds, all combined to give the sub-arctic trading post the appearance of a small New England town. The tundra back of the settlement is composed principally of mosses and lichens, the moss, chiefly sphagnum, predominating. Together they produce a yellowish-green covering, with masses of pale gray, where the lichens are most abundant. The entire surface of the tundra is planted sparsely with sedges and several species of heathworts, the whole crossed in various directions by irregular lines of dwarf birches, of a dark greenish hue, with here and there a small clump of alder or dwarf willow. Upon a closer examination of the tundra the following plants were found in bloom, although the ground was still frozen solid only two feet below the surface: dwarf raspberries, cranberries, blueberries, salmon-berries, crow-berries, red currants, white phlox, blue iris, lupins, trientalis, violet, saxifrages (several species), *Draba archangelica*, carex, equisetum, and several species of ferns. These, with other beautiful plants, combine to change, in a few days or weeks at most, the surrounding country from a dreary arctic waste to a verdant field. But, however rapidly the vegetation may appear, it is not ahead of the birds. The yellow wagtail and the Lapland long-spur were numerous, and the merry, musical notes of the latter enlivened the tundra everywhere. A few ducks, geese, and snipe were to be seen, but, being either nesting or attending to their newly hatched young, were very shy, and seemed only to desire to avoid attracting attention. The patches of alder on the hill-sides concealed nesting green and fox-colored sparrows, with here and there a yellow warbler or black-capped fly-catcher. The numerous brackish pools in the vicinity of the Redoubt, as the settlement is called, were frequented by two species of loons (*Colymbus septentrionalis* and *Colymbus arcticus*), whose harsh cries could be heard on every side, especially during the night, while about the borders of these pools busy groups of the northern phalaropes enlivened the scene with their graceful movements and delicate coloring. On the distant hillside could be seen a few pairs of sandhill cranes stalking about, and now and then giving utterance to their loud rolling notes. In the vicinity of the building darted and circled the numerous barn swallows which yearly seek their summer homes thus near the Arctic Circle. Nor was the appearance on the bay any less interesting. Numerous flocks of coots (*Edemia americana*) were circling about the inner bay. Numbers of jaeger gulls hovered about the vessel to pick up any scraps thrown overboard, while stray parties of Arctic terns and straggling individuals of the burgomaster, kittiwake, and short-billed gulls help to swell the list and enliven the scene. Last, but not the less interesting, come the Innuits in their kyacks, always cruising in pairs. They may be seen day or night if the wind does not blow, for they are fine-weather sailors and never venture out when the water is rough. They catch fish, spear birds, and occasionally kill a hair-seal or white whale (*Beluga*).

While at Saint Michael's we had an opportunity of testing, for the first time, the sea-going qualities of our steam cutter, which had been used a number of times and found to be of the greatest assistance, but it had always been in smooth water. A trial during a fresh northeast wind, which swept the entire width of Norton Sound over fifty miles, raising quite a rough sea and making all the natives' boats seek for shelter, was followed by very gratifying results. The launch proved a very able sea boat, making, without difficulty, six knots an hour, which, considering the state of the sea, was remarkable. In smooth water eight knots were made without difficulty.

Before leaving Saint Michael's we watered ship from a remarkable spring on the east side of the bay. The spring is below low-water mark of ordinary neap-tides, but so great is the discharge that perfectly fresh water may be dipped up from alongside a boat at half tide.

Our interpreter, shipped on our former visit to Saint Michael's, having declined to go any farther with us on account of a prediction by the shaman, that the Corwin would never return,

we engaged a young half-breed named Andrewski to accompany us. He proved to be a very excellent man and of great assistance to us.

The articles obtained by Lieutenant Herring from the natives at Wankerem, taken from the wreck by them, were sent to San Francisco by the *St. Paul* to be placed on exhibition for identification at the Merchants' Exchange.

On the 9th instant we got under way from Saint Michael's and proceeded across Norton Sound towards Golowin Bay for the purpose of investigating a report, which had reached us through the natives, to the effect that a schooner with a large number of men on board was at anchor at that place. It was said that many of the men were back in the mountains looking "for some kind of rock." Arriving at Golowin Bay on the morning of the 10th, we anchored in the outer bay, whence the masts of a schooner were seen to the northward. On examination the schooner proved to be the *H. G. Marsh*, of San Francisco, with a party of mining experts on a prospecting trip. They reported a good find of lead and silver, but some distance from the salt water, and, owing to the constantly frozen condition of the ground, somewhat difficult to mine. They were, however, in good spirits and seemed quite confident of having "got hold of a good thing."

Golowin Bay was discovered by Cramtschenko in 1821. It affords good anchorage in all winds except southerly, to which it is exposed. An inner harbor is formed by a gravel spit, which makes off from the west side of the bay, where small vessels may anchor in safety in all weather. Several rivers empty into the bay, making the water nearly fresh. On the northwest side is a growth of spruce trees (*Abies alba*) growing to the height of 15 or 20 feet. These small bushy-looking trees scattered over the green tundra, the absence of underbrush, and the long dark-green lines of dwarf willows and birches filling the ravines on the sloping sides of the gently rising hills, present the appearance of a number of orchards separated by hedges. The beach was thickly strewn with drift-wood, logs from 20 to 40 feet in length being abundant. This drift, probably from the Yukon River, is piled up many feet above the present high-water mark. Whether this be due to ice pressure at some time, or the elevation of the land, as is claimed, I am unable to state. The natives assert that a change is taking place, that the water is receding, and more land becoming visible each year. Captain Cook, speaking of Cape Denbigh, which lies a few miles to the eastward of Golowin Bay, says:

It appeared to me that this peninsula must have been an island in remote times, for there were marks of the sea having flowed over the isthmus, and even now it appeared to be kept out by a bank of stones, sand, and wood, thrown up by the waves. By this bank it was evident that the land was here encroaching upon the sea, and it was easy to trace its gradual formation.

It is an interesting fact, in this connection, that the English expedition under command of Capt. Sir George Nares found on the north coast of Grinnell Land unmistakable signs of raised beaches in the beds of sea shells, ice-marked cliffs, &c., many feet above the present sea-level. A small native settlement is situated near the end of the gravel pit, but owing to a strong breeze, which increased during the afternoon to a fresh gale, none of the inhabitants came on board. Cape Darby forms the east side of the bay, and Cape Kamennoi (Rocky Cape) the west side. They are about 6 miles apart, and both are high and steep. The former, in clear weather, can be seen from the south side of the sound, 50 miles away. Cape Kamennoi, with the land to the westward as far as Port Clarence, is in reality an island, a boat passage existing from the head of Golowin Bay to Grantly Harbor. The natives say they often make the passage with their oomiacs in preference to following the coast, especially in stormy weather, as it insures them smooth water, a very necessary condition when traveling in an oomiac. From three to five days are required to make the trip.

July 11, the gale having blown itself out, we got under way and proceeded along the coast to the westward. There was considerable sea from the southwest in the morning, but it subsided during the day. In the afternoon a sail was reported off the port bow, which proved to be the schooner *Czar*, belonging to the Western Fur and Trading Company, from Saint Michael's, bound for San Francisco, by the way of Ounalaska and other trading ports. She sailed from Saint Michael's a few hours after us and caught the gale out in the sound. Having put letters on board, we proceeded on our way, stopping in the evening off Sledge Island, but did not anchor. The natives, with the exception of a few, too old or too lazy to travel, had gone to the mainland. Sledge



INNUIT SETTLEMENT, KING'S ISLAND.



ASTU STATION, CHAMISSO ISLAND.



S. EX. 204, 1, 48.

ICY CAPE INNUIITS.



HELIOTYPE PRINTING CO., BOSTON.

PLOVER BAY. TCHUKTCHI WOMEN.

*Photo. by Nelson.*



Island, named by Cook on account of a sledge seen on it when he landed, is about one mile long, half a mile wide, and between five and six hundred feet in height. It is a barren rock with almost perpendicular sides. Passing Sledge Island, we shaped a course for King's Island, arriving there the following evening. This island has about the same area as Sledge Island, but is somewhat higher and more rugged in its outline. Like the latter, most of its inhabitants had gone to the mainland to trade and gather berries, as they are accustomed to do each year. The settlement is on the south side of the island on an extremely rugged slope over one hundred and fifty feet above the sea. The winter houses are excavated in the rocks, and the summer houses are made of walrus hide stretched on poles which are secured to the almost perpendicular cliffs by lashings and guys of walrus hide. Altogether it is a most remarkable place. The men are very expert with the kyack, which they use when killing seal and walrus. The kyack in use by them is probably the finest in the world. It is a marvel of speed, strength, and beauty. Near the village is a cave in the rocks in which a supply of meat is stored for winter use. We remained at this place some hours taking photographs, collecting ivory carvings, &c. The natives dispose of the carvings readily; in fact, being natural traders, they seldom refuse to sell anything they possess. Unfortunately, many of the best carvings had been taken along by the traveling parties, probably in the hope of falling in with Mr. Nelson, who, by his long residence at Saint Michael's and frequent journeyings around the country, had become extensively known among them. His custom of buying these carvings, and many other things which were of no value except as specimens for a museum, pleased the natives very much, and to many to whom his name was not known, he was described as "the man who buys good-for-nothing things."

Leaving King's Island at 1.30, we shaped a course for Cape Prince of Wales, arriving at 4 p. m., and stopped off the settlement. Mr. Nelson again went on shore, and took a number of photographs of the natives.

At half past six in the evening we steamed ahead from Cape Prince of Wales, and were soon after overtaken and surrounded by a dense fog bank, which had been seen approaching for some time from the southward. As it was accompanied by a good breeze, we made all sail, uncoupled propeller and sailed through the straits, keeping the lead going to avoid the shoal before mentioned, which extends northward from the end of the cape. We caught occasional glimpses of the land during the night. On the following morning the fog cleared away, and the sun came out bright and warm. We steamed to the eastward all day, with the land in sight, but the conditions of navigation were altogether different from those of a corresponding date of last year, when the entrance to Kotzebue Sound was blocked by heavy pack ice, to a grounded piece of which we made fast off Cape Espenberg. Now no ice was to be seen. Soon after meridian we saw a sail in shore near Cape Espenberg, which proved to be the trading schooner O. S. Fowler of the Western Fur Trading Company, which was boarded and examined. A boat was also sent in pursuit of some oomiacs which were seen to leave the vessel when we first came in sight. They were overhauled and examined near the shore, after which the houses of the natives were carefully searched, but nothing contraband was found either there or on board the schooner. This vessel sailed from San Francisco with a lot of unstamped tobacco and some breech-loading arms on board, ostensibly for trade on the Asiatic coast. The tobacco was a part of the cargo of the brig *Timandra*, wrecked on Muniok Island in 1879, the facts of which were reported to the Department at the time by the commanding officer of the cutter. It had been taken out of bond at San Francisco for foreign trade. After the loss of the brig the cargo was taken to San Francisco and sold at auction to the Western Fur and Trading Company, and the tobacco, upon which the tax was still unpaid, was again bonded. Subsequently it was again withdrawn for foreign trade and put on board the *Fowler* as stated. A number of breech-loading rifles, such as are prohibited by law in Alaska, were also put on board the *Fowler*, and a bond was given that they should not be sold in Alaska. The schooner was placed in command of a man by the name of Nye, a well-known whisky-seller, who boasted to the boarding officer of the number of Indians he had seen die from the effects of whisky drinking on board trading vessels. As an evidence of the value of this bond, and the oath of the master, or rather their entire lack of value, it may be mentioned that the natives of Saint Lawrence Island told us that the *Fowler* had sold them boxes of tobacco and a number of breech-loading rifles. As the oath and bond had been violated in the case of the rifles, of course they would not hesitate to

do the same with the tobacco, and that sold at Saint Lawrence Island was, without doubt, no other than that originally shipped in the *Timandra*, for which bonds had twice been given that it should not be sold in American waters. So long as this system of bonding goods for the Siberian trade is followed, it will be impossible to prevent contraband articles reaching the American side. The cutter on the station is almost powerless. If a trader is caught with the articles on board, a permit to carry them for foreign trade is produced. It is impossible to catch them in the act of trading, as a sharp lookout is kept for the cutter, and if she is seen approaching, the natives are sent away with their purchases, or, if too late for that, the illicit articles are passed back on board, under protection of the permit, until the coast is again clear, when they are turned over to the natives.

In this connection I will mention a fact that came under my observation a few days later at Hotham Inlet. We were informed by the natives that the schooner *Flying Mist*, Walker, master, before mentioned as having been boarded and examined at Saint Michael's and found with 25 gallons of whisky on board, for which permit from the proper authorities at San Francisco was produced, had visited the place and sold whisky to them by the drink, charging one fox-skin for a drink of whisky. Later I was informed that Walker made his boast of having "beaten the Government" in that way. The natives are easily made to understand that any illicit articles found in their possession will be seized by the cutter, and as they can see no reason for it, having no knowledge that such a thing as law exists, they are easily made to believe that the officers of the law are their enemies, and that it is to their interests to deceive and mislead them when on the track of an illicit trader. In the vicinity of Kotzebue Sound they were very bitter against us, and, I am informed, openly boasted in their *kazhimes* that they would capture the vessel and kill all hands if she came again to prevent their getting whisky. On account of these threats, I had some difficulty in obtaining the services of an interpreter at Saint Michael's, the shaman predicting that the *Mahlemutes* (Kotzebue Sound natives) would not allow the vessel to return if she went among them. They did not, however, attempt to carry their dire threats into execution. On the contrary, they *appeared* quite friendly. Whether they had concealed their resentful feelings from motives of policy, or had forgotten them in their gratitude for some presents of tobacco, may never be known, but they were allowed on board in large numbers and showed no disposition to be warlike. The search of the *Fowler* completed, we stood to the eastward far enough to clear a lot of detached shoals that lie off Cape Espenberg, and shaped a course for Chamisso Island. Cape Espenberg is a low, sandy point which forms the west side of Kotzebue Sound. The sand is thrown up into long ridges parallel with the beach, and between the ridges are pools of water in which abound wild fowl. This point is a nesting-place for eider ducks. The natives brought off for sale small quantities of eider down, taken from the nests. The higher ground is covered with coarse grass, with occasional patches of flowering plants, which, at this season, are covered with bright-colored fragrant flowers. A native settlement of about twenty houses is situated near the end of the cape. Several of the natives visited the vessel, and one brought on board for sale a harpoon of English make, which had been taken from a whale killed by them near their settlement the previous autumn. The iron was marked, "Scorraos, London." As there are no English whalers in this part of the Arctic Ocean, and none of the American whalers use English irons, it is probable that this whale was struck by some English whaler on the Atlantic side, and escaping, had afterwards found his way to the Pacific by either the northeast or northwest passage. Unfortunately this iron, which I purchased from the native, was lost through the carelessness of the person in whose charge it was placed. We arrived off Chamisso Island the following morning (July 14th), but the day being clear and fine, we kept on to the head of the sound and came to anchor off the mouth of a small shallow river called *Kiewalick*.

Some of the officers, accompanied by Muir and Nelson, made a trip up the river, but found little of interest. Muir made a collection of the plants, while Nelson succeeded in shooting a few white-fronted geese, and some young eider (*Anser albifrons* and *Sometaria nigra*). These being in fine condition, and not particularly valuable as specimens, were not kept for the National Museum.

During the day magnetic observations for dip and variation were taken. The cliff a short distance west of the river was examined and found to be composed of mica, slate, and quartz bowlders. Mosquitoes were plentiful and very savage, making excursions inland anything but pleasant or popular.

On the morning of the 15th we got under way and steamed up past Chamisso Island and Choris Peninsula to Cape Blossom, where it was expected to see a large number of natives. In this we were disappointed, only one tent being seen, and that contained only an old man, his wife, and one child, who were busy catching and curing salmon for winter use. At first they were a little shy, but a present of some tobacco soon reassured them, and the old man became quite talkative. He said a large number of natives from the interior had been at Cape Blossom, but had gone north a few days before to Hotham Inlet, where they then were trading with a schooner. A fresh northerly wind having sprung up with rain, we cut short our visit on shore at Cape Blossom, although the old man and his wife tried very hard to entertain us, drawing upon their imagination for the purpose without stint.

Cape Blossom is the northwestern termination of the peninsula between Hotham Inlet and Selowick Lake on one side and Kotzebue Sound on the other. It presents seaward a sheer cliff, which was described by Beechey as having an ice formation similar to that at Elephant Point, to be described hereafter. Although I visited this place several times during my two cruises, yet I saw no signs of ice against the face of the cliff like that at Elephant Point, which remains the same from year to year. Cape Blossom is highest at its western extremity and gradually becomes lower to the eastward, until it forms only a low narrow neck, across which the natives easily draw their boats. To the northwest of the cape a shoal extends eight miles from the shore, and as it shoals up suddenly inside the seven-fathom curve, it is very dangerous and should be approached, even in clear weather, with great caution.

From Cape Blossom we proceeded to Hotham Inlet, and came to anchor about two miles from the native settlement called Sheshorelek, "Sheshore" being the name of the white whale (*Beluga*) and the termination "lek" meaning "the place of." This settlement was variously designated on board as White Whale City, Belugaville, &c. The schooner Fowler was at anchor here with a large number of natives on board trading. Soon after anchoring we were visited by a number of the natives, and after making them presents of tobacco and needles, we informed them that we wished to buy some reindeer-skins for clothing. As it was blowing fresh they did not bring off any that evening, but the following morning, long before the decks were washed down, a dozen oomiacs full were alongside, waiting for permission to come on board and trade. After breakfast the permission was given, and a general scramble ensued, the decks being filled in a few minutes with bundles of reindeer-skins, which upon examination proved to be winter skins and unfit for clothing. They had saved the best skins, supposing that we did not know the difference, and, laughing heartily when they found their attempts to deceive had been detected, they brought out their best skins, of which we bought a hundred or more, with some trousers, boots, parkies, mittens, &c., paying for them in tobacco, calico, and ammunition. Mr. Nelson took some photographs of the natives ashore, and also of the settlement, which consisted at this time of about two hundred drill tents, arranged in regular rows and surrounded by kyacks, sleds, dogs, and upturned oomiacs. Scores of natives also ran in every direction, each with some article which he hoped to sell or exchange for something more coveted. The whole scene was a most animated one. These natives, who are from all parts of the coast, visit this place annually for the purpose of meeting the traders and exchanging with each other, and also for the purpose of indulging in a dance and athletic sports. They come from the southward, Cape Prince of Wales, the Diomedes, and King's Island, and from the Siberian shore as far as Cape Yachau, from the Alaska coast to the northward as far as Point Hope, and from the rivers emptying into the head of Kotzebue Sound and Hotham Inlet. The largest of these rivers, which is the most northern, has its source near that of the Colville, which empties into the Arctic Ocean east of Point Barrow, and it is not unlikely that the natives are the same as those met by Lieutenant Maguire of the Royal Navy at the mouth of the Colville. The native name for each river is the same—"Noyatay"—meaning "inland," and the inhabitants call themselves Noyatayament. The termination "ament," signifying "a native of," is derived from the word "innuit"; the change in the pronunciation is euphonic and does not change the meaning. It is in general use along the coast. A branch of this river takes its rise within a few miles of Cape Lisburne. I had some difficulty in making the natives understand the chart, as the river is not shown, but from what I could gather from them it is quite large, and in places where they describe it as

## CRUISE OF STEAMER CORWIN IN THE ARCTIC OCEAN.

passing between high steep banks it has a rapid current. The exploration of this river, of which so little is known, would be exceedingly interesting. Its existence was first reported to me in 1880, by Capt. E. E. Smith, ice-pilot.

The Koogarook River is next in size to the Noyatay. On its banks a few stunted trees grow, which, in clear weather, can be seen with the glass from the anchorage off the inlet. They were the only trees seen by us inside the Arctic Circle.

Hotham Inlet, described and named by Beechey for Sir Henry Hotham, is between 30 and 40 miles in length and from 5 to 10 miles in width; and although connected directly with the salt water is entirely fresh on account of the number of rivers which discharge into it. To the south-east of Hotham Inlet and connected by a narrow chanel is Selawik Lake, about 15 miles in width and 20 long, but very shallow. The entrance to the inlet was sounded out by one of the Corwin's boats last year, in the hope of finding a ship channel, but not more than one fathom was found at the entrance, although much deeper inside. The land near the inlet is low, but it is surrounded by a range of hills from 1,000 to 3,000 feet high, from 10 to 30 miles distant. Those to the northward were called by Cook, Mulgrave Hills. To the eastward, in very clear weather, may be seen two conical hills called Deviation Peaks. They are also in plain sight at Chamisso Island and bear from it north by compass.

On the morning of the 17th we got under way and proceeded along the coast to the north and west, passing Cape Krusenstern. About 8 a. m. we hauled close in shore and kept the lead going with from five to seven fathoms. I have several times followed this shore with the lead going, without finding any outlying dangers, although a shoal is known to exist, in the vicinity of Cape Seppings, having only 9 feet of water, upon which one of the whalers struck several years ago when beating down the coast. She had just tacked and was heading off shore when she struck, showing that it must be a detached shoal, and it is undoubtedly small.

The coast between Capes Krusenstern and Seppings is low and intersected by lakes and rivers, upon the banks of which a few natives are located. A range of hills, commenced at Cape Seppings and falling back to the northeast, is said by the natives to contain a great many reindeer and mountain sheep. We saw many skins of the latter, also drinking-cups and ladles made of their horns, among the natives at Hotham Inlet. During the afternoon the wind hauled to northeast and breezed up, enabling us to carry fore and aft sail. On the following morning we arrived at Point Hope and came to anchor under its lee, the wind having increased to a gale with snow-squalls.

The whaling bark Sea Breeze, Captain McKenna, was at anchor, having come in for a harbor on account of the gale. Captain McKenna reported having been as far north as Point Belcher, and having communicated with the natives at that place. These had recently met the Point Barrow natives on one of their hunting excursions, and learned from them of the death of one of their old men, a chief or leader among them. This old fellow was being treated by the native shaman at the time of our visit to Point Barrow during the first cruise of the Corwin, and at my request the ship's surgeon was allowed to see him. I made the following reference to him in my journal at the time: "The sick man was brought to the door of the tent, when an examination by Surgeon Rosse showed him to be suffering from paralysis of the left side and some disgusting skin disease. He was a most pitiable object. The surgeon left some medicine for him, but it is probable that the shaman did not allow him to take it, and that he did not long survive the native treatment." The Point Belcher natives also informed Captain McKenna that nothing had been heard on the coast from any of the missing vessels.

We lay at anchor under Point Hope until the morning of the 19th, when, the wind moderating a little, we got under way and tried to work to the northward, but the wind again increased before we got north of the point, and in order to save coal we turned back, and, being short of water, ran down the coast as far as Cape Thompson and anchored off a small clear stream of very fine water which empties into the sea at that place. Although anchored close in-shore, some difficulty was experienced in getting a boat ashore, owing to the strength of the wind. Advantage being taken of a lull, an anchor was planted in the sand with a line attached from the ship, and the boats were hauled back and forth without difficulty, thereby enabling us to take in about eleven hundred gallons of water. A few Point Hope natives encamped near the watering place were on the way to Hotham Inlet, and had come on shore to wait for fine weather. Cape Thompson is a favorite



POINT HOPE. OOMALIK. (CHIEF.)



POINT HOPE INNUITS.



S. EX. 204, 1, 48.

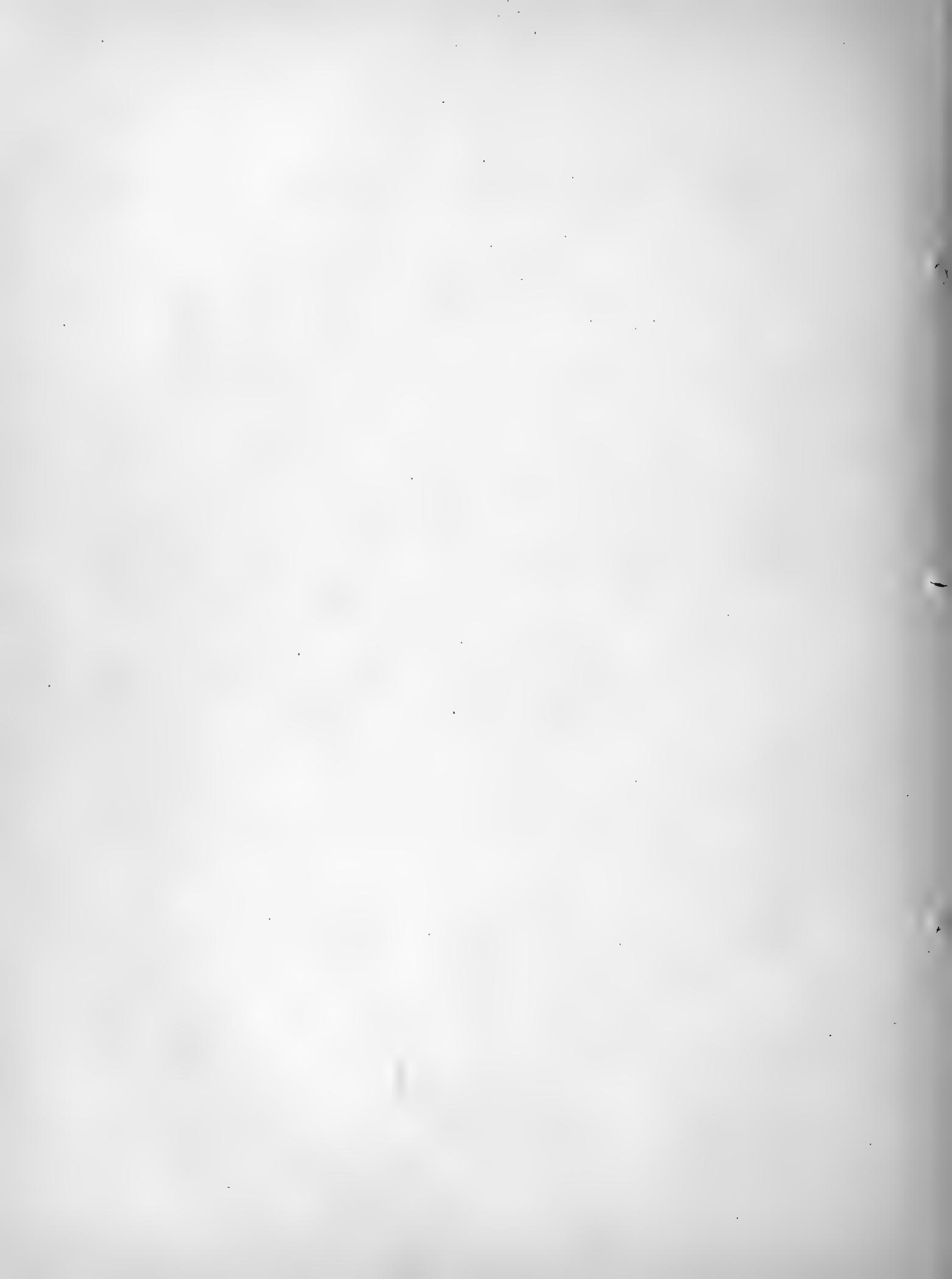
NOYATOG RIVER INNUITS, MET AT  
HOTHAM INLET.



HELIOTYPE PRINTING Co., BOSTON.

NOYATOG RIVER INNUITS.

*Photo. by Nelson.*



camping place with traveling parties of natives on account of the abundance of birds and eggs and the stream of fresh water. The cape terminates in a cliff about four hundred and fifty feet high, composed of stratified fossiliferous rocks, crimped and curved in a remarkable manner.

The natives catch birds by means of a long handled net, which, from some convenient point on the face of the cliff, they scoop among them as they fly past. The eggs are taken by lowering one of their number over the face of the cliff armed with a small egg-net and a basket. This is done by means of a rope made of seal-skin thongs. When the basket is filled the native is drawn up and the basket discharged. The eggs are eaten raw or boiled, as is most convenient. Being less liable to injury when traveling if hard boiled, they are generally prepared in that way. The condition of the eggs is not at all considered by the natives, and even though they may be more or less advanced in the process of incubation, it is a matter of no importance to them.

In the evening we returned to our anchorage at Point Hope, and found two more whalers at anchor, the *Eliza* and one whose name we could not make out. They had come in during the day to avoid the gale. The natives came on board in large numbers during our stay at Point Hope. They are lazy, filthy, worthless, and dishonest, and require constant watching.

A young colored man deserting from the *Hidalgo* after some trouble with one of the officers, spent the winter at Point Hope and was kindly treated by the natives, who shared their quarters and food with him, giving the best of all they had. As an evidence of the rapid manner in which news travels among these people, it may be mentioned that the fact of this man being at Point Hope was known at Saint Michael's, Norton Sound, before the winter was half over. I inquired into the facts of the alleged desertion, but could only learn that some trouble had occurred between the man and the second officer on account of the loss of an ax, and instead of making complaint to the master, the man deserted and remained concealed until the sailing of the brig, probably partly through a romantic desire to winter among these people. On the arrival of the brig the following spring the deserter delivered himself up and was restored to his position by the master, who, so far as I could learn, was in no way at fault in the matter.

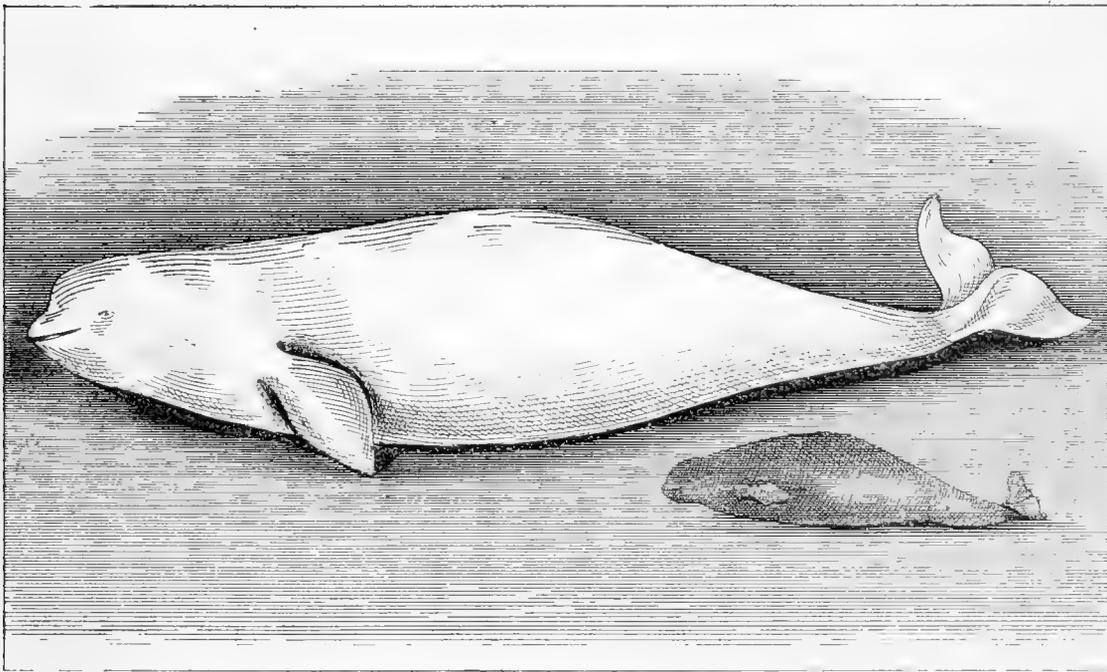
The chief of the Point Hope natives, or "Owalkk," as he is called, is quite a character and deserves a few words of mention. He does not hold the position of a chief as an hereditary right or by influence of wealth, but by sheer force of arms. He is never without his Sharps rifle, and with it he overcomes all opposition. He is well built, rather quiet looking, not much given to talking, and much more cleanly in appearance than the others. He is a good shot, and is quick to act. It is said that he has killed several of the tribe and has the rest thoroughly cowed. We were requested to take him away, but of course could not do so. Although a horror to the natives, he is friendly to strangers. The colored deserter from the *Hidalgo* says that it was mainly due to this man that he received such kind treatment. Of course it is only a question of time when some other native will catch him at a disadvantage and kill him. In their present state of mind, however, they will not attempt it until quite sure it can be accomplished, for failure means death to the one who makes the attempt.

While at Point Hope we had an opportunity of seeing two white whales taken by the natives. They were swimming very near the shore in shallow water, and were shot with rifles as they rose to the surface to breathe, and were drawn out on the beach, or rather parbuckled out. One was a full-grown female 11 feet long, and of a rich cream color, and the other a younger one about 8 feet long, of a light lead color. The natives commenced to eat them before they were fairly out of the water, cutting off pieces of the fins and eating them raw. The white whale, or beluga, I believe, is less known than any other of the marine mammals. It belongs to the order Cetacea, and is a member of the dolphin family. The generic name *Beluga* is derived from the Russian word "byelyi," meaning white. It inhabits only the colder parts of the globe. It reaches a length of about 14 feet, and when full grown is milk-white. The young are nearly black, and gradually change to a brighter color as they grow older until they are eight years of age, when they attain their natural size and color. They are very timid, and when found in the bays by the natives are easily driven into shallow water, where they are dispatched with flint spears. According to native tradition, if these spears are not used the whales will not return again. Even after killing them with the rifle the form of spearing is gone through with. They pass north through Bering Straits as soon as the

ice breaks up, and remain until the sea closes in the fall. They are generally found in the bays or near the coast. This is supposed by some to be on account of their fear of the killers (*Orca delphinus*), which are said to prey upon them. It is probable, however, that they go there to rub themselves on the sand to dislodge the parasites from their skin. Kumlein, in speaking of the large number of beluga which yearly enter the great Kingwah Fjord, says:

One thing I noticed, when they go up the fjord they have a ragged appearance and dirty color, and according to some whalers are covered with parasites, but after they have been rolling and rubbing themselves on the sand beaches for a few days they look much smoother, and their color is a creamy white. I found no external parasites, but the internal ear cavity was nearly filled with worm-like animals nearly two inches long. They were firmly attached by one end, and stood erect, having somewhat the appearance of coarse hairs.

I noticed large numbers of beluga passing north in August. Although I did not see them northward of Icy Cape, it is probable that they go as far as the ice will permit. Richardson speaks of two seen by him off Cape Bathurst. They are not found in sufficient numbers north of Bering



BELUGA AND YOUNG.

Strait to induce the whalers to catch them for their oil, although, like other whales, they are covered with a coating of blubber. Parry speaks of seeing beluga in great numbers in Lancaster Sound during his first voyage. He says:

While the calm and thick weather lasted, a number of the officers and men amused themselves with the boats in endeavoring to kill some of the white whales, which were swimming about the ship in great numbers, but the animals were so wary that they would scarcely suffer the boats to approach them within 30 or 40 yards without diving.

Mr. Fisher described them to be generally from 18 to 20 feet in length, and he stated that he had several times heard them emit a shrill, ringing sound, not unlike that of musical glasses when badly played. This sound he further observed was most distinctly heard when they happened to swim directly beneath the boat, even when they were several feet under water, and ceased altogether on their coming to the surface.

Captain Scammon, U. S. R. M., in his excellent work on Marine Mammals, says:

The beluga is an animal which is distinguished by its uniform light soft hue at maturity, resembles the *Leucorhamphus Pironii* in its symmetry of upper contour. Its linear dimensions average, perhaps, 13 feet, although the longest ones considerably exceed that length. Its head is small, its prominent forehead being protected with a fatty cushion, similar to that of the blackfish. Its short oval and fleshy pectorals are placed more than one-fifth the length of the whole animal from its muzzle, giving that portion between the head proper and the fins the appearance of a true neck. The appearance of the mouth is contracted and curved upward, both upper and lower jaws are

furnished with sharp conical teeth, and among the adults the dental formula may be put down at  $\frac{1}{4} \frac{1}{4}$ , or eleven teeth on each side of the upper jaw, and eight on each side of the lower one. Its diminutive eyes are but little larger than those of the common porpoise. The minute orifice which constitutes the ear is covered with a sort of scale that quite conceals it. Its spiracle is situated a little behind the angle of the eye. The body is full, and tapers rather abruptly towards the caudal fin, which is broad, and in expansion excels that of the *Orca* (*Globiocephalus*). The color of the adults is invariably a yellowish white, while the very young are of leaden or bluish black, but as they mature they become mottled, and eventually assume the soft cream-like tinge of the parent animal. This species of the dolphin family is very rapid in its motion, and its swiftness is brought into full play when in pursuit of the numerous varieties of fish along the sea-shore or up the rapid rivers. When making prey of such bottom fish as the flounder and halibut, it often darts into shallows where it can hardly float, but like the California gray in this respect, it evinces no alarm at the situation and makes but little effort to reach a greater depth. The white whale, like all others of this family, is fond of gathering in troops, yet we have observed that it generally advances in lines of seldom more than two or three abreast, or more frequently in single file, spurting irregularly, and showing little of its form above water. When undulating along in this manner it often makes a noise at the moment of coming to the surface to respire, which may be likened to the faint lowing of an ox, but the strain is not so prolonged. Sometimes these animals will gambol about vessels as porpoises do, but at the slightest noise upon the water or the discharge of firearms they instantly disappear.

Captain Scammon gives the dimensions of a beluga killed on the Tegel River, Eastern Siberia, measuring sixteen feet and six inches in length and nine feet and ten inches in its greatest circumference. This was an unusually large one. The peculiar sound which Mr. Fisher supposed was emitted by the beluga when below the water, and which Captain Scammon compares to the lowing of an ox, is probably caused by its breathing as it breaks the water; it has a clear ringing sound, and occurs the instant that the spiracle comes to the surface and while no other part of the animal is above the water, and as, unless excited, its motions are exceedingly slow, some time occurs before the back comes in sight, giving rise to the belief that the sound is made while the animal is still below the surface. After rising to the surface and breathing it swims without exposing any part of itself above the water until turning to go down again, when it rounds its back high, and, unless very near or under very favorable circumstances, it is not seen until this occurs, although the sound has been heard several seconds before. Captain Scammon is probably in error in regard to the mottled appearance of the young. When changing color the effect was perhaps due to the presence of parasites on the body. We saw large numbers of them of all sizes, but observed none mottled; all were uniform in color throughout, ranging from nearly black to milky white.

The skin of the beluga is considered a great luxury by the inhabitants of the far north. As an article of food it is said that white men soon acquire a taste for it, and that it is an excellent antiscorbutic. The natives kill the beluga for their winter use, and either dry the flesh by exposing it to the sun, or if taken late in the season, when the temperature is near freezing, it is put in caches built of drift-wood, earth, and rocks to preserve it from the attacks of dogs or wolves, and in this way is kept fresh throughout the winter. The blubber and oil are stored in bags made of the stomach and intestines and kept for winter use. The skin is sometimes used for making boot-soles.

July 20, at noon, the wind moderating, we got under way and steamed northward. Passing Cape Lisburne, we shaped a course for Icy Cape, the wind in the mean time having breezed up from the southward, enabling us to make sail, and the following morning we were off Point Lay with a fresh southerly wind. I was anxious to land and take some magnetic observations, but was prevented by the surf on the beach, which was running high, and, owing to the shallow water, breaking a long distance from the shore.

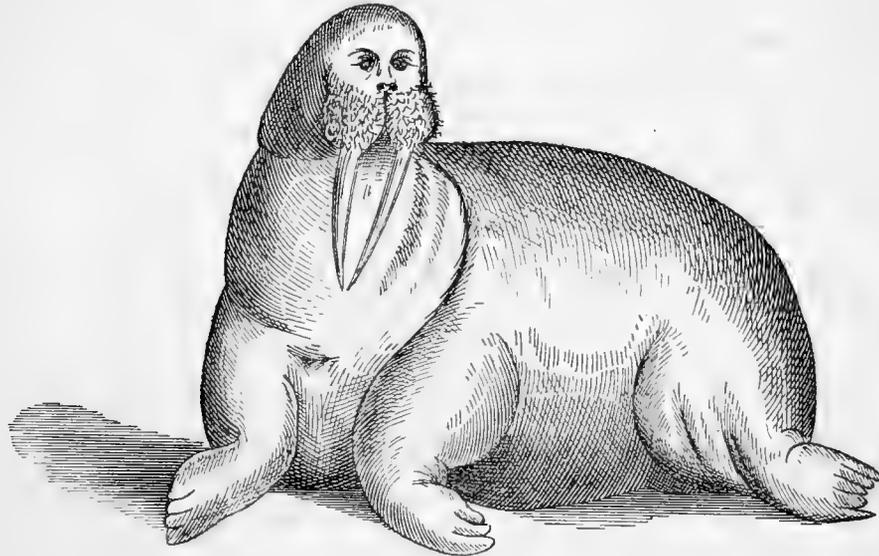
Notwithstanding the cloudy, rainy weather, we had a bright ice-blink in sight on the port beam all the forenoon, and at meridian we saw the same unwelcome sight ahead. The ice being so clear to the southward, I had entertained strong hopes of getting as far north as Point Belcher. At 2 p. m. we came up to the pack off Icy Cape, apparently resting on the shore. Owing to a fresh gale and the increasing thickness of the weather, to avoid the Blossom Shoals we hauled to the southward again under easy steam and sail, making short tacks between the ice-pack and the shore during the night.

On the morning of the 21st, the wind moderating, we kept away, and in the afternoon again came up to the ice in the same place as the day before. Being somewhat open at the edge, and the sea having gone down, we entered it and tried to work around Blossom Shoals. A fog having shut down on us, it was necessary to proceed with great caution.

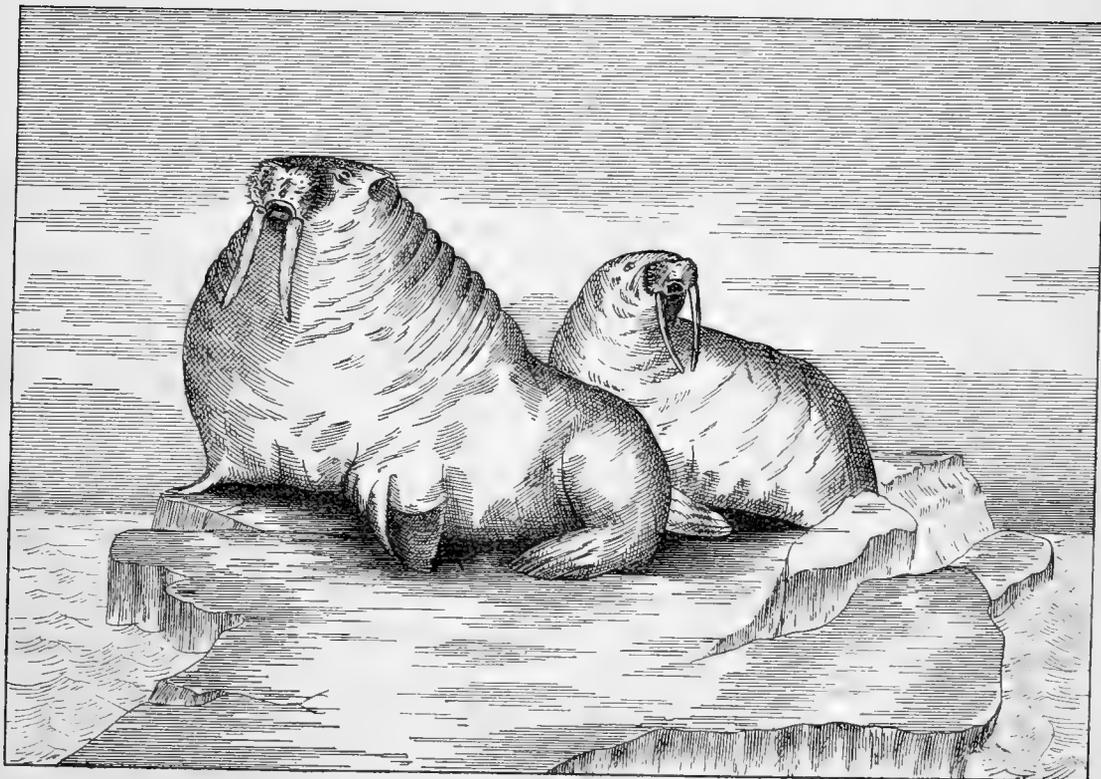
The Blossom Shoals are a very dangerous lot of ridges, lying parallel with the coast at Icy Cape. They have from 1 to 3 fathoms of water over them, and from 3 to 9 fathoms between them. A passage with 3 fathoms exists inshore, but it is narrow and should not be used except in case of great necessity, and the shore side of the channel should be followed if possible, as the water decreases gradually, while the edge of the shoal is steep. If compelled to beat through, it is advisable, when on the offshore tack, to "go about" on the first indication of a decrease in the depth of the water. A slow working vessel will then no more than clear the shoal. It is not remarkable that these shoals should remain the same from year to year. I could find no material change in them since they were discovered and surveyed by H. B. M. ship Blossom, in 1826, as shown on the American Hydrographic chart. If they are, as they appear, merely sand banks, it is somewhat singular that they are not affected by the great quantity of ice which passes over them each year. From their unchanging nature and the fact that the Blossom, after dropping an anchor there, was unable to raise it again, and parted her chain in the attempt, it would appear that the bottom is composed of something more solid than sand. The "Directory of Bering Sea and Alaska" states that these shoals are probably the effect of a large river which here empties itself into the sea. This cannot be, however, since there is no considerable river here, only very small streams, entirely formed from the melting snow. Feeling our way over the shoals, we followed the ice until we could see it resting on the shore at Icy Cape, when we ran back well clear of the shoal and inshore to  $7\frac{1}{2}$  fathoms of water, where we came to anchor south of Icy Cape. During the day we saw many King eider ducks; the sea in the vicinity of the shoal appeared alive with them, great flocks being scared up every few minutes by the movements of the vessel. Many were molting and could fly but a short distance, while others could not fly at all, but used their wings to propel themselves along the surface of the water. When fully feathered they are very beautiful, and fly with a strong, graceful motion.

We remained at anchor during the night and until 1 p. m. the next day, July 23. The fog lifted during the morning and we improved the time by taking observations on shore with the artificial horizon. Magnetic observations were also taken. The geographical position of Icy Cape, like all other points established by Captain Cook during his voyages, was found to be very nearly correct. The place of observation, which was subsequently found to be 7 nautical miles from the pitch of Icy Cape, was in latitude  $70^{\circ} 24' 43''$ , longitude  $161^{\circ} 55'$  west; dip of the magnetic needle being  $79^{\circ} 56'$ , and the variation  $32^{\circ} 12'$  east. We found the variation all along this coast about three degrees less than that shown on the American Hydrographic chart, which was taken from the early English surveys and has not since been corrected. At 1 p. m. we got under way, and following the coast northward in 3 fathoms of water we passed between Blossom Shoal and Icy Cape an hour later, carrying the same depth. The ice-pack was still resting on the north side of the shoal, but was about 4 miles from the cape. We stood to the eastward in the lead between the pack and the shore, about 18 miles, when we came to the end, and as the lead was rapidly closing turned back, and running out through the shoals steamed to the westward a few miles to speak a vessel standing in toward us. This vessel proved to be the whaling bark Northern Light, Captain Campbell, from whom we learned that the bark Daniel Webster was supposed to be in the pack to the northward. About the 1st of July the ice had started off as far south as Point Belcher, opening a lead between the shore and drift ice similar to what we had found on the Siberian coast a month earlier, and extending much farther north. The Daniel Webster and two other vessels had entered this lead, but on the first indication of its closing the latter ships had succeeded in beating out to clear water, while the Webster, apparently unaware of danger, remained, and had not since been seen, as the lead soon closed and the pack set inshore as far south as Icy Cape. Soon after speaking the Northern Light we came up with and boarded the schooner R. B. Handy, of San Francisco, Captain Winants, walrus hunting. Owing to the lightness of the ice they had met with only indifferent success. Walrus "haul out" on the drift ice along the edge of the pack, and in order to guard against surprises from polar bears they select the smallest floes. On account of the unusual lightness of the ice during the present season many of the floes were barely sufficient to sustain the weight of the animals when alive, and when shot and killed they fall over, thus destroying the equilibrium of the floe, and the animals

slide off and sink. . A great many walrus are taken each year for their tusks and oil. When whaling is dull, if walrus are in sight, a small skiff is lowered and, approaching cautiously, a favorable position is selected and the shooting at once begins. To insure success several precautions are observed; First, a place is selected to leeward, as the walrus has a keen scent and readily



EXAGGERATED WALRUS BY CAPTAIN COOK.



WALRUS, MALE AND FEMALE.

detects any one approaching from the windward side, and takes to the water. The hunters avoid wearing dark clothes, and even have the skiff which they use painted some light color, for, although not sharp-sighted, the walrus detects and takes fright at any dark object. In shooting them the best shot always fires first, as it is very necessary that the first three or four should be killed instantly, so that they cannot reach the water. At the first sound of the rifle they all raise their heads, and if one has been wounded and goes into the water the rest all follow; but if the shot has been effective, they soon drop their heads and go to sleep again. This is repeated a few times, until they become so accustomed to the firing that they take no notice of it. Then they are approached within a few feet and dispatched as fast as the guns can be loaded and fired.

Whether these animals are a different species from those described on the Greenland coast, or their ferocity has been overestimated, I am unable to state. It is certain that those frequenting this part of the Arctic seas, while they undoubtedly become enraged at times and attack boats, are, as a rule, harmless and even timid, and much prefer getting away from a boat than fighting it. Two cases of attack by them were reported to me. The first was made by a cow walrus in defense of her young. Coming up alongside one of the hunting skiffs, she struck it with her tusks, knocking the rifle out of the captain's hands and staving a hole in the boat. The other attack, by a singular coincidence, was made upon the same captain by a number of walrus in the water, his skiff being upset and he fiercely attacked by them. They are ferocious appearing brutes, with their flat, bristly-looking noses and long tusks, and their bellow has a most savage sound. When in the water they have an unpleasant habit of facing about, raising their heads high out of the water and bellowing. This, added to their great size, makes them truly formidable in appearance. At times they approach to within a few yards of the boat. An instance of this came under my observation in 1880. Accompanied by Captain Smith, then acting as ice pilot of the *Corwin*, I went out to shoot walrus, cautiously approaching a large number of them on the ice. When quite near, they became alarmed and all slid into the water, but instead of leaving us, as we expected, they faced directly toward us, shaking their heads and bellowing in a savage manner. Whether they really meditated an attack upon us, or were merely drawn there out of curiosity, could not be determined. Prompt obedience to the dictates of "nature's first law" caused us to get out of their sight behind the high ice as quickly as possible and the idea that it might have been from some other cause than a desire to destroy us did not occur until afterwards. The following interesting note on the walrus is taken from the account of McClure's discovery of the Northwest Passage, by Capt. Sherard Osborn, R. N.:

Some of these creatures were conjectured to weigh as much as thirty-five hundred-weight, and the ice when relieved of their weight rose about two feet. These ferocious-looking creatures were found in great numbers in Bering Strait; all our voyagers speak of them, and the well-known sketch in Cook's voyage of the conflicts between his men and the walrus has been seen by most people. It is only fair to observe, however, that this representation does some injustice to a brute whose character is naturally inoffensive, although when assailed in the water it is not deficient in courage. If in company with the female or its young, the devotion evinced by the males exceeds that of most animals. Both male and female have tusks, but these are so situated as to be of little use when the creature is out of the water, unless for aiding them in scaling the steep and rugged sides of ice hummocks. The females are sometimes seen with two cubs at a time, but generally with one. They suckle their young, and from the different sizes and periods at which they have been seen doing so, voyagers are led to believe that for twelve or eighteen months the young one is dependent upon the mother for nourishment. They feed upon the submarine plants of the Arctic regions, and as far as may be judged from the teeth they do not appear to eat fish or seal.

The following note I found written upon the margin of a leaf of the same book:

"They eat both fish and seal"—signed E. F. Nye. This information, coming from a man of so many years' experience as the late Captain Nye, of the ill-fated whaler *Mount Wollaston*, is entitled to consideration.

After speaking the *Hardy* we stood to the southward under slow bell and the following morning, July 24, came to anchor near the shore about 25 miles from Icy Cape, in 4 fathoms of water. The bark *Sea Breeze*, schooner *Handy*, bark *Sappho*, and steam whaler *Belvidere* came to anchor near us during the day. It was then determined to wait a day or two more and, if no improvement was noticed in the condition of the ice, to make a run westward and return later to the eastern shore. I boarded the different whalers to get the "news," which, in the Arctic, refers

to the whales and ice. The reports of the latter were very favorable. Some of the vessels had already been in sight of Herald Island. After learning this I was anxious to get near the island, for I had strong hope of being able to land there and possibly on Wrangel Island later in the season. But the same circumstance which rendered this prospect so hopeful to us had the opposite effect on the whalers. The ice being so light allowed the whales to go into the pack far out of reach, where they would remain until the closing of the ice should drive them out in the fall. Fortunately most of the ships had done well early in the season, many having already made a fair catch.

On the 25th the weather continued fine, with occasional fog banks, which, however, lasted but a short time. Being anxious to get started to the westward, I determined to return to Icy Cape and, if the ice remained the same, to try to go up inside of it in the steam cutter, taking another boat in tow, with fuel for two weeks, extra provisions, &c. Accordingly the steam and second cutters were fitted out; the steamer was housed over with an awning and curtains which had been made for her, and fitted with a mast and sail borrowed from the steam whaler *Belvidere*. Fuel, provisions, clothing, and arms were got in readiness and we hoped to be able to get well up the coast. On arriving at Icy Cape the prospect was rather discouraging. The pack was resting against the shoal, evidently pressing very hard, and, in some places, it was fairly forced out upon the shoal. In trying to get near enough to learn whether any clear water existed to the eastward, inshore of the pack, the vessel touched the bottom, but backed off without difficulty, and, dropping back clear of the shoals, we came to anchor. An examination with the steam cutter, however, showed the pack to be resting against the shore, and with such powerful pressure that it was forced entirely out of water on the shore. Consequently we were obliged to abandon the undertaking, much to our regret. We remained at anchor during the afternoon, and improved the time by examining the coast line. The entrance into the lagoon which lies between the outer shingle beach and the coast line proper was sounded out. This entrance, which has over 2 fathoms of water, is within 2 miles of the pitch of the cape. A vessel drawing 2 fathoms could find good winter quarters here, entirely free from danger from ice pressure. The shingle beach which forms the west side of this lagoon extends for about 100 miles along the shore. Beginning in latitude  $69^{\circ} 20'$ , it ends at Wainwright Inlet, in latitude  $70^{\circ} 35'$ , and is from a few hundred yards to miles in width. The lagoon has several openings to the sea, two at least having been sounded and found to contain 2 fathoms of water. The lagoon is from  $5\frac{1}{2}$  to 10 miles wide, and is crossed by occasional sand bars, some entirely dry, so that it is only navigable for boats sufficiently light to be hauled across the portages. The coast line proper at Icy Cape consists of a series of mud cliffs from 10 to 50 feet in height. The surrounding country is low and slightly rolling; in color it does not differ from all other points of the coast north of Bering Straits, gray and brown, sometimes a greenish tinge; and the ever present lines of dark green, caused by dwarf willows, birches, and alders, following the banks of each little stream of melting snow. All along these shingly beaches we found pieces of coal, probably brought thither by the ice from the coal veins farther south. There are occasional settlements of natives. A more cheerless place it would be difficult to imagine for human beings to live in. During the summer they travel and live in tents. In the early spring and fall they kill walrus and occasionally a whale. At each settlement we saw drift logs set on end for lookout stations. In the whaling season the oomiacs are kept in readiness for immediate use, and one native takes his station on the top of the lookout pole, keeps a watch, and gives the alarm if whales are seen. Then the oomiacs put off, and, if fortunate enough to kill a whale, a great feast ensues. The flesh and blubber are partaken of by all, and some amicable arrangement is made in the disposition of the baleen. In the winter these people hunt reindeer, wolves, and foxes on the mainland. They are visited each year by the whalers, and from them buy a supply of ammunition, tobacco, drilling, &c., paying in whalebone, walrus ivory, and furs.

Being compelled to abandon our boat trip we got under way in the evening, making sail and uncoupling the propeller. The ice was in sight from the shore 25 miles south of the cape, and the blink extended to the southwest as far as we could see from the mast-head. Running southward all night under sail with a moderate breeze and clear weather, and keeping in six fathoms of

water, brought us on the following morning off the place where we had left the whalers at anchor. We found that several more had arrived. After communicating to the fleet the position of the ice and its rapid southerly movement, we kept on towards the coal mine. The weather being fine and the wind falling light in the afternoon, we coupled up the propeller and ran under a "slow bell," keeping along in 6 fathoms of water. At 8 p. m. we were off Cape Beaufort. I was anxious to stop and make an examination of the coal vein said to exist there, but indications of a change in the weather and the uncertainty of being able to find coal in any quantities decided us to keep on to the vein opened by us last year, where we felt sure of getting a few tons without great difficulty, if the weather remained fine, and, in case of bad weather, we could be that much nearer to Point Hope, where we would be able to make a lee. Soon after passing the whaling fleet in the morning, the *Belvidere* got under way and steamed to the southward. In the evening we had a wonderful exhibition of the effect of the refraction of light, in which that vessel took a very prominent part, and the many fantastic forms assumed by her in the mirage, when about 20 miles distant, was a source of wonder and amusement to all on board for several hours. Subsequently I learned from Captain Owens that he had on that occasion seen from the *Belvidere's* mast-head the entire fleet of whale ships at anchor off Icy Cape with sufficient distinctness to tell which way they were heading, although over 50 miles distant. To complete this most remarkable exhibition, just before midnight a stratus cloud not more than two degrees wide by fifteen degrees long appeared beneath the sun, which was still above the northern horizon. This cloud, acting as a prism, decomposed the rays of the sun's light and produced, between the cloud and the horizon, a solar spectrum of great beauty and brilliancy constantly varying in intensity, owing to the change in position of the cloud, at times showing all the colors of the rainbow, and at others only one or two, again dying out completely, only to reappear by running through all the colors successively, each showing but a second of time and giving place to the next. This display lasted half an hour, and was a scene long to be remembered. During the day the sky had been filled with long, streaked-looking, thin, white clouds, which seemed to radiate from a point in the southwest, a few degrees above the horizon, and many of them extended over an arc of one hundred degrees in an almost unbroken line. Below these and somewhat nearer were strata of yellowish-looking clouds, such as often precede rain and are considered an indication of it in the lower latitudes. The higher bands, which I have never seen outside of the Arctic regions, differ entirely in appearance from the streaked condition often shown by cirrus clouds in the lower latitudes, and possess characteristics which the others do not. These bands, which are exceedingly light and fleecy, are parallel to each other from a perspective point of convergence, which, in the few cases that I have observed, appear to be at first in or near the magnetic meridian and to run parallel with it, although changes are constantly taking place in the position of their axes. The bands, while retaining their relative position, often change their point of convergence, through an arc of ninety degrees. They appear at any time without regard to existing forms of clouds, whether cirrus, cumulus, or stratus. At times they form in a few minutes from a perfectly cloudless sky, and, after remaining visible for a short time, fade away and disappear without changing their relative positions. A more common way of disappearing, however, is for them to move off in a direction at right angles to the line of their bands, and without changing the position of the axial points or their relation to each other, disappear below the horizon, leaving no trace behind. I observed these clouds closely during the cruise, but could not discover that they exerted any particular influence on the weather, as I had at first supposed, on account of their preceding a blow on one or two occasions, leading me to refer to them as one of the indications of approaching bad weather; but as on this and other occasions they were followed by several days of very fine weather, I can at best only suppose that they may indicate a change and are in no way responsible for the nature of it. It is more than probable, however, that they indicate magnetic disturbances, which might be readily traced by careful observations made with suitable instruments on shore. A singular fact in connection with these clouds is that, no matter how faint they may appear, whenever they pass over the face of the sun or moon, they produce a bright halo; in fact their presence is often first detected by a faint halo, which increases in brilliancy as the clouds become more distinct.

Their movements appear to be entirely independent of the lower clouds and the direction of the wind. Humboldt, in referring to similar clouds, says:

The probable connection which, according to my views, exists between the polar light and the formation of very small and delicate, fleecy clouds (whose parallel and equivalent rows follow the direction of the magnetic meridian) has met with many advocates in recent times. It still remains a doubtful question, however, whether, as the northern travelers, Thieneman and Admiral Wrangel, believe these parallel fleecy clouds are the substratum of the polar light, or whether they are not rather the effect of a meteorological process, generated by and accompanying the magnetic storm.

This has also been conjectured by Franklin, Richardson, and others.

According to Humboldt these clouds begin in the direction of the magnetic meridian, and on this account he calls them "polar bands"; others place them at right angles to the magnetic meridian. On account of their faintness when first formed, as evidenced by the fact of the halo being produced before the bands are visible, the question of their original direction is a difficult one to decide.

There is also another form of cloud peculiar to the Arctic regions which appears over the barren granite islands, taking nearly the form and shape of the islands themselves. I have noticed it more particularly over the Diomedes, King's Island, and Herald Island. I have also seen it, but to a less marked degree, over Saint Lawrence Island; also over the peninsulas of East Cape and Cape Prince of Wales. The cloud forms at any height, according to the conditions by which it is governed, from a few yards to half a mile. These barren granite rocks, presenting as they do almost perpendicular sides to the sun's rays, become heated. The current of air passing over them is heated by contact with the warm rock, and, expanding, of course rises just in proportion to the amount of heat received and the temperature of the stratum of air immediately above, by which it is eventually cooled. Its moisture is condensed and a cloud formed, which, owing to the fact that it is constantly forming and imperceptibly wearing away, remains for hours apparently without the slightest change, either in position or form, although the wind may be blowing fresh at the time. In calm weather the cloud hangs directly over the rock which forms it, but when the wind is blowing fresh it hangs a little to leeward. As the temperature of the rock decreases the amount of heat transmitted to the atmosphere becomes less, and in consequence the condensation takes place sooner and the cloud lowers, and it continues to spread out until the island or headland is entirely concealed. The Arctic is the home of the fog banks; here the slightest change in temperature creates them, and they can as suddenly pass away. Here, too, constant changes are taking place, owing to the surrounding conditions. A few degrees' change in the direction of the wind may make many degrees' change in its temperature, for, blowing from the heated lands, it may have a temperature of fifty or sixty degrees or even more, or if it comes directly from the ice pack its temperature is thirty-two degrees. The result of these sudden changes is dense fogs, which appear and disappear so suddenly and quietly that it is a common saying among the sailors that Arctic fogs "go to windward." They seldom blow away as in other latitudes, but at all times when seen are either forming or condensing. The first sign of a disappearance of a fog is the collection of drops of water on the rigging and spars, which is soon followed by small patches of blue sky directly overhead. These increase in size until the fog is all gone. These fog banks are not confined to any special locality, but are most numerous and of longest duration in the immediate vicinity of the ice, where it is no unusual thing for them to last several days, and so dense as to make it impossible to see more than a few yards.

On the 27th of July, at 3 a. m., we arrived off the coal mine, and, anchoring close inshore, we went to work at once coaling ship. The steam whaler, coming to anchor near us, also took in a few tons of coal and a quantity of fresh water from a fine stream which here empties into the sea. We succeeded in getting about 13 tons during the day, but found it very hard work. Enormous snow-banks lay against the cliffs, completely covering some of the best veins for a height of 200 feet, compelling us to mine the coal at that height and lower it to the beach in sacks. The ordinary coal-sacks were not able to stand the friction of being slid down 200 feet over a frozen snow-bank, so a couple of large canvas bags were made, capable of carrying three coal-sacks, and these were carried up and down by means of an endless rope passed around a spar at the top, the empty bags being drawn up as the full ones went down. The shore at this place is covered

with large bowlders, and a slight roll of the sea coming in made great caution necessary in handling the loaded boats to prevent their being stove. While here we explored the cliffs to the eastward and discovered several new veins of coal, from one of which we took several tons. These cliffs contain an abundance of coal and of good quality, but it is quite difficult to mine large quantities of it for several reasons. First, the season is very short in which it can be approached with a vessel, probably not averaging over two months and a half, from the middle of July to the end of September. During the whole of the latter month strong winds prevail from northeast to northwest, which, as they blow directly on shore, make the surf too rough for landing, as there is no protection of any kind. Inside of 7 fathoms of water, which is found about 1 mile off shore, the bottom is a flat rock, upon which an anchor will not hold at all, so that with a sailing-vessel the shore cannot be approached nearer than a mile with any safety. Owing to the precipitous nature of the banks in which the coal is found, only the lower part of the veins is accessible without erecting staging, &c., and in the early part of the season there are enormous snow-banks, and the coal can only be reached by ascending to their tops and lowering it down, as we were compelled to do at this time. Until coal becomes very much scarcer nearer home the Corwin mine will not probably furnish much for use outside the Arctic Ocean; but if steam takes the place of sail as a motive-power for our whaling fleet, as it bids fair to do, I see no reason why at least a part of their fuel should not be taken from here. But a small amount of capital would be required to open and work this mine, and a supply might be kept in readiness for the whalers at all times. I took samples of the coal to San Francisco for the benefit of any who might wish to test its qualities. Several applications were made for samples, all of which I was able to supply. Before leaving the place we erected a cross on top of the cliff for the benefit of any who might wish to find the mine. Its geographical position is approximately latitude  $68^{\circ} 50'$  north, longitude  $164^{\circ} 55'$  west. It is about 22 miles east of Cape Lisburne, and some of the veins are easily distinguished at a distance of a mile and a half. The large pockets of coal and dark slate in the face of the cliff are particularly conspicuous. As stated in my report of my first cruise, the existence of this coal was first reported to me by Capt. E. E. Smith, ice-pilot. The mine was first visited and worked by the Corwin, and, with the exception of a small vein at Cape Beaufort, which was discovered by the early English explorers, no other coal has yet been discovered in this part of the Arctic regions.

While the ship's company was employed coaling, Professor Muir and Mr. Nelson each improved the time on shore; the former in making botanical and geological examinations in the vicinity of the coal deposits, and the latter in a fruitless hunting excursion, during which he endeavored to get a shot at two mountain sheep by creeping on his hands and knees in the bed of a small stream for a distance of several hundred yards, when thinking himself near enough to shoot, and rising cautiously, he was just in time to see them disappear over the brow of a hill, half a mile away. The course of the stream unfortunately took him to windward of the sheep, which, having a remarkably keen scent, took the alarm. Mr. Nelson also saw a number of little graylings in a small stream which runs back from the sea-coast, and is, I believe, a tributary to the Noyatag River, which discharges into Hotham Inlet. Unfortunately Mr. Nelson had no net, and these fish, like the big-horns or mountain sheep, escaped being made specimens for the National Museum.

During our stay at the coal mines several oomiacs full of Point Hope natives arrived and pitched their tents near the stream of fresh water. They said they were on their way to a place just east of Cape Beaufort, where they go each summer to hunt reindeer and lay in a stock of meat for winter use. They go north in July and return about the 18th of September, laden with meat. At this season the deer are very fat, and the skins are in excellent condition for making clothing. I also saw a large number of beluga going north, many of them young ones, being quite small and dark colored.

July 28, at 4 p. m., we got under way, having taken on board about 20 tons of coal during the two days. We shaped a course to pass south of Herald Shoal. During the night and on the following day the weather continued fine and warm, with not a cloud in sight, the atmosphere having the same smoky appearance often seen on the coast of California and Oregon in the summer months.



CORWIN COAL VEINS, ARCTIC OCEAN.  
NATIVES ENCAMPED.



S. EX. 204, 1, 48

HELIOTYPE PRINTING CO., BOSTON.

ARCH, OUNALASKA.  
*Photo. by Nelson.*



The temperature of the sea water at the surface at meridian was  $48^{\circ}$ , and at the bottom  $35^{\circ}$ , although the ice was in sight from the mast-head. The wind was very light from the southward. A comparison of the ship's position by dead reckoning and observation at meridian showed no current up to that time, a circumstance probably accounted for by the fact of the ice resting on the shore at Icy Cape, which has the effect of stopping the current along the shore. No better indication is needed of the condition of the ice to the northward than the strength of this current. When the ice reaches the shore the surface current is stopped entirely. It is possible that an undercurrent continues to run, but as the depth of the ice is about one-half the depth of the water, it is more probable that when the current at the surface is stopped, the bottom is nearly so. When the ice leaves the shore as far north as Point Barrow, the current sets to the northward from 1 to 3 knots per hour.

We sighted the ice several times during the day to the northward and once or twice thought we saw the blink to the southward, but owing to the hazy state of the atmosphere we could not be certain. At midnight we passed through a patch of ice, either a detached floe or a point extending out from the main pack. Hourly soundings in about 22 fathoms of water were made during the night. The temperature at the surface was  $45^{\circ}$  and at the bottom  $40^{\circ}$ . Notwithstanding the high temperature of the sea water a comparison of the ship's position by dead reckoning and by observation showed that no current had been encountered up to meridian, at which time Herald Island bore by reckoning northwest by north, true, distant 38 miles.

At 1.40 p. m. the lookout at the mast-head reported land ahead, and soon after Herald Island was in sight from the deck. The weather was fine, the wind light, southwest, and the sky almost cloudless. Temperature of the air  $67^{\circ}$ , sea water at the surface  $48^{\circ}$  and at the bottom  $43^{\circ}$ . We



HERALD ISLAND, SOUTHEAST SIDE.

continued to stand directly for the island, with no ice in sight, or any indications of an ice-blink until 4 p. m., when we made the ice on the port beam, and soon after ahead, and on the starboard beam. When first raised it loomed up and looked very heavy, but upon coming up to it, about half past 5 p. m., it proved to be light, and at the edge well open. It had a very dirty appearance, as if off the shore. I sent an officer with a lead and line to take the drift of the ice, and found it settling to the northward, about 1 knot per hour. Herald Island appeared about 12 miles within the ice. At 5.45 p. m. we entered the ice and made as direct a course for the island as the state of the ice would permit. At 6.25 we sighted Wrangel Land bearing west. As

we approached Herald Island the ice became very much heavier, and the difficulty of getting through it much greater, but after a good deal of bumping, squeezing, and twisting around through narrow, crooked leads, and occasionally charging through an icy barrier, we succeeded in reaching the island at 9.45 p. m., and made fast to a rim of very heavy old ice which lay aground alongside the island. The drift-ice outside of us was setting to the northward about 1 knot per hour. As soon as the vessel was made fast to the ice, and permission was given, a general rush was made for the shore, each trying to be the first to land. The rim of ice was probably 1,000 feet in width, and full of hollows and hummocks, but after many falls, with some narrow escapes from going into the deep crevices which run through it in various directions, the shore was reached and a scramble up the almost perpendicular rocks followed. While this was being done Professor Muir, who is an experienced mountaineer, came over the ice with an ax in his hand, and reaching the island a few hundred feet further north, opposite a bank of frozen snow and ice 100 feet high, standing at an angle of fifty degrees, he deliberately commenced cutting steps and ascending the ice cliff, the top of which he soon reached without apparent difficulty, and from there the top of the island was reached by a gradual ascent neither difficult nor dangerous.

While approaching the island, by a careful examination with the glass, Muir's practiced eye had easily selected the most suitable place for making the ascent. The place selected by the others, or rather the place upon which they stumbled—for the attempt to ascend was made on the first point reached—was a small, steep ravine about 200 feet deep. The jagged nature of its steep sides made climbing possible, and from the sea level the top of this ravine appeared to these ambitious but inexperienced mountain-climbers to be the top of the island. After several narrow escapes from falling rocks they succeeded in gaining the top of the ravine, when they discovered that the ascent was hardly begun. Above them was a plain surface of nearly a thousand feet in height, and so steep that the loose, disintegrating rock with which it was covered gave way on the slightest touch and came thundering to the bottom. Some of the more ambitious were still anxious to keep on, notwithstanding the difficulty and danger, and I found it necessary to interpose my authority to prevent this useless risk of life and limb. A retreat was ordered, and with a good deal of difficulty accomplished. The descent had to be made one at a time, the upper ones remaining quiet until those below were out of danger. Fortunately, all succeeded in reaching the bottom in safety. In the mean time Muir and several others had reached the top of the island and were already searching for cairns or other signs of white men. Although the search was kept up until half-past 2 a. m., nothing was found.

Notwithstanding the bleak, barren appearance of this island at a distance of a few miles, an examination of its summit resulted in the finding of the following species of plants: saxifrage, poppy, silene, draba, dwarf willow, stellaria, two of the compositæ, two sedges, one grass, one veronica, and a number of mosses and lichens. Every rocky projection on the cliffs seemed covered with nesting birds, gulls, murre, auks, guillemots, &c. Some had their broods of young hatched out and others were still sitting on their eggs. Although so tame that they would not fly away when approached, they nevertheless each felt called upon to protest loudly against this invasion of their home, and their combined voices made a din such as is seldom heard. On the top of the island a number of snow-buntings were flying merrily from rock to rock. On the top of the east end, over a thousand feet above the sea, was a bed of turfy moss, about 100 yards in extent and from 3 to 4 feet in depth, containing a number of holes, which at first resembled the tracks of some hoofed animal, but which, upon closer examination, proved to be white-fox burrows. One of the young seen by Mr. Nelson seemed to resent the intrusion of strangers, and retreated step by step, snapping and barking when an effort was made to catch him, until, the chase becoming a little too pressing, he turned and fled into a hole and escaped. The following reference is made to this land in a letter by Professor Muir:

Kellett, who discovered this island in 1849, and landed on it under unfavorable circumstances, describes it as "an inaccessible rock." The sides are indeed in general extremely sheer and precipitous all around, though skilled mountaineers would find many gullies and slopes by which they might reach the summit. I first pushed on to the head of the glacier valley and thence along the backbone of the island to the highest point, which I found to be about 1,200 feet above the level of the sea. This point is about  $1\frac{1}{2}$  miles from the northwest and  $4\frac{1}{2}$  from the northeast end, thus making the island about 6 miles in length. It has been cut nearly in two by the glacial action it has

undergone, the width at the lowest portion being about half a mile and the average width about 2 miles. The entire island is a mass of granite, with the exception of a patch of metamorphic slate near the center, and no doubt owes its existence, with so considerable a height, to the superior resistance this granite offered to the degrading action of the northern ice sheet, traces of which are here plainly shown as well as on the shores of Siberia and Alaska and down through Bering Strait southward beyond Vancouver Island. Traces of the subsequent partial glaciation it has been subjected to are also manifested in glacial valleys of considerable depth as compared with the size of the island. I noticed four of these, besides many marginal glacial grooves around the sides. One small remnant, with feeble action, still exists near the middle of the island. I also noticed several scoured and polished patches on the hardest and most enduring of the outswelling rock bosses. This little island, standing as it does alone out in the Polar Sea, is a fine glacial monument.

While the top of the island was being examined in every direction by the party on shore we cast off from the ice and steamed around to the north side, keeping close to the island inside the drift-ice. On the south and west side the ice was packed so hard against the shore that it was not possible to get through it. Off the southwest point it appeared to be grounded and piled up for some miles, indicating shoal water in that direction. I was informed by Capt. E. E. Smith that a shoal exists there upon which he saw the water breaking while riding out a gale under the lee of the island during one of his whaling voyages. On the east and north we found 10 fathoms of water within half a cable length of the shore, and 20 fathoms but a short distance outside of that. Herald Island is about 6 miles long by 2 wide, and its greatest height, as shown by the aneroid barometer, is 1,200 feet. The barometer used has several times been tested with known heights and found to indicate correctly. It was compared on this occasion both before and after the observation with the mercurial barometer, and this in turn had been compared with a standard at San Francisco before sailing, so that this result may be relied upon as very nearly correct.

From the top of Herald Island a good view was had of Wrangel Land. A sketch made by Professor Muir gives the magnetic bearing of its extremities as south  $40^{\circ}$  west and south  $70^{\circ}$  west, or south  $63^{\circ} 26'$  west and north  $86^{\circ} 34'$  west, true. The contour of the eastern end of the land was clearly defined, and about 40 miles distant, but farther away, on its north side, about midnight a blue line appeared above the horizon, which was supposed by Professor Muir to be land extending in that direction. Herald Island was first discovered by Kellett in 1849 and named after his ship Herald. At the same time he saw Wrangel Land, but mistook the eastern cape for an island, which he named for H. B. M. ship Plover, then cruising north of Bering Strait. In his report of the discovery of Herald Island, Kellett says:

The ship kept off and on outside the thickest part of the loose ice, through which the boats were obliged to be very careful in picking their way, on the southeast side, where I thought I might have ascended. We reached the



THREE ISLANDS SEEN FROM THE ABOVE (BEARING NORTH AND WEST). WRANGEL ISLAND AS SEEN FROM H. B. M. SHIP HERALD, AUGUST 17, 1849. LONGITUDE  $175.10$  W., LATITUDE  $71.02$  N.

[This tracing, which was kindly furnished me by W. H. Dall, U. S. C. and G. S., was taken from the original sketch, made by Captain Kellett on his working chart at the time the land was discovered.]

island and found running on it a very heavy sea. The first lieutenant, however, landed, having backed his boat in until he could get a foothold without swimming, then jumped overboard. I followed his example and others were anxious to do the same, but the sea was so high I could not permit them. We hoisted the jack and took possession of the island with the usual ceremonies in the name of her most gracious Majesty Queen Victoria. The extent we had to walk over was not more than 30 feet. From this space and a short distance that we scrambled up we collected eight species of plants.\* Specimens of the rock were also brought away. With the time we could spare and our materials the island was perfectly inaccessible to us. This was a great disappointment, as from its summit, which is elevated above the sea 1,400 feet, much could have been seen and all doubt set aside, more particularly as I knew the moment I got on board I should be obliged to carry sail to get off the pack and out of the sight of it we were in, nor could I expect that at this period of this season the weather would improve. The island on which I landed is 4½

\* According to Berthold Seemann, botanist of the Herald, these plants were *Hepatica*, *Poa* = *arctica*, and another grass, *Artemisia borealis*, *Cochlearia fenestrata*, *Saxifraga lamentissima*, a moss, and red lichen which covered the rock.

miles long from east to west and about  $2\frac{1}{2}$  north and south, in the shape of a triangle, the western being its apex. It is almost inaccessible on all sides and a solid mass of granite. Innumerable black and white divers (common to the sea) here found a safe place to deposit their eggs and bring up their young. Not a walrus or seal was seen on its shore or on the ice in its vicinity. We observed here none of the small land birds that were so numerous about us before making the land.

Magnetic observations were taken on the ice which shows the dip to be  $78^{\circ} 45'$ , and the magnetic declination  $24^{\circ} 47'$  east. Unfortunately the Lloyd magnetic needle used for observing the intensity of the vertical attraction was accidentally dropped on the ice and broken, so that in the magnetic table the relative intensities are omitted, the vertical angle and the declinations alone being given. I hoped to obtain an altitude of the sun below the pole at midnight for latitude, but the sun being obscured by a cloud before first coming to the meridian, did not reappear until an hour after. We had good observation during the day, both for latitude and longitude, and, carrying the reckoning forward, find it to agree very closely with the position of the island as laid down on the American Hydrographic chart. Just as we were about to cast off from the island a bear was observed in the water near us and evidently very curious to know what the vessel was. He swam directly up to the bow with his head up, snuffing the air as if trying by the sense of smell to learn something of this strange visitor. His curiosity cost him his life. The skin was in good condition and the flesh proved to be fair eating. He was of medium size and probably two or three years old. At 3 a. m. we took in our ice anchor and began working our way through the heavy drift-ice toward open water, fully satisfied that none of the parties of whom we were in search had touched there.

During the first cruise of the Corwin we made four attempts to reach Herald Island, and on the 20th of August succeeded in getting within 3 or 4 miles of it, where we met a solid barrier of unbroken ice extending nearly north and south, and from 12 to 40 feet high. At 6.30 we emerged from the ice, and, entering clear water, steamed southward along the edge of the ice, keeping a sharp lookout for leads or lanes of open water in the direction of the land which might permit us to approach it. While leaving Herald Island several fish which resembled smelt, from 5 to 8 inches long, were seen for an instant as they were brought to the surface by the turning and rolling of the ice.

During the day the hills of Wrangel Island were in sight most of the time. Often, when raised by refraction, they appeared as if coming out to meet us, then faded away until nearly lost to view, and in the evening a thick fog shut them out entirely. Being unable to see the leads on account of this fog, we came to anchor for the night. The set of the current was southward, about half a knot per hour. The ice which we had been passing during the afternoon was very different from that seen in the vicinity of Herald Island, being in much larger pieces, heavier, and also white, showing that it had not formed near the land.

On the following morning (August 1) the fog clearing a little, we steamed along the edge of the ice, which trended to the southwest and west, until 2 p. m., when it again shut down so thick that we could not see the length of the vessel. The engine was stopped, and a cast of the lead showed 21 fathoms of water, with blue mud bottom. Our noon observation put us in latitude  $70^{\circ} 15'$  north, longitude  $178^{\circ} 21'$  west, about 27 nautical miles distant from the position of Cape Hawaii, as shown on the American Hydrographic chart. The fog settled once or twice during the day, enabling us to catch a view of the tops of the mountains for a few minutes, but too far distant and too indistinct to admit of a sketch being taken or any close estimate made of their height.

At 1 a. m. (August 2) the fog began to break away a little, giving us a better view of the mountain tops. At 4 a. m. we sounded in 21 fathoms of water. Temperature at the bottom was  $35^{\circ}$ ; the ice, which was close alongside, was very heavy but well open. At 4.15 we started ahead, and after steaming northward in the ice for an hour, stopped and lowered a boat to observe the set and force of the current, which was found to be to the northward about one-quarter of a knot per hour. At 7.30 the fog again shut down so thick that we could not find the leads and were compelled to stop the engine. Making fast to a huge floe, we waited for a clear-up. The ice was very heavy, many floes being from 1 to 2 miles in length, and probably from 60 to 100 feet thick. We had 21 fathoms of water with blue mud bottom; temperature at bottom,  $35^{\circ}$ .

While fast to the ice a small piece of wood showing ax-marks was discovered floating in the water. It was about 2 feet long and 2 inches thick, and had apparently been cut from a log of 2 feet or more in diameter. It seemed to have been but a short time in the water, and gave rise to many conjectures on board as to how it came there, some declaring that it must have drifted off from the shore of Wrangel Island, where it had been cut by white men. Our reckoning placed us within 15 miles of the land, and we had no doubt but we should be able to reach the shore, or at least the grounded ice, as soon as the lifting of the fog would allow us to see the leads. A sea-urchin was also found on the ice near where we made fast, probably dropped by some bird. At the time, however, it was taken as an evidence of our nearness to the land, and excitement on board the *Corwin* ran very high at the thought that we might be actually within a few miles of some of the missing people. We continued to work in towards the land whenever we could see the leads, until our reckoning placed us within 7 miles of it, where the ice became so close that we were unable to penetrate it any farther, and were obliged to give up the attempt. The soundings in the last few miles had deepened to 22 fathoms, with no perceptible current. A slight roll of the sea indicated that a fresh breeze was blowing outside of the ice, the barometer was falling, and the weather looked threatening. While working in through the leads three polar bears were seen a-sleep on the ice near the ship. As we were moving very slowly on account of the fog and heavy ice, they were shot without difficulty, and two of them taken on board, but the third was lost in the fog. At 1.45 we headed southward and worked out for open water, and although the weather was so thick that we could not see ice far enough away to avoid a collision with it, we succeeded in reaching open water at half past 5 p. m., without accident, by proceeding cautiously and taking the ice "end on" as much as possible. The weather still continued thick, but by the long, regular roll of the sea from the southeast I felt assured that no large bodies of ice existed in that direction. In order to keep our position as nearly as possible we came to with the kedge in 22 fathoms of water, hard bottom; temperature at bottom,  $34^{\circ}$ ; wind moderating, and at 8 o'clock changing to the westward, the vessel dragging her kedge slowly to the east-southeast; weather very thick. During the day we had seen two bow-head whales, the three bears mentioned, and several seals and walrus. Singularly enough one of the latter came up directly under the bow of the vessel, and being struck by the ice-breaker was killed. In addition to these we saw a number of gulls (burgomaster and jaeger), a diver, and three or four snipe. A small fish resembling a smelt was also seen swimming among the ice. The fog continued all night; wind light from west to northwest.

At 7.30, August 3, being able to see a mile or more, we got under way and steamed to the northwest under one bell until 9, when it again shut down thick, just as we came up to the ice. The engine was stopped and soundings made in  $19\frac{3}{4}$  fathoms of water, soft bottom, temperature at bottom  $40^{\circ}$ , the current setting to the westward very gently, not more than a quarter of a knot. At 2.30 p. m. the top of the high hills to the northward could be seen, and a lead was discovered to the northwest, probably the same one we had entered the day before. We entered it and steamed ahead at full speed until 3.30 p. m., when the lead was found to be filled with heavy drift-ice, which became closer as we advanced until it fairly stopped our progress. There was not a patch of clear water as large as the vessel's deck in sight from the mast-head in the direction we wished to go. A light westerly current was here observed. Judging from the distant appearance of the hills, as we had caught glimpses of them from time to time, I suspected, what our observation afterwards confirmed, namely, that the land was considerably further north than it is laid down on the chart.

The solid appearance of the ice, and the fact that there was no material change in the depth of the water, convinced me that there was no possibility of reaching the land from this direction until a decided change should take place. So we determined to follow the ice to the westward and approach from the west where Wrangel, in his attempts to reach the land, had been stopped by open water in March, and compelled to turn back. Accordingly, after getting out of the lead, we followed the edge of the western pack towards the southwest, keeping close alongside of the ice. On account of the thick weather, and in our anxiety to find the pack trending westward, we kept running into leads in that direction, only to find ourselves disappointed and forced to turn back. Instead of trending westward, as I had hoped, it gradually took a more southerly direction, until

it ran nearly north and south, and presented an almost unbroken front, and in this condition it extended to the Siberian coast at Cape North. Apparently the entire sea north of the Siberian coast and west of Wrangel Land was filled with heavy pack-ice.

August 4 the weather cleared, and at 6 a. m. a spar, discovered floating in the water, was taken on board and carefully examined for any mark that might furnish a clew to the name of the vessel to which it belonged. It was a lower yard, 12 inches in diameter, and, when complete, probably 50 feet in length. Both yard-arms had been broken off at the sheave-holes, so that the exact length could not be told. Attached to the yard was a sling-band, 3 inches wide and one-half inch thick, with chain tie of seven-eighths-inch iron, 4 feet 7 inches long, including hook and shackle, and a cast-iron quarter block or gin with two iron sheaves for topsail sheets. A five-eighths-inch iron jack-stay was secured to the yard by iron dogs. Underneath, inside the yard-arm sheave-holes, were small iron chocks, such as are commonly used with chain topsail sheets. Attached to the jack-stay was a small piece of 2 inch hemp bolt-rope, with stitches of cotton twine remaining in it. The outer surface of the yard was so chafed and worn that nothing remained to indicate its original color. The after side of the yard, in the wake of the back stay and lower rigging, had been protected from chafing by strips of yellow metal; upon one piece the words "Muntz patent (18 oz.)" were stamped in an oval about  $1\frac{1}{2}$  inches in its greatest diameter. Beneath the metal the yard appeared to have been painted black. It is probable that this yard belonged to one of the missing whalers, and it was believed that the dimensions might furnish a clew to the name. The bolt-rope attached to the yard shows that the sail was bent when the yard separated from the mast, and that it could not be a spare spar which had been lost from some vessel, as I had at first thought possible.

We continued southward during the day, following the edge of the western pack and steaming through large fields of heavy drift-ice; thick weather most of the time, with light southerly wind, sounding every hour. At 4 p. m. the fog again cleared away a little, when the lookout reported high land, supposed to be in the vicinity of Cape North (Ir Kappai). We hauled in for it, and after running two hours more made out the cape distinctly, but owing to heavy drift and grounded ice could not approach it within 10 miles. A few miles further east we were able to approach within 2 miles of the land, which we endeavored to follow eastward for the purpose of taking soundings and examining the coast line, but were unable to do so on account of the heavy ice-fields that rested on the shore, many of them extending a distance of 20 miles. The floes, although very large, did not rise more than 7 or 8 feet above the level of the sea, but being regular in form, free from hummocks, and very solid and firm, were probably from 60 to 80 feet in depth. Some of the floes were 10 miles in extent, without a break or crack visible, and appeared very solid. Nearly every one showed a decided color, either green or blue, the latter predominating. Captain Cook, in describing his voyage to the Arctic Ocean in August, 1778, says:

When approaching the Asiatic coast, which we had done by coasting more or less along the barrier, having but little wind, I went with the boat to examine the state of the ice. I found it consisting of loose pieces of various extent, and so close together that I could hardly enter the outer edge with a boat, and it was as impossible for ships to enter it as if it had been so many rocks. I took particular notice that it was all pure, transparent ice, except the upper surface, which was a little porous. It appeared to be entirely composed of frozen snow, and to have been all formed at sea, for, setting aside the improbability, or rather impossibility, of such large masses floating out of rivers in which there is hardly water enough for a boat, none of the productions of the land were found incorporated or fixed in it, which must have unavoidably been the case had it been formed in rivers either great or small. The pieces of ice which formed the outer edge of the field were from 40 to 50 yards in extent to 4 or 5, and I judge that the large pieces reached 30 feet or more under the surface of the water. It also appeared to me very improbable that this ice could have been the production of the preceding winter alone. I should suppose it rather to have been the production of a great many winters. Nor was it less improbable, in my judgment, that the little that remained of that summer could destroy the tenth part of what now subsisted of this mass, for the sun had already exerted upon it the full influence of its rays. Indeed, I am of the opinion that the sun contributes very little towards reducing these great masses; for although that luminary is a considerable while above the horizon, it seldom shines out for more than a few hours at a time, and often is not seen for several days in succession. It is the wind, or rather the waves raised by the wind, that brings down the bulk of these enormous masses by grinding one piece against another and by undermining and washing away those parts that lie exposed to the surge of the sea. This was evident from our observing that the upper surface of many pieces had been partly washed away, while the base or under part remained firm for several fathoms around that which appeared above water, exactly like a shoal around an elevated rock. We measured the

depth of the water upon one and found it to be 15 feet, so that the ship might have sailed over it. Thus it may happen that more ice is destroyed in one stormy season than is formed in several winters, and an endless accumulation is prevented. But that there is always a remaining store every one who has been upon the spot will conclude, and none but closest studying philosophers will dispute.

Cape North presents the appearance of two small round-topped islands, but a nearer approach shows them to be connected to the mainland by a low, narrow neck of land. Westward of the capé, as far as we could see, the high land approaches the sea and terminates generally in bluff headlands, while to the eastward the coast line is low and intersected by numerous lagoons and lakes, with more elevated land farther back. The highest and most distant appears to be entirely destitute of vegetation, and, like all of the Arctic mountains, presents a very rugged outline; they are dark, with occasional patches of a reddish color. Whether this was due to the presence of iron or red clay I could not determine. A few patches of snow remained in some of the highest ravines, particularly on the north side. Many shallow streams emptying into the sea were easily located by the discolored water which extends several miles off shore. The shore, wherever we were able to approach it, was gravel or shingled, with but little drift-wood. The low land adjoining, in addition to the saxifrages, dwarf willow, mosses, lichens, and other plants peculiar to high latitudes, was found to contain a rank growth of coarse grass, which gave it a decidedly greenish hue, which, taken in connection with the dark browns and reds of the high lands back, and the blue sea in the foreground, dotted with patches of ice with green and bluish tints, made a very pretty picture. Capé North is the farthest point on the Asiatic coast reached by Cook during his voyage. It is probable, however, that he was not able to take observations there, as the cape and the coast eastward as far as and including Kolatchin Island, was found to be about 30 nautical miles too far west on the American Hydrographic chart, which is taken from the Russian and English surveys.

The latitude of Cape North established by observations by Wrangel during his polar expedition in 1823, is very accurate, but the longitude which was established by reckoning brought forward from Cape Jackson, the geographical position of which had been previously determined by lunar observations, was found to be 30 nautical miles too far west.

On the 5th we stood southeast all day through heavy drift-ice, with a strong breeze from the southward and cloudy weather. The barometer went down to 29.23, the lowest it had been since we entered the Arctic Ocean. At 3 p. m. we hauled in for Cape Wankerem, and at 5 o'clock arrived off the cape, and, slowing down outside, felt our way in with the lead between the cape and a small island which lies 1 mile southeast, and is called by the natives "Carcarpo." At 5.50 we anchored about 1 mile off the settlement in 3 fathoms of water. Cape Wankerem is a bold headland of granite formation, probably 80 feet high by 2 miles in length from northwest to southeast, and 1 mile wide. It is connected with the mainland on the southwest side by a narrow neck, upon which, half a mile from the cape, is the native settlement of twelve houses. The bay is large and shallow and exposed to easterly and southeasterly gales, but affords good protection in northerly or westerly winds, and would make a good safe harbor for a vessel desiring to winter there, by anchoring inside the cape, and as close to the shore as the draught of water would permit. The rise and fall of the tide appeared to be about 2 feet at the time of our visit. The flood sets along the coast northward, and the ebb southward. Wankerem (I use the word as spelled on the American chart, although by the natives it is pronounced Oucarenim) is the farthest point along the coast reached by the sledge party, and is the place where the relics from the lost whalers were found. I hoped by spending a few days there to be able to find something more definite, perhaps books or papers, that would throw additional light on the fate of those vessels.

Soon after anchoring two skin boats approached from the shore, and a dozen natives clambered over the vessel's side. They at once recognized Lieutenants Herring and Reynolds, and seemed quite pleased to see them. Some of the women caused a good deal of merriment by imitating the words and actions of Lieutenant Reynolds in his efforts at dog driving. We made them presents of bread, tobacco, calico, &c., and made them understand, by signs and such words of the Tebuktehi language as we could command, the object of our visit, and promised them liberal

rewards for every article belonging to the missing vessels. At 8 p. m. we sent them all out of the vessel for the night. On the following morning they were alongside bright and early, and as soon as permitted to come on board they scrambled over the side, each dragging some article which he claimed to have been taken from the wreck. We bought everything offered, and paid them well, although many of the things were of no possible use; but I hoped by doing this to induce them to bring out everything in their possession. After purchasing all they brought on board, we went on shore and made a thorough examination of their houses, the natives kindly throwing them open for our inspection, and looking on with a most amused expression while we were making the search. The account given us of the finding of the wreck by these people was substantially the same as that given to Lieutenant Herring and party. It was as follows: In the fall of 1880, just as the new ice was forming, a party of natives from Wankerem was out on the ice seal-hunting, when a black object was discovered, which proved to be a wreck. The masts, bulwarks, boats, &c., were gone, and the hold was half filled with water. They boarded the wreck and carried away such things as they thought might be of use. Four dead bodies were seen in the cabin, three being in their berths and one on the floor. On a shelf at the head of the berth in which one of the dead bodies was lying they found a pair of silver-bowed spectacles (they were brought back by Lieutenant Herring, and have since been identified as belonging to Captain Nye of the Mount Wollaston). Night coming on, the party returned to the shore, intending to make another visit to the wreck when daylight came, but during the night the wind changed to southwest and the wreck disappeared and was seen no more. They were very positive that the wreck had a pair of deer horns on her jib-boom, and when shown a rough sketch of a dismasted vessel one of the natives took a pencil and without the slightest hesitation drew the horns as shown in the illustration. They also stated that the masts had been cut away, and when asked how they knew they said they saw the marks of the ax. This account I believe to be as nearly correct as their defective memory and poor command of language will admit of. It is probable, however, that the wreck was in sight of the settlement several days instead of one, as stated by them, judging from the number of articles found in the possession of the natives which must have come from the wreck. The following-named articles were obtained by us: One chain bobstay with heart attached, several pieces of chain-plate and one complete, with dead-eye strap attached, several small pieces of chain, iron bolts, pieces of iron band, &c., an old worn sheath-knife bearing the initials W. B., a table fork, an iron spoon with the letter H on the handle, a small black leather pocket-book containing a number of articles of cheap jewelry, a finger-ring bearing masonic emblems, two American coins (one cent and five cent), a portion of a truss-pad, and a Rodgers pocket-knife. In addition to these things we saw on shore several axes, saws, &c., but as they bore no marks except the name of the manufacturers, and as the natives were anxious to retain them, we allowed them to do so. A number of oil casks cut in halves were seen and carefully examined, but no names or marks were found other than the gauge marks. Two whisky casks were also seen, marked "Honolulu." The articles obtained were placed on exhibition at the office of Wright & Bowen, ship chandlers, after our return, and we learn that some of them have been identified as belonging to the Vigilant.

The fact that the wreck had a pair of deer horns on her jib-boom; as this vessel only was known to have of all the vessels of the fleet, confirms the belief that she was the one seen. The finding of the Sandwich Island whisky casks also points that way. Although Captain Smithers had instructions from his owners not to trade whisky, he may have disregarded them and taken it on board, while the other vessel *could not* have had any, as she had not been to those islands. All these facts show pretty conclusively that the wreck was that of the Vigilant. The finding of the whale-iron marked "Bk. O." (bark Onward) forms another link in the chain of evidence, as a portion of the outfit of the Vigilant came from that vessel, and had been marked in that way. The finding of Captain Nye's spectacles indicates that that officer was on board of the Vigilant. The last seen of the two vessels (October 10, 1879) they were cruising in company between Herald Shoal and Herald Island in an opening between the northern and western packs, with a large body of heavy ice to the southward, stretching almost entirely across the Arctic Basin. Of this large body of heavy ice to the southward a few words of explanation are necessary. To this, in my opinion, may be attributed the loss of the two vessels in question. By the reports of the masters of other vessels we





WANKEREM. TCHUKTCHI TENT AND FAMILY.

*Photo. by Nelson.*



S. EX. 204, 1, 48.

HELIOTYPE PRINTING CO., BOSTON.

HEAD OF PLOVER BAY. REINDEER TCHUKTCHI.

*Photo. by Nelson.*

learn that this body of ice extended from the Arctic shore to near Point Hope and northward nearly to Herald Shoal, leaving a passage but a few miles in width between it and the point of ice from the northern pack, which extends down in that direction. In what are called icy seasons this filling up of the sea is no unusual occurrence. The loose ice along the edge of the pack is driven down by the northeast wind following the western ice-pack until it strikes the coast of Asia and is deflected eastward past Cape Serdze and across the Arctic Basin to the American side, where it is again turned northward by the current which sets along that shore, so that in leaving the Arctic Ocean it is no unusual thing for the whalers to pass inside the shoal off Point Hope to clear the ice. In fact, as a rule, they sight Point Hope before steering a course for the straits, to avoid this ice in case of thick weather. While steering a course from the vicinity of Herald Island to the coast of Asia in August, 1880, in the *Corwin*, we encountered ice in latitude  $68^{\circ} 10'$ , and working eastward on about the sixty-eighth parallel with heavy pack-ice to the south and a bright ice-blink to the north, we went to within 30 miles of Point Hope before we cleared its eastern edge and were able to make any southing. While crossing from Cape Lisburne to Herald Island, a few days previously, between the parallels of  $69^{\circ}$  and  $70^{\circ}$ , a strong ice-blink had been observed to the south of us. The extent of this body of ice at that time was probably 150 miles north and south and 200 east and west, and although we forced our way through it with a steamer, it would have been impossible for a sailing vessel to do so, even at that time; and there can be no doubt that this field continues to grow larger and becomes more solidly packed as the season advances, until it again attaches itself to the main pack and is formed into a solid mass by the new ice.

The last seen of the missing whalers, as stated, was October 10, at which time they were steering in a northerly direction in search of whales. We now know that they could not have gone north of Herald Island, as the *Jeannette* was at that time fast in solid pack-ice there. It is probable, therefore, that they continued to cruise in the vicinity of the ice near Herald Island until warned, by the making of new ice, that it was time to work south if they wished to escape a winter in the Arctic. This did not occur until about October 18, according to Captain Bouldry, of the *Helen Mar*, who was the last to see the vessels and also the last to leave the Arctic that season. During the night of October 18 the *Helen Mar* and *Mercury* anchored in company near Herald Shoal, and on the following morning were surrounded by newly-formed ice, which held them fast, and continued to increase in thickness until all hope of being liberated again that season was given up. In this extremity they united their forces on board the best vessel, the *Helen Mar*, and taking from the *Mercury* what provisions could be moved, as well as the blubber, which could be used either as food or fuel, they prepared for the worst. To give an idea of the nature of this new ice with which they were surrounded it may be mentioned that the blubber and other articles transferred from the *Mercury* to the *Helen Mar* were drawn on sleds, in loads of nearly a ton weight, by a crew of fifteen men. A few days later a gale occurred and broke this newly-formed ice, and by hard carrying sail the *Helen Mar* forced her way through it, and, passing between the northern pack and the heavy field ice to the south, succeeded in reaching clear water off Point Hope, and by passing so close to Cape Prince of Wales that she touched on the dangerous shoal before referred to off that cape, she succeeded in getting through the strait about November 1.

It is probable that the two missing vessels had, with the exception of the final escape, a similar experience. Finding themselves frozen in they decided to take their chances together, and for some reason the *Vigilant* seems to have been chosen as the vessel upon which to trust their fortunes. Just why this selection was made cannot be stated, as the *Mount Wollaston* was, I believe, generally regarded as the better vessel of the two. But she may have already met with an accident which necessitated her abandonment. The *Vigilant* had on board an extra supply of provisions, fuel, and clothing, taken with a view to the possibility of wintering at Point Barrow, provided a harbor could be made at Port Moore, while the *Mount Wollaston* was fitted for the summer cruise only. Should it have been necessary to make the change from one vessel to the other hurriedly, or when surrounded by heavy drift-ice which would render a transfer of these articles by boats impossible, they would naturally remain by the vessel best fitted in this way. Supposing, then, that the *Vigilant*, with both crews on board, had been frozen in at the same time the *Helen Mar* was and liberated by the same breaking up of the new ice on October 24, being further north

and progress being naturally slow through the broken ice, which, according to Captain Bouldy's account, was so heavy that it was only by carrying all sail that the spars would stand with a fair wind, that he could keep way on his vessel at all. She would naturally reach the place where the passage had existed between the point of the northern pack, and the field of ice filling the center of the sea several days after the Helen Mar had passed through and escaped. Strong southerly winds followed the northern, which assisted the Helen Mar to force her way out, and the effect of this would be to set this body of ice to the northward against the northern pack, thus cutting off all egress by the way of the eastern part of the sea, while to the west and southwest the sea was free from old ice for many miles. Finding escape by the usual route cut off they would naturally follow the western edge of this ice in the hope of passing through or around it in that way, or at least of reaching the coast of Asia, where they might find safe winter quarters.

According to native accounts, along the Siberian coast at that time heavy ice reached so far off shore that no water could be seen, and from the testimony of the whalers, we know that the body of ice, which filled the center of the sea, reached to the straits, filling the west side and resting on the Siberian coast from Cape Serdze to East Cape, thus rendering it impossible for them to either escape by way of the straits or reach the coast, and the result would be that the vessel would be frozen in off the coast of Siberia, near the southern limit of this open water. The season was not an open one in the western portion of the Arctic Basin, and it is probable that the wreck remained frozen in far to the westward of the limits of navigation, until late in the season when she was liberated and driven down upon the coast by the northwest gales which prevailed at that time.

Supposing the foregoing to be in the main correct, the fact that but four bodies were found on board the wreck, although her own crew would amount to over thirty men, still remains a mystery, and in my opinion is much more difficult of explanation than the presence of the vessel on the Siberian coast. The fact that the boats were gone appears as if an attempt might have been made to reach the land by crossing over the ice. If the vessel was any considerable distance from the land such an attempt in the winter season would be almost sure to prove fatal to men poorly fitted as they were. That none of the party survived until spring appears evident, as at that time the passage to the land could easily have been made, and undoubtedly would have been, as there could be no object in remaining by a dismantled, water-logged hulk, if escape to the shore were possible.

The coast of Siberia from Cape Serdze to Cape North contains native settlements every few miles. Their inhabitants are constantly traveling back and forth, and had any white man reached the shore they would have known it, and rendered them assistance; and the fact of their landing would have been known the entire length of the coast in a few weeks. Therefore we may safely conclude that not one of them reached the shore. Whether they perished in the attempt to do so, or died of hunger and disease on board and were buried in the sea by the survivors, we may never know, for unfortunately the natives have a superstitious dread of books and papers, and although they say they saw plenty of them in the cabin not one was brought away. The absence of the boats may be accounted for without supposing that they had been used in an attempt to reach the land. They may easily have been stove at the cranes by high ice. In fact, unless taken on board this would be pretty sure to happen. Several times during the two seasons the Corwin spent in the Arctic we found it necessary to take our boats on board to save them from being crushed by the ice. They received more than one hard thump, and once, in steaming out of Plover Bay through heavy broken ice, which was being tossed around in a lively manner by a considerable roll of the sea, we came near losing all our boats through neglecting to take them on deck before entering the ice, and they were saved only by the greatest effort. The discovery of the wreck of the Vigilant with the corpses on board, the probability of the crew of the other vessel having taken refuge on board of her, the absence of any tidings of her white men having reached the land, which was ascertained by a careful examination of the entire coast line of both continents between Cape North and Point Barrow, and the further knowledge that they did not reach Herald or Wrangel Island, destroy all hope of any members of either crew being alive at this time.

It is also probable that the wreck did not long remain afloat after drifting off shore from Wan-kerem. Although the natives could give me no information in the matter, except that the wreck was surrounded by ice, I am of the opinion that she was frozen into a field and in this way was prevented from sinking. This, however, would be likely to break up during the fall gales, in which

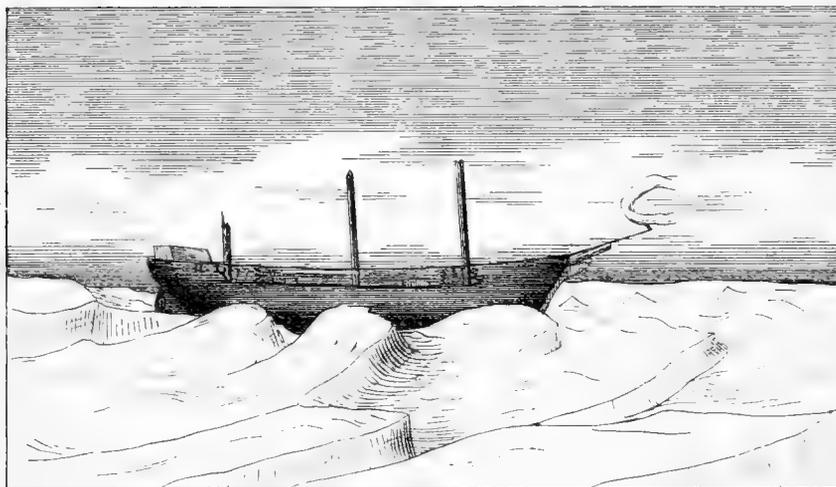
case she would undoubtedly sink and carry with her the last clew by which we might hope to gain a knowledge of the fate of her men. The season of 1881 was remarkably open and the ice very light, and it seems almost impossible that a wreck could have been floating around the sea without being discovered by some of the vessels which were constantly cruising back and forth from June until October. It is with profound regret that I submit these melancholy facts, knowing that they must give pain to the friends of the lost men, and destroy any lingering hope which they may have had. But certainly no good can be attained by concealing this knowledge and holding out hope where no grounds for hope exist. Whatever their fate may have been we know that they met it like brave men.

During our stay at Wankerem we made many visits to the shore, searching for relics from the wreck, studying the character of the people, the natural history, botany, &c. The settlement contains but a dozen houses or yarangas, in all respects similar to those seen farther south, consisting of an umbrella-shaped frame covered with walrus hides, and having an inner sleeping-room or polog made of deer-skins. In one or two instances we saw pologs of polar-bear skins. The skin boat or oomiak used by the natives is of superior make and better model than that in use farther south, having less flaring sides and more shear. The general principles of construction were the same. I saw but one kyaak at Wankerem, and that was a very inferior one. They are used but little. Walrus and seal hunting and fishing are the chief occupation of the inhabitants, varied occasionally by a fight with a polar bear. When hunting the latter they always go in pairs, armed with bow and arrow, spear and knife. The spear is the main dependence. The bow and arrow is used for opening the fight. The two natives approach the bear from different directions, if possible, or at least sufficiently far apart to get the bear between them. When near enough an arrow is shot into his side; the bear naturally turns his head in that direction, and the next instant he is pierced through the heart by the spear in the hands of the other native. Of course a failure to kill, through the breaking of the spear or other mishap, results in a fight at close quarters, in which case the knife is used. The bear-spear is a most formidable weapon. It is about 15 inches long, with a handle (which fits into a socket) about 6 feet long by  $1\frac{1}{2}$  inches in diameter. The spear is about  $1\frac{1}{2}$  wide and one-fourth of an inch thick. It is ornamented on the socket and neck with inlaid brass, and is kept very sharp and highly polished. The handle is also kept clean and bright. It is the only weapon used by the natives on the Arctic shores of either continent that shows signs of proper care. About 2 feet from the spear the handle is wound around with a strip of seal-skin to prevent the hand from slipping when a thrust is made.

The spears are bought at the Russian trading posts and are highly prized by the natives. They were seen by us at every settlement visited on the Siberian side, and a similar spear, minus the ornamentation, was seen in large numbers on Saint Lawrence Island, at the deserted villages. Professor Nordenskjöld refers to this spear in the Voyage of the Vega, but appears to have seen but one and supposed it to be inlaid with gold, and states that it "probably formed a part of the booty won long ago in fights with the Cossacks." The bows in use at Wankerem are the finest I have ever seen, many being neatly covered with birch bark to preserve them from injury by moisture.

At the time of our visit eider ducks were plentiful. Of these we saw three varieties, King eider, Pacific eider, and Steller eider. They are taken by the natives in an ingenious manner. In passing back and forth between the Wankerem Bay and River and the sea, they fly directly over the native settlement in great numbers, and are taken by means of a bird-sling called by them *epluketat*—a number of balls (from seven to ten) of bone or ivory, about one inch in diameter and attached to one end of the same number of pieces of line made of twisted sinew about one yard in length, the other end of the lines being joined so as to form a handle. This sling is wound around the head in such a manner as to be ready at all times for instant use. A number of small boys are kept constantly on the watch, and when a flock of ducks is observed approaching, the alarm is given and a general shout goes up as all the men rush out. The slings are taken in the right hand and when the ducks are almost directly overhead, the sling, after describing a couple of circles in the air, shoots up with its arms spread in every direction like an aerial octopus and seldom fails to bring down its game. The slightest touch is sufficient to bring the bird to the ground. Often half a dozen are taken from one flock. Of course in many cases they are but slightly injured, but escape is impossible. Before the duck recovers from its surprise it is seized by the native, who places it

upon the ground, breast down, and kneeling upon it presses the life out. Whether this is a superstition or merely done to avoid wasting its blood, I could not learn; probably the former, as some superstitious ceremony is observed in nearly every act of their daily life. In addition to the epluketat each native carries at his belt an ordinary sling, with which he is very expert, and can



WRECK SUPPOSED TO BE THE LOST WHALER VIGILANT, AS DESCRIBED BY NATIVES AT CAPE WANKEREM, SHOWING DEER-HORNS DRAWN BY NATIVE.

throw rocks with great velocity and accuracy. They are used for killing ducks when sitting on the water in flocks. I saw but two or three guns at Wankerem. They were inferior shot-guns, of Russian make, and the natives seem to care but little for them, preferring to depend upon hunting implements of native manufacture, which indeed are more effectual and very much less expensive. They make nets of a thread of deer sinew, which is prepared by the women; the net is about 18 feet long by 3 wide, and the meshes are 2 inches in diameter. It is set from the shore by means of a long pole, and is held in a vertical position by the ordinary method of weights and floats. The net is very skillfully made and is the result of a vast amount of labor. We were anxious to secure a specimen for the National Museum, but could not induce the men to part with one, the invariable answer being, "If we sell our nets we can't catch any fish; then we shall starve." This answer was generally accompanied by a pathetic pantomime representing the suffering and death of a native by starvation.

At first we were somewhat puzzled by a dish of willow and birch leaves, which we found at nearly every house, and were curious to know what particular part it played in the domestic economy of the Tchukcheis. Some supposed it to be used in making tea. We soon discovered, however, that these leaves were used as food, and were partaken of by the people in large quantities, being eaten without any preparation, when green or partly dried. Being kept in wooden dishes inside the yaranga, each native helps himself to a handful whenever the fancy strikes him. The amount consumed in this way is considerable. In addition to this they eat during the season a great many berries. According to Professor Nordenskjöld, the leaves and young branches of *Salix rhodiola* and other plants are preserved in seal-skin sacks for winter use, where they are allowed to freeze, and are then cut into pieces and eaten with meat. They are also made into a kind of soup.

Observations were taken at Wankerem for latitude and longitude and for magnetic dip and variation. Like all the coast line from Cape North to Kolatchin Bay, the land in this vicinity was found to be over 30 nautical miles too far west on the American chart. The dip of the magnetic needle was observed to be  $77^{\circ} 09' 7''$ , and the magnetic declination  $19^{\circ} 49'$  east. Near the settlement I saw a portion of a ship's knee bearing evidence of having been exposed to the weather for many years. At first I thought it possible that another wreck had occurred at or near this



INNUIITS, POINT BARROW.

*Photo. by Nelson.*



S. EX. 204, I, 48.

HELIOTYPE PRINTING CO., BOSTON.

WANKEREM, TCHUKTCHI CHILDREN.

*Photo. by Nelson.*



place at some time in the past, but a careful search failed to show anything additional. It is probable that this piece was brought by the natives from some other part of the coast on account of the iron bolts which it contained. I regretted very much not having an interpreter at this time, as I feel confident we could have gained much interesting information.

Like all true Tehuktchis, these people are in every way superior to the Innuits; they appeared to be honorable among themselves, and we saw no attempt made by them to pilfer while on board our vessel. They are quiet and good-natured, and apparently happy and contented, and it seems difficult to realize that they are descendants of the warlike Tehuktchis who gave the Russians and other early travelers in Siberia so much trouble.

Near the extremity of the cape we found the ruins of houses similar to those now in use by the Innuits, half under ground, with frames of the bones of whales. Probably they were former dwellings of Innuits, who for some reason crossed the straits and attempted to establish themselves on the Siberian side. These houses have been found by different travelers at many places along this coast, and various causes assigned for the abandonment of the attempt to settle here by the Innuits. Some believe they were driven back or entirely exterminated by the more warlike Tehuktchis; others think it is because the whales are now seldom seen in this vicinity, which formerly came in great numbers. It is not unlikely that these causes united have discouraged the Innuits from making any further attempts. In order to gain the entire good will of this people, that they might hold back nothing which would furnish light on the subject we were investigating, I made it a point to give them presents of tobacco, calico, drilling, thread, needles, and whatever articles they most desired whenever they came on board or I visited the shore, and I was particularly struck with the evidence of gratitude displayed in each case. One old woman, partly blind, with gray hair and bent shoulders, was offered drilling, thread, and needles to make a "parkie" to wear over all in the winter to keep the snow from her fur garments. At first she declined to take them, saying to a young man who stood near, "What does he want for them?" Upon being told that nothing was asked in return, she took the prize in her arms and felt of it as if to assure herself that it was real, stood still for a moment, while the tears filled her eyes, then turned away unable to utter a word. I have never witnessed an exhibition of more genuine gratitude. People who are capable of such feeling cannot be such bloodthirsty wretches as the Tehuktchis have sometimes been represented. But that they have courage and will fight in defense of their rights there can be no doubt.

In order to gain a knowledge of the language of these, as with any other people who have no written language, a long residence among them is absolutely necessary; and although a vocabulary made up in a few weeks or even months may assist to a certain extent in communicating with them, it is quite sure to be made up of Tehuktchis, Inuit, Kanaka, and sailor English, and can have but small philological value. The same is true of their traditions, religion, &c., for a native gifted with a vivid imagination, and such are by no means rare, will at short notice furnish any number of traditions of the most blood-curdling character, and do it with such an air of apparent sincerity as not to arouse the suspicions of the most careful observer, especially if the native sees a prospect of reward. But they are exceedingly reticent in regard to their real traditions, and seldom speak of them even among themselves.

August 8 we got under way and proceeded northwest along the coast through large fields of heavy drift-ice. At meridian we anchored among grounded ice in 5 fathoms of water, and observed the latitude on shore with the artificial horizon to be  $68^{\circ} 05' 52''$  north; longitude, brought forward to meridian from morning observations,  $176^{\circ} 30'$  west. While at anchor the inhabitants of a small reindeer Tehuktchi settlement came down to meet us. We could see their houses with our glasses a few miles back from the coast, and were very anxious to see their herds while they seemed equally anxious that we should not see them, and assured us by signs that there were "several sleeps" back in the mountains. Although satisfied that they were not stating the truth in regard to the distance we did not persist in going to the herds, knowing their superstitious dread of having white men look at their deer. They were very much afraid of the box containing the photographic apparatus, which Mr. Nelson always took along in his trips among the natives, and they insisted upon being shown its contents. We gave them presents of needles, thread, tobacco, and hard bread, and by constantly repeating the Tehuktchi word "*meschinka*" (good),

we succeeded in gaining their confidence sufficiently to allow themselves to be grouped for a photograph, although they evidently did it with many misgivings, and a constant desire to back out and run away. This party was rather inferior looking, with small, pinched features, dull-looking eyes, and sharp noses. They all carried large knives, some of enormous size, and one had a bear-spear. Only one gun was seen, a small single-barrel shot-gun of Russian make, and that was so broken as to be entirely useless. They had no boat of any kind, but a fish-net and pole for setting it were observed near where we landed. They had a few salmon trout, which they offered for sale, but being too stale for use by white men we did not purchase.

After completing our observations, we again got under way and continued along the coast, working through heavy drift and grounded ice, keeping as close to the shore as the depth of water and condition of the ice would permit. In the evening we arrived at Cape North, where we were again compelled to leave the land, the ice becoming so closely packed that it was found impossible to pick our way through it any farther. It did not extend far off shore, however, and a run of about three hours brought us to clear water, when we again shaped a course for the southeast coast of Wrangel Land, hoping that the ice had thinned out sufficiently to enable us to reach the land. We had a fresh southeast breeze all night, with no ice to interfere, and with all sail and steam we made good time. Towards morning the weather became thick and misty, with fine rain, and the wind continued to increase. At 10 a. m., when, according to our reckoning, we were about 25 miles from the land, we passed several pieces of drift-ice. The weather being quite thick, with a strong breeze and considerable sea, we hauled to the wind and hove to, under sail, to avoid the pack which we knew could not be far away. The lead showed 22 fathoms, with hard bottom; this gradually decreased during the day to 20 fathoms. In the afternoon a huge polar bear swam out from the ice to the vessel, probably attracted by the smoke. Approaching within about 100 yards, he took a good, long look, and after snuffing the air several times, as if trying by means of the senses of smell and sight to determine the nature of his strange visitor, he turned and swam away as leisurely as he had approached, notwithstanding several shots were fired at him, which, owing to the rolling of the vessel, were without effect. We remained standing off and on under sail during the night of the 9th, with a fresh breeze from the southeast, considerable sea, and very thick weather, making a west drift of about one-half a knot per hour; the temperature of the sea-surface, 34°. During the morning of the 10th the wind moderated, although the sea kept up, showing that a fresh breeze was still blowing to windward. This was taken as an indication that we were drawing very near to the ice-pack, consequently a close watch was kept on the temperature of the water, which soon after dropped to 32°, and at almost the same instant we heard the beating of the surf on the edge of the ice. Wind blowing onto the ice-pack seldom "blows home." Even with a strong breeze, a moderated belt, and oftentimes a calm one, will be found along the edge of the ice and for some distance within the pack. As the weather still continued thick, about 11 a. m. we came to with the kedge, and observed the set and force of current, which was found to be north-northwest true, and about one-fourth of a knot per hour; temperature of the water, 32°. At meridian the sun broke through the fog for a few minutes and the weather showed signs of clearing, but soon after shut down again thicker than before, compelling us to wait as patiently as one could for a clear-up, which occurred about midnight, when the fog commenced to condense, and by 1 a. m. (August 11) the atmosphere was perfectly clear and Wrangel Island in plain sight, about 30 miles distant, covering an arc of the horizon from northwest to north-northeast, true. The ice-pack, which was within half a mile, surrounded us on all sides except between south and southeast by east, in which direction was open water. A narrow lead of open water also showed towards the northwest as far as we could see from the mast-head. We got under way immediately, and, entering this lead, steamed in towards the land until 2.30 a. m., when we came to the end of the lead, but the drift-ice still being open, we continued on until 4 a. m., when the ice, which had been gradually getting closer as we approached the land, became so densely packed that it was found to be impossible to force the vessel any farther. We judged the land to be about 15 miles away. The clear atmosphere affording a fine view of the land, the opportunity was improved by taking sketches and bearings of prominent points, &c. After making several ineffectual attempts to force our way in closer to the land, and finding it impossible, we reluctantly turned our backs on it and pushed out for clear



CAPE SMITH (WOMAN AND CHILD) INNUIITS.

*Photo. by Nelson.*



S. EX. 204, I, 48.

NEAR CAPE NORTH. REINDEER TCHUKTCHI.

*Photo. by Nelson.*

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water to wait for a more favorable chance. The ice was so closely packed around the vessel that the operation of turning around, assisted by steam and sail, poles and small spars to push against the ice, and all means at our command, occupied just one hour. After several hours' more hard work we reached the head of the lead. Although sadly disappointed at the failure of this third attempt this season to reach the land, I felt relieved to be again in clear water, and did not despair of ultimate success.

While in the ice a number of polar bears were seen near the vessel and one or two walrus. They showed no signs of fear of us, but a good deal of curiosity. One of the bears was just making a breakfast of seal, which he seemed to enjoy very much. It was evidently just killed, being still bleeding, and the bear's head, neck, breast, and fore legs being covered with blood. He seemed to be taking his breakfast very leisurely, and after eating awhile would go away a few feet and roll and play like a kitten. Although we were quite near him he paid no attention, not even looking at us. During the day we were fortunate enough to get good observations for latitude and longitude, which, with the bearings already attained, gave us a very close approximation to the position of the land. These were subsequently confirmed by bearings and observations taken near the land off its east coast. They show the land on the American Hydrographic chart to be laid down 18 miles too far south, although the general trend of the coast is very nearly correct. After reaching open water we followed the edge of the eastern ice, which gradually changed the direction of its trend from southeast to east and northeast. The weather, which had been very clear in the evening, had grown misty, so that the land became less distinct and seemed farther away during the afternoon. The trend of the ice was observed to be more to the northward, and it was noticed that as the mist cleared away a little from time to time the snow-banks on shore seemed nearer than at any time before. Bearings of one of these snow-banks taken from different points showed its distance to be only 13 miles. Soon after the edge of the pack fell back, so that we were enabled to steer a course almost directly for the land. We had just taken in all sail and changed our course, when the lookout reported ice on the starboard beam making off to the eastward as far as he could see, showing that we had been running into a lead. This we continued to follow until we came to its end, where we found the ice heavy and closely packed. We had 15 fathoms of water, with sticky bottom, and judged ourselves to be about 8 miles from the land. I believed that no great difficulty would be encountered in crossing on the ice to the land. Lieutenant Reynolds, Assistant Engineer Owens, Professor Muir, Mr. Nelson, and Coxswain Gessler, having volunteered, were very anxious to make the attempt, but, owing to the mist and fog, which was rapidly shutting out the land from our view, and the uncertainty of holding our position in the lead, I was compelled to withhold my consent at that time, but determined to try to hold on in the lead until the fog should clear away. We observed the set of the current to be northeast, about one knot per hour. Running back to the eastward a short distance, to where the lead was about 3 miles in width, we came to with the kedg, in 19 fathoms of water.

The constant changes taking place in the position of the lead, owing to the set of the current, necessitated changing our position several times during the night to avoid the ice. We got under way at 4 a. m. (August 12). The mist began to clear away, giving us occasional glimpses of the snow patches that lined the cliffs. We had made all necessary preparations for crossing on the ice; the skin boat had been placed on runners, and arms, ammunition, provisions, &c., served out. At 4.30 we reached the end of the lead, which we judged to be 8 miles from the land, and which we found by bearing of points on shore that we could recognize as those we had observed the night before to have changed their position to the northward 8 miles during the night. The ice appearing to be much less closely packed than on the previous evening, I determined to shorten up the journey over the ice by pushing in with the vessel as far as possible before embarking the party. Accordingly we entered the ice at 5.30 and worked in the direction of a place where the land appeared low, with high, dark-looking cliffs on each side. The ice, which was quite heavy, continued to open as we advanced, until, at 6.30, we could see the shore line distinctly, and, in the direction in which we were steering, what appeared to be a small space of open water adjoining the land. As the ice still remained sufficiently open to admit of forcing a way through it at the expense of a good deal of hard bumping, squeezing, and pushing, hopes were entertained of reaching the open space of water with the vessel. The last 2 or 3 miles were made with a good deal

of difficulty. Inside of the 10-fathom curve we found much of the ice aground, while the floating portion was drifting past and occasionally shooting up over the top of the grounded pieces. Navigation under such circumstances was anything but safe or agreeable. However, we felt that the land was certainly within our reach, and thought of nothing but pushing ahead. At 7.30 we reached the open space and dropped anchor within a cable's length of the land in 5 fathoms of water. We immediately landed and, raising the American flag, took possession in the name of the United States of America. We landed at the mouth of a river, which at this time was about 75 yards in width, although the entire distance between its banks was about 200 yards. The cliffs in the vicinity of our landing place were of a dark slate formation, and from 100 to 300 feet high. On the beach small pieces of sandstone, quartz, and mica schist were found. The surface of the land where the slate has weathered away is composed of sticky clay, and is but sparsely covered with vegetation. As observed from the ship, while cruising in the vicinity and also from the shore, it presents the general appearance of smoothly-rounded hills, which, towards the interior and near the south side, are from 1,000 to 3,000 feet in height. The upper portion of the higher hills appeared more rugged in outline, as if composed of more enduring material, probably granite. These summits resemble those seen on the Siberian coast in the vicinity of Plover Bay, being entirely destitute of vegetation, with occasional red patches probably indicating the presence of iron. Those near the coast are remarkable for the smoothness and beauty of their outlines, and present here and there patches of green or gray, according to the nature of the vegetation. On the beach near the mouth of the river we found a kayak paddle, a cask-stave, a piece of small spar, probably part of a boat's mast, and a piece of board about a foot in length bearing ax-marks. All these things were below the marks of extreme high water, and were undoubtedly brought there by the current. Although the beach showed undoubtedly signs of a rise and fall of tide, no tidal change could be detected, probably owing to the fresh southerly wind which was blowing. The presence of this drift matter on the beach would seem to indicate that the east coast of Wrangel Island was at times entirely free from ice, though it does not necessarily follow, as it could easily have been carried through the pack to the shore by the constant twisting and turning to which it is at all times subject. I believe that it is a very unusual thing for the ice to leave any portion of Wrangel Island entirely. Our stay on shore was necessarily short on account of the strong northerly current, which was sweeping the ice-pack along with irresistible force. Much of the ice inside of 10 fathoms, as stated, was aground, but not sufficiently firm to form any protection from the drifting mass, the largest pieces of which were constantly being pushed and turned in every direction when struck by the drift, and the utmost vigilance was required to avoid getting caught between the drifting and grounded masses. At 9.30 a. m., being unable to maintain our position any longer, a gun was fired to recall the parties sent out to explore the cliffs in search of cairns or other signs of human life, and we began to work out towards the lead, which we reached at 11 a. m. We left the American flag flying and also a record of our visit. We had good observations during the day, and found our landing-place to be in latitude  $71^{\circ} 04'$  north and longitude  $177^{\circ} 40'$  west. This is undoubtedly the part of the land seen by Captain Kellett, R. N., in 1849, when he discovered and landed on Herald Island, and which since appeared on the British Admiralty charts as Plover Island, although erroneously laid down somewhat further to the eastward. We now know that Plover Island has no separate existence, and that what Kellett saw was the main island. As there is no record of any one else having seen the land previous to that date, or in fact until several years after, when, in 1876, it was seen by nearly the entire whaling fleet, all must accord to Captain Kellett the honor of its discovery.

While steaming through the ice, in our several attempts to reach the land, a number of species of sea-fowl were seen from time to time, and carefully noted by Mr. Nelson. Among these the most numerous were the murre and guillemots (*Uria-arra* and *Uria-grylle*), with numerous kittiwake gulls (*Larus tridactylus* Kotzebue) and the common ice-gull (*Larus glaucus*). More rarely single individuals of the Sabine's gull (*Xema Sabinei*) came circling about the ship. Numerous small flocks of black-headed turnstones (*Streptopelia melanocephala*) were seen near shore, and two parties of common eider ducks (*Somateria nigra*). In both instances the latter were females with their young. The second brood of eiders was seen swimming close along the shore and away from the mouth of the river as we made our landing. On shore we found numerous snow-buntings (*Plectrophanes nivalis*) and a snowy owl (*Nyctea nivea*), which, with a shrike picked up dead on the

beach and a solitary golden plover (*Charadrius fulvus*), complete the short list of land birds seen. At a number of places on the hillsides we found the droppings of wild geese so numerous that it was evident this place must have been a common resort for flocks of these birds earlier in the season. Their absence at the time of our landing is easily accounted for by the fact this was the time when the geese shed their large wing feathers and lose the power of flight. As this season comes on they congregate in large flocks in low marshy land and remain until their new growth of feathers enables them to spread over the country again a month or six weeks later.

Saddle-backs and hair-seals were rather common among the ice, and in addition there was a small species of hair-seal unknown upon the American coast and perhaps new to science. Walrus were not rare on the outer edge of the pack, and their foe, the polar bear, was seen almost every time we entered the ice; on several occasions it was seen swimming in the water several miles from the pack. Upon the hilltops on shore were found numerous burrows of some animal, probably white fox (*Canis lagopus*), as some tracks of that animal were found mingled with those of the polar bear in the mud along the banks of the river. Stranded on the sand-bar at the mouth of the river lay the skeleton of a whale (*Balæna mysticetus*), which closes the list of mammals observed.

Numerous small fish, from two to four inches long, and having large heads, were brought to the surface by rolling masses of ice as it was turned over by contact with the vessel in her passage through it. These are called by the whalers ice-fish. No specimens were obtained, unfortunately.

The following plants we collected: Grasses, three varieties; dwarf willow, phlox, saxifrage, sibbaldea, draba, potentilla, anemone, papaver, veronica, artemisia, carex, stellaria, three; mosses, three; lichens, five; and four compositæ. In many places where the snow remained in the ravines and in banks against the steep cliffs, it presents the peculiar reddish color caused by the presence of *Protococcus nivalis*, commonly called red snow. This is a minute plant with which the surface of the snow is often covered in high latitudes. It was seen and its appearance described by Sir John Ross in 1818, and by Sir Edward Parry in 1827, but its true character was not understood until many years later, when it became known as a vegetable growth.

Upon taking possession of this land in the name of the United States, the name New Columbia was provisionally given to it. The provision being the approval and concurrence of that portion of the Government having the authority to issue charts, &c., the decision of that body was adverse to my suggestion, and by its action I cheerfully abide not only on account of its undoubted right to decide according to its own judgment in this and all other matters over which it has jurisdiction, but because the size of the island, as now known, does not justify the bestowal of a name of this character, the name of one of the early Arctic navigators being much more appropriate. At the time I suggested the change of name I believed the land to be an island and had so reported it to the Department, but I supposed it to be considerably larger than it has proved. In the report of my first cruise in the Corwin, submitted November 1, 1881, page 50, I say, in reference to this land:

The part of Wrangel Land which we saw covered an arc of the horizon of about fifty degrees from northwest quarter north to west quarter south (true), and was distant from 25 miles on the former bearing to 35 or 40 on the latter. On the south were three mountains, probably 3,000 feet high, entirely covered with snow, the central one presenting a conical appearance and the others showing slightly rounded tops. Northward of these mountains was a chain of rounded hills, those near the sea being lower and nearly free from snow, while the back hills, which probably reach an elevation of 2,000 feet, were quite white; to the north of the northern bearing given the land ends entirely or becomes very low. The atmosphere was very clear, and we could easily have seen any land above the horizon within a distance of 60 or 70 miles, but none except that described could be seen from the mast-head.

Again, on page 52, I say:

I am of the opinion that Wrangel Land is a large island, probably one of a chain that passes entirely through the polar regions to Greenland; that there is other land to the north there can be no doubt \* \* \* large numbers of geese and other aquatic birds pass Point Barrow going north in the spring, and returning in August and September with their young. As it is well known that these birds breed only on land, this fact must be regarded as proof of the existence of land in the north. Another reason for supposing that there is either a continent or a chain of islands passing through the polar regions is the fact that, notwithstanding the vast amount of heat diffused by the warm current passing through Bering Straits, the icy barrier is from six to eight degrees farther south on this side than on the Greenland side of the Arctic Ocean, where the temperature is much lower.

The belief that Wrangel Land is an island and that other islands exist to the north, has since been confirmed by the remarkable drift of the *Jeannette*, and the more recent work of the *Corwin* and *Rodgers* on Wrangel Land gives us a comparatively definite idea of its extent, although from the official report of Lieutenant *Berry* we learn that the *Rodgers* did not sail around that island, and that the boats sent out for the purpose of circumnavigating it did not succeed. Still, they went far enough to enable them to form a definite idea of its size and the general trend of its coast line, topography, &c. Although the discovery of three new islands by the *Jeannette* does not in any manner prove the existence of others extending entirely through the polar regions, the natural inference is that others are there. In fact it would appear almost miraculous that a vessel drifting helplessly in the polar regions for twenty months should be carried in sight of the only three islands which exist there. It would also be remarkable, to say the least, if, after the islands had been seen throughout the polar regions, at the highest degree of latitude attained by man, they should suddenly come to an end, and the thousands of miles of unexplored space be entirely free from them. While they are perhaps not sufficiently near to each other to be designated as a continuous chain of islands, they may, taken in consideration with other facts, be regarded as reasonable proof of



WRANGEL ISLAND, FROM THE TOP OF HERALD ISLAND, DISTANCE 40 MILES.

the existence of islands throughout the polar regions at no great distance from each other. I quote the following from my private journal, written July 30, just after landing on Herald Island:

While working in through the ice toward Herald Island, we saw Wrangel Land, and from the tops of the island a very good view was had of it, the extremes bearing southwest and west by south (magnetic). It consisted of rounded hills of medium height and presented abrupt terminations at each of the above bearings, although it was thought by some that low land could be seen extending farther to the north, but owing to the hazy condition of the atmosphere we could not make out positively, and probably it was a mistake.

Having thus shown that the theory advanced by me that Wrangel Land is an island has been proven, and that in regard to other islands existing throughout the polar region has received strong confirmation, I will now briefly state the consideration which induced me to suggest the change of name. In order to do this a short review of its history is necessary.

The first account of the existence of land north of the continent of Asia was received through a Cossack trader named *Staduchin*, in the year 1644. By the natives, also Russian traders, who had preceded him, *Staduchin* was informed that in the Polar Sea off the mouth of the *Jana* and *Indegirka* there were large islands which in clear weather could be seen from land, and which the *Tchuktchis* reached in winter in reindeer sledges in one day from *Cheekotska*, a river emptying into the Polar Sea east of the *Kolyma*. An examination of the chart shows that the land referred to off the *Jana* and *Indegirka* can be no other than the Siberian Islands, and that to which the natives are said to drive with reindeer in one day from the mouth of the *Cheekotska* is the *Medvii* or *Bear Islands*; that they could have had no reference to Wrangel Island, which is over 300 nautical miles east of the *Cheekotska*, is evident. About the year 1668 *Nikifar Malgin* made a trading voyage by sea from the mouth of the *Lena* to the *Kolyma*, and during the voyage discovered an island far out at sea, west of the mouth of the *Kolyma*, and at *Kolyma* he met another trader, who reported that in cruising along the same coast with nine vessels, or more properly boats, three of them were driven ashore on this island. Traces of unknown animals were found, but no inhabitants. The location of this island between the mouth of the *Lena* and *Kolyma* is vague and indefinite, but with our present knowledge of that coast we may safely assume that the island referred to was *Blischni*, the most southern of the New Siberian Islands, which is the only island between the rivers named that could be seen while sailing along the coast. The first report which definitely locates these islands is the account of a trip from the *Lena* to the *Kolyma* by *Jacob Permakov*, a Cossack, in the beginning of the eighteenth century, who states that off the *Sratoinos* he had seen an island (*Blischui*), and that likewise off the mouth of the *Kolyma* there was an island that could be seen from land (*Bear Islands*). Then, as now, reports of explorers required confirmation before receiving full credence.

The following year another Cossack by the name of Wagin was sent out accompanied by Permakov to verify this report. They rode over the ice with dog sledges and not only reached and explored the island seen by Permakov, which they found barren and uninhabited, but discovered another, which they could not reach for want of provisions. Another point of similarity between those days of early exploration and the present time is the fact that the perpetuation of the memory of explorers depended more upon the tragic nature of their accounts than upon the amount of their addition to knowledge; and had it not been for the fact that their men mutinied and murdered Permakov and Wagin, these accounts would not have been preserved. They are said by Müller, to whom we are indebted for much of the early history of this country, to have been founded on the confused information obtained during the examination of the murderers at their trial. In 1763, a Cossack, named Andrejew, was dispatched by the governor of Siberia to make a trip northward over the ice with a view to ascertain the truth of these reported discoveries of land in that direction. He succeeded in reaching some islands, which he landed upon and found inhabited. His account is that "after driving to the north about 50 versts (33 miles) from the mouth of the Krestonoi River, I discovered a group of inhabited islands containing traces of a much more numerous population at some former period. The Bear Islands are 50 versts north of the Krestonoi, and are undoubtedly the ones referred to." Andrejew appears, also, to have claimed other discoveries, as in the instructions given to Billings, an English officer in charge of a large Russian expedition fitted out some years later for the purpose of exploring the Polar Sea north of the continent of Asia, the following words occur:

One Sergeant Andrejew saw from the last of the Bear Islands a large island to which they (Andrejew and his companions) traveled in dog sledges; but they turned when they had gone 20 versts from the coast, because they saw fresh traces of a large number of men who had traveled in sledges drawn by reindeer.

In 1769, a party consisting of three surveyors, Loutiev, Lussn, and Puschkarer, were sent out over the ice to the northeast, but they neither succeeded in reaching nor seeing land, although they traveled in the direction indicated 130 miles. The part of the sea in which Andrejew claimed to have made his discovery has since been thoroughly explored by Anjou, Wrangel, and others, but no signs of any land were seen. That he could not have landed nor even have seen Wrangel Land we now know, as it is over 300 miles distant, due east, from the Bear Islands, from which place the discovery is claimed to have been made. The natives who accompanied Andrejew on his journey to the Bear Islands were met with by Loutiev and his party, but had no knowledge of any discovery of new lands. These reports of the existence of land to the north of the continent led the Emperor Alexander, in 1820, to equip two expeditions, which were to proceed to the northern part of Siberia to explore and survey the coast. One of the expeditions was placed under the command of Lieutenant Anjou, with instructions to commence operations at the mouth of the Jana, and the other under the command of Lieutenant Wrangel, who was to commence at the Kolyma, and proceed east as far as Cape Shelagehoi, and thence in a northerly direction in order to ascertain whether an inhabited country existed in that quarter, as asserted by the Tchuktchis. After four years spent in unavailing effort, Wrangel returned home without even seeing this land or gaining the slightest particle of knowledge in relation to it. It is true he had received an account from the natives of Cape Jakan that, on a very clear day, from a hill in the vicinity, high land could be seen to the north; but this was not new. Native reports of land seen to the north had been current for over one hundred and seventy years, and on the strength of these reports the land had actually been shown on Strahlenbeyg's map at least one hundred years before the time of Wrangel's voyage. In submitting his report on his return Wrangel refers to it as "the problematical land of the North," and evidently has no confidence in its existence. His four years of exploration along the Siberian coast were conducted with great heroism, and were prolific of good results, and to him, more than any one else, are we indebted for the knowledge we now have of its geographical and climatic conditions; not so, however, in regard to the land which now bears his name, of which he not only gave us no knowledge, but threw doubt upon its very existence. In 1849, Captain Kellett, in H. B. M. ship *Herald*, saw this land and was undoubtedly the first European who had ocular proof of its existence. On his return to England, 1853, his discovery was reported. A chart of the region north of Bering Straits was compiled

from the information gained by the *Herald*, *Blossom*, *Plover*, and others, upon which this land appeared under the name of "Kellett Land," by which name it has since been known upon the British Admiralty charts. In 1867 this land was seen by the American whaling fleet. That season was a remarkably open one, probably as much so as that of 1881, and Captain Long, in the bark *Nile*, sailed past its southern limit, and a sketch, purporting to have been made by him, is now shown upon the American Hydrographic chart. Captain Long gave to this land the name of Wrangel Land. The strait through which he sailed, between the island and the mainland, has been given the name of Long's Strait in honor of that navigator. The land, as already shown, had been discovered and named for its discoverer fourteen years previously. It is presumed that Captain Long was not aware of this fact, or that this sound, upon which was bestowed his own name, had been navigated at intervals by the Russians since 1648, when Deschueo sailed from the Kolyma River through this and Bering Straits to the Anadyr, or he would have conferred that honor upon one of his many predecessors. A mountain included in Captain Long's sketch, the height of which he seems to have approximated very closely, was very appropriately named or him, but singular as it may appear this name, to which Captain Long was justly entitled, has, notwithstanding, our pretended custom of adhering to original names, been set aside on a recent issue of American charts. Subsequent to the discoveries of Kellett and the American whalers, Commodore John Rodgers visited the Arctic Ocean in the *Vincennes* as late as 1855. He spent twenty days in the Arctic, and went some miles north of Herald Island, but did not see the land under discussion. The following note, which appears upon the American Hydrographic chart, compiled from the surveys of that expedition, and from Russian and English authorities, implies a doubt of its existence:

Captain Kellett, of H. B. M. ship *Herald*, discovered and landed on Herald Island in 1849. Another island, and high land which he thought he saw, were not under more favorable circumstances of weather and position seen by the United States ship *Vincennes*.

Thus it will be seen that Kellett was the actual discoverer, and that Wrangel's name only became associated with it through the report of Captain Long, who was apparently unaware of the fact that it already bore the name of Kellett by right of actual discovery. But notwithstanding the slight ground upon which Wrangel's name has been associated with this land, had his been the only name connected with it, the thought of changing it would not have been entertained for a moment; and in provisionally applying a new name I disclaim any thought or wish to throw discredit upon the praiseworthy labors of Wrangel or Kellett. But as bearing two names was calculated to create great confusion, it was believed that as the island had become, by our act of landing upon it and taking possession of it, a part of the territory of the United States, by selecting a name of a national character, no disrespect would be shown to the memory or offense given to the friends of the gallant officers whose names it bore, and that the name given would be adopted by all nations. The name *New Columbia* was suggested by the name which had been given to the islands farther west, *New Siberia*. It is probable that the name *Wrangel Land* will continue in use upon American charts, but its justice, in view of all the facts, is not so apparent. In my opinion the adoption by us of the name given by the English would be appropriate, and avoid the confusion which is sure to follow in consequence of its having two names. Headlands and other geographical features of the island were named by us, but as the names which were applied to features actually discovered by the *Corwin* and heretofore unnamed have been ignored, it is possible that a desire to do honor to the memory of Wrangel is not the only consideration. To avoid the complications which would result from duplicating geographical names I have dropped all bestowed by the *Corwin* and adopted the more recent ones applied by the Hydrographic Office. I have also adopted the plan of the island, as shown on the small chart accompanying Hydrographic Notice No. 84, although the trend of the coast and the geographical position of the mouth of the river where we first planted the flag do not agree with the result of the observations and triangulations made by the *Corwin*. From the foregoing facts, which are derived from the voyages of early navigators, as compiled by Wrangel and Nordenskjold, and other sources, the following summary may be deduced: The first reports of land existing to the north of the coast of Siberia were made by the early Russian travelers; unfortunately the names

and exact date of their explorations are not known. The earliest record appears to be about 1644. Wrangel among others was sent in 1821 to ascertain the truth or falsity of this report. This he failed to do, but favored the belief that the reports were false. The land was first actually discovered by Captain Kellett, in H. B. M. ship *Herald*, in 1849. The discovery of the fact that it is an island of limited extent was first made by Commander De Long, U. S. N., in his drift in the *Jeannette* during the winter of 1879-'80, when he actually passed directly across the meridians embraced within its extremes, in plain sight of the land. Having shown that the report that Andrejew had landed upon Wrangel Land and found it inhabited could not be true, not only from its distance from the Bear Islands, 300 miles, which places it beyond the possible range of his vision, but by the more recent discovery by the *Corwin* and the *Rodgers* that the land contained no signs of human life, either past or present, we may, I believe, justly claim for ourselves the credit of being the first to land upon its shores. A Captain Dallman claimed to have landed here in 1866, but as Captain Dallman, who was almost constantly in communication with scientific men, and well knew the value of such an achievement, did not mention it until thirteen years later, and as his account corresponds with charts known to be erroneous, and cannot by any possibility be reconciled with the corrected charts now in use, and although these discrepancies have been pointed out to Captain Dallman, he has failed to produce further proof in support of his statement, it is not believed that his claim to priority can be established. Many traditions of a large and inhabited land to the north have existed among the natives of the north coast of Asia for centuries, and some of the early Russian explorers of the Polar Sea believed this land to be a continuation of Nova Zembla and a part of the American continent.

After reaching the lead through which we had entered the vessel was stopped, and the set of the current taken and found to be north (true) about one knot and a half. I was anxious to remain in the vicinity and watch every opportunity to approach and examine the shore, but as the fate of the whaler *Daniel Webster* which had been seen to go in the direction of Point Barrow, and was supposed to be in the pack, was still in doubt, I decided to go eastward with a view to learning her fate, and render such assistance as might be needed, having no doubt that later in the season we should be able to effect other landings and make a more thorough search for cairns, which, however, we had but slight hope of finding. The entire absence of all traces of human life on the eastern end of the land, where Captain De Long had directed any vessel to search that might be sent to look for traces of him, showed pretty conclusively that the island had not been visited by any one from the *Jeannette*. After calling all hands to "splice the main brace," we shaped a course for the east shore and made sail. As we drew out clear of the ice, we found the wind blowing fresh from southwest, and uncoupled propeller. To the south of *Herald Island* we found more ice than when we landed there nearly two weeks before. Passing to the southward of the island we made the best of our way to Cape Lisburne, of which we got a glimpse on the afternoon of the 14th, as the fog cleared away for a few minutes, bearing south about 20 miles. From Cape Lisburne we shaped a course for the native settlement south of Icy Cape, where we hoped to learn the fate of the *Daniel Webster*. On the following morning, however, before arriving at the Icy Cape settlement, we saw two vessels ahead, which, on being overtaken, were found to be the *John Howland* and the *Rainbow*. When first seen from the deck they were supposed to be about 12 miles distant, but in reality were over 30, such is the effect of refraction. From these vessels we learned that the *Webster* had been crushed in the ice. A part of her crew had been picked up, having followed the shore south from Point Barrow to Icy Cape and fallen in with some of the whaling fleet. The rest were supposed to be still on the shore and in need of assistance. Having found the journey along the shore too difficult, they had returned to the native settlements at Point Barrow and Cape Smith, preferring to take their chances with the natives to wading through soft, deep snow and fording rivers. From the account furnished by these men it appears that the master of the *Webster* had had but little experience in the Arctic Ocean, having been there but one season before. He saw two vessels enter a lead extending north between the pack and shore ice, and supposed he was perfectly safe in following two experienced whalers. During the night, however, the others became alarmed at finding the shore ice still unbroken, and, the lead becoming narrow, turned back and beat out, escaping with difficulty. From some cause this action was not

noticed by those on the *Daniel Webster*, who still supposed them to be ahead, and only learned their mistake when they came in sight of the end of the lead near Point Barrow, which was found to be rapidly closing. Of course an attempt was made to beat out, but the strong northerly current and the narrowness of the lead, which gave them barely room to work ship, rendered this impracticable. \* Running alongside of the shore ice they made fast and held on, hoping the pack would set off shore again; but no such good fortune was in store for them, for in less than an hour the lead closed entirely, and the pack and shore ice coming together crushed in the bottom of the vessel as if made of paper, barely giving the crew time to get out on the ice. The wreck occurred within 5 miles of Point Barrow, and the natives being on hand in force, of course helped themselves to whatever they could carry away. After being crushed the vessel fell over on the ice, remaining in this position twenty minutes or more before sinking.

The crew, having escaped to Point Barrow, lived with the natives for some time, and although not treated with very great consideration, they were furnished with shelter at night and with food enough to sustain life. Upon learning that some of the men were still on shore, we stood in to within 2 miles of the land, and followed the coast-line to the north, keeping a sharp lookout for boats or traveling parties on the beach. At midnight we stopped at Wainwright Inlet and sent an officer on shore with the interpreter to communicate with the natives, but could learn nothing additional in relation to the wrecked men.

Continuing northward as close to the shore as possible during the rest of the night, we arrived on the following morning, August 16, at a small settlement called Saurarua, about 20 miles from Point Barrow. From the natives, whom we found very busy fishing, we learned that several whaling vessels had been seen to pass up the coast the previous evening, and that probably the men had been picked up. The ice had left the shore the day before. These people knew all about the wreck of the *Webster*, and the efforts of her crew to get south along the coast. They said some had turned back from the Cogma River, near Point Belcher. This we subsequently learned to be true. The river had to be forded, and being quite full from the melting snow the party that decided to keep on followed its banks inland for 20 miles before finding a place sufficiently shallow to admit of their crossing. The natives at Saurarua assured us that they had treated the wrecked men with great consideration, giving them food and shelter. We expressed our gratitude for their kindness, although we placed little confidence in their story, and giving them a bucketful of hard bread and a few hands of tobacco proceeded on our way, not, however, without a good deal of difficulty. The shore was lined with large pieces of grounded ice, extending out to 10 fathoms of water, and a fog shutting down off Refuge Inlet, we had to proceed very cautiously, feeling our way along by the lead, and did not reach Point Barrow until evening; when the fog cleared away we found several vessels at anchor, they having arrived a few hours before. The remaining members of the crew of the *Webster* were still at Point Barrow, and were divided up among the different vessels, nine being taken on board the *Corwin*. We investigated a report of the death of one of the men by starvation and found it incorrect; the man had lost his mind temporarily and had wandered away from the rest, but returned subsequently. Thus every man was accounted for. Extra rations were also furnished to such vessels as required them on account of the extra men. One of the vessels at anchor at Point Barrow proved to be the bark *Legal Tender*, Captain Fisher, which had sailed from San Francisco June 11, and bringing letters and papers of that date, which were gladly received, it being our first mail since leaving San Francisco. We also procured from the *Legal Tender* a lot of fresh vegetables. A vessel is sent to the Arctic each year to bring to San Francisco the oil and bone taken by the fleet in the early part of the season, in order to reduce as much as possible the risk attending the fall whaling.

On the 17th we got under way and steamed to the eastward of the point for the purpose of boarding the bark *Rainbow* at anchor there, returning in the afternoon, and before coming to anchor boarded several vessels which had arrived during the day. The ice was in sight from the shore both to the west and north, but appeared to be working off. It had left the shore to the eastward as far as we could see from our farthest point, probably 20 miles. The steam whaler

Belvidere and several sailing vessels spent the day cruising along the edge of the ice to the northward, but without success. The following reference to Point Barrow is quoted from my report of last year's cruise:

Point Barrow is the most northern point of the United States, and lacks only 25 miles of being the most northern portion of the continent (a point of land called Boothia Promontory, in longitude  $95^{\circ}$  west, lies a few miles farther north). Point Barrow is a low sand spit which makes out to the northward about 8 miles from the regular coast-line, which terminates at Cape Smyth, thence turning to the eastward and extending about the same distance forms a bay named by Beechey, Elson Bay, after one of the officers of the Blossom. This bay is too shallow to be of any value, being navigable only for vessels of very light draught.

To the north of the point, lying nearly parallel with the shore, and from 1 to 2 miles distant, is a shoal with only 2 fathoms of water on it, possibly less in places. It is probably 3 miles long from east to west, and 1 mile in breadth. The space between the shoal and the point affords excellent anchorage out of the way of the drift-ice which sets past the point. Small pieces from the southward are constantly starting off shore, and being carried northward by the current, so that an anchorage on the west side of the point is not always safe or comfortable. A vessel running for this anchorage from the southward should round the point within one half a mile, keeping the lead going and not getting inside of 3 fathoms; the anchorage is in  $3\frac{1}{2}$  and 4 fathoms. Vessels going eastward of the point should not "shut in" the west shore of the point nearer than  $2\frac{1}{2}$  miles; and in hauling around the lead should be kept going, and care taken to keep outside of 4 fathoms, which will clear the shoal. In approaching from the north keep outside of 4 fathoms until the coast-line to the south is open to the westward of the point, when the end of the point may be run for with safety until past the shoal.

The foregoing directions for avoiding the shoal are such as were observed by the Corwin, and may be relied on as safe. The position and extent of the shoal and depth of the water are approximated from a few lines of sounding made by the Corwin and from such information received from the whalers as was in their possession, and are subject to correction.

On the morning of the 18th several more vessels arrived, making fourteen in all. After putting our mail on board the Legal Tender we steamed to the south with no ice in sight, wind fresh, southwest, and overcast. Having less than 20 tons of coal, it became necessary to procure a supply. Accordingly we made the best of our way to Cape Lisburne, intending to stop at the mine should the weather prove favorable, and if not to continue on to Plover Bay.

On the morning of the 19th we attempted to land at a native settlement near Point Bililur, but finding the surf heavy we gave it up and kept on down the coast, feeling our way past the Blossom Shoals with the lead. The weather was hazy and wind fresh from southwest. During the night of the 19th, the wind backing to southward, and moderating, led us to expect moderate weather for coaling next day. On the morning of the 20th we made the land to the east of Cape Sabine, and followed the shore westward, keeping as close in as the depth of water would permit. I stopped the vessel several times during the forenoon to examine cliffs which presented the appearance of coal veins, but no coal was to be found. At meridian, when nearly off the coal mine, the wind suddenly changed to northwest and blowing fresh soon raised such a sea that boating coal was entirely out of the question; so we kept on past Cape Lisburne, which was reached about 5 p. m., and shaped a course for Point Hope, passing it, inside the shoal, about 9.30 p. m. The long daylight had now given place to a decidedly dark night. Although we passed within half a mile of the point it was with difficulty that we could make it out with night glasses. The long twilight which had lasted throughout the night had been gradually growing fainter until it had finally left us, and the first night which could be called dark was more than six hours in length. During the night of the 20th the wind changed to the southward again and became light and baffling, and continued so the following day with occasional fog banks. During the afternoon of the 21st we caught glimpses from time to time of the tops of the high hills on each side of the straits, but towards evening the fog became very thick, and during the night the wind freshened from southeast with no signs of clearing.

At 4 a. m., August 22, we passed the Diomedes very close. Although we could see nothing the vessel's length away, we had no difficulty in knowing when we approached the islands by the baffling of the wind and the sound of the thousands of birds on the cliffs. Throughout that day and

the following we continued southward, sometimes under steam and sail, and at others under sail alone. The wind increased during the 23d to a strong gale; weather thick and rainy; sounded every half hour; vessel making good weather under short sail on two-hour tacks.

At 3.40 a. m., August 24, the fog cleared away and gave us a fine view of the coast from Saint Lawrence Bay to Indian Point. Shaping a course for Indian Point, we made the best of our way, hoping to reach Plover Bay before dark, as our coal supply would not last through another night. Our noon observations showed a current of 75 miles northeast by north (true) from 4 a. m. of the 22d to meridian of the 24th. We passed Indian Point at 11 a. m., and arrived at Plover Bay at 6 p. m., and came to anchor near the coal pile, having less than one ton of coal left in the bunkers. We found at Plover Bay the schooner *Golden Fleece*, under charter by the United States Signal Service to convey Lieutenant Ray, U. S. A., and party to Point Barrow for the purpose of establishing a signal station at that place. Lieutenant Ray had put into Plover Bay for the purpose of rating his chronometers. The *Golden Fleece* sailed from San Francisco on the 17th of July, and brought letters and papers to that date. Through them we learned of the attempted assassination of the President, but from the accounts up to that time we were led to hope for his recovery. I gave Lieutenant Ray a fine dog-sled and a few suits of deer-skin clothing; also a number of deer-skins not made up. Mr. Nelson had on board a very fine sled, which he had used in his journeys in the interior of Alaska; this he very generously presented to Lieutenant Ray. The duties upon which this officer has entered are of great importance, and their successful performance necessarily entails much hardship and danger.

On the morning of the 25th we took the *Golden Fleece* in tow and steamed out of the harbor, giving her an offing, after which we returned to the coal pile and began coaling ship with the boats.

The following day we completed filling the bunkers and watered ship. The day being fine I took advantage of it to visit a "deerman" at the head of Plover Bay, accompanied by Professor Muir and Mr. Nelson, and two Plover Bay natives to act as pilots and interpreters. We made an early start in the steam cutter, and after many assurances by the natives that we would "pretty soon see him," about noon we espied two native houses on a point at the extreme head of the bay, and soon after came to anchor in a small cove and went on shore.

Although this point is at the head of the bay, the valley continues on for many miles. The point upon which the houses are situated makes off from the east side of the valley as a low ridge extending nearly across the valley. It is separated on the west by an arm of the bay and a small stream of water which runs down the valley and empties into the bay. It is a picturesque place, and the day spent there was one never to be forgotten. On the highest part of the point near the end we saw the remains of two houses built and occupied by a party of Americans in the employ of the Western Union Telegraph Company during the winter of 1865-'66. The native houses were of the true Tchuktchi type, such as we had found at all points along the coast of Asia. The largest was occupied by the deerman and his family, consisting of wife, daughter, and two sons, and the smaller by an aged couple who, as we were assured, although in no way related to the deerman, were permitted to live upon his bounty. No better illustration could be shown of the thorough independence and self reliance of the Tchuktchi deermen than this small colony of only seven persons living here in this most inhospitable region, with no want unsupplied by their herds, and what a lesson in charity is taught by the care of these two aged people by the deerman and his family. The objects of his generosity possess no claim upon him, and he expects no reward. To the unsophisticated mind of the savage the fact that these old people are in want and he possesses the means of relieving them is sufficient. He has no thought of turning them off; they are as safe in his bounty as if under the immediate charge of some civilized charitable institution—possibly more so. These natives received us in a very friendly manner, spreading deer-skins on the ground for us to rest on and offering us food to eat, and although our civilized tastes and prejudices compelled us to decline the latter, we could not but admire the spirit of hospitality which prompted the offers. After a few friendly interchanges of civilities through the interpreter, and some presents of needles, thread, and tobacco, we made known our desire to see their herds of reindeer, and, if possible, to purchase a carcass for food. Knowing their objection to selling live deer, we carefully avoided the mention of such a thing, lest they should become

alarmed and refuse to bring them in. The old deerman held a consultation with his two sons, in which his wife and daughter joined occasionally. As these consultations seemed unnecessarily long to us we endeavored to hurry them up, and asked the interpreter what was the cause of it, what was being said, &c., to all of which we received for reply, "Hold on; by and by." After a while the conference broke up, and the two sons, who were muscular-looking fellows of probably sixteen and eighteen years, withdrew to the tent, and one of the interpreters remarked, "All right, he go; soon plenty deer come." In a few minutes the young fellows emerged from the tent prepared for a run. Their outer garments, consisting of deer-skin shirts and trousers, had been removed. They were clad only in an inner suit, which is a close-fitting garment of young deer-skin, worn with the hair side next to the person. The flesh side, as with most Tchuktchi deer-skins, was colored red by a preparation of willow or alder bark, giving it a very singular appearance. Each carried in his hand a bear-spear, and after a few words, which we were told meant that they would not be gone long, and a few more, which we understood by what followed to mean "tie up the dogs," they sped away up the valley and were out of sight in a few minutes, so rapid was their pace. While waiting their return we amused ourselves in various ways. Muir, Nelson, and I were plying questions to the deerman hard and fast, when we were startled by one of the interpreters saying, "Hello, what in hell is that? By God, I believe I see a bear," at the same time pointing to a dark object seen to be moving near the top of a mountain about 2,000 feet high, and some distance away. For a minute this caused considerable excitement, and the prospect of a bear chase seemed to be good, but on examination with the glasses it proved to be the doctor, who from the height he had climbed must have been absent some time, but who had not been missed. After this interruption we again settled down to asking questions. The deerman, although perfectly good-natured, was not communicative, but his wife took great delight in answering questions. She had not had an opportunity for a good gossip before, probably, for some time, and she made the best of it. She remembered perfectly well the telegraph people, and seemed to enjoy talking about them. She pointed with great satisfaction to a scar on her face, and informed us by pantomime, too striking to be mistaken, that when she received it she was very drunk, and having what she considered a delightful time.

Mr. Nelson, who was always ready to catch up anything of ethnological interest, whether a specimen or a dry fact, came upon a curiosity in the shape of a "doll baby." This was a forked branch of willow, and originally had borne but slight resemblance to the human form, but Tchuktchi ingenuity had made the resemblance very striking. This, the mother informed us, belonged to the daughter, and was made by her. The sight of it caused a smile to go round. A graphic description in English of this doll, by one of the interpreters, was entirely too much for the gravity of the party, and a general shout followed. About 3 p. m. the quick eye of the old deerman detected the approach of the herd far up the valley, and soon after we started out to meet them. The herd consisted of about one hundred and fifty deer, of all ages and colors. They were very tame, and allowed us to approach them without showing the slightest sign of fear, even allowing us to touch them with our hands. They seemed somewhat fatigued by the long walk they had taken, and many of them, especially the young, laid down to rest within a few feet of us as soon as they were allowed to stop. After satisfying our curiosity in regard to these animals, and having their habits explained and commented upon by our interpreter in his peculiar forcible manner, we were compelled to suggest to our hospitable friends that it was getting late, and that, having a long distance to go, we must start; and if they proposed to sell us the carcass of a deer it was now time, as the operation of slaughtering and dressing would occupy some time. After considerable trouble we induced them to kill two for us. Two male yearlings were selected and caught without difficulty, and led a short distance away from the herd. One of the sons stood directly in front of the deer, holding him by the horns, while the other, with a dexterous motion of the arm, stabbed him in the heart, holding the knife in the wound until the animal was dead, to prevent the blood from escaping. The skin was removed in a few minutes, the head cut off and the legs at the knees, and the entrails and blood carefully saved. We tried to buy the skins, which were very pretty, but could not induce the natives to part with them. This is somewhat remarkable, in view of the fact that they readily disposed of the garments when made up. I have

noticed the same peculiarity among the Innuits. The price asked for one untanned skin is generally equal, and sometimes exceeds, that asked for a skin shirt made up of two or more deerskins and trimmed with wolf, wolverine, or beaver, and upon which weeks of hard labor had been spent in preparing the skin and cutting, sewing, and trimming the garment. All labor done on the skin appears to detract from rather than add to its value. Before leaving our reindeer friends I endeavored to overcome their prejudice against selling live deer by making very liberal offers for two young ones, but without success. Superstition proved a stronger trait than avarice in the Tchuktchi character. Among other stories told us by the talkative old woman was one of a narrow escape by herself and daughter from a black bear. The father and sons were absent, attending to their herds, and, as often happened, remained away overnight, leaving only the two women, mother and daughter, in camp. During the night a noise was heard near the camp, which proved to be a bear. The women, being alone and unarmed, were naturally very much alarmed, and retreated to the interior of the polog or sleeping room. The bear, after walking around the outside of the camp, determined to examine the inside, and with one or two blows of his heavy paws, easily cleared away a place in the skin covering of the tent large enough to admit his body, and went in. Fortunately for the women, he made a satisfactory meal on a quantity of meat found there, after which he retreated without molesting the polog or its occupants. Our interpreter, in reply to the question what would the bear have done to the women if he had found them, said, "He eat 'em, damn quick." We reached the vessel about 8 p. m., and all united in calling the day one of the pleasantest and most interesting of the entire cruise.

In addition to coaling and watering ship, the day at Plover Bay had been improved in various ways. Everything in the engineer's department had been put in the best possible order. The old wire lashing on the rudder was found, upon examination, to be badly corroded by galvanic action, several turns being eaten off. The lashing was replaced by a chain, and the rudder put in the best possible condition. From the natives at Plover Bay we learned that two steamers had been in port, but they could not tell us what they were or where they had gone. We supposed one of them to be the relief steamer Rodgers.

Getting under way on the morning of the 27th, we proceeded northward along the land, intending to touch at Marcus Bay and Indian Point, but were prevented by a dense fog. I hoped, by communicating with the natives at these places, to learn something more definite in regard to the steamers which were said to have visited Plover Bay. The fog remained thick all day and the following night, with a fresh breeze from the northeast. After leaving the land at Plover Bay, a course had been shaped for the Diomed Islands, and upon running up the distance and judging ourselves in the straits, the course was changed for Cape Serdze. Sail was made, the wind being fresh and the fog very thick; we had only run a few minutes, however, when the almost perpendicular granite cliff of the west Diomed showed out through the fog, close on the weather bow, all sail was taken in, and, hauling up for the island, we came to anchor off the settlement in 10 fathoms. We went on shore and were met by our old acquaintance, Dick, who invited us to his house and gave us all the news. He said he had been to Hotham Inlet, and had only returned the day previously. We spent some hours on the shore and visited a number of the houses, which are made of walrus hide drawn over a square frame, and are very warm and comfortable. The winter houses are made of granite boulders piled up and roofed over with drift-wood, earth, and small stones. In many of the houses we saw piles of whalebone and fine furs of marten, fox, and beaver, which we learned were intended for the East Cape trade to purchase rifles, cartridges, and whisky. I tried to buy some of the marten, but could not induce the natives to part with them, although offered nearly as much as they would cost in San Francisco.

The Diomed natives reported having seen a steamer pass the island bound north several days previously, but could give no idea of her rig or nationality except the fact of having three masts. About 5.30 p. m. the fog cleared up, and getting under way a course was shaped for Cape Serdze, where I wished to touch, to recover our dogs and other property left in the care of the natives by the sledge party. Arrived off the cape the following morning, the northeast wind having freshened to a moderate gale, made the sea so rough that we did not attempt to land, but kept on northward, making good time under steam and sail. We ran until noon, August 30, when the lookout at the



HOTHAM INLET. INNUITS DRYING SALMON FOR WINTER USE.

*Photo. by Nelson.*



S. EX. 204, I, 48.

PLOVER BAY. HERD OF REINDEER.

*Photo. by Nelson.*

HELIOTYPE PRINTING CO., BOSTON



mast-head reported land ahead, and half an hour later the blue hills of Wrangel Island were in sight from the deck. Soon after ice was sighted ahead on each bow, and at 3 p. m. we came up to heavy ice extending northeast to southwest as far as could be seen from the mast-head. Taking in the square sails we headed eastward on the port tack under fore and aft sail, the engine turning over slowly. The wind continued to blow hard during the night from northeast with a heavy sea from about east by south. On the following morning we hauled westward and run in to take a look at the ice, which we sighted from the mast-head at 6.30 a. m., and soon after Herald Island came in sight. The wind continuing to increase we hauled up for the latter, hoping to make an anchorage there that would afford us shelter until the gale abated. When within about 18 miles of the island, the wind having increased to a strong gale with a very heavy sea, we hove to on the port tack and lay over comfortably, making a southeast drift. About 8 p. m. one of the guys which held the ice-breaker in place parted and the action of the sea wrenched off one of the wings. As the sea was running so high that it could not be taken on board without great danger to the lives of the crew, and being so badly broken as to be useless for further service as an ice-breaker, it was cut adrift to save the bows of the vessel from the hard knocks which it was getting. During the night of the 31st the gale blew very hard, with snow-squalls and a high sea. This continued until September 2, and we remained hove to, making good weather but rolling heavily, at times dipping the boats in the water. The starboard waist boat and steam cutter were taken in and secured on deck to prevent them from being washed away from the cranes. I expected the heavy lurches the vessel was making would carry away the crippled rudder, but fortunately it held on, nothing more happening to it than a parting of wheel-chains. At meridian the wind began to moderate, and at 3 p. m. admitted our steaming ahead. With our ice-breaker gone and the oak sheathing entirely off around the bows, having nothing more substantial to receive the heavy shocks than the 3 inch pine planking, the stem already started, and a crippled rudder, I did not consider the vessel in condition for further encounter with the ice, which longer cruising in this region at this season of the year would necessitate. In this connection it may not be out of place to state that the Corwin was, and is, entirely unfitted for this kind of work. In addition to being built almost entirely of soft wood, and consequently not having even the strength of an ordinary oak built vessel, she was illy fitted for Arctic work; with only an inch of oak sheathing, designed merely to prevent the ice from coming in direct contact with the soft pine planking, and an ice-breaker to protect the thin sharp gripe and the stern and the hood ends from injury. Aside from this she was in all respects the same as when doing duty on the Columbia River. Justice demands that, in making comparisons of the Corwin's work with that of other vessels, these facts should be considered.

I wished to revisit Kotzebue Sound before leaving the Arctic for the season. Accordingly a course was shaped for that place and continued during the 3d with moderate wind and thick weather. During the night of the 2d, the bobstay bolt having carried away, a temporary bobstay was provided by taking the end of a hawser through the hawse-pipe and setting it up to the steam windlass. At 8 p. m. on the 3d, the weather being very thick, we came to with the kedge for the night in 29 fathoms. The current during the night set to the northwest about three-quarters of a knot per hour. On the 4th the weather was still thick, but lighted a little at intervals. We got under way at meridian and steamed slowly along, with the lead going. At 9 p. m., the weather being very dark and thick, we came to with the kedge in 30 fathoms. Since August 31 we had been unable to take observations for latitude or longitude, and in the run from near Herald Island to our present position, which we supposed to be near the American coast south of Point Hope, the depth of the water had varied but 3 fathoms.

The bed of the navigable part of the Arctic Ocean lying north of Bering Straits is a vast plain, with an average depth of less than 30 fathoms. South of Wrangel Island the soundings are remarkably regular, at 22 fathoms for many miles, but toward the Asiatic side of the strait the water deepens to 27 fathoms at a distance of 20 miles from the coast, gradually shoaling to 14 in the next 10 miles. Just east of Herald Island the depth exceeds 30 fathoms, and to the northeast a few miles reaches 40. This is undoubtedly caused by the current which sets northward between Herald Island and Herald Shoal. This plain is between the northern and western packs, and the ice is generally somewhat broken and open toward the end of the season. It is

generally referred to as "the hole" east of Herald Island. The Hon. Clements Markham, in a paper read before the Royal Geographical Society of London, among a number of other mis-statements, says :

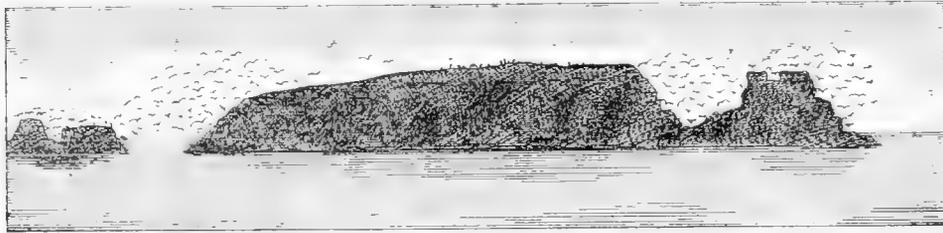
Captain Hooper reports that a long, open passage extends northward to the eastward of Herald Island, the current setting steadily at the rate of from one to three knots per hour. He described the passage as being like an ocean river running between fixed banks of ice, either frozen to the bottom or held in place by land on each side. He believes that the Jeannette passed far to the north in this channel.

The Hon. Mr. Markham further says that "this theory of channel and current has been upset by the more extended and detailed observations of the Rodgers."

In reply to the foregoing animadversion I prefer to let the logic of facts speak for itself. We now know that the Jeannette passed north in this channel, and also that the current carried her northward to the spot where she was lost, so it seems hardly necessary for me to say that I only reported the current as it was observed by us, and that the result of our observations has been confirmed by the drift of the Jeannette. Consequently the theory of a northerly current has not been upset. In referring to this paper by the Hon. Clements Markham my only purpose is to correct its inaccuracies so far as they are of geographical importance. I will therefore state that I did not describe this channel as an ocean river running between fixed banks of ice; neither has it that appearance. It is simply a place which is generally a little more open than the surrounding ice, and navigable a short distance when the other ice is not. It has been stated that from the top of Herald Island navigable water was seen in this lead for a distance of 100 miles. The absurdity of this statement is so apparent that it needs no contradiction. From the highest point of Herald Island the visible horizon would be distant less than half that number of miles owing to the curvature of the earth's surface. At the time of our visit no one could have distinguished ice from water at a distance of twenty miles. The ice-pack was not over 6 feet high, and supposing the condition of the atmosphere to be favorable, it would not be possible to distinguish ice from water more than 12 or 15 miles at the farthest when looking down from an elevation. Herald Shoal lies over 100 miles southeast of the island. It has 7 fathoms of water and gradually deepens to 16 in all directions within 5 miles, so far as known. There are no outlying dangers. It was discovered by Kellett and named after his ship. Eastward of the meridian of Herald Shoal the deepest water is found south of the sixty-ninth parallel of latitude, averaging about 30 fathoms, while to the north as far as Point Barrow the greatest average does not exceed 20 fathoms, decreasing regularly as the shore is approached, Point Hope being the only exception to this rule north of Cape Prince of Wales; the 30 fathoms' curve almost touches its shore.

At 5 a. m. September 5th, we again got under way, shaping a course east by north and proceeding cautiously through the thick fog until meridian, when the weather cleared up a little and we got a sight of the tops of the Mulgrave hills, distant nearly 50 miles. At 9 p. m. the water shoaling to 9 fathoms off Cape Krusenstern, we came to anchor for the night. At daylight the following morning we got under way, and, steaming to Hotham Inlet, we anchored in 3 fathoms, about 2 miles off the native settlement. The large number of natives from all parts of the coast, which were congregated here on the occasion of our last visit, had all gone, and with the exception of half a dozen tents of Selawik Lake natives, catching salmon for winter use, the place was deserted. The salmon frequenting this part of the Arctic Ocean (*Oncorhynchus keta*), known as dog salmon, are caught in gill-nets in large numbers, and dried for winter use. The preparation for drying them consists in cutting off the head, splitting the fish, and taking out the back-bone; after which the flesh is cut horizontally every 2 inches, the skin only remaining uncut. It is then thrown across a pole to dry. It furnishes food for both men and dogs, being eaten raw. During several hours spent on shore at Hotham Inlet, we learned nothing of interest from the natives beyond the fact that but little whisky was sold there the present season. Probably the small quantity on board the Flying Mist was all they received. Ducks and geese were found here in large numbers. As the cold weather approaches, they migrate south over the land, making a few miles each day and feeding upon berries as they go. In consequence they are very fat and have a more delicious flavor than I have ever found elsewhere. We bought all the natives had for sale, and enjoyed them very much. Returning to the vessel about 1 p. m., we got under way and steamed to Chamisso Island where we arrived at 10 p. m. The night was clear, the moon

full and bright, and the air so warm and pleasant that it seemed hard to realize that we were still north of Bering Straits. The dry-bulb thermometer at 10 p. m. stood at  $47^{\circ}$ , and the sea water at  $49^{\circ}$ . This place cannot always boast such fine weather at this season. We left here on the same date the year before, and winter had already set in; the entire country seemed buried beneath a snow-bank, while heavy gales were of daily occurrence. At meridian of the 7th we steamed over to Elephant Point, and came to anchor off the remarkable ice formation for which that place

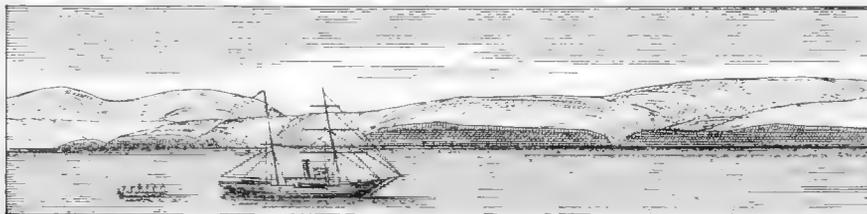


PUFFIN ISLAND, KOTZEBUE SOUND.

is celebrated. During the afternoon, accompanied by Messrs. Muir and Nelson, I went on shore to make an examination of the ice cliff. In my report of the cruise of the *Corwin* in 1880, I made the following mention of this phenomenon:

I visited Elephant Point, about 15 miles distant, on Eschscholtz Bay, near the mouth of the Buckland River. This place is remarkable for a singular ice formation, which Kotzebue described as glacier covered with soil 6 inches thick, producing the most luxuriant grass, and containing abundance of mammoth bones. Captain Beechey, of the Royal Navy, while cruising in the Arctic, in 1826-'27, claims to have fully established the fact that Kotzebue was mistaken; that what he called a glacier was occasioned either by the water from the thawing ice and snow trickling down the surface of the earthy cliff from above, or by the snow being banked up against the cliff in winter and afterwards converted into ice by alternate thawing and freezing, producing the appearance which deceived the Russians.

The cliffs in which the singular formation is found begin half a mile from the eastern extremity of Elephant Point and extend westward, nearly in a direct line, about 5 miles. They are from 40 to 150 feet in height, and rise inland to rounded hills from 200 to 300 feet high. The eastern part, where the ice formation is found, is nearly perpendicular for about one mile; from thence to the western extremity it is slightly inclined, and intersected by small valleys and streams of water. I examined the ice, and, although not fully convinced that Beechey has given the true explanation of it, I do not think it is a glacial formation. In several places where the water had run over the face of the cliff in small streams from the melting snow above, I found holes melted, at least 30 feet in depth, showing solid walls of clear ice. I also ascended the cliff and dug down from the top in several places, and each time came to solid ice, after digging through frozen earth for a few feet. I searched the face of the cliff for fossil remains but found none, either in the ice or in the soil above it. I was more fortunate, however, on the beach below after the tide fell. There I found a large number of mammoth bones and tusks, and some smaller bones, belonging, probably, to the aurochs, or musk ox.



ELEPHANT POINT, KOTZEBUE SOUND.

We spent several days in the vicinity of Elephant Point examining this and smaller ice formations which were discovered by our exploring parties from day to day; and although it is not claimed that all doubt is set at rest on this subject, we can safely assert that the large quantity of ice known to be here precludes the possibility of Beechey's explanation being the true one. Several hundred feet back from the edge of the cliff, at a place where a cave had occurred, caused by a small stream of running water, we found ice clear and solid. Ice appears in the face of the cliff

in several places, but that discovered by Kotzebue is much the larger. This is about half a mile in length, and although its exact width is not known, it may safely be assumed to be not less than 300 feet. At about 400 feet back from the edge of the cliff the ground rises quite abruptly for 80 or 100 feet, and changes from the springy, mossy covering to a solid mass of earth and stones, and in several places large bosses of lichen-covered granite are exposed to view. Although but 2 feet beneath the surface, in no place is ice exposed on the top. The layer of mossy turf covers it as evenly as if laid on by man to protect it from the sun's rays. That it owes its existence now to this covering of moss I have no doubt, but its origin is not so clear. The grass referred to by Kotzebue grows along the edge of the cliff, and on all irregularities on the face of the ice where the soil from above has been undermined by the melting and falling over, has lodged. Considering its cold foundation and the shortness of the season, the growth of this grass is almost phenomenal. Specimens collected by us, growing on a mere handful of soil on the very face of the ice cliff, were 4 feet long, and when dry emitted the fragrant odor of fresh, new hay.

Ice formations, in many respects similar to that at Elephant Point, occur in various parts of the northern regions, both in America and Siberia, wherever the frozen subsoil is found. This, according to B er, is coincident with the isotherm of 32  Fahr., and its thickness increases in proportion as the mean temperature of the locality falls below that degree, its unlimited descent being checked by the interior heat of the earth. The extent and thickness of this frozen substratum, whether increasing or decreasing, and to what extent affected by local causes, are interesting subjects of inquiry. The thickness of the frozen mass has been measured in various parts of the north by boring. At Yakutz, Siberia, latitude about 62  and mean annual temperature 14 , the ground was found frozen to a depth of 382 feet. At Fort Simpson, on the Mackenzie River, in nearly the same latitude as Yakutz, the mean annual temperature 25 , the frozen substratum was found to terminate at 17 feet from the surface; and at the close of the summer of 1837 the surface was found to be thawed to a depth of 11 feet, leaving only 6 feet of ground frozen. So far there appears nothing remarkable in the frozen substratum, it being controlled principally by the mean annual temperature of the locality and the internal heat of the earth. But why this frozen substratum should occur at certain places in the form of pure ice does not appear so clear. Whether these ice masses are fragments of the original ice sheet which overswept the polar regions, or are formed by the waters from the melting snow draining through the soft, light mosses which form the tundra, is a matter for scientific investigation. The presence of fossil remains of extinct species of animals in some of the Siberian ice masses points to the supposition that they have existed for many thousands of years, while some of the ice examined by us near Elephant Point showed unmistakable signs of having been formed by the melting snow filtering through the surface covering. The mass, though many feet in thickness, was composed of fine strata of ice, some pure and free from vegetable matter, and some so filled with decayed moss as to present more the appearance of frozen earth than ice. Upon being melted, however, it was found to contain but a small amount of vegetable matter, which had a rank, disagreeable taste and smell. This peculiarity was first attributed to the presence of animal matter, but, on examination with a microscope, revealed nothing but the remains of the same species of plants which formed the covering of the whole. A number of wedge-shaped pieces of ice found in the banks around Eschscholtz Bay were probably formed by a small crack in the ground filling with snow and ice, and continuing to enlarge under successive changes from freezing to thawing.

While making investigations in the vicinity of Elephant Point, Mr. Nelson discovered the remains of a beaver dam at one end of the ice cliff, which gave rise to a good deal of speculation and discussion on board as to whether this particular body of ice was not originally a lake; and indeed, considering the habits of the beaver, it is difficult to account for the presence of this dam upon any other hypothesis. The dam was in a good state of preservation, the wood plainly showing the marks of the animals' teeth. It is readily seen how the land forming the north shore of the lake may have been washed away, and the ice exposed, by the water from the Buckland and other rivers, which discharge into Eschscholtz Bay. The shallowness of the bay, and the difference in the height of the cliff, on its opposite sides, show that a large amount of washing away has taken place. The moss and grass covering the surface of the ice are also easily accounted for.



ICE CLIFF, ESCHSCHOLTZ BAY.  
(KOTZEBUE GLACIERS.)



S. EX. 204, I, 48.

BEAVER DAMS, ESCHSCHOLTZ BAY.

*Photo. by Nelson.*

HELIOTYPE PRINTING CO., BOSTON.



The germs are readily transported from the surrounding hills by small streams on the surface, snow-slides, high winds, &c. It is of a parasitic and very rapid growth, covering the most barren ground in a short time, even the dry hard surface of volcanic rock, and that it readily thrives on the ice is shown by the luxuriant growth found by us on every projecting point on the face of the ice cliff. Kotzebue was undoubtedly in error in supposing that the fossil remains of animals found in the vicinity were embedded in the cliff. I examined them carefully each season and saw no signs of animal remains of any kind, while on the shore, below high-water mark, we found them in abundance. They were not confined to the locality of the cliff, but extended each way as far as our investigations reached. They evidently came from the Buckland River, and were brought down by drifting ice in the spring. The other rivers emptying into Kotzebue Sound contain large numbers of them, as also those emptying into Norton Sound. The natives assured us that large beds of these bones were to be found in the rivers but a few miles inland. Many of the tusks found in America up to the present time are very much decayed from exposure, but it is probable that by digging into the frozen earth they would be found in a perfect state. Our half-breed interpreter, Andrew, claimed to have seen large quantities in the bed of a stream which he discovered while on an overland trading voyage from Norton Sound to Kotzebue Sound the previous winter. He said he had taken a small piece on his sled and brought it down near the coast, but finding that it was overloading his dogs, he threw it off and left it. Some of our men accompanied him to the spot and found a portion of a small tusk in a perfect state of preservation. The bones are found generally in the bed of rivers or in the alluvial deposits near their mouths. Many theories have been advanced to account for the accumulation of these bones, and by some writers it was supposed that the animals may have died in large numbers when in herds, but it is altogether likely that the remains were brought together by the action of the thousands of small streams of water formed by the melting snow, which everywhere flood the tundras in the spring. In this way they are carried to the larger rivers, and by them swept down, until by the widening of the river and the consequent decrease of the strength of the current they become stationary and are in time buried in the alluvium.

Although the hairy mammoth, as well as a species of ox, whose fossil remains are found, and the hairy rhinoceros, are now extinct, and have been for many thousands of years, they appear to have been adapted to the cold climate of the present time, as shown by the thick, hairy coat. And from the fact that remains of the mammoth and rhinoceros have been found with the skin and flesh in a good state of preservation, we may safely conclude that, whatever geological changes may have taken place since these animals became extinct, the climate has not been much warmer than at present. They fed upon the larches, birches, and dwarf willows which abound in the Arctic regions, lining the banks of every ravine, no matter how small. Branches of these trees have been found in the beds of earth with the remains of the animals, and undigested twigs have been found in the stomach of the mammoth, and a small portion of the same species in the teeth of the rhinoceros. The form of the teeth of both of these animals fits them for masticating this kind of food. According to Professor Ward the height of the mammoth was about 16 feet, and its length, including the forward curve of its tusks, 26 feet or more. Remains of the mammoth were discovered B. C. 300. Later writers mistook some of the larger bones of these animals for antediluvian giants. Some of the bones preserved in ancient Rome were believed to be from part of the skeleton of Pallas, and are described as being as high as the city wall. Such bones were exhibited in Switzerland as those of a man 19 feet high. In 1638 the same thing was done in France, and a few years after in Scotland were exhibited the bones as of a man 14 feet high. The mammoth has also been described as the behemoth of the ancient Hebrew Scriptures. Cuvier, in 1796, discovered and announced the fact that these bones belonged to an extinct species of elephant. Their remains have been found in all parts of Europe, Asia, and America in the Pliocene and post-Pliocene strata. They are most abundant in the far north on the Arctic slopes. In Siberia the natives collect and sell the tusks to Russian traders, who, in time, send them to Europe for the use of manufacturers. Many of the tusks are badly decayed, and the best, although sound and firm, are not white. The Siberian natives believed the mammoth to be a species of huge mole, which burrowed under the ground and lived and died there, the name

"mammoth" being a Yakut word, signifying an animal that burrows under the ground. The Innuits, of Alaska, still have the same belief. They told us wonderful tales of these animals having been seen digging with their enormous tusks in the beds of the rivers. These marvelous tales of the natives recounted the experience of some one else, the man who actually saw the wonderful sights either being dead or at a great distance. Although the stories told us were preposterous, even from an Inuit point of view, they were evidently believed by the narrators. Richardson says mammoth teeth are numerous in the crevices of the sandy banks of the river Kuskokvim. The natives have a tradition that the great animals to which the tusks belonged came in old times from the east, but that they were destroyed by a shaman of the river Kroichback. Some, however, say that the herd was merely driven into the earth, and that it came up one night of the year. The cause of the extermination of these animals was probably a period of greater cold, causing vast accumulations of snow and ice. Although the present climate of the north is well adapted to the support of this kind of animal life, but a slight change would be required to render it absolutely impossible for herbivorous animals to exist there. A few degrees lower temperature throughout the year would soon form a permanent coating of snow and ice over all the Arctic regions, through which it would be impossible for any animal life to penetrate. The willows, alders, and birches of the far north are dwarfed and stunted, and, as during the winter months they are constantly flattened down by the weight of snow, they attain a height of but a few feet, and often during the heavy snow-storms of winter are entirely covered. The climatic change which exterminated these animals may have come on gradually or it may have been a complete and sudden change. The wide range of their distribution argues against the latter supposition. It is probable that the change was gradual, and that while many perished in their native tundras, many retreated south before the long winter of the Glacial period, which followed, until, owing to the ever-changing climatic condition, they, many centuries ago, ceased to exist. In Europe and America they were coeval with early man, and on tusks found in caves in France good likenesses of the mammoth are found cut with flint or some hard substance. In Missouri a stone arrow-head was found under the shoulder-blade of a mammoth, now in the British Museum. In Wisconsin was found an ancient drawing of another species of fossil elephant, supposed to have been drawn from life by man. Australia is the only continent upon which the remains are not found. Nearly thirty different varieties of elephants, now extinct, have been found in different parts of the world. In 1799 a party of Tungoose fishermen discovered, near the mouth of the Lena, the body of a mammoth in such a perfect state of preservation that they cut pieces from the flesh to feed their dogs upon. Parts of the skin and long hair of this animal are now in the Imperial Academy of Science at St. Petersburg, the Paris Academy of Science, and the Royal College of Surgeons in London. Many of the carcasses of both the mammoth and rhinoceros have been found from time to time by the Tungoose and Yakuts.

Nordenskjold speaks of the discovery, in 1877, on a tributary of the Lena, of a well-preserved carcass of a hairy rhinoceros of a different species from those heretofore discovered, and from which it was concluded that this animal belonged to a high northern species, adapted to a cold climate, and living in or occasionally wandering to the region where the carcass was found. Speaking of the possibility of these large animals finding sufficient pasture in the regions in question, Nordenskjold says:

It ought not to be overlooked that in sheltered places overflowed by the spring inundation, there are found, still far north of the limit of trees, luxuriant bushy thickets, whose newly-expanded, juicy leaves, burned up by no tropical sun, perhaps form a special luxury for grass-eating animals, and that even the bleakest stretches of land in the high north are fertile in comparison with many regions where at least the camel can find nourishment, for instance, the east coast of the Red Sea.

On the New Siberian Islands and on the islands discovered by the Jeannette fossil remains of extinct animals abound. At Cape Wankarem, coast of Siberia, a piece of tusk, in a fine state of preservation, was brought on board by a Tchuktchi and bought by some of our people for a few hands of tobacco.

September 9 we got under way in the morning and started over to the north side of the bay, for the purpose of examining the cliffs there, but had not proceeded more than half way before we found the vessel aground. Although we were proceeding very slowly, with two leads constantly

going, we could not stop in time to avoid taking the bottom. I had selected the first of the flood to make the attempt, and as the tide rose the vessel floated and was backed off without difficulty. Eschscholtz Bay, although about 15 miles in length and 10 miles in width, is very shallow, and not more than half of it is navigable for a vessel the size of the *Corwin*. Its greatest depth is about  $4\frac{1}{2}$  fathoms; it shoals gradually, however, to the  $2\frac{1}{2}$ -fathom curve, so that it can be navigated in safety by a careful use of the lead. Inside of this curve the soundings become irregular, and banks with only 1 fathom of water over them, and having steep sides, are numerous. The tides appeared to be very regular, with about 3 feet rise and fall, the velocity of the ebb being about 3 knots and the flood probably not over 2. There was no perceptible difference in the height of the night and day tides at that time. While in Eschscholtz Bay we replenished our supply of water from a stream on Choris Peninsula. The water, however, was strongly impregnated with the decayed vegetable matter through which it runs, and as the operation of getting it was attended with some difficulty, on account of the distance from the beach, we took only what was required for immediate use. During one of my rambles on shore at this place, on the south side of the bay a few miles west of Elephant Point, I discovered several pieces of the wreck of a vessel, consisting of a part of a lower mast, including the head, the heel of a topmast, a hatch, several pieces of light upper work, stanchions, &c. I also saw a great many cask-staves, such as are used by the whalers for oil. As these things bore evidence of many years' exposure, and were all more or less charred by fire, I conclude that they belonged to the whaling bark *Louisiana*, which I mentioned in my former report as having been run on the Choris Peninsula and burned to avoid capture by the *Shenandoah*.

The cairn on Chamisso Island, in latitude  $66^{\circ} 13' 11''$ , longitude  $161^{\circ} 46'$  west, referred to in my former report, was revisited, but no new discoveries were made. A note in Fridlay's Directory of Bering Sea and the coast of Alaska, states that Kellett's party found, in July, 1849, the barrel of flour left by Beechey twenty-three years before, and that it was in good condition. The sand around it was frozen so hard that it required enormous exertions to get it out.

Near Chamisso is another and smaller island, which, in consequence of the great number of birds of that species found in the vicinity, is called Puffin Island. Like the larger one, it is composed of crumbling granite, and covered over the top with a rank growth of moss, grasses, and dwarf bushes. At the northwest end is an isolated eminence, resembling an ancient castle. The island is about 150 feet in height, its sides are steep, and on account of the crumbling state of the rock, it is difficult of ascent. Eschscholtz Bay is the only place on the Arctic coast of Alaska that can be termed a harbor. By shifting anchorage half a mile, good shelter may be found from all winds. Entering the bay with a fair wind, a vessel may pass between Chamisso Island and the peninsula. By keeping within a half or three-quarters of a mile of the island, after passing a line drawn from the center of the island to the east side of the peninsula, she may haul up to the northward and anchor within half a mile of the latter place in 5 fathoms and good holding ground. For a vessel beating in, however, the passage south of Chamisso is recommended, and in either case the lead should be kept going. In the cliffs to the eastward of the Choris Peninsula it is said that garnets are found, but we saw none. The land in the vicinity of this bay consists of rounded hills from 100 to 400 feet in height, and gradually rising to 1,000 feet further inland, with here and there an isolated peak 1,500 or perhaps 2,000 feet high. Occasionally these higher hills present a rugged outline, but generally the smooth regularity of their contour is very noticeable. This peculiarity extends throughout that part of the Arctic regions visited by us. As a rule the hills up to a height of 1,200 or 1,500 feet are smooth and regular, and composed of loose earth and rock. The many and extreme changes of temperature cause weathering and breaking of even the firmest granite. The detached particles roll down, and, by the action of the eddy winds, are formed into smoothly rounded hills, with the higher ridge of rock still projecting through or appearing as isolated pillars and columns. At Plover Bay we saw this smoothing process going on from the beginning, when the rounded portion appeared as a small talus but a few feet in height, through all the stages to a hill of 1,500 feet in height, and perfectly formed with the exception of the summit, a few feet of which still retained its original structure and appearance. This change is constantly taking place and at a much more rapid rate than might be

supposed. On windy days in summer a cloud of dust can always be seen on the lee side of the higher peaks, and the sound of the detached pieces rolling down may frequently be heard. Banks of snow which remain on the lower portions of the hills, after the peaks are bare, are sometimes covered to a considerable depth in this way, by fragments ranging in size from a grain of sand to several feet in diameter.



CAPE DECEIT, KOTZEBUE SOUND.

On the afternoon of the 12th of September we got under way and steamed to the head of Kotzebue Sound, and about 7 p. m. anchored off a peculiar-looking headland, named Cape Deceit, in latitude  $66^{\circ} 07'$ , longitude  $162^{\circ} 30'$  west. This cape is readily recognized by a detached rock off its extreme end probably 200 feet in height. The cape was named by Beechey, who described it as being "composed of a compact limestone, devoid of any visible stratification." A single native came off to the vessel, in his kyack, and, darkness coming on soon after, he remained on board during the night. This man, whose home was at the mouth of a small stream, nearly opposite our anchorage, seemed quite intelligent, and after indulging in a hot supper and a smoke, became quite talkative. He told us wonderful tales of the mammoth which he said lives in the interior of the earth, and, coming to the surface occasionally, forms the beds of the rivers in which these bones are found, by digging with his immense tusks, and that, having completed this task, the animal laid down and died. He assured us that they were often seen, but that unfortunately the men who had seen them were up in the mountains. He told us of immense beds of fossil bones about one day's travel inland, and also of a hot spring near them, in which the natives cooked meat and fish. These stories were confirmed by our half-breed interpreter, Audruvski. We tested his knowledge of the geography of the peninsula between Kotzebue and Norton Sounds, but found it very defective, and did not amend our maps according to his suggestions.

On the following morning a party went on shore from the vessel, but the wind breezing on from the northwest directly on shore I was compelled to recall them, and, getting under way, we steamed northward, passing Cape Espenberg about 6 o'clock in the evening, shaped a course for Cape Prince of Wales. The night was clear and beautiful, and it was difficult to realize that we were actually within the Arctic circle.

On the afternoon of September 14 we passed Cape Prince of Wales about 4 p. m., having a strong northerly current while in the straits, which we estimated at 3 knots per hour. The following day we arrived at Saint Michael's about 9 p. m. and came to anchor in the outer bay. We found here a portion of the prospecting party previously met at Golovin Bay. They had lost their schooner, she having been driven ashore during a gale of wind and had stove in her

bottom on the rocks. This party, nine in number, was taken on board the *Corwin* for passage to San Francisco. During the 16th and 17th we coaled, and landed the extra stores taken on board at Ounalaska.

The following is compiled from the general notes taken by Mr. Nelson on the climate and meteorology of Saint Michael's, by permission of the United States Signal Service. Mr. Nelson's observations cover a period of four years, and are the result of careful and intelligent labor, and will be found both useful and interesting.

#### ICE.

Ice generally begins forming in the bay about the 12th to the 18th of October, and between the 25th and 28th the ice on the bay is usually strong enough to bear a man. Up to the 15th of October vessels could safely enter here (Norton Sound), risking, of course, the gales liable to occur at this season. In spring there is far more uncertainty, since the date of open water depends wholly upon the direction and force of the wind. Northerly and westerly winds pack the ice into the sound and may effectually debar any vessel up to the last of June, while high southerly and easterly gales may free the sound of ice, so that a vessel may enter the first of June. In 1875 a vessel came in, following tide-cracks in the ice, on May 25th, but it was in the hands of an experienced ice navigator. Ordinary seasons vessels may safely enter between the 10th and 15th of June. They will be almost certain to strike ice off shore, but may usually pass through or around it and find open water. The severe winter of 1879-'80 made very heavy ice, which kept the coast blockaded until the 20th of June, but this was exceptional.

#### CLOUDS.

The most common and widely-spread cloud formation is a dull-gray stratus, presenting frequently for days together a dead unbroken front, and while seldom at an elevation exceeding 2,000 or 3,000 feet, it is very frequently so low that the coast hilltops are hidden down within 300 to 500 feet of the sea level. The cumulo stratus of this vicinity is usually formed by the breaking up of this uniform stratus. Large rounded mountainous masses of cumulus clouds with white edges are not uncommon in spring and summer in fine weather, and when appearing to the south or east during the spring generally presage warm weather. Cirrus clouds of almost every imaginable form occur, and as a rule precede a change of weather. The most interesting as well as one of the commonest cloud formations of this region is the peculiar arrangement of any of the varieties of clouds in long lines or bands extending across the sky in long parallel series and appearing by perspective to converge near the horizon in two opposite points of the compass. Mr. Nelson always distinguishes this formation by the word "linear" or "lin." prefixed to the name of the kind of clouds forming the bands, as in this way are given both the distinctive formation and the clouds of which it is formed, and the latter includes every variety, and in some cases two or three forms intermingled. Two motions have been observed in this formation: In one the whole series shifts its axis slowly round, often from a few degrees to one hundred and eighty degrees of azimuth, the bands meanwhile retaining their relative positions unbroken. The second motion consists in the apparently stationary position of the axial points near the horizon, while the bands, retaining their relative position, move slowly over the zenith and down to disappear behind the horizon in a direction at right angles to the course of the lines. The line of demarkation between the clear sky directly bordering on the last band and the clouds is sharply defined. This form was rarely observed except previous to or in conjunction with atmospheric disturbances, and a gale and rise or fall in the temperature may be the accompaniment.

## CRUISE OF STEAMER CORWIN IN THE ARCTIC OCEAN.

The following table gives the date of occurrence of this formation, its character as to the clouds, its axial direction, and the change of the weather following the same or the next day:

Date.	Kind of clouds.	Axes of bands.	Change in weather same day.	Change in weather next day.
1877.				
Aug. 18	Cirrus	(?)	0	Rain*
Sept. 2	Haze	(?)	Rain	Rain†
Sept. 3	Haze	(?)	Rain	Rain
Sept. 14	Haze to stratus	E. and W.	Gale (E.)	Rain †
Oct. 11	Haze and cirrus	N. NE. and S. SW.	Aurora	Gale from NE;
Oct. 16	Haze	E. and W.	Snow	Rain
Oct. 25	Haze	N. NE. and S. SW.	Snow	
Nov. 13	Haze	S. SE. and N. NW.	Snow	
Nov. 15	Haze	S. SE. and N. NW.		
Nov. 18	Haze	SW-NE		
Nov. 20	Haze	SW-W, NE-E		
Nov. 23	Haze	E. NE, W. SW.		
Dec. 13	Haze	N-S		Fall in temperature
Dec. 18	Haze	N-S	Fall in temperature; rising wind from N.; temperature falling.	
1878.				
Jan. 10	Haze	NE-SW		Gale, NE
Jan. 11	Haze	NE-E-SW, W	Gale, NE	
Jan. 13	Haze	E-W, to NE-SW, in evening.		
Jan. 14	Haze	NE-SW		
Jan. 15	Haze	N-S		Fall in temperature.
Jan. 28	Haze	NE-SW		
Feb. 10	Haze	N-S	Followed by gale from NE	
Feb. 11	Haze	E. NE-W, SW	Gale on 13th from north	
Mar. 10	Haze	N-S	Fall in temperature	
Apr. 11	Haze			Snow
May 8	Haze	N-S	Rising temperature	
Aug. 26	Haze	N-S	Gale from N	Rain
Sept. 7	Haze	NE-SW	Rain	
Sept. 9	Haze	N-S		Showers
Sept. 11	Haze	E-W		Showers
Sept. 14	Haze	N-S	Showers	Showers
Oct. 30	Stratus	E-W	Snow	Gale (E.)
Oct. 31	Stratus	E-W	Gale (E.)	Gale (E.)
Nov. 10	Cirrus, cumulus	N-S	Gale	
Nov. 27	Haze	N-S	Temperature fell	
1879.				
Feb. 5	Haze	N-S		
Mar. 8	Haze	E-W		
Mar. 19	Cirrus	N-S	Sleet	Rise in temperature
Mar. 22	Haze	SE-NW	Aurora	Aurora
Mar. 20	Haze	N-S	Aurora	Temperature fell
Mar. 25	Haze	N-S	Snow	Snow
Mar. 26	Haze	N-S	Temperature fell	Snow
Mar. 28	Haze	N-S	Aurora	Gale from NE
Apr. 4	Haze	(?)		Rise in temperature
Apr. 18	Haze	NE-SW		Snow; temperature rising.
May 9	Haze	E-W	Rise in temperature	
July 9	Haze	E-W		Rain
July 13	Haze	E-W	Rain	Gale, S-E
July 28	Cirrus, haze	N-S	High temperature	
July 29	{ Haze a. m. Stratus p. m.	NE-SW N-S	High temperature High temperature	
Aug. 2	Cirrus, haze	NW-SE		(S.) gale; rain
Aug. 6	Cirrus, stratus	E-W		Showers
Aug. 23	Haze	NE-SW		
Aug. 27	Haze	N-S	Heavy dew	
Sept. 1	Haze	NE-SW		
Sept. 6	Haze	NW-SE	Showers	
Sept. 14	Haze	N-S	Fog, evening.	Showers
Sept. 24	Haze	NE-SW		Gale, N
Sept. 25	Haze	N-S	Gale (N.)	Rain, frost
Sept. 30	Haze	E-W	S. SE. gale, snow	SE. gale
Oct. 1	Cirrus, haze	N-S	Gale, S-E	Gale (E), rain and snow
Oct. 3	Cumulus	E-W		Snow
Oct. 4	Haze	NE-SW	Snow	
Oct. 7	Stratus	NW-SE	Rising wind	Gale, snow, rain, and aurora.
Oct. 17	Haze	(?)	Gale (SE.)	Gale (E)
Oct. 23	Haze	N-S	Gale (N.)	Gale (N.)
Oct. 28	Haze	NE-SW	High bar	Gale (E.)
Nov. 6	Haze	NE-SW		Snow
Nov. 17	Haze	E-W	Aurora	Aurora
Nov. 18	Haze	N-S	Aurora	
Nov. 24	Stratus	NE-SW	Gale	Snow
Nov. 25	Cirrus, cumulus	NE-SW	Snow	
Nov. 26	Haze	NW-SE		
Nov. 27	Cirrus	NE-SW		
Nov. 28	In evening change to Cirrus	NW-SE E-W		Gale (N.)
Dec. 1	Haze	E-W		
Dec. 20	Stratus and cirrus	E-W, morning, NW-SE, middle of day.	Rising temperature	Gale and rain (SE.)
Dec. 20	Haze	E-W, evening		
Dec. 26	Cirrus	N-S		Gale (S.)

\* The air shifted to E. and NE., and in evening light wind arose from E. NE.; wind light and variable from SE. to E. NE.

† Gale from east in afternoon.

‡ Aurora.

Date.	Kind of clouds.	Axes of bands.	Change in weather same day.	Change in weather next day.
1880.				
Jan. 29	Cirrus, stratus	E.-W., then S.E.E. to N.N.W.		Gale (N.), snow
Feb. 7	Stratus	E.-W.		Gale (S.)
May 14	Haze	NE.-SW.		Fog
May 16	Cirrus	NE.-SW.	Fog	Snow
May 19	Haze	NE.-SW.	Temperature rising	Temperature fell
May 20	Cirrus, stratus	N.-S.		Fog
May 29	Haze	NE.-SW.		Barometer falling briskly
June 1	Haze	E.-W.	Fog	
June 3	Haze	E. NE.-W. SW.		
June 4	Cirrus, stratus	E. NE.-W. SW.		
July 4	Haze	N.-S.		Rain
July 9	Cirrus	NW.-SE.		Fog
July 17	Haze	NE.-SW.	Fog	Rain
July 21	Cirrus	N.-S.		
Sept. 10	Stratus	N.-S.	Showers	
Oct. 7	Cirrus, stratus	E.-W.	(E.) gale and aurora	Gale, snow (NE.)
Oct. 15	Cirrus, stratus	N. NE.-S. SW.	Gale (N.)	Gale (NE.), snow
Nov. 11	Cirrus	N.-S.	Gale (S.)	Snow
Nov. 16	Cirrus, cumulus	NE.-SW.		Gale, rain
Dec. 11	Haze	NE.-SW.	Snow and fog	
1881.				
Jan. 25	Cirrus, stratus		Gale (E.)	Snow, gale (S.)
Jan. 29	Haze	N.-S.		
Mar. 3	Cirrus, haze	N.-S.	Warmer	Snow
Mar. 4	Stratus	N.-S.	Snow	
Mar. 5	Cirrus, stratus	E.-W.	Colder	
Mar. 7	Cumulus	N.-S.	Colder	Colder
Mar. 12	Cirrus	N.-S.	Cold	
Mar. 13	Cirrus, haze	N.-S.	Gale (N.)	Gale (S.)
Mar. 18	Cirrus	N.-S.	Aurora	Aurora
Mar. 23	Haze	N. NE.-S. SW.	Snow	
Mar. 24	Haze	E.-W.	Fog	
Mar. 25	Haze	E.-W.		
Mar. 26	Haze	E.-W.		
Mar. 30	Haze	E.-W.		
Mar. 31	Haze	N.-S.		
Apr. 4	Haze	NE.-SW.	Warm	Rain
Apr. 9	Haze	NE.-SW.		Colder
Apr. 10	Cirrus	NE.-SW.	Colder	Gale (N.)
Apr. 12	Haze	NW.-SE.	Gale ends (N.)	Fog
Apr. 13	Cirrus, haze	N.-S.	Fog	Snow
Apr. 20	Cirrus, cumulus	N.-W. SE.	Gale (SW.)	Snow
Apr. 23	Haze	NW.-SE.		Gale, snow
May 2	Haze	NW.-SE.		Snow
May 4	Cirrus	NW.-SE.		Snow
May 7	Cirrus	E. and W. to N. and S.	Warmer	Gale (E.)
May 8	Cirrus, stratus	NE.-SW.	Warmer	Colder
May 15	Haze	NE.-SW. to NW.-SE. in evening.	Warm	
May 16	Haze	N.-S.	Warm	Gale (N.)
May 20	Cirrus	NE.-SW. to NW.-SE. in evening.		Snow
May 30	Cirrus	N.-S.	Rain	Rain
June 1	Cirrus	N.-S.		Rain
June 3	Cumulus, haze	N.-S. to W., p. m.	Showers	
June 4	Cirrus	E.-W. morn., N. NW. S. SE. in evening.	Warmer	Very warm, 58°
June 5	Cirrus	NE.-SW. to E.-W. at evening.	Very warm	
June 7	Cirrus	N.-S.	Fog	Cold and sleety, showers in early morn.
June 8	Cirrus	N.-S.	Fog	

The following table shows the average monthly cloudiness of weather the four years preceding April 30, 1880:

Average number of—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Totals.
Totally cloudy days.....	11.5	6.7	9.2	18.2	17.5	16.0	19.5	21.0	20.0	19.2	13.7	9.7	182.2
Fair days.....	13.2	9.0	13.5	8.0	11.5	12.2	10.2	8.0	80.0	11.2	13.0	13.7	131.5
Clear days.....	6.2	12.5	8.0	3.7	2.0	1.71	1.2	2.0	2.0	.5	3.2	7.5	53.5

FOG.

In spring the fogs usually occur oftener than at any other season. They are mainly limited to the night, and to small areas over low land, along the mountains, and over ice-fields at sea after a warm day. Beyond this, the last of May or first of June usually has two or three days of more or less foggy weather following the breaking up of the ice on the Yukon, and in addition may be placed the fogs which nearly always accompany westerly winds, except in midwinter. Compared

with more southern points on the Alaskan coast, the foggy weather here is almost a minus quantity. The misty rains occurring in summer so frequently take the place of fog, and are certainly no more agreeable.

The following exhibits the relative humidity for each month as averaged from the four years preceding April 30, 1881 (the averaged observations are the 7 a. m., 2 p. m., and 9 a. m.): January, 97.5; February, 98.5; March, 97.0; April, 96.1; May, 89.6; June, 86.4; July, 82.4; August, 87.6; September, 89.0; October, 91.9; November, 92.4; December, 96.5.

As would be expected, the relative humidity is greatest during the winter months and least in summer.

The lowest recorded humidity during this period was 37.4 on June 17, 1877, at the 5.24 p. m. observation, the hygrometer 70°, and 56.50 for the dry and wet bulbs respectively. In spring, during warm days in May and June, strange variations in the temperature and humidity frequently occur. These are so pronounced that they are at once felt by any one standing outside at the time, and appear to be cold waves laden with moisture and passing along with the wind. These waves may pass in a few moments or may last an hour or over, and are followed by the previous condition of the atmosphere, the contrast being sharply defined.

The distribution of the annual precipitation is shown in the following table, which includes the average monthly precipitation for the four years preceding April 30, 1881. Owing to the high wind which so frequently accompanies rain or snow here, and in consequence renders a considerable rain or snow fall nearly immeasurable, Mr. Nelson has added, as nearly as possible, to this series of figures an estimate of the error ensuing through this cause, and which he believes may be reasonably placed at 50 per cent. of the measured, or 33½ per cent. of the total, precipitation.

Month.	Measured amount.	Estimated correction.	Estimated amount. Total.
January .....	.54	.26	.77
February .....	.05	.02+	.07
March .....	.07	.03	.10+
April .....	.34	.17	.51
May .....	.87+	.44-	1.31
June .....	1.22+	.61	1.83+
July .....	1.65+	.83-	2.48
August .....	2.38	1.19	3.57
September .....	2.69+	1.35-	4.04
October .....	.88+	.44	1.32+
November .....	.74+	.37	1.11+
December .....	.84+	.42	1.26-

The average annual precipitation thus being as measured for the preceding four years, 12.24 inches, and plus the correction, which is undervalued if anything, equals 18.36 inches. As the direction from which most of the rain or snow falls has been mentioned in connection with the winds, it is unnecessary to repeat it here. In but a single instance was a hard downpour of rain witnessed, such as is common in lower latitudes, but either fine showers of short duration, or long, steady, misty rains, which at times fall for a day or two, and scarcely produce a measurable quantity of moisture in the gauge, though every exposed object becomes saturated like a water-soaked sponge. The snow usually bears the same character, and falls in fine, amorphous flakes, rarely showing perfect crystalline forms, and as rarely falling in large flakes. During the summer months, counting from the first of June to the end of September, there are a large proportion of cloudy days, upon which no rain falls here, while many showers fall along the before-mentioned range of coast hills. Some days not a drop of rain occurred here, though scarce ten minutes pass during the entire day but a shower may be seen passing slowly along the line of hilltops some 8 to 12 miles away. In winter the same phenomenon is witnessed with snow showers. In both cases the showers almost invariably traverse the hills from south to southwest to a northerly direction, and leaving the hills, when the latter decrease rapidly in elevation to the eastward, the showers pass on and are expended upon the sea. These showers are usually discharged from more or less fairly-marked cumulus clouds, and may be frequently seen passing to the north or northeast, while the wind at the place of observation may be in an exactly opposite direction, and the clouds overhead present an unbroken and apparently motionless surface of dull gray stratus.

July 28, 1878, snow fell upon the hills and mountains along the coast to a depth of about a foot, and extending down within 250 feet of the sea-level. This snow disappeared by noon the next day, upon which occurred an eclipse of the sun. September 7, 1880, a heavy snowfall occurred on all the mountains and hills around Norton Sound, within 400 feet of the sea-level, and on the 17th and 18th of June, 1880, snow showers occurred at the sea-level. Nearly every winter, during the last half of December or first part of January, occurs a series of southerly and easterly gales, accompanied by more or less heavy rains and a temperature sometimes rising from the 40° of a few days before to +46° or over. This thaw frequently lasts a week or ten days, during which all the snow is melted from the ground, the sea ice is generally driven off shore and broken up, and in the interior the smaller rivers open and are freed from ice. The most extensive thaw of this character observed occurred the last of December, 1880, and first of January, 1881, when the ice upon the Yukon was rendered too thin to travel upon, and many large openings appeared, while the Koskoquim River rose many feet, exceeding the ordinary height at the spring freshet, and the ice broke up and was swept away from bank to bank as in spring. These thaws are of such regular occurrence at this season that the fur-traders speak of the "Christmas thaw" as a settled fact, and observation justifies the belief. It is during this storm that some of the severest gales of the year are usually experienced.

DEW, FROST, FOG, ETC.

Clear, calm nights in spring and summer are frequently accompanied by a copious dew, the grass-blades bearing large drops in the early morning. Frosts are less common, their relative infrequency being due, probably, to the greater number of cloudy days during the time that frost might be expected. A sudden fall of the temperature in winter, if the sky is clear, almost always results in a precipitation of beautiful snow crystals of minute size. In some instances these crystals become aggregated and form feathery snow-flakes of extremely loose texture. The snow fog rarely occurs, however, except in perfectly calm, clear weather, with a temperature below zero. At temperatures from -25° to -35° and below, it only requires a change of a few degrees to produce the falling crystals. In some cases this fog consists of minute globules of ice which are barely visible to the eye and are deposited upon every object presented to them, for this phenomenon usually accompanies a slight wind when the circumstances appear unfavorable for the formation of the crystals. These globules appear to still preserve the power of changing their shape even at a temperature of -35° to -40°, and build up a thick coating of icy spiculæ upon a feathery background of frost-work upon anything presenting the slightest inequalities to the wind. The spiculæ present their points to the wind and are often bordered with feathery frost-work. North winds prevail over all others, and south winds follow in their order.

The following list of the winds for four years preceding April 30, 1881, compiled by Mr. Nelson, will give the relative frequency and the percentage of each in a series of eleven thousand four hundred and sixteen observations :

Direction from.....	N.	NE.	W.	SW.	S.	SE.	E.	NE.
Number of times.....	2,552	410	558	1,304	1,928	567	1,539	2,025
Relative frequency.....	.22+	.035	.048+	.11+	.167	.049	.13+	.175+

Number of calms, 633 ; total, 11,546.

Relative frequency, .057, 100.70.

North winds, when not caused by a return current to be mentioned hereafter, nearly always produce a fall in the temperature and at the same time the sky is cleared, so that it is a well-established rule, even with the natives, that a change of wind to the north will give clear weather and colder, while to the south or southeast gives warmer weather with the sky obscured and commonly accompanied by rain or snow, according to the season. East winds are also rain or snow winds, but less marked than the south or southeast. If the wind blows from the north for a time, and then change by the northeast by east to south, a rise in the temperature with more rain may be expected in summer, or warmer weather with snow in winter. Should the wind change

by the northwest and west to southwest or south, very little rise in the temperature, if any, may follow, and the rain, if in summer, will be cold and disagreeable, and in winter the sky may clear with a falling temperature or an intensely cold wind and snow storm may follow.

In spring and summer southwest and west winds are almost invariably raw and cold, and accompanied by fog and mist. In winter a west wind frequently clears the sky. Northeast winds are equally cold with those from the north, and the months with the lowest average temperature have the prevailing wind from this quarter. Strange as it appears, however, the months of highest average temperature appear to have the prevailing wind indifferently from various quarters, but as often from the north as from any other. A part of these north winds, especially in summer, results in the following curious manner: The relative position of the low range of coast hills across the bay on the mainland has been given. These hills are so placed, extending about northeast by southwest, that they frequently deflect a south wind either to the right and northeast along the flank of the hills, or the wind strikes the hills, and, being forced up, glances over their tops and becomes a low upper current. The station at Saint Michael's is about 8 miles from these hills, yet it is a common occurrence in summer to see the heavy masses of vapor-like leaden clouds pass over at a few hundred feet elevation from south to north, while the wind-vane points to the north and a brisk breeze blows thence. In a short time the north wind may be seen bringing back a layer of clouds, which discharge misty showers on the land as they pass until they glide up the hilltops and rejoin their fellows. At times this return current may be blowing a gale from the north at this place, while a few miles out at sea, and what appears to be directly in the wind's eye, the ice may be broken up and driven off shore by a heavy gale from the south. A north wind is frequently observed to blow steadily in this return current from twelve to twenty-four hours before being succeeded by the wind from its normal quarter. In the spring violent flurries of snow often occur with this return wind. As will be noticed, this current produces an aerial eddy, with the plane of the revolutions vertical in place of horizontal, as in ordinary cyclonic movements of air or water. When the wind is deflected laterally, as it often is, either in conjunction with or independent of the upper current just described, it passes along the inland face of the hills to the northeast until, about 10 to 12 miles up the coast, the hills become very much lower, when the wind, released, goes on its course, and if blowing strongly produces an eddy and an insetting current toward shore to the left of its path. In summer striking examples of this have been seen when observing the arrival or departure of the fur-traders' boats. It is by no means an uncommon occurrence to see one of these boats sailing rapidly along with a fair wind a few miles away, while at the station a stiff breeze was blowing exactly in the opposite direction. Upon one occasion a boat was seen apparently sailing against the wind with such a heavy breeze that a reef was required in the sail. It is very curious to watch a boat approaching thus. It sails easily along until within two or three miles, and perhaps a little further, and apparently has nothing to do but sail directly to its destination, when suddenly it reaches a calm, and after a moment's hesitation the oars are put out and they row for a time, with the sail still up, hoping to have the breeze renewed, when the sail is taken back by a head wind, and after it is lowered the crew have a hard pull to the shore. This latter incoming current has the ordinary cyclonic movement, and may attain the velocity of a strong gale, and be accompanied by the precipitation of rain or snow. Fogs are sometimes produced in summer and fall by this northerly current.

On one occasion the cloud-laden southerly current was seen meeting and mingling with the foggy and somewhat lower current from the north; this was followed by a calm of about two hours' duration, when the wind arose again from the south stronger than before and prevailed the rest of the day. The intermingling of the two currents was well seen, as the clouds from the south were darker colored than those from the north.

*Average number of miles traveled by the wind during 1878, 1879, and 1880.*

Month.	Monthly average number of miles.	Average of maximum hourly velocity.
January .....	7.906	61
February .....	8.604	61.6
March .....	7.648	50
April .....	8.029	60.3
May .....	7.774	64
June .....	7.078	36
July .....	7.455	49.3
August .....	9.234	64.7
September .....	8.388	55.7
October .....	10.642	66
November .....	9.739	58.7
December .....	8.993	66.6

The most windy portion of the year is from the 1st of August to December, culminating in October.

In the four years preceding April 30, 1881, the highest hourly velocity was 78 miles in April, 1879. The greatest amount traveled for any single month was 12,598 miles in March, 1880, a month remarkable for the great amount of snowfall and accompanying gales. The least amount for any month was 3,961 miles in March, 1879, a cold but clear and pleasant month. Heavy gales appear to be rather irregularly distributed through the year, with a time of moderate winds in March, and during May, June, and a portion of July. Autumn appears to be a time of severe gales, especially in October and November. These gales, driving blinding clouds of snow before them, and at a temperature in the neighborhood of or below zero, are by no means uncommon. Before these even the hardy fur-traders and the natives shrink in dread, and frost-bites are the certain result of braving them, while in several instances natives have perished in these chilling blasts. During summer there blows at times a fitful wind from seaward to the land, which is apparently an aspirated breeze (after rising to a light gale) caused by warm ascending currents in the interior. Of the many storms occurring during the year, by far the greatest number are from the south and north, rising in nearly equal number from each of these directions. With the storms opening with a north wind may be classed those starting with a northeast wind, and with the storms opening with a south wind may be placed those rising from the southwest, as they appear to be very similar in their course and duration. Storms rising in any quarter from southwest to west, and thus to north, are of great variety, while from the other points of the compass they are common and especially numerous from the northeast and south. It is commonly observed, however, that the north and south gales may be classed in one set, and the easterly gales in another, with a third and anomalous set from westerly quarters. The easterly gales continue for this period with little change in direction, as a rule, and as the gale clears away the wind frequently remains unchanged, and this storm is ended and no further effect need be apprehended. With the storms from the north or south, however, it is quite different, for a gale may begin by the wind becoming steady south and rising rapidly, and may continue any length of time up to several days, then the gale dies away sometimes quite abruptly, and a calm or period of light or variable winds lasting from an hour to a day or more may occur, when the wind becomes fixed in the north and rises with more or less rapidity, according to the manner of the end of the preceding gale. This gale passes through a course about equaling the corresponding one from the south, and, as it dies away, we see the last of this storm; sometimes one follows another in a series lasting a month or longer. There is generally more or less precipitation attending the gales from the east and south. About an equal number of storms begin with a north or northeast wind, followed by a calm and a change of the wind to an easterly or southerly direction. In a number of cases the gale from one direction may be followed by a stiff breeze from the other, while in many cases the storm may only show its passage by the gale from a single direction. It is only a small percentage of cases that storm winds in passing from north to south or south to north change by the west, nearly always moving to the east.

## AURORAS.

The following gives the average frequency, monthly, of auroras witnessed at Saint Michael's during the four years preceding April 30, 1881 (owing to the almost constant daylight it became impossible to see an aurora from the last of April until the middle of August): January, 1.5; February, 5; March, 1.7; April, 0; May, 0; June, 0; July, 0; August, .2+; September, 1.5; October, 2.5; November, 3.5; December, 1.7. The total number observed in four years is 71, or 17.7 per year. Brilliant displays are rare, and the majority consist of a pale arch, or a diffused, half-disk shaped glow near the northern horizon.

Below a complete list is given of the auroras as observed by Mr. Nelson, with remarks upon the character of each, and the date and time of occurrence:

## 1877.

- August 10* (6.30 to 10 p. m.)—Faint glow in the northern horizon. Wind east, light.
- October 11* (5.45 to 12 p. m.)—Low arch with pale yellow tongues and bars of light projecting and waving on upper border. Wind variable. Linear bands north-northeast, south-southwest.
- October 12* (midnight to near morning).—Pale glow from display of last evening and again in evening. Northeast gale in afternoon.
- October 13* (5.30 to 9 p. m.)—Faint glow in northern horizon where aurora of 11th and 12th instant was seen. Gale from northeast.
- November 7*.—A faint glow discerned through a rift in the clouds to the north at 7 p. m. Change of wind from north to east at 8 p. m.
- November 26*.—Faint glow in the north, light northeast winds (6 p. m. to midnight). Gale from northeast, and haze the next day.
- December 5* (7 to 9 p. m.)—Faint glow in north; wind light and variable; snow next day.
- December 31* (9 to 10 p. m.)—Faint arch in north; east wind; gale next day and falling temperature.

## 1878.

- February 5*.—Faint arch near northern horizon; high south wind 9 p. m.; in early evening of the 6th lowest temperature of year, 52°.
- February 26*.—Two faint arches in the north, low down; about 25° to upper one from horizon; separated by 10°; brightest at 9 p. m.; no color or motion. Wind light and variable.
- February 27* (midnight to daylight).—In forenoon the same aurora continued as last evening. Wind brisk from north all day. At 9 p. m. the arches were visible as yesterday, but very faint; they lasted about two hours.
- September 22*.—Sky cleared at 11 p. m., showing a glow extending over 20° of azimuth and 10° above horizon; this continued unchanged until—
- September 23*, 2.30 a. m., when it faded away. Wind variable in morning; northeast, steady, rest of day. First in early evening, at 9.30 p. m., a faint arch was formed in the position of outer edge of last night's glow, and continued till midnight.
- September 24*.—Midnight to early morn, the arch of last evening continued. Frost 10.30 p. m. to midnight. Arch same as last evening renewed; east wind.
- September 25*.—Midnight to early morning the arch continued; light northeast gale. About 8 p. m. the aurora appeared, and at 9 p. m. the display was well marked. First there arose from the horizon, in the magnetic north, a half disk (the arc uppermost) of what appeared to be a bank of jet black stratus cloud; presently it became bordered with a pale light and arose until about 25° above the horizon, and shutting out the light from all the stars in that quarter, and extended 35° of azimuth. In the magnetic south simultaneously formed an exactly similar disk, except that it arose about 45° from the horizon, and covered 60° to 75° of the azimuth. The light bordering the dark disk in the south was much paler than that in the north, but its intensity waxed and waned with the display in the north. The dark disk was also less intense, as the larger stars could be faintly seen. In the north the display was fine. The bordering arc of light would become more intense, then a flickering light would appear in the midst of the dark disk, and spreading rapidly, it would form an interior moving band of light parallel to the border, toward which it sent up tongues and bars of light, until the projections touched the light of the border, when increased activity ensued, and suddenly numerous tongues of intense yellow light bridged the intervening space, and then the bordering arch appeared to draw and incorporate the lower arc with itself, leaving the disk unbroken, black as before. Then, close to the horizon near each end of the dark half disk, appeared a patch of light, which developed rapidly and soon appeared to flow toward the center where it seemed to unite with its fellow and vanish as it came, after a short display. This continued for hours, the bordering arc also sending out moving tongues of light, both up and down. After each display the black disk was left intact, and only once was a star seen within the outer arc, and this showed through one of the developing patches of light near the center, but the closest scrutiny, after the light had vanished, failed to reveal the star again, though it was quite distinct when seen through what appeared like a rent in the curtain.

- September 26.*—The aurora of last evening ended at 2.30 a. m. To-day wind brisk from east in early morning. Frost.
- October 22.*—Faint auroral arch, 8 to 10.15 p. m. Gale. Haze and snow the next day.
- November 18.*—Faint arch and diffused glow in north. Light wind (7.40 p. m. to midnight).
- November 19* (midnight to 1.30 a. m.).—Aurora continued from last evening. Wind variable and light snow. Showers next day.
- November 30* (6.30 p. m. to midnight).—Arch in north along which traveled masses of light. Sometimes the arch was continuous; then it showed only in series of broken waves moving back and forth, but mainly from east to west. The light waxed and waned frequently, and was often very bright and of a straw yellow. Linear haze from northeast the next morning.
- December 1* (midnight to 2.30 a. m.).—End of last night's aurora; haze in morning.

1879.

- February 11* (8.30 to 11 p. m.).—Pale half disk of light on northern horizon; no movement or color; light south wind
- February 17* (7.45 to 10 p. m.).—Pale yellowish arc in north about 30° long at base and 20° high; high barometer; low temperature; snow fog.
- February 18* (8 to 10.30 p. m.).—Hazy in morning; snow in afternoon.
- February 22* (8.30 to 10 p. m.).—Faint arch 25° high in north. Gale from north ended in morning; falling temperature.
- February 23* (10.45 to midnight).—Arch same size and location as yesterday; a trifle more intense; falling temperature.
- February 24.*—Arch of last evening ended at 12.30 a. m. to-day. At 7 p. m. an arch exactly like that ending this morning appeared and continued until 10.30 p. m. North wind all day; gale from north next day.
- March 2* (8.15 p. m. to 10.30 a. m.).—Wind light; snow fell the next day. An arch was formed about 15° to 20° high, with its center to the west of the magnetic north about 10°. At first the color was a faint yellow, but the original arch soon broke up into long waving pencils of light, tipped, and at times entirely pervaded with a fine rose-tint, changing to purple as the aurora increased in brilliancy. This color invariably began at the lower end of the pencil and remained there, or passed like a wave upward along its entire length. The pencils were continually passing back and forth, one moment scarcely visible, the next bright and glowing. At times the pencils expanded until they formed lovely undulating curtains of rose-colored light, with passing shadows of purple, green, and yellow. The pencils of light were about 10° in height.
- March 22* (8.15 to 10.30 p. m.).—Poorly defined arch in north. Linear haze northwest by southeast in afternoon.
- March 23.*—Faint auroral glow seen through clouds at 9 p. m. Linear haze in middle of the day.
- March 28* (8.15 to 11.30 p. m.).—Linear haze north and south in middle of day. Faint glow in north. Gale from northeast next day.
- October 8* (8 to 9.30 p. m.).—Two arches formed; the upper was about 20° high, and sent long pencils of straw yellow light which gilded slowly from south to north with a tremulous motion. The inner arch, about 5° below the other, remained stationary. Accompanying the auroral light was a dark, opaque arch, rising in a curve from the northwest horizon, close to the termination of the auroral arch and sweeping in a curve about 25° high across the western sky, terminating at the southwest horizon. This arch was composed of a uniform band 2° to 3° broad. The upper border of each was transparent, as the stars could be seen through it, but from the upper edge it increased rapidly in density so the lower half showed inky-black and opaque. The segment of sky included in this arch was illumined by a pale, indistinct light, which was barely intense enough to make a contrast between it and the sky outside the arch. Gale from south on same and on next day. Snow and rain same day. Air filled with a peculiar, smoky, Indian-summer-like haze the next day.
- November 11* (8 to 10.30 p. m.).—Two point arches low in northern horizon. Gale from east; northeast in evening and next day.
- November 13* (8 to 10 p. m.).—Faint glow in north. Temperature fell next day.
- November 16* (9.30 to 11.45 p. m.).—Linear haze east and west next day. Faint glow in north.
- November 17* (11 p. m. to midnight).—Faint glow in north. Linear haze same and next day.
- November 18* (midnight to 2 a. m.).—Aurora of last evening developed to bright arch, with moving pencils of light soon after midnight; then faded. Linear haze from north to south in middle of day.
- December 9* (8.30 p. m. to midnight).—Faint arch in north, light north wind.
- December 10.*—Arch midnight to 8 a. m.; also 5 p. m. to midnight. The latter aurora reached its greatest intensity at 9 p. m., when it consisted of two arches, the outer of which rising from the horizon just north of east passed in a curve over the sky just beneath the pole star, and touched the horizon just north of west. This arch consisted of a faint nebulous light through which the stars were plainly visible. The lower arch, rising and terminating just within the outer, contained about one-third the space. The lower arc was rose-tinted along its lower border, and on its upper half flickering straw-yellow, and inclosed a half disk of inky blackness, effectually hiding the stars. The lower arc repeatedly broke along its upper surface, throwing up long filaments and tongues of yellow light over which passed shades of rose and green, which invariably moved from east to west. Steady north wind, light.
- December 11* (midnight to 3 a. m.).—Fading aurora of last evening; also from 8 to 10.30 p. m. a faint arch in the north, a few pencils and rays of light, with slight motion for a time; wind light and variable. Early the next morning the sky was covered with small, round, uniform balls of fleecy white clouds. Towards noon

this formation changed to irregular cirrus clouds much higher up, and with only a trace of their former shape. They could be seen only through the interstices of large, lead-colored, rounded, fog-like patches of clouds. At 12.30 p. m. these fog patches had changed abruptly to a fibrous cirrus with an interwoven appearance and distributed in patches. The upper clouds were gone, and at 2 p. m. not a fragment of cloud was to be seen over the entire sky. Wind light, variable. These clouds had a motion from the west.

1880.

*January 7* (2 to 5 a. m.).—Faint arch in north. Calm and cold.

*January 9* (1 to 4.30 a. m.).—Faint arch in north. Calm and cold.

*January 17* (9.30 to 11.40 p. m.).—Faint arch in north. High gale next day.

*September 28* (8 to 11.30 p. m.).—An aurora of three arches arranged in the north. The middle arch gave out long pencils, streamers, and curtains of light in wavy motion and at times extremely bright, traversed with waves of green, violet, and rose-red, besides straw-yellow and white. The display of colors was generally seen accompanying the waving, curtain-like masses of light which hung downward from the middle arch. The lower arch wavered and threw out streamers a few times, but held a very secondary place in the display, while the outer arch appeared like a pale reflection of one of the others, and the only changes it gave were a waxing and waning of the light as the lower arches brightened or faded. The bases of the two inferior arches were close together. Temperature fell the next day.

*October 2* (7.30 to 10.15 p. m.).—Faint arch in north. Light east wind.

*October 7* (7 to 9.30 p. m.).—Two faint arches were seen rising about  $15^\circ$  each above the horizon, one in the magnetic north, and the other in the south. During the day bands of linear clouds crossed the sky from east to west, and these two auroral arches occupied the exact position of the two lower bands, one in the north end, the other in the south. In the west some scattered stratus clouds extended in a broken line across the aurora there. Neither arch exhibited any change in position or color. Gale from the east.

*October 8* (8 to 11.30).—Faint diffused light in the north. Gale from south. Rain next day.

*October 30* (6 p. m. to midnight).—Auroral corona at 6 p. m. Extremely faint arch formed  $20^\circ$  high from horizon. This steadily increased in brightness until 7.30 p. m., when a faint luminosity was diffused through the atmosphere, rendering distant objects quite distinct. This luminosity remained until the display was reduced to a faint arch in the north toward the end. With this appeared a second arch crossing the southern sky and duplicating the arch in the north, except being fainter. The two arches appeared to continually extend farther from the horizon, until at 9 p. m. the upper points of the arches came in contact near, but to the northeast of, the zenith, and, losing their curved form, the arches broke up and formed a pale corona. At first but little motion was observed, but the light steadily increased in brilliancy until at 11 p. m., and for a time after, the maximum was reached and a gorgeous display of colors occurred near the zenith, after which the aurora slowly faded away during the night, its final condition being a pale arch in the north. From 9 to 11 the sky was irregularly covered with long pencils of light converging toward the central point or apex. This latter was first located about  $20^\circ$  to  $25^\circ$  to the east of the zenith at 9 p. m., and as the display increased in intensity the apex slowly passed from the east-northeast to the west-southwest, an apparent distance of from  $15^\circ$  to  $20^\circ$ , which brought it a little to the east and about  $10^\circ$  to  $15^\circ$  to the south of the zenith, at the time of greatest intensity. At 10 p. m. extending from the apex to the eastern horizon (almost due east, magnetic) was a broad band of dull blood-red, which lasted half an hour, after which it brightened to a dark rose-red; then its color gradually faded. As a continuation of the red band just described a band of equal size, but of pale yellow, extended from the apex to the western horizon. The light appeared several times to run in pulsations from the lower to the upper part of the red band, but it always ended abruptly at the apex. These two bands were formed by the union of the two arches extending from east to west  $6^\circ$  or  $8^\circ$  to south of zenith, and remained until the corona vanished. Arches of light appeared to form repeatedly in the north and then slowly expand toward the zenith, until they would suddenly break up into long pencils and rays of light which would glide with a waving motion up and meet at the apex. In the south similar but weaker displays were seen. From 10.30 to 11.30 p. m. beautiful displays of color occurred every five to ten minutes. The colors ran in pulsating waves of bright rose, violet, purple, and ending in rich green about the apex. The motion of this colored light reminds one strikingly of the movement of flame upon the surface of alcohol. Extending across the sky from an easterly to westerly direction, and along which the apex moved, appeared to be an invisible diaphragm, against which, from north to south as the waves of light extended up, they seemed to strike and gain intensity, but not in a single case to overstep this boundary. This was best observed for about an hour during the height of the display, and the light was invariably far more brilliant just to the left of the apex on the last  $2^\circ$  or  $3^\circ$  of the red band, through the center of which, and continuing down the center of the pale yellow western band, the diaphragm appeared to pass. As the intensely colored light struck along the diaphragm to the left of the apex, it appeared to be broken up into numerous small wavelets, and then to flow out on either side a short distance, at the same time glowing with increased brilliancy. High north wind.

*October 31*.—Fading remnant of last display from midnight to morning; 7.40 to 11 p. m. faint arch in the north; fresh north wind.

*November 1* (5.30 to 8.30 p. m.).—Faint arch in north formed below the dense stratus clouds which covered the sky all that day. High north winds, 1 to 5 a. m.; faint corona, 9 p. m.; arch in north. Fresh north wind all day.

- November 4* (midnight to 4 a. m.).—Fading arch from last evening, 9 p. m. to midnight. Faint arch in north. Fresh north wind all day.
- November 5* (midnight to 3.40 a. m.).—Fading arch from last evening. Gale from south and snow the next day.
- November 9* (8.30 to 11.40 p. m.).—Faint arch in north, barely visible in moonlight. Gale from south in morning, and from north the next day.
- December 4* (7 to 9.40 p. m.).—Plain arch in north. Falling temperature. Gale from east the next morning.
- December 24* (8.30 to 11 p. m.).—Bright arch with rays and streamers. Gale from the east.

1881.

- January 22* (8.20 to 11.10 p. m.).—Faint arch in the north. Gale from north the next day.
- January 30* (9.30 to midnight).—Arch in the north, pale yellow. South wind, light.
- January 31* (midnight to 6 a. m.).—A pair of beautiful straw-yellow arches formed in the north soon after midnight from the single arch of last evening. Long pencils and sheets of light extended in waving motion upward almost to the zenith (the maximum of this display was not seen) 5.30 p. m. to midnight. An arch in the north threw out a few streamers toward midnight, but was far paler than the aurora of last evening. Falling temperature.
- February 1* (midnight to 1.20 a. m.).—Faint arch from last evening. North wind. Gale the next day.
- February 4*.—Bright arch increasing in intensity and throwing out bright waves and pencils of light toward midnight. Wind north.
- February 5* (midnight to 2 a. m.).—Conclusion of last night's display, 8.30 to 10.40 p. m. A faint arc barely visible in the north; wind light and variable.
- February 18* (8.10 to 11.40 p. m.).—Faint arch in north. High east wind.
- February 19* (7.15 p. m. to midnight.).—Faint arch in north. Gale from north the next day.
- February 20* (midnight to 1.40 a. m.).—Faint arch, 7.45 to midnight; a bright arch  $15^\circ$  high in north; brightest at 9 p. m., when straw-yellow bands and waves of light passed along its upper surface from east to west. The display faded down to an almost invisible arch at 11.30 p. m.; then was renewed about midnight. Gale from the north. Rising temperature.
- February 21* (midnight to 2.40 a. m.).—Bright arch from last evening.
- February 25* (8.45 p. m. to midnight.).—Faint arch in the north, developed a few bars and waves of straw-yellow about midnight; light north wind.
- October 26* (midnight to 3 a. m.).—End of last evening's display; 7.30 to midnight, three arches of nearly equal brightness, the two upper arches with bright straw-yellow waves and pencils of light, brightest at 10 p. m.
- February 27* (midnight to 2 a. m.).—End of last evening's display; 8 p. m. to midnight, two to three arches in the north, the highest about  $35^\circ$  from horizon. The outer palest, and the two inner arcs brightest, giving up and down bright curtains, pencils and waves of straw-yellow; light most intense at 10 p. m. The number of arches varied as the two inner ones frequently united. Light north wind. Falling temperature.
- February 28* (midnight to 2 a. m.).—End of last evening's display in a single pale arch; 8 to 11.30 a. m. a low but bright arch in the north; wind light and variable.
- March 2* (5.30 p. m. to midnight).—Pale bands of light extending in parallel lines from east to west in exactly the same arrangement common to the linear bands of clouds, having the same appearance of convergence at the east and west horizon, with the same spaced formation overhead and throughout the lines. Wind light and variable. Linear haze from north to south the next morning.
- March 18* (8 to 10.40 p. m.).—Faint arch in north, with pale waves and tongues of light running from east to west. Linear cirrus in the afternoon, which hid part of aurora in the evening. Light snow next day, March 19. A break in the clouds was seen, edged with auroral light, in the evening; north wind, light; light snow the next day.

## \* ELECTRICAL PHENOMENA.

Thunder showers are said to be quite common on some parts of the Yukon River during summer, but in the vicinity of Saint Michael's flashes of lightning are recorded upon but two occasions, and in neither case was any thunder heard. Both instances were during warm, calm days in summer when the sky was dotted with cumulus clouds. Probably the low temperature and high relative humidity combine to lessen these displays here. During the coldest weather in winter, nearly always after the snow fog has fallen, the air is in a highly-charged condition, and at such times a passing stroke upon any loose fur causes the hairs to stand up so fully charged that by presenting the finger to a single hair tip the snap of the spark may be heard 3 feet away, and in the dark a train of sparks follow the hand in stroking any dry fur.

## HALOS, PARHELIA, AND PARSELENÆ.

These phenomena, with the exception of the first named, are far from common here, and it is rare that a well-formed or perfect series of rings and arcs are seen. During the cold months and

in spring the greatest number occur when the air is filled with ice crystals. Halos occur rather commonly from the frequent formation of haze. In one instance, while reading the anemometer, during a white fog, Mr. Nelson says, "I saw on the side from the sun my shadow faintly traced upon vapor, and surrounding it a perfect and bright white halo." Imperfect halos of this kind were several times observed.

#### TWILIGHT.

In autumn and during the first part of winter, and again towards the end of winter and in spring, occur beautifully-colored twilights, the shades of which are only equaled by the gorgeous richness of tints whose fleeting touches change the clouds into a beautiful mass of colors as the sun sets or rises.

#### MIRAGE AND HEAT RAYS.

During the fine weather from the last of February until into July most of the clear days are accompanied by more or less mirage, which is generally strongest on cool, clear days in March and on fine, warm days in May and June. The coast hills, 30 to 75 miles away, are lifted up and contorted into the most fantastic shapes, which constantly assume new forms with Protean rapidity until the whole landscape appears but a form of air. The least change in one's altitude produces a disproportionate change in the scene. Tall pinnacled hills, apparently hundreds of feet high, are made to melt away and totally disappear under the horizon by the observer descending about 15 feet from the first point of view; and the changes in outline are equally abrupt and surprising. During the entire year, upon pleasant days, the air is constantly vibrating more or less appreciably to the eye, but during the clear, intensely cold days in the last two thirds of winter these vibrations are so energetic that everything on or near the surface of the ground becomes, at a distance of about 2 miles, blended in an indistinct, tremulous blur.

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### GENERAL NOTES.

#### CHANGE OF SEASONS.

As in most other places in high latitudes there is no long gradation from season to season, but in place thereof are two well-marked periods—a long winter of about seven months extending from in October until well into May, with a five-month summer. The winter has by far the best weather, as there are long periods of beautifully clear days, which are welcomed in spite of the usually accompanying intense cold. The summer is rendered very disagreeable by the large number of cold, misty rains and the low, overhanging clouds which appear to shut down all about like a leaden cover.

#### TIDES.

The ordinary tides are small and give a rise and fall of only about 2 to 3 feet, but the winds from either north or south produce a striking variation. A long continued and heavy gale from the south raises the water of Norton Sound at least 10 feet above ordinary tide-mark and floods large stretches of the low coast to the southward. Some of the heaviest of these gales occur during winter, and it is not rarely that the sea, covered with heavy ice, sweeps over the low coast lands between the Yukon and Kuskokvim Rivers for miles, and native villages have been thus destroyed, and many of their inhabitants, within a few years. As the tide falls the ice, from 3 to 4 feet thick, is left stranded over the low land. A light south wind is sufficient to raise the tide from a few inches to several feet above the ordinary. North winds affect the tides in proportion to their strength, exactly in the reverse of the south wind, and when in fall long-continued and strong gales from this direction occur the shallow bays are laid bare, dark reefs exposed, and a general fall of about 8 feet occurs in the water. It is to

the high tides and south winds of spring or early summer that the inhabitants of Saint Michael's are indebted for the drift-wood, which, floating from the Yukon, is cast upon the beaches, and furnishes their only fuel and building material.

#### VEGETATION.

The whole coast in this part of the country is bare of any kind of timber, and a few patches of scraggy alders on the sheltered southern hill-slopes, with the arctic willows creeping over the mossy ground, are almost the only bushes to be found. The ground is covered with a soft layer of decaying vegetable matter and mosses which hold water like a sponge. In addition a varied and hardy subarctic flora manages to thrive everywhere, except on the northern slopes of the hill-tops, where lichens or total sterility hold possession. As soon as the warm days begin the hardier plants start up, and a week of warm weather shades the country with green in sunny spots by the first of June, making pleasant contrast to the gray and russet elsewhere. A few days later and the southern hill-slopes, are thickly dotted with flowers. Repeated attempts to raise vegetables have been made, but with poor success, as turnips, radishes, and lettuce appear to be the only vegetables from which any adequate return may be expected, and in these cases the trouble far exceeds the reward, could fresh vegetables be obtained otherwise.

#### MIGRATION OF BIRDS.

The earliest arrival in spring is generally a solitary goose. The last few days of April, and from then to the 1st of June, birds continue to arrive, with the general migration from May 15 to 25. The barn swallow comes about May 20. The water-fowl, geese and ducks, begin nesting the last of May. In the autumn migration the birds begin passing back to the south the last of July, and only a few of the hardier water-fowl remain at the end of September.

#### MIGRATION OF FISHES.

The arrival of fishes depends largely upon the time of open water along shore. Herring generally arrive from the 5th to the 20th of June, the delicious king salmon following from the 15th to the 25th of the month, and the inferior species of salmon during July and in August.

#### TEMPERATURE.

The thermometer shows a range during the past seven years of from  $+76^{\circ}$  to  $-55^{\circ}$ , or  $131^{\circ}$ , though for the past four years the average yearly variation has been from  $+71^{\circ}.5$  to  $-44^{\circ}.7$ , or  $116^{\circ}.2$ . The maximum variation of the past four years was in both 1877 and 1878, when the yearly extremes were respectively  $75^{\circ}$  to  $-50^{\circ}$  and  $73^{\circ}$  to  $-52^{\circ}$ , amounting to  $125^{\circ}$  range. The least range in 1879 was  $100^{\circ}$ , from  $+68^{\circ}$  to  $-32^{\circ}$ . The averages of the mean monthly temperatures (made up from the daily average of the 7 a. m., 2 p. m., and 9 p. m. observations) for the years 1877, 1878, 1879, and 1880 are as follows: January  $-5$ ; February,  $-6.5$ ; March,  $9.5$ ; April,  $22.1$ ; May,  $32.8$ ; June,  $45.2$ ; July,  $53.1$ ; August,  $52.1$ ; September,  $43.3$ ; October,  $28$ ; November,  $18.3$ ; December,  $8.9$ .

The minimum averages for any single month are  $-23^{\circ}.7$  for February, 1877, and  $-19^{\circ}.8$  for January, 1880. The highest monthly means are  $54^{\circ}.50$  and  $53^{\circ}.4$  in July and August, 1877. The mean annual temperature for the four years is  $25^{\circ}.5$ . The highest mean for one year is  $26^{\circ}.8$  in 1879, and the lowest  $23^{\circ}.9$  in 1880. January and February rank as the two coldest months, as July and August are the warmest.

One of the most remarkable phenomena in connection with the temperature is the rise which appears to occur regularly so as to be appreciable between the 5.24 and 9 p. m. observations during about the last twenty days of November and first twenty days of December. When the sky is cloudy or the wind changes during the evening the conditions are, of course, unfavorable for satisfactory results, so only clear evenings are counted in which the wind is calm or retains the same character it has had all the day. As near as has been ascertained the thermometer shows a depression from 4 to 6 p. m., then a rise from 6 to 8 p. m., followed by another depression

continuing the remainder of the night, and in winter attaining its minimum temperature from one to two hours before sunrise. A series of fine, clear evenings in November, 1879, gives the following, the character of the wind being noted with each :

Date.	Rise.	Character of wind—9 p. m.
November 14 .....	1°	Calm.
15 .....	4°	Calm.
16 .....	4°	Variable.
18 .....	3°	Variable.
26 .....	1°	NE. (steady).
December 1 .....	1°	E.
3 .....	1°	NE.
10 .....	2°	N.
11 .....	5°	Fair, light west to calm.
12 .....	3°	N. steady.
16 .....	6°	NE. to N., indicating colder weather.
24 .....	4°	NE. to calm.

In the majority of the instances given above the temperature at the time of the observation was between  $+10^{\circ}$  and  $-10^{\circ}$ . Calm nights in June when the days are clear and warm, the layer of air next the ground for a thickness of 10 to 15 feet is frequently reduced to the freezing point or below, while above a sharp line of demarkation separates it from the superincumbent mass of warm air. There will be frequently a difference of from  $6^{\circ}$  to  $10^{\circ}$  between these layers, so that a person moving along in the raw, chilling atmosphere on the ground will, by climbing up a ladder, experience the same sensation of warmth as in entering a room. This was frequently noticed by Mr. Nelson when taking observations, the instrument shelter being elevated about 12 feet from the ground.

#### BAROMETRICAL PRESSURE.

The mean barometer for 1878 and 1879 and 1880, taking the 7 a. m., 2 and 9 p. m. observations, is 29.778 inches, the mean monthly average for the same period as follows: January, 29.709; February, 29.841; March, 29.785; April, 29.720; May, 29.915; June, 29.817; July, 29.835; August, 29.732; September, 29.647; October 29.755; November, 29.635; December, 29.947.

The lowest monthly average for any single month is 29.278 inches, November, 1878, and the highest monthly mean 30.179 inches, February, 1879. The highest corrected single reading was on January 3, 1880, of 31.012 inches, and the lowest 28.846 inches, November 8, 1878 (January, 1881, 28.808).

The barometer appears to have a general tendency, during winter at least, to rise with a falling temperature and to fall with a rising temperature. The greatest barometrical range occurs during the winter months, and the least in summer, the maximum range being 2.078 inches January, 1880, and the minimum .751 inch September, 1880, and the total barometrical range for the four years preceding May, 1881, is from 28.808 (January, 1881) to 31.012, or 2.204 inches. As a rule the barometer moves sluggishly, and it is unusual for it to rise or fall an inch in twenty-four hours.

The changes are more rapid during the winter months than in summer. The only things that may be predicted with tolerable certainty from the barometer are, in winter, a rising barometer after or during warm weather probably indicates cold; a fall in the barometer after or during cold weather generally precedes a rise in the temperature. This is uncertain, however, as the change in the temperature may be simultaneous with the barometrical change, or precede it but a little. A certain connection thus results between the changes in the winds and the movements of the barometer, as it is a general rule that a change of wind to the north precedes a fall in the temperature, and to the south a rise.

Getting under way on the evening of the 17th we made the best of our way towards Saint Paul's Island, where we arrived on the 21st at meridian, and after taking on board Lieutenant Doty and the two seamen detailed for duty on Otter Island, a course was shaped for Ounalaska, and on the evening of the 22d we anchored at that place in the inner harbor.

## INNUIITS.

Neither the origin nor meaning of the name Esquimaux, or Eskimo, as it is now spelled, is known. According to Dr. Rink the name "Esquimaux" was first given to the inhabitants of Southern Labrador as a term of derision by the inhabitants of Northern Labrador, and means *raw-fish eater*. Sir John Richardson says the name "Esquimaux" is probably of Canadian origin, and has reference to a peculiar shout given by the natives when paddling with their kyacks, *ceux qui miaux*. Dall says the appellation "Eskimo" is derived from a word indicating a sorcerer or shaman in the language of the northern tribes. It is probable Sir John Richardson's explanation is the true one, since the people themselves do not recognize the name as belonging to their language.

The name "Innuits," which they recognize as properly belonging to them, is in common use from Greenland to Bering Strait. The name is understood by all to mean the people inhabiting the regions referred to, and probably had its origin when they supposed themselves the only inhabitants of the earth.

The Innuits are divided by Dr. Rink into groups as follows:

First. The East Greenlanders; few in number, every year advancing farther south, and having intercourse with the next section.

Second. The West Greenlanders; civilized, living under the Danish crown, and extending from Cape Farewell to 74° north latitude.

Third. The northernmost Greenlanders, the "Arctic highlanders" of Ross, confined to Smith, Whale, Murchison, and Wolstenholme Sounds, north of Melville Bay glaciers. These are very isolated and have greatly decreased of late years. They did not until recently possess the kyack or skin-covered canoe, the oomiak or open skin-boat, or the bow and arrow. They are bold hunters, and are perhaps the most typical of the Innuits of Greenland.

Fourth. The Labrador Eskimo, mostly civilized.

Fifth. The Innuits of the middle regions, occupying the coast from Hudson Bay to Barten Island, beyond the Mackenzie River.

Sixth. The Western Innuits from Barten Island to the Western Innuits in America. They differ somewhat from the other groups in various habits, such as the use of the bidarka or double-manned skin-covered canoe, in the clothing of the men, in their labrets, and in the head-dress of the women. They are allied to the Aleutians and the Indians of Alaska.

Seventh. The Asiatic Innuits or Tuski. No exact statement can be made in regard to their numbers. At the date of the last census the entire population of Greenland was about 10,000. The entire Innuits race is roughly estimated at 40,000. This does not include the Tuski (Tchuktchis) or Asiatic Innuits, of which Dr. Rink speaks; and indeed, although classed with the Innuits by both Richardson and Rink, the inhabitants of the coast of Asia adjacent to Bering Sea and Strait differ so greatly from them in appearance, habits, language, and character that I cannot think they are the same people. Richardson says:

They even cross the Straits of Bering, a part of the nation dwelling on the Asiatic coast between the Anadyr and the Tchukatsky Noss, where they are known to the Russians by the name of Nomallos or sedentary Tchuktchis.

Undoubtedly a few Innuits have at some time crossed over Bering Strait and attempted to settle on the Asiatic side. But these should not be confounded with the sedentary Tchuktchis, who are descendants of the reindeer men of Siberia. Having lost their herds through disease or other cause, they have been compelled to abandon their nomadic mode of life and settle upon the sea-shore, where they manage to exist by hunting seals, walrus, and birds, catching fish, and trapping a few foxes. At Cape Wankerem and at other places on the Siberian coast we found the ruins of houses similar to those now in use by the Innuits. These houses, which have been found by different travelers at many places along that coast, are not at all like those used by the Tchuktchis, which, on account of the migratory habits of the reindeer tribes, are so constructed that they can be taken down and put up again at will. They are composed of a covering of skin stretched over an umbrella-shaped frame of poles. Inside of the houses are square sleeping-rooms (called *pologs*) of deer-skin. These resemble an inverted box. They have no door and can only be entered by raising the edge and crawling under. The space between the outside covering or tent proper

and the pologs is used as a store-room and contains all articles belonging to the owner of the tent. Various causes are assigned for the abandonment by the Innuits of the attempt to settle here. Some believe they were driven back by the more warlike Tehuktchis, and there are traditions extant among the latter of a strange people coming among them to settle, and of desperate fights, in which the intruders were either killed outright or driven back, at times being pressed so hard by their enemies that they were glad to escape by sea. Others believe it is because the whales, which formerly came there in great numbers, are now seldom seen. It is not unlikely that these causes united have discouraged the Innuits from making any further attempts.

Richardson, and probably Dr. Rink also, in classing the sedentary Tehuktchis with the Innuits, were guided by the accounts of Baron Wrangel, and it is probable that when Wrangel made his famous voyage along that coast, sixty years ago, a few Innuits still remained. Now, however, they have entirely disappeared, with the exception of a few in the immediate vicinity of East Cape, who have intermarried with the Tehuktchis, and perhaps four hundred on Saint Lawrence Island. The latter are rapidly disappearing, being carried off by disease and famine. This island lies about two degrees south of Bering Strait, and, although forming a part of Alaska, the boundary line separating that country from the Russian possessions passing to the westward of it, the inhabitants can only reach Alaska by way of the Siberian coast, the distance between the nearest points of Alaska and the island being far too great for them to travel direct.

Like all their class, with the exception of a few who live in parts of the country that are entirely barren of game at some season of the year, the inhabitants of Saint Lawrence Island are improvident, and depend upon the game they can take from day to day for their subsistence. And if from any cause they fail to take a supply for any considerable length of time hunger and want follow, and starvation is only a question of time. They subsist almost entirely upon seals and walrus, which they take during the winter at or near the edge of the ice and at the holes which open as the ice breaks and changes its position. When the ice remains unbroken a long distance from the shore and thick, stormy weather prevails, so that the natives cannot hunt, their supply of food is cut off. This seems to have been the case during the winter of 1878-79. Judging from native accounts, the ice remained in this unbroken state several months, resulting in the loss of not less than one thousand lives out of a population of less than fifteen hundred. The percentage of deaths appeared so extraordinary that I have at times thought the island must have been visited by an epidemic. But the invariable answer of the survivors when asked the cause was, "No get eat," and no amount of cross-questioning could elicit any other. It is evident that they attribute the mortality to starvation, and indeed the fact that the dogs had all been eaten shows that their hunger must have been great, as they will only eat their dogs when reduced to the last extremity.

I made a personal examination of five of the six settlements on the island. At three of them all were dead, not one left alive. At a fourth about sixteen, two families, were still alive, and at the time of our visit had plenty of food. At the large settlement on the northwest end of the island we were informed that about two hundred had died, and that nearly four hundred yet remained alive. I have since learned that at the sixth settlement, on the southeast end of the island, the inhabitants had nearly all disappeared. In one house we counted thirty dead bodies thrown together in a heap in the corner. In every house opened by us great ghastly piles of dead bodies were exposed to view. At one deserted settlement I saw eight or nine bodies, probably an entire family, dead in a summer-house, showing that they must have survived the winter, as they would not put up the summer-house until the weather was warm enough to melt the snow and ice, thus making the winter-houses wet and uncomfortable. It appears strange that, after surviving the winter, and with strength enough remaining to put up and move into their summer-houses, they should be unable to supply themselves with food and regain their health and strength. By the time they could occupy their summer-houses the ice must have been broken so as to render seal hunting possible. It is probable that this family, having seen so many die, made no effort to save their own lives. Believing they were doomed, they submitted quietly to what to them appeared inevitable, and daily growing weaker, stretched upon the ground and covering themselves with furs, waited for the end. In this position we found them lying as if asleep, their guns, bows, arrows, spears, and traps lying strewn on the ground. I could not learn that any

cannibalism had been practiced among them, and do not believe such to have been the case. On the contrary, I saw no indication of any struggle of existence. In many places I saw things untouched which have been eaten by white men and which have sustained life, such as the skin of seals, deer, and other animals. But one circumstance pointed to the possibility of cannibalism, the almost entire absence of the corpses of young children. This was regarded by some as suggestive of their having gone to this last extreme. If so the bones must have been very carefully concealed, as the most thorough search in and around the villages failed to reveal anything resembling a human bone. In all cases the corpses, although shrunken and changed by a year's exposure to the weather, were free from mutilation. It is likely that, had time permitted us to make a thorough examination of the surroundings, the absence of the children could have been explained in a less horrible manner.

It is difficult to understand why a people who have lived and flourished for so many generations should be so suddenly and almost entirely swept away in one winter. I can only account for it by supposing that no such severe winter as that of 1878-'79 has occurred for many years, and that during those years the habits of the people have changed; they have become less provident than before. They have acquired a taste for liquor, for which they will barter anything they possess, and when obtained, remain drunk until the last drop is gone. Hunting, of course, is entirely neglected at such times, and hunger and starvation are the results. Unless something is done for these people their total extinction is a question of a few years.

About three thousand Innuits inhabit the northwest coast of America, from the Colville River, on the east, to Bering Strait, including the islands therein, on the west. Many of these came under my observation while cruising in the Arctic Ocean in command of the Corwin.

In appearance they are tall and muscular, many being 6 feet in height, and some were seen that would exceed that even. Their peculiar dress gives them a squat appearance, and their stature seems less than it is in reality. The women are much shorter than the men, but both sexes are strong and active, though not equal in these respects to the Tchuktchis and other reindeer tribes of Siberia.

The face of the Inuit is broad below the eyes, the forehead is narrow and receding, the chin and lower jaw broad and heavy. The nose is usually broad and flattened, but not always; occasionally one is seen whose features are well formed and handsome. In the young children this is the almost invariable rule; many of them are really beautiful. The eyes are small and black, and appear to be slightly oblique, and for this reason, perhaps more than any other, they have been classed with the Mongolidæ. They have large mouths, thick, loosely-hanging lips, and fine, strong teeth. These, however, from eating raw food, are usually very much worn. The labrets worn in the lips are hideous-looking things, made of bone, glass, stone, ivory, or in fact anything within the reach of the native which can be worked into the requisite shape.

They have rather light skin, very different from the Indians of the plains; and in this also they differ from the Tchuktchis, being much lighter, and when cleansed from the dirt which usually covers them, and freed from the sunburn and tan due to long exposure, they become quite fair. They have small, well-formed hands and feet, much smaller in proportion than white men. This was particularly noticeable when buying boots and mittens from them for our use; only the largest sizes made by them could be used at all. They are generally without beard, but as the men grow old, they sometimes have a thin, straggling mustache and beard, but it is never full and regular. The hair is coarse and black; the front is clipped, and the top of the head shaved, while the rest hangs loosely just clear of the shoulders. The women wear the hair in two braids. Strings of bright-colored glass beads are sometimes worn in the braids, and considerable taste is displayed in their arrangement. The Innuits are cheerful in appearance, and exceedingly good-natured. They are inclined to laugh at what they do not understand, and when visiting the vessel their faces wore an expression of mingled curiosity and amusement.

The dress of the male consists of deer-skin shirt, or *al-le-ghe*. In winter he wears trousers and boots of the same material, and in summer these articles are made of seal-skin. The seal skin boots are water-tight, and with a little moss or grass in the bottoms are very comfortable. The winter boots are made of the skin of the reindeer's legs. The hair is very fine and close, and

although quite short, is a better protection against the cold than any other fur known. Stockings of deer-skin, worn with the hair side next the feet, are also used, and keep the feet warm in the coldest weather.

The dress of the women differs but little from that of the men. The al-le-ghe worn by the former is more elaborately trimmed and rounded at the bottom, and the deer-skin trousers, which are more loosely made, are not exchanged in summer for seal-skin, as is the case with the men. The al-le-ghe worn by both sexes has a hood attached which serves as a covering. It is trimmed around the face with wolf-skin, the selection of which is a matter of much importance. The best skins are always chosen, and from these only the long, black-tipped hair found along the back will answer. A narrow strip of wolverine skin is generally used with this, and also around the bottom of the garment. The fur of the wolverine is supposed to possess a charm against evil, and is therefore highly prized by them.

The intestines of the walrus and seal are made into garments called by the Russians kam-layka. These are worn over all to shed rain or snow. A similar garment is made of drilling or calico, which answers very well for use in snow, and soon becomes so saturated with oil as to shed water. Occasionally garments made of the skins of squirrel and marmot are seen, and more rarely of water fowl, and once at Hotham Inlet we noticed an al-le-ghe made of the skin of the mountain sheep. Although the Innuits travel during the summer for the purpose of hunting, fishing, and trading, they have regular winter habitations to which they return in the fall. They are fond of collecting in large numbers during the summer at some central point, where they trade and exchange with each other, and also indulge in dances and athletic sports. At Cape Blossom a party of this kind was encountered, numbering, perhaps, a thousand people. Generally at the larger settlements a few of the old and lazy remain behind during these summer migrations, but it is not unusual to find a settlement entirely deserted. Before setting out on their journey all destructible articles are put upon a scaffold or elevated platform, erected for the purpose, where they are beyond the reach of wild animals and stray dogs. Travel during the summer is performed entirely by water in their oomiacs. Indeed, the latter forms a very important factor in the problem of Inuit existence in the far north. The oomiac is generally referred to as a "woman's boat," while the fact is it is used by both men and women and at all times, except when the work to be performed is of such a nature that great dexterity is required, such as seal and beluga hunting; then the kyack is used.

The oomiac has a frame of wood and a covering of walrus or seal hide. It is from 20 to 30 feet in length, about 2 feet in depth, and in width about one-fifth its length. The frame is fastened by lashings and made with slip joints to allow it to accommodate itself to the motion of the sea. It is flat-bottomed, sharp at both ends, and nearly straight on top. A square sail made of drilling or deer-skin, according to circumstances, is used. When propelled by hand the men use paddles and the women use oars.

The carrying capacity of the oomiac is enormous. When used in traveling it contains a tent of drilling or deer-skin, guns, traps, spears, bows and arrows, a kyack, a seal-skin poke filled with water, a quantity of dried meat or fish, and, in the warm season, a lot of birds and eggs; a sled, several pairs of snow-shoes, a fish-net and some smaller nets for catching birds, a shaman drum, and several bags of skin clothing. Perhaps, in addition, a stock of oil, whalebone, ivory, or furs is taken along for the purpose of trading.

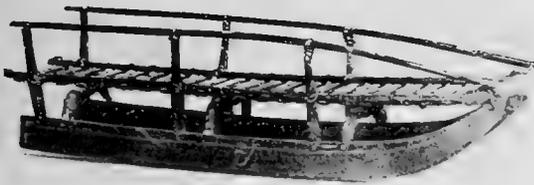
The *personnel* consists of three or four men, about as many women, and two or three children. Add to these two or three dogs, each with a litter of puppies, and some idea may be formed of what a traveling oomiac contains. The working dogs are generally left on shore to follow on foot, which they do, keeping up a continual and most dismal howl. If the wind comes ahead, and the natives desire for any reason to continue their journey, they catch and harness the dogs, and attach them to the oomiac after the manner of a canal-boat and horses, and continue on their way, making four or five miles an hour. When they wish to stop for a night or day they land and pitch the tents; the oomiac is unloaded and turned up on the shore, and the Innuits are as much at home as if in their winter houses.

Notwithstanding the frail character of these skin canal-boats, long distances are made in them along the coasts and even crossing wide bays and straits.



INNUIT PIPES.

1. Man's Pipe. Bowl, Stone. Stem, Ivory. (Rare). 2. Woman's Pipe. Bowl, Iron. Stem, Wood. Ornamented with beads. (Common).



S, EX. 204, 1, 48.

INNUIT SLED.

In use from Behring Strait to the Colville River.



HELIOTYPE PRINTING CO., BOSTON.

INNUIT KYACK.

In use along the Coast of Alaska from Norton Sound to Nounerak Island.

*Photographed from specimens in the possession of Mr. Nelson.*



In May, 1881, we took on board at Saint Lawrence Island two families of natives for passage to the Siberian coast. Their outfit, which probably embraced all their earthly possessions, consisted of a small quantity of dried seal meat, a couple of old rusty guns, a few camp utensils, and a bag containing some extra garments. A bundle of short poles, with a roll of walrus hide, some oars and paddles completed the outfit. The party was landed at Marcus Bay. Some weeks later, stopping again at Saint Lawrence Island, this same party came alongside, having just returned from the Siberian coast in an oomiak constructed of the poles and walrus hide which they had taken along with them. The distance from the coast of Siberia to Saint Lawrence Island is about 50 miles. At that season of the year the sea was filled with large fields of drift-ice, and subject to dense fogs, snow-storms, &c., yet this party of ten persons had safely crossed in their frail boat, and this without the aid of a compass or any guide except native instinct. When asked if they were not afraid to venture so far to sea in such a boat, they laughed heartily and said "*Pow,*" (no) with a manner that left no doubt of their entire confidence in the seaworthiness of the oomiak.

The winter houses, called tupecs, are built half beneath the ground and roofed over with wood or whale's bones covered with earth. They are very damp and can only be occupied when the ground is frozen. The entrance is made through an underground passage from a sort of stockade, 15 or 20 feet away. Walrus hide, rendered translucent by drying and oiling, sometimes serves for windows, and is placed directly in the top of the house, but generally the lamp furnishes light and heat. The situation of the settlements depends upon several things, such as a good landing-place for their boats, or a protection from drifting snow, the latter being the more important. No more cheerless place can be imagined than some of the village sites selected by these curious people. At Cape Lisburne the settlement is on the north side of the cape, exposed to the full force of the northerly gales, the land to the south rising abruptly for 1,000 or 1,200 feet, completely shutting out the sun except for the short time that it does not sink below the horizon at midnight. Then it can be seen during the night only when the sun is north of the prime vertical. One of the most remarkable places for the location of a settlement, and one which best illustrates their utter disregard for comfort in the selection, is on the side of King's Island. This island, which lies at the southern entrance to Bering Strait, is small and high and surrounded by steep rocky cliffs. The village is on the south side of the island, on an extremely rugged slope, and reaching more than 150 feet above the sea. The winter houses are excavations in the rock. The summer houses are made of walrus hide stretched on poles, which are secured to the almost perpendicular cliffs by lashings and guys of walrus hide. The inhabitants of King's Island are very expert walrus hunters, and kill large numbers as they pass the island in the spring on their way into the Arctic Ocean. The walrus crawl out on the ice and sleep, and in this way are carried through the straits by the current. The natives easily approach them with the kyack, and dispatch them with their spears, without danger, while upon the ice, but to attempt to kill them in the water in their frail kyacks is both difficult and dangerous. As the season when they can be reached on the ice is short the natives, unlike those at Saint Lawrence Island, provide for the future by laying in a stock of meat, a cave in the rock near the village being used as a store-house. Meat hung in this cave remains fresh, winter or summer, without any preparation whatever.

The state of filth in which the Innuits live is beyond description, and their appearance when they first emerge from their houses after a long winter of hibernating in the smoke, filth, and vermin is disgusting in the extreme, their skin being fairly covered with scales of dirt, their eyes sore, and their hair and clothes alive with vermin. They never wash, but late in the season much of the filth wears off. The mothers wash the babies by licking them with the tongue, as a cat does its kittens. They also eat the vermin found on the hair and clothing. Their cooking utensils consist of a lamp and a camp-kettle of iron. When the latter is not obtainable they make a very good substitute of stone, which is suspended over the lamp by thongs of skin or straw. The lamp is simply a stone vessel capable of holding a small quantity of oil, perhaps a gill, and into which a piece of moss is placed and lighted. Sometimes the supply of oil is kept up by suspending a piece of blubber over the lamp. The heat causes the blubber to melt and drop into the lamp. The lamp furnishes light, fuel for cooking food, heating the houses, and drying clothes. Each family has a separate lamp, although several may occupy the same room.

During the summer, when fires are built out of doors, drift-wood, which is found in great abundance along the shore, is used for fuel. Fires are lighted either by means of flint and steel or by friction. With the former a plant resembling wild cotton is used. This being soaked in a solution of gunpowder and dried, becomes very inflammable, and readily ignites from a spark. For producing fire by friction, the drill bow is used by the women and children, and the ease and rapidity with which they start fires is truly surprising. Matches are highly prized, but are used principally for lighting the pipes.

Food is eaten without the slightest regard to its condition. Rancid oil, rotten eggs, putrid meat, and decayed fish are staple articles of food, and are eaten from the same wooden bowl, or kantag, which is used for all purposes, from the chamber to the kitchen. A spoon or ladle made from the horn of the mountain sheep is also in common use and serves as a spoon and drinking dish.

Although the Innuits bolt their food much in the same manner as a hungry dog does, they do not appear to be large eaters, and I am inclined to think their reputation as such owes its origin to their ravenous manner, and perhaps a few isolated cases of unusually large appetites. We tried them many times, giving them all they could eat, and generally found them to be satisfied with what would make an ordinary meal for a white man, and often with less. While drifting in the ice-pack off Cape Romanzoff, in June, 1880, a party of natives from Askenac coming on board and asking for bread, a dozen biscuits were given to each with a quantity of molasses. Supposing we were about to witness an exhibition of remarkable eating, we prepared to take notes for the benefit of ethnologists who favor the glutton theory. But great was our disappointment when, after eating four or five biscuits, they carefully put the rest away and lighted their pipes with an air of entire satisfaction. Another popular error exists in the belief that the Innuits eat no vegetable food. The fact is they eat large quantities of berries, willow and alder leaves, sorrel, scurvy-grass, and a small bulbous root which in appearance, smell, and taste, resembles wild parsnip. These articles are generally eaten raw, although they are sometimes cut up and allowed to ferment before being eaten. At Hotham Inlet I was offered a small wooden dish half filled with moss berries floating in oil. I was compelled to decline, much to the astonishment of the generous-hearted squaw who had been to some trouble to prepare them for me. A present of a few hands of tobacco, however, amply repaid her and established friendly relations with the entire family.

While taking in a supply of fresh water at Cape Thompson we had an opportunity of observing their entire disregard for the condition of their food. A small traveling party from Point Hope was encamped near, having stopped over to take a supply of sea birds and their eggs which abound there.

A lively trade was soon begun between the seamen and the natives, a boiled egg being equivalent to a chew of tobacco. But as some of the eggs were found to be bad from a civilized point of view, they were returned by the sailors and good ones demanded in their places. This fastidiousness amused the natives very much. They exchanged them, however, and ate the bad ones first, taking the tobacco from the mouth and placing it carefully behind the ear, a favorite place with them for carrying "old quids."

One peculiarity of the Innuits, considering that they eat no salt, seemed to me very remarkable—their constant thirst. They drink enormous quantities of water. When traveling, if the weather is not too cold, they are constantly taking up handfuls of snow to eat. I was the more surprised at this, as I had heard it stated to the contrary, it being said that snow eaten in this way in any quantities would make the mouth and throat very sore, and that the relief from thirst was only temporary. The Innuits appear to suffer no ill effects from it. They chew tobacco and smoke. Their manner of smoking is entirely original. The pipes are made of stone or metal, with a stem of wood, and, as in all the other articles of Inuit manufacture, considerable ingenuity is displayed. A small bag worn suspended at the neck or waist contains the pipe, tobacco, and utensils for lighting it. A pointed piece of metal used for cleaning the ashes from the pipe is attached to the stem by a thong or perhaps a string of bright-colored glass beads. The latter is often seen on the women's pipes, tastefully arranged. In using the pipe a small quantity of fur is plucked from the most convenient garment and placed in the bottom of the bowl, and over this a pinch of finely cut tobacco. The pipe is lighted, and the smoker takes two or three vigorous draws,

inhaling the smoke, which he retains in his lungs as long as possible. This is generally followed by a fit of coughing. It is not an unusual occurrence for a native who has been without tobacco for a long time to retain the smoke in his lungs until he falls over senseless, having the appearance of a person under the influence of opium. This state lasts but a few minutes, however, when he recovers, and the same performance is gone through with again.

Their manner of taking fish and game is peculiar to themselves, and could only be practiced successfully by the aid of InnuIt patience. The seal hunter lies flat on the ice for hours waiting for one to appear. The seal is very sly and seldom moves far away from the hole in the ice, which is kept open by scratching. The hunter approaches cautiously by crawling over the ice, his body nearly prostrate, raised slightly on one elbow. He has a piece of bear-skin attached to the thigh on the side upon which he rests. This enables him to slide more easily over the ice. The elbow rests upon a ring of grass. To imitate the sound of the scratching of the seal under the ice, the native carries in one hand the claw of some animal or bird attached to a short stick. In the other hand he carries his rifle or spear ready at all times for instant use. In the spring, when the ice is breaking up, the seals are found along the edge of the floes either on the isolated pieces asleep, or sporting in the water. The manner of hunting them is changed. The Innuits hunt in pairs, their outfit consisting of a sled and kyack for each, and either a spear or rifle. The former is preferred as it makes no noise. When crossing ice-floes the kyack is placed on the sled. In this way they travel for days paddling the canoe and drawing the sled by turns. When sealing on solid ice a small sled is sometimes used, the runners of which are made of walrus tusks. It is perhaps 16 inches long by 14 inches wide and 3 inches high. It is used in dragging the carcass of the seal over the ice. Fish are taken by means of the gill-net, and by hook and line. The net is set from the shore. It is made of seal-skin thongs, is from 30 to 40 feet in length and about 5 feet in depth. It is held vertically in the water in the usual manner by means of floats and sinkers, wood and stone being used for the purpose. To the outer end is secured a flat stone, somewhat larger than the rest, which serves as an anchor. A number of short poles, about 3 inches in diameter, are joined together by lashings to a length of 60 or 70 feet. This pole which is used for pushing the net from shore into the desired depth of water, has its end attached to the stone anchor by a loop which allows it to be withdrawn when the net is set, the outer end of the net being held in place by the stone anchor while to the inner end is secured a line of seal thong leading to the shore by which the net is drawn in.

The beluga or white whale is hunted in kyacks in the shallow bays. Taking up a position near the entrance, where they can be seen as they come in with the tide, the natives wait for them to pass; then they rush out, beating the water and shouting. The beluga, being naturally timid, are easily driven into shoal water, where they are dispatched with flint spears. According to InnuIt belief to kill a beluga with any other weapon would cause bad luck to fall upon the hunter. While lying at anchor at Point Hope, a short distance from the settlement, noticing a party of Innuits collected near the shore with their guns, apparently trying to get a shot at something in the water, I went on shore to join in the sport, taking my rifle along with me. When I arrived the party was moving up the beach at a rapid pace. I was informed that a beluga had been seen heading that way and that they hoped to shoot it as it rose to the surface to breathe, as it must soon do. I joined in the chase, but found running over the loose shingle beach very difficult and was about to give it up when I was seized by each arm by a stalwart native and fairly carried along, my feet barely touching the ground. In this way we soon came up to the party and ran along with them for some time, until a halt was made and near, as I was able to distinguish, the milk-white form of the beluga just beneath the surface of the water. The natives were very much excited, and urged me by signs and gesticulations to "watch for its coming up and shoot." As he arose slowly to the surface I carefully adjusted the sight of my rifle and, taking good aim, fired just as his back came above the water. Almost simultaneously with the report of the rifle a shout went up from the natives, as a purple spot was seen on the side of the beluga indicating that it had been struck. An oomiak was soon launched and the prize towed to the shore, not, however, before it had been struck by the natives with much ceremony with a flint spear, although probably dead before the oomiak reached him. Before fairly out of the water the natives began to devour it, cutting off enormous pieces of blubber and eating it raw. My successful shot hav-

ing made me the hero of the hour, I was patted on the back by the men and smiled at by the women, while the children looked on admiringly, and all muttered "*Nekouruck*" (good) between the bites of blubber.

The spear used for killing whales consists of a head either of ivory or stone, the former sometimes pointed with a bit of iron or copper. The handle is of wood and about 6 feet in length, and to it is attached a float or seal-skin poke. A number of these spears being thrown into a whale, the floats prevent his going far below the surface and enable the natives to keep track of and be on hand to kill him when he comes up to breathe. The oomiac used for whaling is somewhat narrower than those used ordinarily for traveling. It contains nothing but the spears and lances and other necessary appliances for killing whales. They seldom go out to hunt for whales, but keep the oomiac in readiness and put out when one is seen from the shore. A sharp lookout is kept at all times and on the low coasts in the vicinity of Icy Cape. They have lookout poles 15 or 20 feet high, from which a more extended view is had. At Point Barrow a number of oomiacs were seen fitted out with all the modern appliances for killing whales—harpoons and lances of the best make, manila line, &c. These were taken from whale-ships which had been wrecked along that coast.

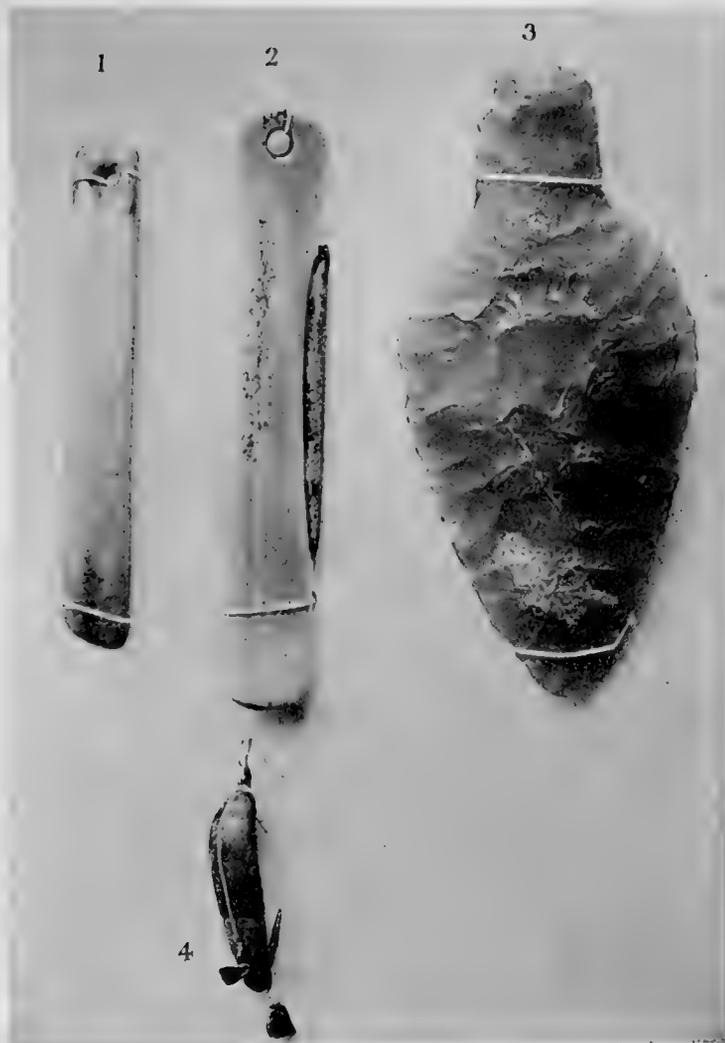
The kyacks in use among the Innuits, although differing somewhat according to location, are alike in all the essential points and are marvels of speed and beauty. They are composed of a light frame of wood entirely covered with seal or young walrus hide, with the exception of a round hole in the top, in which the native sits to paddle or spear game. It is nearly straight on top, sets low in the water, and is sharp at both ends. The Aleutian islanders use a kyack with two and even three holes. These, however, were invented by the Russians for their own convenience in traveling among the islands, and are not characteristic of the natives, as supposed by Dr. Rink.

Knives are very generally worn by the Innuits. Some are worn at the belt and others in a sheath secured to the thigh. Many of them are of native manufacture and are finely tempered, but as a rule they are bought from traders. In Kotzebue Sound we saw knives bearing the name and trade-marks of English manufacturers. These had been purchased from the English trading post on the Mackenzie River. The knife is ground on one side only, like a carpenter's chisel. A small stone for sharpening the knife is usually attached to the belt. The knife being worn under the al-le-ghe can be produced at any time without attracting attention by withdrawing the arm from the sleeve and taking the knife from the belt, so that when the hand reappears in the sleeve it holds the knife. Revolvers are drawn in the same manner, and good ones of various patterns are not at all scarce among them. Fortunate it is that these people are good-natured and not inclined to quarrel, for armed as they are and knowing no law, they would be exceedingly troublesome. In the few instances where trouble has occurred between Innuits and white men, it appears to have been the fault of the latter.

The Point Barrow natives gave Lieutenant Maguire, of the Royal Navy, some trouble while wintering there in the Plover in 1851-'52, but it seems to have been more from a spirit of mischief on the part of the natives than anything else. They mistook Maguire's forbearance for cowardice. In his anxiety to conciliate them, and secure their friendship for any of the Franklin party, or other white men who might come after, many offenses were overlooked. Then the contempt of the Innuits was incurred by firing blank cartridges. This was mistaken for bad marksmanship, and "had not the effect of dispersing them as had been expected." In Lieutenant Maguire's interesting account of his experience there, after referring to some of the pranks played by their tormentors on shore, he says:

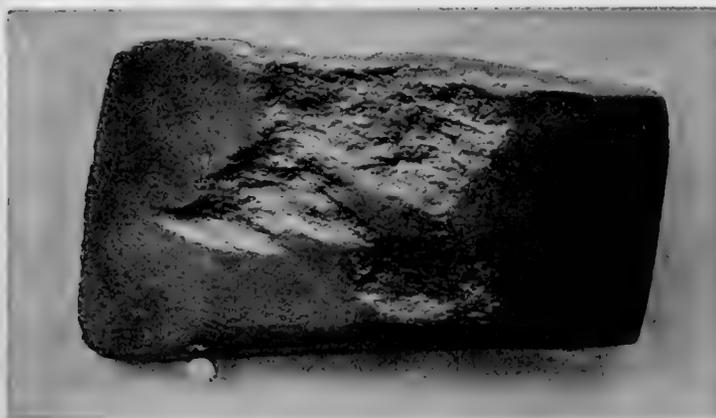
A more serious affair took place on board the ship. The officer in charge, Mr. Hull, second master, in keeping back a large, powerful fellow that attempted to force his way over the side, had a knife drawn on him by a friend of the others on board the ship, who immediately called out for the women and children to retire. Mr. Simpson, the surgeon, was standing near, and very soon produced before the man with the knife one of Colt's revolving pistols, and explained to him the use of six charges, which had the effect of keeping them very quiet for the remainder of the day.

The dog, the only animal domesticated by the Innuits, fills an important place in their domestic economy. In their nature and appearance these animals are exceedingly wolfish, and although they have been domesticated and used as draft animals since the Innuits first became known to



No. 1. Stone for sharpening knives.  
 No. 2. Tchukutchi Skin Scraper.

No. 3. Flint Spear-head, found in the blubber of a  
 Whale, taken near Herald Island by the  
 bark HELEN MAR, in 1880.  
 No. 4. Fish-hook from Diomed Islands.



INNUIT STONE AXE, HOTHAM INLET.

*Photo.*



white men, it is probable that they came originally from the wolf. Indeed the resemblance is so strong now that many dog-skins were brought on board by the natives, for sale as wolf-skins, and in one or two cases the cheat was successful. Mr. Skeoch, one of the members of the Parry expedition in search of a northwest passage, made a skeleton of one of these animals and found the number of all the vertebræ to be the same as that of the wolf. They usually bring forth six or seven at a litter. The young grow rapidly, and are soon put in training for the harness; until full grown they are taken into the tents in cold weather, and fed and cared for like children. They are harnessed in pairs with a leader. A team consists of five, seven, or nine dogs, according to the weight of the load to be drawn. With a well-constructed sled and a team of nine dogs, over a comparatively good road, seven hundred pounds should be drawn without difficulty. The harness is made of seal-skin, a strap going around the neck, from which a trace leads to the sled. They show no affection in return for any amount of kindness, and can only be controlled by the lash; and although certain words are used to direct them to the right or left when driven, the command is generally accompanied by a lash from the whip. They are continually fighting among themselves, and from this cause are often lame and covered with scars and wounds.

Though many are his bad qualities, the Innuït dog fills his station in life admirably. His long hair and close, thick undercoat of wool enable him to stand the coldest weather without injury, and even on the legs where this wool does not grow the hair is so close and fine that the cold cannot affect them. Parry says, "We have seen a young puppy sleeping with his fore paws laid on an ice anchor, with the thermometer 30° below zero." Their sense of smell being very acute, they are sometimes trained to assist their masters in discovering game. It is said they greatly fear the wolf and will not attack or give chase to him.

The Innuïts build their houses near together for mutual protection and assistance in hunting and capturing whales, walrus, &c.; but although associated together in this way they have no hereditary chiefs or rulers. There is, however, one in each settlement who is regarded as a leader. This may be on account of his strong will or his success in hunting and fishing. I could not learn that this leader, whom they call *omalik*, has any vested rights other than the social distinction, and the privilege of giving gratuitous advice on all occasions, which license it is presumed the Innuïts enjoy in common with the rest of the human family. They have only such special privileges as their prowess can command or their bounty purchase. The *omalik* at Point Hope is self-appointed and controls his band by force of arms. He is well armed, a good shot, and quick to act. He has two wives who take turn in keeping guard while he sleeps, to give warning of the approach of danger. It is said that he has killed several of the band, and the rest appear thoroughly cowed. Although a terror to his own people he is friendly to the whites, and appears anxious to possess their good will. Of course it is only a question of time when some Innuït will kill him. The attempt will hardly be made, however, until he becomes less wary, as failure means death to the one that makes the attempt. And although the custom of exacting blood for blood prevails, it does not seem to be necessary in order to avenge the death of a relative that an Innuït should run any risk to his own life. There is no haste, and he generally waits until vengeance can be accomplished in safety. The following reference to the Cape Hope Innuïts, which I made in my note-book at the time, illustrates some traits of their character:

"We went on shore to examine their houses and learn something of their mode of living. Mr. Nelson, who was ever on the alert for anything of etymological interest, took his camera and a small package of trade goods. Upon reaching the settlement Nelson established himself under the lee of a turned-up *oomiac* near the shore, and signified through the interpreter his desire to buy any old worthless things they might possess. A general raid was made on the old collections or rather accumulations of the settlement. Carved images, drill bows (for making fires), and implements of various kinds, made of ivory and stone, were brought out and offered for sale by the natives, each trying to be the first to trade, as if afraid the supply of beads, calico, tobacco, &c., would not hold out, or that the market for articles of native manufacture might be overstocked. Each article offered was taken by Nelson and examined, and if of any value as a specimen the interpreter was told to ask what was wanted in return, and upon being told what the native most wanted a fair quantity was given. This was generally satisfactory, but the slightest show of eagerness on the part of the buyer run the price up out of all reason. A very

fine hammer, made of quartz crystal, was brought for sale, but unfortunately several of our party wanted it, and started an opposition trade. The native seeing our anxiety to possess it must have suspected that quartz crystal hammers were valuable and raised the price accordingly, until finally the amount demanded exceeded the entire supply of trade goods taken on shore; in consequence the coveted article remained in the possession of the original owner, who will no doubt wonder, when too late, why he did not sell when he had an opportunity of getting such things as he was in need of, and make another hammer for himself. On the return of our party we were followed by the entire population of the settlement, each with some useless article which he endeavored to dispose of. One old fellow loudly demanded more tobacco for some article which he had sold. Mr. Nelson stopped to ascertain the facts and, if possible, satisfy the old man, who was apparently very earnest in his pleadings. Noticing something in his hand, which he was trying to conceal, one of the party caught hold of and opened it, and found therein a comb, which he had stolen from Nelson; a discovery which raised a general shout, and caused the old man to slink quietly away. The others seemed to regard the affair as an excellent joke, and I think the sudden departure of the thief was more through fear of punishment than shame at having been detected at stealing. Another native brought the skin of an Arctic hare with the tail of a red fox sewed onto it, and assured us in the most solemn manner that it grew that way. It was bought, not as a natural curiosity, but as an evidence of the advancement of the Innuits in the 'ways that are dark.' The reputation of the Point Hope natives is not good, but with all their kvavishness they do not appear cruel or vindictive, and ordinarily a party of white men thrown among them would be well treated. They would never be quite sure of a continuance of friendship, however. Any ill luck, loss of property, or sickness might at any time be attributed by the shaman to the presence of the '*Nileaugameuts*' (strangers), when they would not hesitate to kill them."

They are said to have a few long-established rules which are general throughout the north. For instance, every seal caught at a wintering place shall be equally divided. Any one picking up drift-wood has only to put a few stones on it, as it lies upon the shore, to establish his ownership.

All game which is large or rare is common property. On the Alaska coast the flesh of the whale is common property, but the bone belongs to the parties engaged in taking the whale. In Greenland whoever is the first to see a bear has ownership in it, no matter who kills it.

They have many superstitions. In fact, although they appear rollicking and thoughtless, nearly every action of their lives is attended by some serious observance which is followed as closely as if absolutely necessary to their existence. They are, as a rule, honorable in their dealings with each other, but the temptation to steal from white men often proves too much for their not very firmly fixed principles of honesty.

Parry, speaking of the want of gratitude shown by the Innuits in their transactions with him, says: "In general, however considerable the benefit conferred, it was forgotten in a day." The indifference and lack of gratitude of which Parry complains is probably due to nothing more than their careless, thoughtless nature. They appear to be hospitable and readily divide their food and lodging, or do anything necessary for the comfort of a guest, whether native or stranger.

Like all aborigines the men are lazy and require the women to perform most of the manual labor. I have many times observed the women engaged at tasks much too hard for them, while the men sat carelessly by, smoking their pipes, without offering the slightest assistance. When spoken to about it, they seemed perfectly willing to help and acted as if the idea of showing any consideration to the women was a new one, and rather amusing. A party, consisting of the parents, two sons, and a daughter, being detained on board the *Corwin* during a cold storm, were given a pot of hot tea and some hard bread, and permitted to go into the pilot-house for shelter. The men went inside with the food, leaving the women outside without giving them a look or apparently a thought. When told that they must divide the hot tea with the women and give them a chance to share the shelter, both men and women looked puzzled and amused. The men readily did as told, and the women seemed pleased but embarrassed, and acted as if they felt that they were being crowded with honors which did not belong to them. Of course, being entirely untaught, the morals of the women are low, and virtue is a thing of which they have no conception. The men object to this lack of virtue in their wives, not upon any moral grounds, but because of their belief that it brings them bad luck in their hunting and fishing. An unsuccessful beluga hunt is

attributed by the native to his wife's infidelity during his absence, and is likely to result in her being chastised on his return. When not engaged in hunting or fishing, in place of objecting, the men rather encourage it. The marriage ceremony is simple or elaborate, according to the taste of the contracting parties. In most instances a present of an al-le-ghe is made by the man to the maiden of his choice, and if accepted she is regarded thenceforth as his wife. The selection of the wedding al-le-ghe is a matter of much importance. Those made of the skins of the domesticated reindeer are most highly prized on account of their variegated appearance, the fineness of the hair, and the superior manner of dressing the skins practiced by reindeer owners. To secure an al-le-ghe of this kind for a wedding present, an InnuIt will travel many miles in the coldest weather and pay a fabulous price. Without it an InnuIt bride's trousseau is incomplete. Immediately after marriage the InnuIt makes and presents his wife with a pipe. When visiting the vessel, the young brides were readily distinguished by the newness and elegance of their pipe and tobacco-bag.

In general, but one wife is taken, and separations are unusual. Occasionally, however, an InnuIt is met with having several wives. In cases where there are no children by the first marriage, it is not unusual for a second wife to be taken, in which case the two women occupy the same house without envy or jealousy.

I could not learn that the parents of either party are consulted in the matter, although it is not improbable that the sons, who are much more subject to the control of the parents than the daughters, are guided somewhat by them in the choice.

The bride is taken to the house of the husband's parents, where they all reside in harmony until compelled by increasing numbers to provide quarters for themselves.

Both men and women are very kind to the children, and bestow much care upon them. They are kept warm and comfortable as circumstances will permit, and fed and caressed with every evidence of affection; and being, as a rule, gentle and tractable in disposition, they seem happy and comfortable, and cry but little. They are provided with toys by their parents. The boys have miniature bows and arrows, spears, kyacks, seeds, and in fact, every article used by the father is reproduced in smaller size for the son; while the little girl has a doll made of ivory or wood, and dressed in furs in exact imitation of herself. These toys are made with great care, and differ from the articles in actual use in size only. The carved images of men and women, although possessing no claim to artistic skill, are made true to nature. The little ones are constantly with their parents and learn very young to make themselves useful. They light the fires, melt snow and ice for drinking, sew furs, and tend the lamp; while the boys, when only seven or eight years of age, go hunting and sealing with the older ones, and assist in all the cares and duties of life. The women seldom have more than one or two children, the youngest being carried on the mother's back until two or three years of age. The hood of the al-le-ghe worn by the women is made large to accommodate them, and the sharp black eyes of the child peeping out over its mother's shoulder, are often the first indication of its presence. It is said that they destroy all deformed children at birth. Whether this be true or not, we certainly saw no deformed natives of either sex. They are also remarkably free from any appearance of disease, although frequently covered with scars and marks of wounds received in their encounters with bears and other wild animals. But one case of insanity came under my observation among either InnuIts or Tchuktchis—a young man belonging to the latter tribe, taken on board at Saint Lawrence Bay for passage to Plover Bay. While lying at anchor off the south side of Saint Lawrence Island, and about to get under way, this young man, who had acted strangely for several days, asked permission to visit the shore. He was told that the vessel would steam away in a few minutes, whereupon he became greatly excited, and seizing his rifle jumped into a boat. He was brought back without difficulty, and the affair was nearly forgotten, when the quartermaster of the watch called out, "The Indian has jumped overboard." He was drawn out of the water and again brought on deck, when he was found to be shaking violently. Supposing this to be the effect of his cold bath, I ordered him stripped and a dry suit of clothes put on him. Upon removing his garments blood was noticed, and an examination showed a knife wound in the left breast from which the blood spurted at each respiration, showing that the knife had penetrated the lung. The wound was dressed, and a guard placed over the native, who by

this time had developed into a raving maniac, to prevent his inflicting further injury upon himself.

The father of this young man was a wealthy deerman named Omniscott, living at Mechigue Bay, from whom I expected to purchase a supply of deer-skins for clothing; therefore I was anxious to please the son in order to gain the good will of the father, and on this account I had shown him particular attention, making him presents of tobacco, clothing, &c., but notwithstanding this, it was evident that he regarded me with suspicion, secretly considering me his enemy. While being conveyed to Plover Bay, after his attempt to end his own life, he offered large rewards to the guard to allow him to escape and kill me while I slept. For several days previous to this occurrence he had been in the habit of appearing suddenly at the cabin door. At such times, I had noticed a wild, unnatural look in his eyes, but attributed it to nervousness, the result of being away from home and surrounded by strange people, and always endeavored to make him feel at ease by giving him a small present, or ordering the steward to give him something to eat. Asking a few questions about his son, a child five or six years of age, and for whom he appeared to feel affection, had the effect of changing his manner. The wild look disappeared, and he seemed to forget everything else in his anxiety to see the child. I thought but little of these visits at the time; but in the light of the subsequent events, I feel sure that he came to the cabin for the purpose of killing me. This failure to accomplish it was no doubt due to the fact that when in the cabin I usually sat at the table writing up my notes, with my face towards the door, in order that I might see who entered without turning my head; and having arms always within reach, the native did not deem it safe to make the attempt unless he could take me entirely unawares. The cause of the poor fellow's insanity was probably the presence of a large number of the bodies of dead Innuits from Saint Lawrence Island, taken on board for the National Museum at Washington. The superstitious dread which he, in common with his kind, held towards the dead, aided no doubt by hints and threats from the sailors, had been too much for his naturally weak mind and driven him crazy. On our arrival at Plover Bay he was turned over to the natives on shore, who promised to care for him. Having been a source of great annoyance to me during his stay on board, and although much relieved at seeing him taken away, I felt at the same time great pity for the poor wretch as he left the side, cowering in the bottom of the boat in mortal fear of being killed, and urging the men to "paddle quick before the captain shoots me." Although his wound was a serious one, he recovered in a few days sufficiently to walk to his home, a distance of 200 miles.

In pleasing contrast to this was our experience with "Joe," the young Tehuktchi who acted as interpreter and dog driver. Having determined to send a party along the Siberian coast to investigate rumors of a wreck having been seen near Cape North, we stopped at Marcus Bay, on the evening of May 28, to communicate with the natives and endeavor to engage the services of an interpreter and purchase some dogs and sleds. We came to anchor, and were visited by a party of natives, who clambered on board without ceremony. Upon being asked if any of them could speak English, one of the party whose name we subsequently learned to be "Joe," was pointed out with the remark, "He speak too much." I at once made Joe acquainted with the nature of our business, and asked if he would accompany us with his dog team. At first he was in doubt, and said, "I plenty 'fraid." But our assurance that he would be brought back in safety and be well paid for his services quieted his fears, and he consented to go with us, and returned to the shore to prepare for the journey. I followed, hoping by frequent references to the reward to prevent a change of mind. As soon as the boat touched the shore Joe shot away like a deer saying, "Pretty soon I come." In a few minutes he returned, completely changed in appearance, having substituted for his fur suit a less comfortable but more showy suit of blue flannel, ornamented with red shoulder-straps, the boots being the only article of native apparel retained by him.

The effect of the change was very ludicrous, and caused a hearty laugh, in which Joe joined good-naturedly. His wife accompanied him on board and remained until the vessel got under way when she took her leave, sobbing and looking very unhappy, while Joe looked glum and smoked hard, and apparently tried to relieve his mind by swearing at his dogs in a mixture of English, Tehuktchi, and Kanaka. He soon recovered his spirits, however, and proved a valuable acqui-



INNUIT IVORY CARVINGS. KING'S ISLAND.



TCHUKTCHI IVORY CARVINGS.

- 1-2. Belt buttons. 4. Eye for Oomalik rigging.  
 3. Hook for Oomalik sail. 5. Woman's thimble found in use at Cape Wankerem.



S. EX. 204, 1, 48.

INNUIT CARVINGS.

1. Doll. 2. Box with Cover.



HELIOTYPE PRINTING CO., BOSTON.

INNUIT CARVINGS ON IVORY,  
 FROM HOTHAM INLET.

*From Photographs.*



tion, being a good interpreter, a good driver, and in every way thoroughly reliable, accompanying the sledge expedition along the Siberian coast. Although owing to the lateness of the season the journey was a remarkably hard one, he made no complaint, but plodded along by the side of his dogs, urging them forward by words and blows, and when stalled in the deep soft snow and sludge, taking hold of the lines and drawing with them, and when resting, standing guard while the others slept to prevent the half-famished dogs from devouring their harness and everything within reach.

As we approached Marcus Bay on our return I sent for Joe for the purpose of paying him for his services and for the loss of his dogs. Assuring him that I was very much pleased with the manner in which he had performed his duties, both on board the vessel and while on the sledge journey, I asked what he desired in payment, and received for answer, "Anything you like." Laying out what I considered a fair compensation, consisting of twelve sacks of flour, a musket, a quantity of powder, shot, lead, caps, calico, drilling, &c., I asked if he thought that was sufficient; "Yes, I suppose so," Joe replied, with a grunt. Thinking that he did not look altogether satisfied, I added several other articles—a hatchet, knife, some tobacco, needles, thread, &c., but as these had no other apparent effect than to make him look more displeas'd as each article was added, I gave up the attempt to elicit any outward show of gratification. Soon after, we reached the anchorage at Marcus Bay, where we were to part with him. Remembering the amount of feeling manifested by Joe and his wife at parting, we expected some show of rejoicing at his safe return, and no little interest was felt by all to know what form the expected exhibition of Tchuktchi affection would assume; and as the oomiac approached in which Mrs. Joe was recognized all waited intent upon witnessing the meeting. But to the astonishment of all they exchanged neither word nor glance, and, so far as we could see, no sign of recognition. Although unable to entirely conceal their grief at parting, the joy at meeting which they undoubtedly felt was stoically hidden. Joe passed into the oomiac the articles which had been given to him, and his wife assisted in receiving and stowing them away. With a grunt, which was no doubt intended as a parting salutation, Joe left the vessel, and taking a seat in the oomiac paddled away for the shore, not, however, without a feeling of regret on my part at the loss of so true a man as he had proved to be.

The Innuits show some taste in drawing and readily understand the use of charts and maps, and when explaining the trend of a coast-line, or the course of a river, it is no unusual thing for them to take a pointed stick and trace it on the ground. They often keep a record of events by carving on ivory. The ivory is cut into strips of perhaps 1 foot in length by 1 inch in width and half an inch in thickness. These are used as handles for the kantags, and bows for the fire drills, for which the natural curve of the walrus tusk particularly fits them. Although these "bows" often contain carvings having reference to events covering a series of years, perhaps a life-time, they attach but little value to them, and readily dispose of them for a trifle. At Cape Blossom I purchased two from an old man for a few hands of tobacco. These contain, among other things, carvings representing the vessels of the Western Union Telegraph Service, which were sent north in 1865 for the purpose of laying a cable across Bering Strait. The men belonging to the expedition on shore, and the houses erected by them, are also graphically shown.

A knowledge of the traditions of the Innuits can only be obtained by a long residence among them. There are many obstacles to be encountered and overcome in the pursuit of knowledge in this direction.

First, a superstitious dread which the natives have of mentioning them. They are told to the children from a sense of duty, and occasionally are related in the presence of all, as they are collected around the fire in the kayhame or dance-house, during the long winter nights, and are remembered by a few, so that they are not entirely lost, although they no doubt change from time to time, dependent upon the strength of the imagination of the narrators, each of which may embellish or enlarge upon the previous account.

Second, the native dread of ridicule. This feeling seems to have more influence on their acts than any other, except their superstitions. To avoid being laughed at they will do many things not otherwise characteristic of them, and if relating one of their most interesting stories, the slightest indication of doubt or ridicule on the part of his listeners will cause the native to stop and say that he has forgotten the rest, or that he had only learned so much of it, and nothing will induce him to go on.

A third and very serious obstacle is their inability to understand or make themselves understood upon any but the most commonplace subjects.

Although the idiom spoken by the Innuits is said to be the same from Greenland to Bering Straits, the differences in dialect are sufficient to prevent the natives at different settlements from conversing readily. Indeed, in some cases, they cannot understand each other at all. An Innuite from Saint Michael's, Norton Sound, who acted as interpreter during the first cruise of the *Corwin*, could not converse with the natives of Icy Cape and Point Barrow, while Andrews, a bright young Russian half-breed, who had received some education, and who accompanied us during a part of the second cruise, experienced but little difficulty, occasionally remarking, "These fellows speak the other way." Dialectic differences which, to a civilized person, would be scarcely noticeable, are to the Innuite insurmountable difficulties. One word may serve to illustrate this. Negation is variously expressed among the different bands from Cape Prince of Wales to the Colville River by *pèchuk*, *pètuk*, and *pèluk*. These slight changes are sufficient to render a sentence unintelligible to the Innuite of another settlement. According to Dr. Rink, the Innuite idiom differs from the whole group of European languages, not merely in the sound of the words, but in the construction. Its most remarkable feature is that a sentence in a European language is expressed by the Innuite by a single word constructed out of certain elements, each of which corresponds in some degree to one of our words.

That which the Innuite lacks in language he makes up for by the use of signs. A knowledge of their sign language, however, like their traditions, can only be gained by a long residence among them. One sign which I frequently saw made is essentially masonic, both in the manner of making and its significance. I made every effort to discover the origin of this sign among them, whether it had been taught them by white men or had been in use before the advent of the latter, but they either could not or would not tell. Although I frequently saw it used by parties on approaching the vessel, they seemed unwilling to speak of it after coming on board.

According to the best authorities the Innuits everywhere hold to nearly the same religious ideas, except where they have been brought under the influence of Christianity. They believe the whole world is governed by supernatural powers or owners, each of whom holds his sway within natural limits. These powers are called "*Innas*." In general, each individual may have his or her *Inna*. Before embarking on any voyage, hunting expedition, or other important undertaking, they invoke the blessing of the particular *Inna* under whose jurisdiction they are to come as earnestly as the most devout Christian invokes the blessing of the Deity. They have no idea of one great Creator, and but a slight undefined idea of reward or punishment in a future world, although they all believe in a future state in which the good are separated from the bad.

The Innuits as well as the Tehuktchis practice shamanism, and seem to have implicit confidence in it. The shaman is a kind of doctor, who professes to cure physical diseases by a sort of jugglery. He is also supposed to be able to foretell events. In their predictions they show great shrewdness, and after predicting a certain event no effort is spared by the shaman to bring it to pass. This fact does not, however, lessen his influence or detract from the credit of the prediction. Shamanism is a mixture of the spiritual and material which it is difficult to define or understand. Unlike all other forms of spiritual belief, it has no creed, no dogmas. No particular forms are observed by the shaman, each creating his own forms or ceremonies.

In ministering to the physical wants of their people no material medicines are used. All bodily ailments are attributed to the presence of evil spirits, and the cure, if effected at all, is by means of jugglery. If the patient recovers, the shaman claims the credit. If he dies, some plausible excuse is offered and promptly accepted, implicit faith in the shaman being one of the leading tenets of Innuite belief. To the ordinary observer shamanism as practiced by these people appears sheer humbug, but when we consider the great length of time that it has held its own in various parts of the world, widely separated from each other, the power exercised by it and the confidence reposed in it by its followers, we can but ask the question, Can a doctrine based upon mere deceit and fraud do this?

Wrangel, who for three years traveled among the followers of shamanism in Northern Siberia, believed that a true shaman was not an ordinary deceiver, but rather a psychological phenomenon, by no means unworthy of attention; and, indeed, after witnessing the earnest, impassioned manner

of the shaman when exorcising an evil spirit, and the entire absence of anything implying a doubt of its genuineness on their part, I can readily concur in the belief.

When an Innuït dies his body is taken outside of the settlement and deposited on the ground, with everything which in life belonged to him—his sled, kyack, arms, &c. During the winter, when the ground is covered with snow, the body is placed upon a sled and drawn to the burial place. At other times the body is attached to a pole and borne out by some of the men. If stones or drift-wood are obtainable, the body is covered as a protection against wild animals or dogs. This, however, is not regarded as necessary, and, if at all inconvenient, is omitted. Dead bodies half devoured were often seen. In one case among the Tchuktchis a dog was seen in the act of eating the body of a half-grown child within plain sight of the settlement. They have a superstitious dread of murdered persons or those killed by violence in any way, and will not touch them unless absolutely necessary. I have known a summer settlement of more than a dozen tents to be moved to escape the presence of the body of a man killed in a quarrel.

Various opinions are extant as to the origin of the Innuït. Richardson says, "The question has been much discussed as being the pivot on which the inquiry into the original peopling of America has been made to turn."

Whether they descended from the Mongolians and crossed over Bering Strait in their skin boats, or earlier during the Glacial period they crossed on the tongue of ice which still filled the straits and extended into Bering Sea, or are descendants of the reindeer men of the Pliocene age, and crossed over from Europe to the Faroe Islands, Iceland, and Greenland, when those places were connected by the elevation of the Atlantic ridge, it is not my purpose to discuss. To the three thousand Innuïts who inhabit the Arctic coast of Alaska, and who are entitled to the protection of the American flag, the origin and past history of the Innuït race are not of such vital importance as the present and future. I believe the Innuïts could readily be civilized if any opportunity were given them. They must, however, be taught by example. They are great imitators, while they have little confidence in mere verbal statements, especially in matters which they do not comprehend. A missionary going among them to preach the doctrines of some particular sect and levy assessments would fail; but one who would teach them by example to build better houses for themselves, to be more cleanly in their habits, to treat their women with more consideration, to be industrious and provident, virtuous, truthful and honest, point out to them the evils of intemperance and teach them the rudiments of self-government, is the kind of missionary they require. First, create in them a desire for knowledge by showing them its benefits, and it will be gladly received. In this way they could be civilized without cost, as the means of supplying themselves with everything they will require, even if brought to a high state of civilization, is within easy reach, and they only need be taught industry and providence to be above want at all times.

The condition of the Innuït of Arctic Alaska at the present time is in sad contrast to that of the Greenland Innuïts who, under Danish rule, are enjoying many of the blessings of civilization, with comfortable dwelling-houses, schools, and good laws for their government. Although for more than twelve years these people have been the wards of the American Government, made so through the voluntary act of the Government itself, and as such, by all the laws of humanity, entitled to a chance to develop into civilized beings, if they will, not one step has been taken looking towards the improvement of their condition. On the contrary, they are sinking each year lower and lower, being left entirely at the mercy of the whisky-seller. This is a great wrong, and unless remedied will prove a lasting disgrace to our country.

#### REINDEER.

Little though the reindeer's importance is to civilized communities, there is probably no animal in existence which has contributed so much towards the support of human life. With the reindeer many thousands of human beings are now, and have been for centuries, able to exist, and apparently to enjoy life, in regions which without it would be uninhabitable, for there is no other animal known which could supply its place.

The reindeer (*Tarandus rangifer*) ranges in its wild state over the entire Arctic regions of both hemispheres, even to the most desolate of the outlying islands. It is found on Cape Chelagshoi, the

most northern point of the continent of Asia, and on the Seven Islands, which are the northernmost islands of the Old World. It inhabits the northern part of Nova Zembla, and has been seen on King Coil's Land, east of Spitzbergen, and on the north coast of Northeast Land, and also upon Caslon's, Parry's, Phipps's, and other islands lying still farther north. Notwithstanding the high latitude of these places and consequent extreme cold and almost constant snow and ice, the hardy reindeer finds food and thrives. Barentz says: "Although Spitzbergen lies under and over the eightieth degree of latitude, there are to be found deer and abundant leaves and grasses there." Upon that island alone the annual slaughter of reindeer formerly amounted to fully three thousand. A party of Cossacks who passed six years there are said to have killed two hundred and fifty deer without the aid of guns, so plentiful were they. Whether the vast numbers yearly killed by hunters exceed the natural increase, and their ranks have been diminished, is not known. It is certain, however, that great herds of them still exist, both in the wild and in the domesticated state. These herds vary in size according to locality. On the islands north of the American continent they are small, seldom exceeding two or three hundred, and usually not even so many, while on the continents they run up into the thousands.

Among the Koraks and other wandering tribes of Kamtchatka the herds often number from a thousand to four thousand and even eight thousand animals. But among the Tehuktchis inhabiting the shores of the Arctic Ocean and Bering Strait the herds seldom exceed five hundred, although herds owned by interior bands of the same tribe are much larger.

There are at least two varieties of reindeer on the American continent, the caribou, a woodland deer, and the barren-ground deer. The latter is the more numerous, and inhabits the barren, desolate lands within or near the Arctic circle, while the former inhabits the wooded regions farther south. These varieties differ in size, the caribou being the larger; they also differ in the shape of the antlers, those of the caribou being more palmated. In color they differ but little, each being dark brown in summer, but much lighter in winter. In the domestic deer of Northern Siberia there is not this uniformity of color; they are found in many colors—white, the different shades of brown, and occasionally, though rarely, black; many are beautifully spotted with pure white and a dark shade almost black, the outlines of the colors sharply defined, as though laid on with a brush. According to J. D. Caton, who made a study of the reindeer while traveling in northern lands, this is not true of the deer of Norway and Lapland. He says none were spotted, as we see our cattle spotted, with well-defined margins to the different colors, but the colors were confluent, so that portions would be gray or roan. These animals were undoubtedly, when in their wild state, of the same uniform color as the wild deer now inhabiting those regions, and the change is the result of their domestication. These facts may have a bearing upon the relative lengths of time they may have been subject to the control of man in the two hemispheres. The young of neither wild nor tame reindeer have the peculiar spots of the fawns of the red deer. They change with the seasons, as do the older ones, not only in color, but in the texture of the hair, which in summer is short and fine, while in winter it is coarse and thick, and very brittle. This brittleness of the hair of the reindeer has been attributed to the amount of starchy matter contained in the food upon which it subsists.

The antlers are long, branching, and slightly palmated, and, contrary to the otherwise invariable rule among antlered animals, they are present in the female, and are shed and renewed every year like those of the males; they are smaller, however, and less branched. This is true of the reindeer, wherever found, and is one of its distinguishing characteristics. When the antlers first appear they are covered with a short fine hair, commonly called the velvet, which remains until they attain their full growth, when the velvet is shed, and later the antlers themselves.

The process of shedding the velvet, although probably painless, presents a most sanguinary appearance, as it hangs in long bleeding shreds, often covering the entire face and obstructing the sight, causing the deer to keep up a continual shaking of the head.

Fighting among themselves is usually the immediate cause of the shedding of the velvet and also of the shedding of the antlers, which occurs in early spring. The broken antlers frequently seen among them are doubtless due to the same cause. As fighting is much less frequent as well as ferocious among the females, they do not shed their antlers until later, usually in May. The young are brought forth about the same time. Then the females are found separated from the

males in herds with their young until October, when they again all herd together for mutual protection and warmth. The domestic reindeer is somewhat smaller than the wild deer; its hoofs are broad and deeply cleft. This allows the foot to spread when placed upon the ground, making a large track, which gives the impression of a much larger animal, and one is disappointed upon seeing the deer for the first time. Its legs are short, and its feet so large that they look out of proportion. The reindeer lacks entirely the graceful form of the red deer or antelope, and as it raises its feet very high when traveling, a habit acquired by wading through deep snow, and also raises its nose high in the air, its appearance is very awkward and not at all suggestive of the great speed it can attain—from 80 to 100 miles a day. In its wild state it is very fleet and easily distances all its pursuers, the gaunt, long-limbed wolf alone excepted. In winter the wild herds, as they paw the snow in their search for the nutritious lichens, which instinct teaches them lie buried beneath its surface, are often surrounded by packs of these hungry, ferocious animals, giving forth the most dismal howls and darting back and forth in their efforts to frighten and stampede the deer. While traveling from place to place in search of food they are almost constantly followed by their tormentor, and should one lag behind but a few yards he is instantly surrounded, and pays for his thoughtlessness with his life. It is only the instinctive herding together of the deer and the cowardice of the wolves, who will not attack men or beasts in large numbers, that prevent the extermination of the deer. In the summer time the feet of the wolves become tender from traveling over the sharp flinty rocks, and the deer enjoy a few weeks of freedom, as they can then easily distance them.

Not only is the reindeer very fleet, but its senses of seeing, hearing, and smelling are wonderfully acute. The regions which it inhabits are almost entirely free from cover, and the greatest caution is necessary on the part of the hunter in order to approach without being observed. This is particularly the case when hunting with the bow and arrow, on account of the shortness of its range. When the ground is bare the native hunters wear squirrel-skin suits, whose color is nearly that of the mossy tundra. They approach from the leeward side by crawling on hands and knees. At the slightest indication of alarm among the deer the hunter drops flat upon the ground and remains motionless until quiet is restored, when he again advances, even more cautiously than before, until within shooting range. When the ground is covered with snow it is still more difficult to reach them, and the native hunters often resort to such stratagems as digging pits in the deep snow-drifts into which the deer are driven, or concealing themselves in the snow, where they remain for hours patiently, and often fruitlessly, waiting for the deer to pass within range. In very deep, soft snow they are sometimes easily approached by the hunters on snow-shoes, when a general slaughter takes place. The reindeer, both wild and domesticated, is greatly troubled by mosquitoes, which, throughout the Arctic regions, come in great numbers as soon as the bare ground appears in the spring. There is also a fly (*Estrus tarandi*) which deposits its eggs beneath the skin, causing the deer much pain and itching. Sometimes, when tortured by these insects, it is said they rush blindly into danger and become an easy prey to their enemies. The skins of animals affected in this way are often so perforated as to be entirely valueless, containing several dozen holes half an inch in diameter. They are also subject to various diseases, the most deadly of which is called the Siberian plague. This disease attacks all, but is more frequent as well as more fatal among the domestic herds. It is not unusual for the entire herd to die when this disease appears. The flesh of animals afflicted with this disease is poisonous, and at times even the men who tend the herds are attacked.

The food of the reindeer consists principally of varieties of lichens, *Cladonia rangiferina*, *Cladonia cornucopioides*, *Cladonia incolis*, and *Cladonia gracilis* being the most important.

It is said that upon the west shores of Davis Strait the deer come down to eat the fuci which are exposed at low tide. Some writers have claimed that the Greenland deer do not subsist upon this moss. It is possible, however, that this is a mistake. There seems no reason why this hardy plant, which flourishes in all other portions of the Arctic regions, should be wanting in Greenland, and wherever found the deer will eat it in preference to all other food.

It is altogether probable that wherever reindeer are found there will be found the *Cladonia*, or some lichen closely allied to it and equally nutritious, and that without it they could not exist, and without the deer the tribes that inhabit the vast desolate plains bordering on the Arctic seas

would soon become extinct. There is no doubt that the reindeer can and do eat various kinds of leaves and grasses and young sprouts of willow, alder, and dwarf birches. When brought to lower latitudes they browse like others of their class; yet a certain amount of lichen food is necessary to them. When confined in zoological gardens they are fed each day with moss brought from the north for them, and they do not continue healthy without it. Owing to the great length of time required for this food to digest after being eaten, the deer is able to abstain from food for several days together without feeling hunger, and on this account the owners, when traveling with their herds or in sledges drawn by deer, can make long distances without stopping.

In the Arctic regions there are but two seasons, winter and summer. These follow each other so closely that spring and autumn may be omitted from the calendar. Scarcely is the snow off from the ground when the flowers spring up and the air is filled with their fragrance, and with the songs of birds and the hum of insects. This lasts but a few weeks, when winter returns with its snow-laden gales, and spreads its mantle over all. In this short time, however, nature has done its work; plants have sprung out of the ground, and put forth their blossoms, their seeds have been scattered over the tundras by the summer breezes to perpetuate their kind, and the parent stalk has begun to decay. Not so the hardy lichen and fungus of the order *Ascomycetes*, reproduced by cellular union within itself, subsisting upon and nourished by the lower orders of *Algae*; it does not wither and decay, but retains its nutritious juices throughout the long cold winter, furnishing food for the reindeer when there is absolutely nothing else to sustain life. The wonderful instinct of the deer teaches them to search beneath the snow for food, which is often covered to a depth of several feet. This small, dull-looking plant, which hardly raises its head above the frozen soil of this region of ice and snow, occupies a prominent position in the economy of nature.

The domesticated reindeer forms almost the only subsistence of many of the natives of Kamtchatka and Siberia. As far back as our knowledge goes, and probably for hundreds, perhaps thousands, of years earlier, these animals have been subject to the control of man.

Although they become very tame and apparently fond of their master, they retain their timid nature and regard strangers with suspicion. The large herds owned by these people and the quantity of food required by them necessitates constant changes from place to place in search of fresh pastures. The owners and their families, and, indeed, all their earthly possessions, must be moved also. Years of this kind of life makes roving second nature, and the term "wandering tribes" is fitly applied to them. The mossy plains of Siberia, over which these people roam with their herds, are often thousands of feet above the level of the sea, swept at all times by cold winds and clouds of rain and snow, and have a winter temperature many degrees below zero. It appears almost impossible for human beings to exist and endure exposure to such intense cold. Yet we are assured by George Kennan, in his "Tent Life in Siberia," that these reindeer people spend night after night watching their herds, with no other protection than a little hut built of snow or a few branches of trailing pine. There they wait and watch throughout the long cold hours of the winter night, sleepless and vigilant, armed only with knife and spear, listening for the sound of wolves and bears, and watching for a gleam of their terrible eyes. Many a fierce fight they have and many a scar they carry, bearing testimony to their courage and the ferocity of their foes. But their lives depend upon the safety of their herds, for, in return for the hardships endured by the men on their account, the reindeer furnish their owners with food, clothing, and shelter, and all the necessities of life. The flesh, blood, and entrails are eaten, the skin makes the garments, beds, and tents. The skin of the leg, which is covered with fine short hair, makes the boots. From the antlers are made many of their implements, drill bows for lighting fires, knife handles, &c. The sinews of the deer make the native thread, and a most excellent thread it is.

The bones, soaked in oil, are burned for fuel, and in addition to all this, the deer furnishes his master with the means of transportation, and indeed to a large extent assists in forming the character of the man. This nomadic life, constant vigilance and exposure to hardship and danger, have combined to make the wandering deerman of Siberia, in strength, courage, and endurance, second to no human being. With his herd and a desolate plain he knows no master and no law, and has no want unsupplied. The houses of these people are made also to conform to their migratory habits, being so constructed that they can be taken down and put up again at will, and

are easily transported. They are composed of a covering of skin stretched over a number of poles, forming a frame, their lower ends resting on the ground and curved so that the upper ends unite, giving the house the appearance of a large umbrella of from 25 to 50 feet in diameter by 12 or 15 feet high; the whole is fastened together by leather thongs. Inside the houses are square sleeping rooms, called by the Koraks pologs, from two to six in number, according to the number of people in the band. These sleeping-rooms are made of deer-skin drawn over a frame and suspended by thongs from the top of the house like an inverted house. They have no door, and are entered by raising the edge and crawling under. They are almost entirely air-tight, and are warmed and lighted by a bit of moss which is burned in oil in a vessel either of wood or stone.

The space between the sleeping-rooms and the walls of the house is used to store food, spare garments, furs, and in fact everything belonging to the family except the deer and sleds. The deer are never allowed to approach the houses near enough to smell the smoke, for which they have a great aversion. The sleds are stored upon end against the outside of the house or some convenient rock, to avoid the necessity of digging them out of the snow when required for use. When the food for the deer becomes scarce the house is taken down, and with everything it contains is packed upon sledges and drawn by the deer to the location decided upon, where it is again put up, and the people feel as much at home as if they had never known another. The wandering reindeer tribes are probably the only people on the face of the globe who have absolutely no patriotism, no place which they regard as home, and who have never said, "This is my own, my native land."

But a small portion of the larger herds are used in sledges or as pack animals; only a few of the males are used. These are selected when young and emasculated to make them perfectly docile. In some of the smaller herds it is not unusual to find that nearly all of the males have been subject to this operation, a few only being kept for breeding purposes. In a herd of about two hundred and fifty seen by the writer on the Tchuktchi Peninsula, but two males remained entire.

The harness is a very simple affair, consisting of a stout collar, to which a strap is fastened at the breast. This passes between the fore legs and under the belly, and is long enough to allow the deer to be several feet from the sledge. They are harnessed single or in pairs. When in pairs one of the antlers is cut from each animal to prevent their becoming entangled, and a rein is attached to the remaining antler, which, however, appears to be less relied upon than words in the guidance of the animal. The Siberian deer sledge is a rough, clumsy affair, and as it is tied together with thongs, it is constantly working loose and falling apart. Very different is it from the broad-backed, graceful, and comfortable looking sled of the Laplander.

The trained deer are allowed to graze with the rest of the herd; their ears are split so that when wanted they are easily recognized, and as they are very tame and gentle, they are easily caught and harnessed.

The reindeer is not domesticated by the Greenlanders. So rough and impassable is the interior of that country that travel is confined to the sea-coast and performed either by water or over the ice along the shore, according to the season, and as traveling over hard ice is as difficult to the deer as it would be to our own domestic cattle if not shod, they are useless under such circumstances as beasts of burden.

Parry, in his attempts to reach the North Pole by boats and sledges over the ice from Spitzbergen, tried to utilize the deer in this way. The following interesting reference to them is found in his narrative of the cruise:

In the afternoon (April 23, 1827) Lieutenant Crozier returned in the boat from Alten and was followed the next day by Mr. Woodfall, who brought eight reindeer for our use, together with a supply of moss for their provender. As, however, the latter required a great deal of picking so as to render it fit to carry with us over the ice, and as it was also necessary that we should be instructed in the manner of managing the deer, I determined on remaining a day or two longer for these purposes. Nothing can be more beautiful than the training of the Lapland reindeer. With a simple collar of skin round his neck, a single trace of the same material attached to the "polk," or sledge, and passing between his legs, and one rein fastened like a halter about his neck, this intelligent and docile animal is perfectly under command of an experienced driver and performs astonishing journeys over the softest snow. When the rein is thrown on the off side of the animal, it immediately sets off at full trot and stops short the instant it is thrown back to the near side. Shaking the rein over the back is the only whip that is required. In a short time

after setting off they appear to be gasping for breath as if quite exhausted, but if not driven too fast at first they soon get over this and then go on without difficulty.

Parry further says that the amount of moss required for each deer was about four pounds, and that no water was necessary as long as the deer could get snow, which they like to eat as they go along. A snow-bank, or even the solid ice, is to them a comfortable bed.

With such qualifications [he says] it may well be imagined how useful these animals seem likely to prove to us, and the more we became accustomed, and I may say attached, to them the more painful became the idea of the necessity which was likely to exist of ultimately having recourse to them as provisions for ourselves.

Upon embarking on his venturesome voyage Parry discovered that owing to the rough nature of the ice over which he was compelled to travel, his reindeer would be useless, and although he makes no further mention of them it is presumable that they met the fate which he predicted for them.

Singularly enough the natives of Northern Alaska do not domesticate the reindeer, although they have abundant opportunities to capture the young. This appears the more remarkable when we consider that they are yearly in communication with the reindeer people of Siberia, and fully realize the superiority of the skin of the domestic animal for garments, often crossing Bering Strait and making long and dangerous journeys along the coast and islands to secure them, and paying for them many times the value of the skin of the wild deer.

The Innuits also make long journeys in their own land in search of game and for the purpose of trading, using sledges drawn by dogs, which must be fed daily, while with deer they could make longer distance, carry larger loads, and, above all, it would not be necessary to transport food for their animals, as the deer could obtain its own. The milk of the deer is used by the Laplanders but the amount obtained is small, seldom exceeding one pint at a milking. Caton says the female deer dislikes greatly to be milked, and will never submit except by actual force. It is necessary to tie her while it is being done. It is probably for this reason that the reindeer people of Siberia, with possibly few exceptions, make no use of the milk.

The utmost care is observed by them to avoid alarming or annoying the deer in any way. Dogs are never allowed to approach the herds, although, as they are in reality only wolves, with all their savage instincts, the greatest vigilance is necessary to keep them away.

The reindeer men are also much averse to allowing strangers to approach their herds, and although they do not positively refuse, they try by every means in their power, including a vast amount of lying, to dissuade one from going near them. They have a superstitious dread of selling live deer, while dead ones are sold for a trifle. Efforts to purchase the live ones are invariably met with a shake of the head, and the assurance that the loss of the rest of the herd would be sure to follow; and numerous instances are cited where the too-yielding natives have been persuaded by the arguments of the whites, backed by presents of whisky, tobacco, beads, &c., to prove recreant to the traditions of their fathers, and by selling a few live deer have entailed endless bad luck upon their band, lost their herds, and had to settle upon the sea-shore and become fishermen, which to the mind of the proud deerman is the worst that could befall them. The killing of deer, either for their own food or for sale, is conducted very quietly and with certain ceremonies, in order to avoid giving fright to the deer or offense to the god which presides over them. The deer to be killed are selected by the owner of the herd, but the slaughtering is done by the younger men. Upon making a selection the old man, without pointing or even looking in the direction of the doomed animal, carefully describes him and his location in the herd to the younger men, one of whom enters the herd, and approaching the deer designated (which is always a male; the females are not killed for food) seizes him gently by the antlers and leads him away from the herd a short distance; then, after facing to the four points of the compass and making many gestures which probably signify something, but to the uninitiated appear exceedingly ridiculous, he steps directly in front of the deer, seizes an antler in each hand and draws his head so close that surrounding objects cannot be seen. An assistant approaches with a knife, which he also points in the direction of the four points of the compass and flourishes in a mysterious manner, after which he plunges it into the deer's heart, holding the knife in the wound until life is extinct to prevent the escape of the blood.

The task of skinning the deer is always allotted to the women; they also tan the hides and

make the clothing. The process of tanning is very simple and effective. It consists in drying the skin in the open air, then removing with a scraper of flint or iron all the particles of flesh and muscular fiber that remain attached, after which the skin is rubbed with the hands until it is perfectly soft and pliable, then willow or alder bark, scraped fine and soaked in water, is rubbed on, care being taken to prevent its coming in contact with the hair. When dry it is ready for use, the flesh side presenting a rich terra-cotta color. The skins taken from the animals killed in summer are preferred for clothing, while those taken in winter are used for tents and sleeping-rooms, and also for bedding. These are not tanned but only dried.

The Tehuktehis make an undergarment of the skins of the unborn young; it is exceedingly soft and pliable, and very much prized by them. Many of the garments manufactured by the women belonging to the wandering deer tribes of Siberia display a good deal of taste and marvelous patience in their arrangement. A garment in the possession of the writer has a border round the bottom 8 inches in depth, containing 1,800 pieces of deer-skin, with an aggregate length of 300 feet, all neatly sewed together with the sinew of the animal, the different colors so arranged as to form the whole into a very neat and original design. This is no unusual case; indeed, these garments are rarely seen without some ornamentation upon them.

The antiquity of the reindeer is not one of the least interesting features in relation to it. Far back in the Quaternary period, when the climate of Europe, as geologists assure us, resembled that of the polar regions of the present time, the reindeer was present as the contemporary of the hairy mammoth, the hairy rhinoceros, the horse, the aurochs, and the gigantic deer, together with the cave animals, bear, wolf, and hyena. The true reindeer epoch, however, did not begin until after the second advance of the glaciers into the valleys of Europe—the second Glacial era—when it made its appearance in great numbers and covered a large area. A few hairy mammoths and other animals were still alive, but it is probable that the reindeer was by far the most largely represented numerically of the fauna of that period. Indeed, geologists tell us that the horse and reindeer furnished the principal articles of food for the men of the reindeer epoch. A fragment of a reindeer's skull which still contained the stone arrow-head with which the animal was slain shows that the men of that day hunted and killed the reindeer in much the same manner as the Innuits of to-day.

There are many other points of resemblance between these people so widely separated by years, showing that they were in much the same state of advancement towards civilization, and equally dependent upon the reindeer for support. Their implements of stone, ivory, bone, and horn, their rude pottery and their slight advancement in the art of delineation as evidenced by the rude figures of men, reindeer, horses, and other animals engraved upon the tusks of the elephant and horns of the reindeer found in the south of France, England, and Wales; their custom of depositing with the dead articles used by the deceased, such as hunting implements and articles which must have been used as charms or ornaments; in all these respects they are like the people inhabiting the reindeer regions of our day.

Sir Charles Lyell says of these discoveries:

If the fossil memorials of Auriquoe have been carefully interpreted; if we have here before us at the northern base of the Pyrenees a sepulchral vault with skeletons of human beings consigned by friends and relatives to their last resting-place; if we have also at the portal of the tomb the relics of funeral feasts and within it indications of viands destined for the use of the departed on their way to a land of spirits, while among the funeral gifts are weapons wherewith in other fields to chase the gigantic deer, the cave lion, the cave bear, and woolly rhinoceros, we have at last succeeded in tracing back the sacred rites of burial, and, more interesting still, a belief in a future state, to times long anterior to those of history and tradition.

With the reindeer people of our time, however, this same custom of placing articles in tombs seems to be due to a superstitious dread of everything belonging to the dead.

The love of personal adornment and the means used for gratifying it were much the same then as now, as shown by the bracelets and necklaces composed of strings of shells and of the teeth and claws of carnivorous animals found with their remains. Even their disregard for cleanliness, as shown by the accumulation of filth in the caves inhabited by them, bears out the resemblance. The clothing worn by the men of the reindeer epoch, we are told, was composed of deer-skin. The sinews of the deer were used for thread, and a piece of bone, pointed and per-

forated at one end, served them as a needle, just as now. Skulls and other bones of the reindeer have been found in the caves of that period still bearing the incisions made by some sharp instrument in taking the skin from the animal.

The shank bones are often found incised at the point where the tendon is cut at the present day, showing that it had been removed for some purpose; while needles and awls of bone are said to be by no means of rare occurrence.

Under the advance of a milder climate the glaciers gradually receded to the north, closely followed by the reindeer, then, as now, in search of the nutritious food which flourishes only in a cold climate, until it was no longer found in Middle Europe, and finally stopped in its retreat only when met by the shores of the Polar Ocean, and even then not until it had inhabited all the outlying islands. There it remains to the present day, furnishing all the necessaries of life to the human beings who inhabit its regions just as it did when the reindeer men represented the highest state of civilization extant, and by far the largest portion of the human race.

#### ARCTIC CURRENTS.

On account of the varied and extensive duties assigned to the *Corwin* and the limited time in which to perform them, a regular connected series of current-observations in Bering Strait was not taken, as it was hoped to do. It was my intention to return for that purpose, after dispatching the sledge party along the Siberian coast, early in June, but the rough treatment received by the vessel in the ice-pack, resulting in the loss of rudder, &c., necessitated a change of plans. It became necessary to seek a place of comparative safety with the vessel where the rudder might be repaired, and to intrust the current work to a boat's crew left for the purpose on the West Diomedé Island. Unfortunately the boat's crew accomplished nothing. Owing to boisterous weather the boat could not be launched. So much time was consumed in making the necessary repairs to the vessel, owing to the fact that the harbors were still frozen up and we were compelled to do the work at sea, that I did not feel justified in remaining longer in the vicinity of the straits, but pushed on to the northward as fast as the ice would permit; consequently we were limited in our current observations to such as could be made from time to time by noting the drift of the larger masses of ice by comparison of the ship's position as shown by dead reckoning and that shown by observation, and by noting the velocity and direction of the current when at anchor, and as we remained at anchor but little, the latter class of observations were seldom taken, and never in a sufficiently connected form to be of much value. Many of our observations were taken in the vicinity of the ice-pack, and as this pack, where found, occupies about one-third, and in many places one-half, of the entire depth of the shallow Arctic Sea, it exerts as much influence on the surface currents as a body of land of the same area; and as the pack, or that portion of it which we are able to observe, is constantly changing its position, not only from month to month in the same season, owing to the destruction of the ice by melting, difference of prevailing winds, &c., but also varies its position from season to season according to the amount of ice formed during the previous winter, it will readily be seen that the consequence is constant change in the force and direction of the current, and the result of one set of observations in the vicinity of the pack is but slight indication of what may be found by the next observer.

In addition to these constant changes in the vicinity of the ice-pack other difficulties are encountered in making observations on the currents while a vessel is cruising from place to place. Owing to almost constant fog it frequently occurs that several days pass without an observation for position. Then, if a difference is found to exist between the position by dead reckoning and that by observation, which can only be accounted for as a current, it is impossible to determine in what part of the ship's track the current was encountered, how much is due to tidal current, and how much to wind. There is yet another difficulty encountered by navigators in high latitudes which bears upon the subject, that of accurately determining the ship's position by observation even in clear weather. This difficulty arises from several causes. The great amount of refraction and consequent difficulty of obtaining a true horizon and the slow change in altitudes of the heavenly bodies, their change of position being almost entirely in azimuth, the apparent

daily evolution being a horizontal one. The imperfect action of the compass is also a prolific source of error in the ship's position. Owing to the obliquity in the direction of the magnetic current as we approach the magnetic pole of the earth, and its consequent decrease of horizontal attraction, the compass not only becomes sluggish in its action, but is very susceptible to local errors. Large errors are produced from small ones, and small errors result from local magnetic attractions which in lower latitudes would have no appreciable effect, the local magnetic attraction remaining the same, while the horizontal attraction of the terrestrial magnetism decreases as the cosine of the magnetic dip or vertical angle. The same causes interference with the accurate location of coast lines, and no doubt accounts for errors that are attributed to other causes.

When we consider the extent of these difficulties and the fact that they are almost constantly encountered, it will readily be seen that any theory based upon a few observations taken from time to time and in different parts of the Arctic Ocean rests upon slight grounds and is susceptible of grave error, and that, unless supported by evidence of a more definite character, it should be given but little weight, and in submitting the result of my observations they are subject to these explanations. Perfect accuracy is not claimed. They are, however, in the main correct, and, taken in connection with other facts to be presented, may be of some value.

On the 28th of May the *Corwin* anchored at Saint Lawrence Island and swung to a northerly current, which, however, slackened, and indeed entirely stopped a few hours later. This change was undoubtedly due to tidal action; although the wind was from the northward, being light, it would exert but little influence on the current.

On the 30th of the same month, being anchored at the West Diomedes, the ice was observed to be setting to the northward about 2 knots per hour, the wind blowing fresh southeast with snow-squalls.

During the night of June 3 the *Corwin*, while trying to get south through Bering Strait, was met by a large body of ice drifting through into the Arctic Ocean from Bering Sea which completely filled the strait. Being compelled to heave, until the next forenoon, the drift of the vessel was noted and found to be northwest, velocity about one-half a knot per hour, weather calm.

June 7, steaming from Saint Lawrence Bay to Saint Lawrence Island, in calm weather, a current set the vessel 30 miles in an east-northeast direction in twenty hours.

July 2, steaming from Bering Strait to Marcus Bay, time nineteen hours, the vessel was set to the northeast 18 miles. There was no wind at the time, but for several days previously a fresh north-northwest gale had been blowing. In passing through the strait near the Diomedes Islands at that time a strong current had been encountered, which had been the subject of remark on board, some estimating it as high as 3 knots per hour.

From 7 p. m., July 2, to 4 a. m., July 3, steaming from Marcus Bay towards Saint Michael's, Norton Sound, the current set the vessel east-northeast 30 miles.

On the afternoon of July 12 a short trip was made at Cape Prince of Wales. A strong northerly current necessitated frequent working of the engine to hold the vessel in position. Wind moderate and variable.

July 30, while made fast to the shore ice at the east end of Herald Island, the current was measured with the chip and line and found to be to the northward 1 knot per hour. There was no appreciable change in the velocity or direction of the current during the time the *Corwin* remained at the island—from 9.45 p. m. until 3 a. m. The ice was setting steadily northward during that time.

At Cape Wankarem, latitude  $68^{\circ} 05'$ , longitude  $176^{\circ} 30'$ , a tidal current was observed with a rise and fall at that time of about 2 feet, the flood setting along the coast to the northward.

On the 4th of August, while cruising in the strait south of Wrangel Island, our observations showed a west-northwest set of 12 miles, the wind light and variable.

On the 4th and 5th of August the ship's position was determined by observation, showing a current of 1 knot per hour north-northwest; wind moderate, from east to southeast.

On the 10th of August, while at anchor off the south coast of Wrangel Island, near the edge of the ice-pack, the current was observed to be setting in a northeasterly direction, from one-quarter to one-half a knot per hour.

On the following day, when about 8 miles off the southeast end of Wrangel Island, the current was measured with a chip and line, and found to be about three-quarters of a knot per hour in a northeasterly direction (the direction of the coast-line). During the night the ice continued to drift to the northward, the lead in which the Corwin was at anchor changing its position about 8 miles. On the following morning (August 12), while at anchor near the shore off the east end of Wrangel Island, the current was observed to be north  $1\frac{1}{4}$  knots per hour. The wind during the 11th and 12th was moderate from west to southwest.

August 13, the vessel's position was determined by observations, and the reckoning brought forward showed a north-northeast current of 1 mile per hour for the twenty-four hours.

At midnight, August 16, stopping at Point Belcher, the current was found to be setting along the coast to the northward about 1 mile per hour. The same current was observed a few hours later near Point Barrow. The wind during the day was light and variable.

August 17, measured the velocity of the current while at anchor at Point Barrow, and found it to be  $1\frac{3}{4}$  miles per hour, following the direction of the land to the northeast. During our stay at Point Barrow the wind was light and variable, so that it would have but little effect upon the current.

August 18, got under way from Point Barrow, and steamed to the southward, with a strong head current, which was no doubt accelerated by a fresh southwest wind. At 7 a. m. the following day at Point Belcher found the current setting to the northeast along the land, but very much decreased in velocity; the wind light southerly.

From noon August 19 to noon August 20, steaming to the southward between Icy Cape and Point Hope, the vessel was set to the northward 30 miles.

From 5 p. m. August 20 until meridian of the 21st the current was found to have set 12 miles north by east one-half east.

From 4 p. m. August 22 until meridian August 24, in Bering Strait and Sea between the Diomed Islands and Plover Bay, the current set 75 miles to the northward, the wind blowing a fresh gale from south and southeast. Three days later, in returning over this track with a moderate northerly wind, no current was encountered.

In September the result of our observations in Kotzebue Sound showed a tidal current with a rise and fall of about 3 feet.

The great currents of the Arctic regions, so far as known, may be briefly described as follows:

First. An easterly current through the cluster of islands lying to the northward of the American continent. This current is best shown by the drift of the English exploring vessel, the *Resolute*. After being abandoned by her people in Melville Sound she drifted with the currents through Barrow Strait, Lancaster Sound, and Baffin Bay into Davis Strait, a distance of about 1,200 miles.

Second. A southerly current between Grinnell Land and the west coast of Greenland. This current has been often remarked by navigators, but is best shown by the *Polaris* while beset in Smith's Sound, and the remarkable drift of a part of her crew on the ice-floe through Smith's Sound and Kennedy's Channel to the coast of Labrador.

Third. A southerly current between the east coast of Greenland and Spitzbergen. The strong southerly set met by Parry in those seas in his attempt to get north from Spitzbergen by means of boat and sled will be remembered by all readers of the account of that heroic but futile undertaking.

Fourth. Still farther to the eastward, between Spitzbergen and coast of Norway, a branch of the Atlantic equatorial current, so much modified, both in temperature and velocity, as to be almost unrecognizable, passes to the northward and loses itself in the icy regions.

Fifth. The current through Bering Strait and in that part of the Arctic Ocean lying to the northward. The existence of this current has been questioned by the Hon. Clements Markham, in a paper read before the Royal Geographical Society of London; and in support of this belief the incidental mention of the currents contained in the report from the relief steamer *Rodgers* is quoted. These reports are said to show no northerly current in the vicinity of Wrangel Island, but a regular tidal current, with a rise and fall of 5 feet. The *New York Herald* correspondent with the *Rodgers*, however, says it was surprising to see the ice moving constantly along the

shore (on the south coast of Wrangel Island). This is not only inconsistent with the theory that the Rodgers found no current other than a tidal one, but it agrees with the result of the Corwin's observations. On the south coast of Wrangel Island she found a westerly current, and on the east coast a northerly current. A glance at the chart will show that a northerly current through Bering Strait, if unobstructed by ice, would have precisely the directions indicated along the south and east coasts of Wrangel Island. As already stated, however, all currents are subject to change in the vicinity of the ice pack.

The discovery of a tidal current in Bering Strait and the Arctic Ocean is not new, it having been known to exist and been reported by several navigators. The boat expedition under Commander Pullen, R. N., along the north coast of Alaska, in 1849, found 18 inches rise and fall at Point Barrow and the same at the mouth of the Mackenzie. Richardson speaks of the ebb and flow of the tide east of the Mackenzie. The Corwin found 2 feet rise and fall at Wankerem and 3 feet in Kotzebue Sound. Parry found a tidal current in Melville with the flood tide setting to the southward. W. H. Dall, United States Coast Survey, found a tidal current in Bering Strait in 1880 with the flood tide, which was the stronger, setting to the northward.

Theoretically, the rise and fall of the tide should decrease as we approach the poles of the earth, but in reality, owing to the interruptions of coast lines, &c., this rule is far from holding good. The average rise and fall in Norton Sound, just south of Bering Strait, is about 2 feet; a few degrees of latitude farther south, at Nouchagak, it is nearly 30 feet; and still farther south at Ounalaska, it is not over 6 feet. Thus, although the tides are caused by lunar and solar attraction, the amount depends not so much upon these as upon local causes, coast lines, &c., and the excessive amount of rise and fall discovered by the Rodgers on the south side of Wrangel Island must be due to the ice-pack, and can hardly be regarded as representing the normal characteristics of the tide at that place. One theory advanced in relation to the Bering Strait current is that it is caused by the rivers emptying into Bering Sea and Norton Sound. The effect of the rivers in Kotzebue Sound was remarked by Captain Beechey, R. N., who, in speaking of a current encountered between Point Hope and Kotzebue Sound, says:

It varied from  $1\frac{1}{2}$  to 3 miles per hour and was strongest inshore. It was very constant, and the water was much fresher than the ordinary sea water.

He adds:

It is necessary here to give some further particulars of this current, in order that it may not be supposed that the whole body of water between the two continents was setting into the Polar Sea at so considerable a rate. By sinking the patent log first 5 fathoms and then 3 fathoms, and allowing it to remain in the first instance six hours and in the latter twelve hours, it was clearly ascertained that there was no current at either of those depths. But at the distance of 9 feet from the surface the motion of the water was nearly equal to that at the top. Hence, we must conclude that the current was superficial and confined to a depth of between 9 and 12 feet. By the freshness of water alongside, Captain Beechey believed the current was occasioned by the many rivers which at this time of the year empty themselves into the sea at different parts of the coast at Schischmareff Inlet.

He further says:

So far there is nothing extraordinary in the fact, but why this body of water should continually press to the northward in preference to taking any other direction or gradually expending itself in the sea is a question of considerable interest.

The remark applies with equal force to such rivers in Kotzebue Sound as pass through Bering Strait, while the decreased specific gravity of the river water, due to its higher temperature and freedom from salt, would prevent its readily mingling with the surrounding salt water. The fact of its flowing northward through Bering Strait, notwithstanding the course of the current is broken by shoals, sand bars, capes, islands, &c., is not so readily explained except upon the theory of the surrounding current having the same direction.

As evidence of the existence of a current northward through Bering Strait, we have first the remarkable drift of the Jeannette. This vessel entered the ice near where the observations of the Rodgers are said to have upset all existing theories in relation to Arctic currents, yet notwithstanding the enormous friction of the ice, at points of contact, to be overcome, and in the face of adverse winds, which many times set her back to the south and eastward during the twenty months she was helplessly embayed in the ice, as a resultant of all currents she made a drift of 500 miles

in a northwesterly direction. Unlike the drift of the *Resolute* through Barrow Strait and Lancaster Sound, or the *Polaris* party in Smith's Sound and Baffin Bay, the *Jeannette* drifted in the open sea, where she was subject in a much greater degree to the varying influence of the wind, and where the strength of the current would naturally be less than if confined within the narrow limits of a strait or sound.

Then we have the formation of shoals on the north side of all points on the American coast from Bering Strait to Point Barrow. Beginning at Cape Prince of Wales, we find that although the water to the southward shoals gradually to the shore, the detached shoal lies wholly to the northward of the cape.

At Point Hope we find the detached shoal, with  $4\frac{1}{2}$  of water on it, lying entirely to the northward of the point. The same is true at Cape Lisburne; a shoal with 5 fathoms of water lies wholly to the northward of the cape. The Blossom Shoals, off Icy Cape, are also to the northward. These differ from the other shoals along this coast in that there are several of them lying parallel with each other and with the coast line, with deep water between them and inshore of them.

At Point Barrow the detached shoal lies entirely to the northward, although shoal water exists along the shore to the southward. The drift of the Bering Sea ice through the straits into the Arctic Ocean each year, and the fact that the southern limit of the Arctic pack retreats to the northward with well-closed edges during the summer until brought south again by the fall gales, cannot but be regarded as another evidence of the northerly direction of the current; also the fact that of all the whale ships lost north of Bering Strait but one has been found south of where wrecked.

The discovery near Herald Island of part of a vessel burned south of Bering Strait must also be regarded as evidence pointing in the same direction. We have also the testimony of the whalers, the only men who navigate these seas regularly, not one of whom, so far as I can learn, doubts the existence of this current. Then comes the testimony of the natives living on the shores of Bering Strait to the same effect. But in all this evidence there is nothing inconsistent with a regular tidal current in Bering Strait.

In Smith's Sound, near where the men from the *Polaris* commenced their remarkable ice-drift, Dr. Bessels observed a tidal current, and determined its characteristics. In Melville Sound, where the *Resolute* commenced her drift of over 1,200 miles, Parry found a regular tidal current, with the flood setting to the eastward.

In the case of the wrecked whaling bark *Vigilant*, it has been claimed that, although beset near Herald Island, the *Vigilant* had drifted down to, and been seen by the natives on, the coast of Asia. From the information gained by the *Corwin* at Cape Waukerem, there seems little doubt that the wreck boarded by the inhabitants of that place about October, 1880, was the *Vigilant*. The last seen of that vessel previous to the discovery of the wreck was on October 10, 1879. At that time she was cruising in company with the bark *Mount Wollaston*, between Herald Shoal and Herald Island, in an opening between the northern and western ice-packs, with a large body of heavy ice to the southward, stretching almost entirely across the Arctic Basin. Of this large body of ice to the southward, a few words of explanation are necessary, as to this may be attributed the loss of the two vessels in question. By the accounts of masters of other vessels we learn that this body of ice extended from the Asiatic shore to near Point Hope, and northward nearly to Herald Shoal, leaving a passage but a few miles in width between it and a point of ice from the northern pack which extended down in that direction. In what are called "icy seasons," this filling in of the sea is no unusual occurrence. The loose ice along the edge of the pack is driven down by the northeast wind, following the western ice until it strikes the coast of Asia, and is deflected to the eastward until coming into the influence of the Bering Strait current its eastern limit is carried to the northward not far from the American coast. In leaving the Arctic Ocean in the fall it is not unusual for the whalers to be compelled to pass inside of the shoal off Point Hope to keep clear of this ice; many of them make it a rule to sight Point Hope before steering a course for the straits, to avoid coming in contact with these fields in case of thick weather.

While steering a course from the vicinity of Herald Island to the coast of Asia in August, 1880, the *Corwin* encountered ice in latitude  $68^{\circ} 10'$ , and working to the eastward near the sixty-

eighth parallel, through very heavy drift-ice, she went to within 30 miles of Point Hope before clearing its eastern edge. I estimate the extent of the body of ice through which we passed to be 150 miles north and south and 200 miles east and west; and, although we picked our way through it with a steamer, a sailing vessel would not have been able to do so even at that time, and there can be no doubt that this field becomes larger and more solidly packed as the season advances, until it again attaches itself to the main pack, and is formed into a solid mass by the new ice.

When the missing vessels were last seen (October 10) they were steering in a northerly direction in search of whales. We now know that they could not have gone north of Herald Island, as the *Jeannette* was at that time fast in the solid pack which surrounded and extended southward of that island. It is probable, therefore, that they continued to cruise in the vicinity of this pack until warned by the increasing formation of new ice that it was time to seek a milder climate. This did not occur until about October 18, according to Captain Bauldy, of the *Helen Mar*, the last person who saw the missing vessels.

During the night of October 18, the *Helen Mar* and *Mercury* being becalmed, anchored in company near Herald Shoal, and on the following morning were surrounded by newly-formed ice, which continued to increase in thickness until all hope of being again liberated that season was lost. In this extremity they united their forces on board the best vessel (the *Helen Mar*), and taking from the *Mercury* what provisions could be moved, as well as a quantity of blubber, which could be used either as food or fuel, they prepared for the worst. A few days later a northerly gale broke up the ice, and by hard carrying sail the *Helen Mar* forced her way through it, and, passing between the northern pack and the heavy field ice to the south, reached clear water off Point Hope, and passed through Bering Strait, which was almost blocked with ice, about November 1. It is probable that the *Mount Wollaston* and *Vigilant* had, with the exception of the final escape, a similar experience. Finding themselves frozen in they decided to take their chances together, and for some reason the *Vigilant* appears to have been the vessel selected upon which to trust their fortunes. Supposing, then, the *Vigilant*, with both crews on board, had been frozen in at the same time as were the *Helen Mar* and *Mercury*, and liberated by the same gale which broke the ice and enabled the former of these to escape (October 24), being farther north, and progress being naturally slow through the broken ice, the *Vigilant* would have reached the place where the passage had existed between the point of the northern pack and the field of ice filling the center of the sea several days after the *Helen Mar* had passed through and escaped. Strong southerly winds followed the northerly gale, which assisted the *Helen Mar* in forcing her way out, and the effect of this would be to set this body of ice to the northward, against the northern pack, thus cutting off all egress by the way of the eastern part of the sea, while to the west and southwest the sea was free from old ice for some distance. Finding escape by the usual route cut off, the *Vigilant* would undoubtedly follow the western edge of this central field southward in the hope of finding a passage through or around its southern limit, or, failing in this, to reach the coast of Siberia, where they might find safe winter quarters.

According to native reports along the coast of Siberia north of Bering Strait heavy ice extended so far off shore at that time that no open water could be seen.

From the whalers who left the Arctic late in the season we learn that this large field of ice extended to Bering Strait, filling the west side, and resting on the shore from Cape Serdze to East Cape, thus rendering it impossible either to escape by the way of the strait or to reach the Siberian coast, and the result must be that the vessel would be near the southern limit of this open water, which would close up with the first northerly wind. The season of 1880 was not an open one in the western part of the Arctic Basin, and it is probable that the wreck remained frozen in to the westward of the limits of navigation until late in the season, when it was liberated and driven in upon the coast by the northeast gales which prevailed at that time. As before stated, the belief that the *Vigilant* was sailed south, and did not drift there, is confirmed by the drift of the *Jeannette*, which vessel was caught in the ice within a few miles of where the whalers were last seen, and was actually beset in the pack in sight of Herald Island at that time, and setting out upon her most remarkable drift to the northwest. Had the *Vigilant* become permanently beset near where last seen she would have been subject to the same current as was the *Jeannette*, and would have gone in the same instead of an opposite direction.

In a paper read before the Geographical Society of the Pacific, soon after my return from the Arctic Ocean in 1881, I stated my belief in a tidal current in Bering Sea and the Arctic Ocean, and also that a branch of the Kuro Siwo, or Japanese Warm Stream (so called), passes through Bering Strait; both, however, subject to the ever varying condition of wind and ice. Having shown in the preceding pages the grounds upon which I based my opinion, I will now explain the meaning of the term "Japanese Warm Stream" in the sense in which I used it. In this I cannot do better than quote from Thalassa an essay on the depth, temperature, and currents of the ocean by John James Wild, a member of the civilian scientific staff of the Challenger:

A branch of the North Pacific equatorial current flows into the basin between the Philippine and Ladrone Islands, which basin, like the Caribbean Sea, is separated from the ocean by a chain of islands, the projecting points of a submarine ridge, and the northern and narrow half of this basin stands in the same relation to the southern half as the Mexican Gulf to the Caribbean Sea. The current, after passing along the east coast of the Philippines, of Formosa, and the islands which connect the latter with Japan, has to force its way, and, like the Gulf Stream, in the face of a polar current over the shallow barrier which joins Japan with the chain of islands terminating with the Ladrone group. After crossing this barrier it unites itself to the portion of the North Pacific equatorial current, which flows along the eastern side of these islands, and the two combined form the Kuro Siwo, whose waters are traced through Bering Strait into the Arctic Basin, and to the eastward so far as the coast of North America.

The Kuro Siwo, thus defined, may be compared for the purpose of illustration to the Gulf Stream of the Atlantic, and each may be described in a few words as a small portion of the great equatorial current cut off for a time from the main body by intervening islands, and uniting with it again as soon as the obstructions will permit, when it loses its own identity in the greater current. In applying this name to the origin of the current which my observations lead me to believe passes through Bering Strait I referred not to the small stream separated from the main body of the equatorial current by the Japan islands, and which flows northward as a separate stream only so long as it is separated by these islands, but to the western edge of the great equatorial current which makes the circuit of the North Pacific, and to which the name of the smaller stream has been applied. The impossibility of this small stream maintaining a separate existence from the Japan islands to Bering Strait must be apparent when we consider the fact that it emerges from the islands, by which it has been separated from the main current, with a depth of only about 100 fathoms, and average temperature of  $84^{\circ}$ , and a velocity of about 75 miles per day. Beneath this shallow stream of warm water the temperature of the sea rapidly falls to within a few degrees of the freezing point. By the application of the known principle that two strata of different temperatures cannot remain in contact without producing a third stratum of intermediate temperature we see that the high temperature of this comparatively small stream would soon be reduced by contact with the lower temperature of the under current, and its velocity would become less in direct proportion to the distance traveled, gradually accommodating itself in these particulars to the other and larger currents with which it would come in contact.

Bodies of sea water of the same specific gravity when brought in contact mingle and become as one. The specific gravity of sea water depends upon the temperature and the amount of saline matter held in solution, and these conditions, to a certain extent, depend one upon the other, the higher the temperature the greater the percentage of salt, owing to the greater evaporation. The Kuro Siwo, being a part of the equatorial current, contains the same percentage of salt, but, owing to its accelerated velocity, retains a greater amount of heat. This, however, as already shown, is soon reduced to that of the surrounding water, and as its percentage of salt is the same the reduction of its temperature increases its specific gravity until it corresponds to the surrounding sea and becomes in all respects a part of it.

The effects of wind upon the surface currents of the ocean are well understood. To them are due the equatorial currents of both oceans, while ocean currents would occur if uninfluenced by winds, in the constant efforts which are made by the sea to maintain its equilibrium, in spite of disturbances due to difference of temperature and the consequent difference in evaporation. These currents would necessarily be slight and nearly in the direction of the meridian on account of the relative positions of the disturbing elements, heat and cold, and not at right angles to the meridian, as is the case with the equatorial currents of both the Atlantic and Pacific Oceans.

These currents, caused by the trade winds, run in a westerly direction until turned in the direction of the meridian by contact with the eastern coasts of the great continents. In the case of the Atlantic current the new direction is to the northward, owing to the direction of the coast line upon which it impinges, while the Pacific current is divided, one portion going southward and one northward, the latter being the current now under consideration, a small portion of which I believe passes through Bering Strait, but in a modified form, both as to velocity and temperature.

Referring again to the causes of the difference in the specific gravity of sea water in different parts of the ocean, the temperature and percentage of salt, we find that the former decreases and the latter increases it; and, as in the case of two strata of different specific gravity coming in contact, the stratum having the greater would, in obedience to the laws of gravitation, sink below the other, it will be seen that an equatorial current can exist as a surface current only so long as its temperature is sufficiently high to render it lighter than the adjoining stratum. As it comes in contact with the colder waters in its passage its temperature falls and it sinks below the waters of the higher latitudes, which, on account of decreased evaporation and the larger amount of fresh water discharged into it from streams of melted snow and ice, contains much less salt, after which it may continue its course as an under current until neutralized by the surrounding water; or, as in the case of a water like Bering Sea, the result of a contact between two currents must be the creation of a single current, whose direction will be that of the stronger of the originals, and whose velocity, temperature, and specific gravity will be their mean.

A branch of the Kuro Siwo, thus modified, would have a temperature but little above the normal temperature for that latitude. Its velocity would also be so much reduced that it would be readily influenced by winds, retarded or wholly stopped by northerly winds, and accelerated by winds from the south, and also subject to modification by the ever-changing position of the ice-pack.

#### ARCTIC ICE NOTES.

The great impenetrable mass of ice which, so far as has been observed by man, surrounds the polar regions, is called the "pack." The loose ice or detached pieces which float near the edge of the pack, and, under certain conditions of wind and current, become a part of it, is called "drift-ice," and is designated "patch," "floe," or "field," according to its magnitude, ranging from the smallest pieces to several miles in extent. Icebergs are formed from glaciers, and although found floating on the sea are entirely foreign to it. The glacier, being formed on land above the sea level, descends, in obedience to the laws of gravitation, until it meets the sea, where large pieces called "bergs" are detached. The large, high floes of sea ice, which in size resemble the smaller bergs, were appropriately named "floebergs" by Captain Fielding, of the Royal Navy, a member of the Nares Expedition.

Sea ice forms at a temperature of  $28^{\circ}.5$  F., and at first retains a portion of the salt and other impurities. When its temperature is low sea ice is brittle, but under a higher temperature it becomes tough and flexible. Successive changes of its condition in this respect eliminate the salt, so that in time it becomes pure, and resembles glacier ice. At times it is difficult to distinguish one from the other. Sea ice, when first formed, is opaque, and is white or grayish in color, according to the condition of the water. If near the shore, or in shallow water, the latter color prevails. As the process of purifying itself goes on it becomes green, and later (when the salt and other impurities are almost entirely eliminated) it shows a clear deep blue. It is no unusual thing to see these different colors in the same floeberg, caused by the action of the currents pressing layers of ice of different ages one over the other. As these colors are bright and distinct the effects in the clear sunlight are often very beautiful. There are also occasional small yellow patches on the surface of the ice, due to the presence of microscopic animalcula. The thickness of the ice in the Polar Sea is variously estimated. The specific gravity of sea ice is less than .9, and if the floebergs were regular in form, by measuring the height above water, the depth might be ascertained by a simple calculation. But the irregularities of their form render this impossible; consequently these estimates vary greatly. Dr. Hayes mentions seeing ice 100 feet thick in Smith's Sound. Scoresby speaks of ice in the vicinity of Spitzbergen 20 feet in thickness. Parry, when

he saw the Polar Ocean at the western entrance to Melville Sound, speaks of ice found to be 42 feet in depth, and expresses astonishment at its enormous thickness. McClure saw ice off the Mackenzie River and on the west coast of Banks Land drawing from 40 to 50 feet of water, and sometimes even 70 to 80 feet. At one time he saw hummocks 90 feet high. Dr. Kane saw ice 60 feet high. Wrangel encountered hummocks 90 feet high off the north coast of Asia. Captain Nares, R. N., estimates the thickness of the main pack to be upwards of 80 or 100 feet. A floeberg stranded and turned on its edge near the winter quarters of the Alert was measured by Nares and found to be 120 feet long, 105 feet broad, and 80 feet in depth. This floeberg, which is described as by no means the largest in the vicinity, was shown by calculation to weigh about 25,000 tons. The greatest thickness attained by direct freezing is about 18 feet, at which thickness the increase by freezing at the bottom does not exceed the waste at the top by evaporation, which goes on slowly but surely at all times. The maximum thickness by direct freezing is generally reached the third winter. It is seldom that more than 9 feet forms during one winter. The extraordinary thickness attained by the pack is due to accumulations of these naturally formed layers, as they are forced one over the other by pressure due to currents of air and water. On account of the difficulties of ascertaining the thickness of the ice by measurement, the most reliable way appears to be by noting the depth of water at which it touches the bottom. This we found at Herald Island, Wrangel Island, and on the coast of Asia near Cape North, to be about 10 fathoms. In Bering Sea we made fast to ice grounded in 6 fathoms, and passed a number of detached pieces grounded in 8 fathoms.

Field-ice, when not broken and piled up by the force to which it is subject, constantly grows smoother on the surface. The hummocks are reduced by melting during the summer, and the water thus formed partly fills the hollows. In winter the hollows are further filled by snow, so that in time the surface becomes comparatively smooth.

The lanes of water separating these floes or fields, and which at times penetrate, to a limited extent, the pack itself, are called "leads" and "water-holes." Places where leads and water-holes are numerous are called by the Russians "polynia." Land ice is that which adheres to the coast. This, when broken and thrown up by the action of the sea, is called "ice-foot." The ice-pack is seldom, if ever, seen from the mast-head more than 12 miles, and from the deck not more than 7 miles.

Light reflected from the ice to the clouds above is called "ice-blink." The blink may often be seen at a distance of 30 or 40 miles, and by it the nature of the ice, whether pack or drift, may generally be determined. The blink, over drift ice, shows dark lines, while over the solid pack it presents a uniform yellowish color to the horizon. This rule, however, is not invariable. The vapors arising from a small lead or water-hole in the pack will sometimes change the entire appearance of the blink and give the impression that a large body of open water exists. It is not impossible that many of the reported discoveries of open polar seas may be accounted for in this way. It should always be borne in mind that the pack can be seen but a short distance—12 miles at best—and that, under certain conditions, no blink is shown, and that when looking across ice for clear water beyond, or indications of it, a lead may produce as perfect a water-sky, or one in which there is an entire absence of ice-blink, as an open sea. This was frequently observed by Mr. Nelson during his sojourn at Saint Michael's, Norton Sound. In the winter-time, from an unbroken ice-blink, a few hours' southerly wind would produce a perfect water-sky and horizon, with no indication of ice beyond. Of course the only effect of this southerly wind on the ice would be to open leads or water-holes of limited extent, which the first change of wind would close again.

The dark shadow over open leads of water is at times so perfect in outline as to be taken for land. An instance of this came under my observation during my cruise in the Arctic Ocean in 1880. Near Point Barrow the pack was in sight from the deck, probably 4 miles away, when land was reported bearing northwest. The appearance was so perfect that, had it not been for the fact that this part of the sea had many times been sailed over, I should have believed that I was actually looking upon land. Captain Nares attributes to this cause the erroneous report of the existence of land to the north of Robeson Channel by the *Polaris* Expedition, and states that

it was only by most carefully noting the movements of the darkened patches that he was enabled to say positively that the reported land did not exist.

In regard to the purification of sea-water by freezing, Dr. Kane says that the cold, if intense enough, will, by its unaided action, independent of all other considerations, produce from salt water a fresh, pure, and drinkable element, but that ice formed in this way, when exposed to a high temperature, becomes infiltrated with saline matter by forces allied to endosmosis. He discovered that the floes which formed in midwinter at a temperature of  $30^{\circ}$  were still fresh and pure, while the floes of slower growth or those formed early and late in the season when the temperature was higher were distinctly saline. Ice which two months before he had eaten with pleasure was soon so salt that the very snow which covered it was no longer drinkable. Ice formed with the temperature  $20^{\circ}$  or  $30^{\circ}$  below zero was of almost flinty hardness, and when tested with nitrate of silver gave no trace of salt. Sir Charles Lyell states that sea-water ice is fresh, having lost its salt by the decomposing process of freezing. Dr. Sutherland, in his "Journal of Parry's Voyage," says that sea-water ice is salt, containing about one quarter part of the salt of the original water, the proportion depending upon the temperature. It is very probable that the lower the temperature the more salt the ice will contain. Parry himself, in his account of his attempt to reach the North Pole by boats, says: "I was desirous, also, of ascertaining whether any part of the real sea-ice was so entirely fresh when melted as to be drank without injury or inconvenience. For this purpose," he says, "we cut a block of ice from a large hummock about 10 feet high above the sea, and having broken, pounded, and melted it without any previous washing, we found it, both by the hydrometer and the chemical tests—nitrate of silver—more free from salt than any which we had in our tanks and which was procured from Hammerfest." He considered this satisfactory, because in the autumn the pools of water met with upon the ice generally become very brackish, in consequence of the sea-water being drawn up into them by capillary action, as the ice becomes more rotted and porous; and he might, therefore, have to depend chiefly upon melted snow for their daily supply. During the two cruises of the *Corwin* in the Arctic seas, I tried the sea-ice many times, and to the taste (we had no means of applying delicate chemical tests) the clear blue ice, although taken from below the surface of the sea, appeared perfectly fresh. The ice melted, and, standing in pools on the surface of the floes, was also found to be fresh in most instances, and we several times filled our water-tanks from them with good drinkable water. Experiments have shown that successive freezing and thawing of sea-water tends to reduce the percentage of impurities which it contains; but I am not aware of these having been carried far enough to render it absolutely pure. After several attempts on board the *Fox*, the specific gravity of sea-water was reduced, by repeated freezing and thawing, to five ten thousandths (.0005). Wrangel says the salt left by evaporation on the surface of the ice is mixed with the snow that falls upon it, and is eaten as salt with food, though bitter and aperient. Dr. Walker, who accompanied McClintock in the *Fox*, and who made a careful and systematic set of ice observations in Baffin's Bay and Davis Strait during the winter of 1857-'58, noticed the saltiness of the crystals on the ice, but shows that it could not be due to evaporation, as supposed by Wrangel. Evaporation is less in proportion to the cold, while the amount of salt crystals increase in the same proportion. Dr. Walker says when the temperature of the water and air fall below  $28^{\circ}.3$ , sea-water exposed will in a short time be covered with a thin and almost pellucid pellicle of ice of a very plastic nature, allowing of a great amount of bending, curling, and such like accommodations to external circumstances. In proportion to the increased temperature this covering becomes thicker, and presents a vertically striated appearance, identical with that of sal-ammoniac, gradually disappearing as the mass thickens and gets more compact; still, the lowest portion or that most recently formed, always presents this aspect. When this pellicle or covering becomes of the thickness of a quarter of an inch or more, small white crystals appear on the surface, at first sparse and widely separated, but gradually forming into tufts and ultimately covering the whole surface. Mr. Nelson, in his general notes on the climate and meteorology of Saint Michael's, says of the formation of ice:

Sludge ice forms in the bays with the temperature at  $30^{\circ}.5$  F., and in addition the whole surface of the sea, if calm, appears covered with large oily-looking patches, which slowly increase in area, and as the water reaches  $30^{\circ}$  the sludge begins to unite. In the oily-appearing spots the water, on close view, has a milky shade, and is seen to be full of extremely fragile laminæ of ice, floating with their edges vertical. These plates, when broken and ground up,

form the sludge along the shore. Many of the plates are an inch or more in diameter, but so fragile that a breath destroys them. The bays are sometimes covered with a foot of this sludge, under which the swell or roll of the sea travels 3 or 4 miles, but a fall in the temperature over night consolidates the mass. Ice formed in this way is generally rough, but a rapid and extended fall of the temperature directly after the oily spots appear sometimes throws a thin sheet of glossy ice over the sea for many miles in a single day.

Arctic ice may be divided into two classes, the first comprising that found in the Polar Ocean, or palæocrystic sea of Nares, and the second, the ice found within the channels, sounds, and bays of the Arctic Archipelago. The latter seldom exceeds the thickness attained by direct freezing—18 feet. It is generally much less, and may be classed as navigable, although its navigation is difficult and often attended with great danger, while the former, as has been shown, attains a much greater thickness—estimated at from 20 to 100 feet, and, according to the best Arctic authorities, is not navigable. “When once fairly beset by the great polar pack,” says Lieutenant Payer, of the Austrian Expedition, “they are in fact no longer discoverers but passengers against their will on the ice.”

Captain Nares, who has the honor of having sailed his ship nearer to the North Pole than any other explorer, after describing a narrow escape of the *Alert* from the pack, says:

After our late escape, all could appreciate Captain Buddington's recommendation, when the *Polaris* was placed in precisely similar circumstances, to get out of the polar pack as quickly as possible.

Captain Nares further says:

It is either affectation or want of knowledge that can lead any one seriously to recommend any attempt being made to navigate through such ice. No ship has been built which could stand a real nip between two pieces of heavy ice.

Referring to the report of open water having been seen towards the north from the deck of the *Polaris* when she attained her highest latitude, Nares says:

It is perfectly evident that the report meant merely that disconnected water pools were observed, but not that a water channel fit for navigation existed. In Lancaster Sound or Baffin's Bay a water pool in the pack may, under favorable circumstances, be expected to open out and become navigable; here, with this decided polar pack, it is out of the question that any commander should leave the shelter of the land and force his way into the pack without insuring a retreat if necessary.

An admiring friend of Captain McClure, of the Royal Navy, in describing that officer's discovery of the Northwest Passage, says: “He was last seen, after passing through Bering Strait, carrying a hard press of canvas on the *Investigator*, and standing gallantly for the heart of the polar pack.” McClure's own account of it, however, shows that he did nothing of the kind. He carefully avoided the polar pack, fully realizing that his only hope lay in keeping in the land water. At one time, when near the Pelly Islands, the appearance of clear water to the eastward and a slight roll of the sea induced Captain McClure to steer a course for Banks Land. After running some hours with a fresh westerly breeze and thick, snowy weather, the discovery was made that the *Investigator* had run into a blind lead in the main pack for a distance of 90 miles, and was compelled to beat out. In his private journal Captain McClure refers to this as “an escape which all were truly grateful for, there being no two opinions on the ship as to what would have been her fate had the ice closed upon the *Investigator*.”

When the enormous thickness of this ice is considered it does not appear necessary to produce evidence to show that it is not navigable. If any were needed, however, we have, in addition to that already quoted, the well-known experience of the *Jeannette* and the *Teghetoff*, which should be sufficient to convince the most enthusiastic Arctic theorist that a ship once fairly beset is no longer an explorer.

The earliest date on which I find any reference to the ice in the Arctic Ocean north of Bering Strait and the coast of Asia is in the year 1610, when a party of Russian fur hunters descended the Yenisei River in boats, with the view of penetrating the coast of the Polar Sea for the purpose of levying tribute upon the native tribes. But their plans were frustrated by encountering ice. In 1646 Cossack fur hunters made expeditions along the coast to the eastward from the Kolyma, and reported the sea filled with ice, with a warm lead of open water next the land, in which the explorers sailed two days. The following year an expedition sailed from the Kolyma for the purpose of searching for the mouth of the Anadyr, which the Russians supposed emptied into the Arctic

Ocean. This voyage was said to be unsuccessful on account of the sea being filled with heavy ice. A year later (1648) the experiment was repeated, and with success. A part of the expedition, under command of Dashuoff, actually passed through what is now known as Bering Strait and reached their destination, where they established a trading post. No mention is made of any obstruction by ice. In 1650 a party of hunters and traders sailed from the Indigirka and cruised to the eastward as far as the Kroma, but were there beset by ice and drifted out to sea, where their vessel was crushed, and the crew escaped over the ice to the land. The early history of that country shows that a regular and quite extensive communication by water was carried on between the Lena and Kolyma through open channels near the land, and always with the pack in the offing. Many attempts were made to reach the New Siberian Islands by water, but failed; although we are informed that in 1667 a party of explorers were driven on these islands by wind and their boats destroyed.\*

In 1740 an expedition from the Yenisei, after being prevented by ice for two years from leaving that river, succeeded in reaching a place on the west coast of the Taimyr Peninsula, in latitude  $75^{\circ} 15'$ , through comparatively open water; but at that point met with impenetrable ice, and turned back. Five years before (1735) two expeditions sailed from the Lena to explore the coast in each direction. The expedition bound to the westward did not get out of the mouth of the Lena until August, and even then did not succeed in making but a short distance on account of ice. After wintering in the Aleusk River it was again liberated in August, and proceeded along the coast to the northward with the pack in sight to seaward. On the 31st of August, in latitude  $77^{\circ} 29'$ , it was stopped by impenetrable ice, and, after much difficulty and many narrow escapes, turned back. The expedition to the eastward, after proceeding along the coast about 80 miles, was stopped by ice, and during the winter nearly the whole party died of scurvy. The following year this expedition, newly manned, penetrated as far as Cape Great Baranoff, where it was again stopped by ice, and returned to the Kolyma.

In August, 1739, Cheluyskin found the sea at Cape Thaddeus, on the Taimyr Peninsula, latitude  $76^{\circ} 47'$ , entirely covered with unbroken ice, and the following year Lapter lost his vessel in the ice on the east coast of the Taimyr.

In August, 1778, Cook encountered the pack in the vicinity of Icy Cape, latitude  $70^{\circ} 41'$  north, and only succeeded in getting 3 miles farther north that season. To the westward he found the pack near Cape North. In the following year Captain Clerke, who succeeded to the command after the death of Captain Cook, found the pack-ice in latitude  $69^{\circ} 30'$  in July, and later in the season as far north as  $70^{\circ} 30'$ . April 26, 1794, Vancouver found drift ice in latitude  $59^{\circ} 30'$ , Cook's Inlet being blocked with it. In 1817 Kotzebue found drift ice in  $65^{\circ}$  north latitude. Saint Lawrence Island was surrounded by ice at that time.

In 1820 the pack was encountered north of Bering Strait, in latitude  $69^{\circ} 30'$ . Kotzebue Sound opened that year on the 27th of July. The following year the pack was found a degree farther north. The same year Wrangel and Anjou found leads of open water about 100 miles off the coast of Asia; the former between the Kolyma and Indigirka, and the latter off the Koteinos Islands. During the two years following they were frequently interrupted in their travels over the ice by leads of open water.

In August, 1826, Beechy found the pack in latitude  $71^{\circ} 30'$ , near Point Barrow, with heavy drift ice farther south. In 1787 Mackenzie found the sea at the mouth of the Mackenzie River blocked in the month of July. In 1848 Richardson found navigable water along the coast between Cape Bathurst and the Mackenzie, and a party of Innuits informed him that for two months each summer the ice in that vicinity left the coast. In 1849 Kellett reached latitude  $72^{\circ} 51'$ , in longitude  $164^{\circ} 45'$  west.

In 1850 McClure and Collinson passed Point Barrow, and the former found drift and pack ice, with a narrow channel of navigable water, along the north shore of the American continent to Prince of Wales Strait, where he wintered in latitude  $72^{\circ} 50'$ , longitude  $117^{\circ} 30'$ . Collinson reached Point Barrow too late to venture round, but steaming to the northward a few degrees farther west, he reached latitude  $73^{\circ} 23'$ , where he was stopped by the pack. This was in Septem-

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\* In August, 1728, Vitus Bering passed through the straits now bearing his name, and as far north as  $67^{\circ} 18'$ , without seeing ice.

ber. In the following year Collinson sailed along the north coast of America to Dease Strait, following the navigable channel through which McClure had sailed, with the same impenetrable pack in the offing, and returned a year later under similar circumstances. In 1855 the Arctic Basin north of Bering Strait was open to latitude  $72^{\circ} 2'$  in longitude  $174^{\circ} 50'$  west. In 1861 the southern limit of the pack was found in latitude  $68^{\circ} 31'$ . The seasons of 1865, '66, '67 appear to have been remarkably open north of Bering Strait. In the latter year many of the whalers went as far north as  $72^{\circ} 30'$ ; one reached  $73^{\circ} 5'$ , in longitude  $173^{\circ} 30'$ . Several went around Point Barrow and some nearly to the Mackenzie River, where they remained until the 15th of September. The strait between Wrangel Island and the coast of Siberia was nearly free from ice in August of that year.

During the summer of 1878 the steamer Vega made the passage along the north coast of Asia, encountering drift-ice most of the way, and sighting the pack many times. The Vega passed the Taimyr Peninsula, the most northern point of the Asiatic continent, on the 20th of August, steaming through drift-ice, and arrived at a point on the Tehuktehi Peninsula, about 100 miles from Bering Strait, on the 27th of September, where she was frozen in and held a prisoner until the 18th day of July, 1879, when she was released by the breaking up of the ice, and passed south through Bering Strait the following day, the first and only vessel up to the present time to make the passage from the Atlantic to the Pacific by the north coast of Asia, commonly called the "Northeast Passage." In 1880 the first whalers passed through Bering Strait on the 22d of May. The same year the Corwin encountered ice on the east shore of Bering Sea on the 11th of June, in latitude  $60^{\circ} 50'$ , and after battling with it for ten days reached Saint Michael's with no other damage than the loss of her screw steering gear.

On the 29th of June the Corwin passed through Bering Strait and made the circuit of the navigable sea north of the strait, keeping the pack in sight. This navigable sea was of an oval form, about 200 miles by 100 in extent, its major axis lying in the direction of northwest and southeast. The Corwin entered Kotzebue Sound on the 14th of July through heavy drift ice, and reached Point Barrow on the 25th of August, the pack at that time being about 4 miles off shore.

On May 30, 1881, the Corwin passed through Bering Strait, and on June 1, by following a lead into the pack over 100 miles, she reached latitude  $68^{\circ} 20'$ , in longitude  $176^{\circ}$ , where she was caught in the ice during a blinding snow-storm, and barely escaped with the loss of her rudder. On the 13th of July Kotzebue Sound was found free from ice. On the 30th of July the Corwin reached Herald Island through heavy drift-ice, and on the 12th of August she reached Wrangel Island under the same circumstances. On the 15th of August of that year the whalers reached Point Barrow, the ice having left the shore only on the day before.

It will be seen by the foregoing that from the earliest date of which we have any account, the ice-pack has remained permanently near the north coast of the Asiatic continent. Generally a narrow lead of navigable water exists along the shore during the month of August and part of September. This lead is partly filled with broken ice, and is liable to close at any time by a wind blowing on shore. The Taimyr Peninsula, extending from latitude  $73^{\circ}$  north to latitude  $77^{\circ} 40'$ , is bounded on the east, west, and north by the ice-pack. In summer the ice is detached from the land by the small streams of water which everywhere trickle down its banks, but always remain near. I can find no record of this peninsula being entirely free from ice. Along the American continent we have much the same condition—the navigable channel along the shore and the pack in the offing. Indeed, it is no unusual thing for the ice to remain "hard and fast" on the shore as far south as Icy Cape for several seasons in succession. The ice-pack is generally found near Icy Cape on the east side of the Arctic Basin, and near Cape North on the west side, the southern edge of the pack forming an irregular curve between those places. In exceptional seasons large fields of drift ice are found south of this curve, but generally this part of the sea is free from ice in August and September. It must not be supposed, however, that the ice which fills this sea and extends south into Bering Sea during the winter months, is all melted during the short season of warm weather. The ice-pack, which is at all times broken and rent by currents and by changes in temperature, is constantly in motion, and with the temperature above the freezing point, a continued wasting away of the ice occurs, owing to the friction of its parts, aided to a certain extent by the direct rays of the sun and by evaporation.

As this wasting and melting goes on all through the polar regions, the southern limit of the pack, under the influence of the Bering Strait current, the outset from the large rivers and the innumerable small streams formed by the melting snow, which empty into the Arctic Ocean, is pressed to the northward, closing the open spaces in the pack, and leaving the lower part of the sea comparatively free of ice. In the latter part of September and October northeast and northwest gales prevail. These force the heavy ice down from the north and on to the shores of each continent, and sometimes entirely through Bering Strait, leaving open leads and water-holes to the north. Now, however, these are soon filled with new ice, which holds the pack in the southerly position until the melting and wasting of the following season begins and allows it to retreat to the northward again.

In the Greenland and Nova Zembla seas, according to the observations of the early navigators and others, the southern limit of the pack is generally found from the seventy-sixth to the seventy-eighth degree of north latitude; but in what are called "open" seasons navigable water extends to  $81^{\circ} 30'$ . In 1594 William Barentz encountered pack-ice between Spitzbergen and Nova Zembla, referring to which, he says: "We came to so great a heap of ice that we could not sayle through it."

In the year 1607 Henry Hudson, in a poorly-fitted vessel of only 50 tons, sailed to latitude  $81^{\circ} 31'$  in the Spitzbergen seas, where he encountered impenetrable ice and returned home, reporting on his arrival the impossibility of reaching the Pole by this route, as the sea was filled with ice. Scoresby, in 1806, reached the same latitude in the vicinity of Spitzbergen, but was prevented from proceeding farther by the ice. In 1828 Parry, during his attempt to reach the North Pole by boats, encountered the pack in latitude  $81^{\circ} 13'$ , and by almost superhuman efforts succeeded, by dragging his boats over the ice, in reaching latitude  $82^{\circ} 45'$ .

In 1874 the *Teghetoff* was beset in latitude  $76^{\circ} 22'$ , and after two years helpless drifting in the frozen ocean, was abandoned by her people, who, on their retreat towards the coast of Nova Zembla, encountered open water in latitude  $77^{\circ} 49'$ .

In September, 1879, the Dutch Arctic exploring schooner *William Barentz* sighted Franz Joseph Land on the meridian of  $55^{\circ}$  east longitude. In 1881 the same vessel found heavy ice in latitude  $78^{\circ}$  north, longitude  $65^{\circ}$  east, and between the meridians of  $45^{\circ}$  and  $33^{\circ}$  east she found the ice as far south as latitude  $76^{\circ} 30'$ .

We know by the accounts of all Arctic navigators, from the earliest dates of which we have any record down to the present time, that the region surrounding the Pole, so far as it has been penetrated, is filled with the heavy ice already described, except in the immediate vicinity of land, and there it is open but a few weeks in the summer. Hence we see that the northern limit of navigation depends upon the northern limit of the land. All attempts to ignore this fact have resulted in disastrous failures. The same is true of sledging. According to the best authorities, in the absence of continuous land, sledge-traveling has never yet been found practicable over any considerable extent of uninclosed frozen sea, although conditions may be found to exist which would enable parties to travel for limited distances by sledge and boat operations combined. We have reason to think that all lands yet discovered, with the exception of Franz Joseph Land and the west coast of Grinnell Land, terminate several degrees from the Pole. It appears, therefore, that these are the points towards which we must look for a higher northern latitude to be made at some future time.

The distance from the pole at which navigators have been stopped by the ice-pack varies from 400 to 800 miles, the former north of Davis Strait and the latter north of Bering Strait, leaving but a comparatively small area unexplored in which to locate an open polar sea. And when we consider that the ice-pack surrounding this small area is constantly in motion, broken by expansion and contraction of its own parts, due to great changes in temperature, and changes its position in obedience to currents of air and water, we must believe an open navigable polar sea an impossibility. Even were no ice formed within the unexplored regions, the surrounding and ever-moving masses, unless prevented by barriers of great strength, must crowd in and fill any temporarily open space.

We remained at Ounalaska cleaning boilers, coaling ship, &c., until October 4, when we sailed for San Francisco at meridian. The following day, the wind blowing fresh from northeast with a

heavy sea, the bowsprit and jib-boom were carried away, being the second jib-boom lost during the season. A very good substitute was fitted from the lower yard picked up in the Arctic Ocean, so that the head sails could be used. During the first ten days of the passage we had strong easterly gales with a heavy hard sea; after that light variable winds with thick weather, until we reached San Francisco on the 20th of October.

In closing my report of the cruise of the *Corwin*, I cannot refrain from making a brief reference to the fate of one of the objects of our search—the *Jeannette* and her officers and crew. The details of that sad affair are too fresh in the minds of all to require repetition here, but I desire to express my profound sorrow for their misfortunes, over which all the civilized world grieves, and my unbounded admiration for their fortitude and their heroic exertions in making the most remarkable retreat over the ice ever made by man, from the place where the vessel sank to the *Lena Delta*, for their brave struggle for existence after reaching the land, and their cheerful resignation to fate when death in its most awful form stared them in the face and claimed them one by one.

The diary of Captain De Long, written almost as he drew his last breath, relates acts of heroism and self-sacrifice which are not excelled in the annals of history. Not the least of them was the devotion of the faithful Alexai, an Inuit from Saint Michael's, going out almost daily in search of game, and, freezing and starving as he was, bringing the small amount secured to the commanding officer to be distributed fairly to every one of the party, and at night, with the temperature at zero, or perhaps lower, taking off his seal-skin robe to cover his beloved captain. Surely when the final summing up shall be made in the list of heroes who have laid down their lives for the benefit of their fellow-men, the name of Alexai will not be absent.

The loss of Master Putnam, of the relief steamer *Rodgers*, adds another chapter to the already tragic history of the exploring expeditions north of Bering Strait. This brave young officer perished in his efforts to assist his shipmates. After the burning of the *Rodgers*, he started with dog teams to carry provisions from the depot at Cape Serdze to Saint Lawrence Bay for their use, and having completed successfully the object of his undertaking, he started on his return, but a great storm came on and he was seen to drift helplessly out to sea on an ice-floe, and disappear in the distance, notwithstanding all the efforts which were made to save him.





ONE OF THE MOUTHS OF THE FAIRWEATHER ICE-SHEET, IN THE RECENTLY-DISCOVERED GLACIER BAY TO THE NORTH OF CROSS SOUND, SOUTHEASTERN ALASKA.

ON THE GLACIATION OF THE ARCTIC AND SUBARCTIC REGIONS VISITED BY  
THE UNITED STATES STEAMER CORWIN IN THE YEAR 1881.

By JOHN MUIR.

The monuments of the glaciation of the regions about Bering Sea and the northern shores of Siberia and Alaska are in general much broken and obscured, a condition of things due in the main to the intensity of the action of the agents of destruction in these regions, together with the perishable character of the rocks of which most of the monuments consist. Lofty headlands, once covered with clear Glacial inscriptions, have been undermined and cast down in loose, dragged taluses, while others, in a dim, ruinous condition, with most of their surface records effaced, are rapidly giving way to the weather. The moraines, also, and the grooved, scratched, and polished surfaces are much blurred and wasted, while glaciated areas of great extent are not open to observation at all, being covered by the shallow waters of Bering Sea and the Arctic Ocean, and buried beneath sediments and coarse detritus which has been weathered from the higher grounds, or deposited by the ice itself when it was being melted and withdrawn towards the close of the main Glacial period. But amid this general waste and obscurity a few legible fragments, favorably situated here and there, have escaped destruction—patches of polished and striated surfaces in a fair state of preservation, with moraines of local glaciers that have not been exposed to the heavier forms of water or avalanche action. And had these fading vestiges perished altogether yet would not the observer be left without a sure guide, for there are other monuments of ice action in all glaciated regions that are almost unalterable and indestructible, enduring for tens of thousands of years after those simpler traces that we have been considering have vanished. These are the material of moraines, though scattered, washed, crumbled, and reformed over and over again; and the sculpture and configuration of the landscape in general, cañons, valleys, mountains, ridges, *roches moutonnées*, with forms and correlations specifically glacial. These, also, it is true, suffer incessant waste, being constantly written upon by other agents; yet, because the Glacial characters are formed on so colossal a scale of magnitude, they continue to stand out free and clear through every after inscription whether of the torrent, the avalanche, or universal eroding atmosphere; opening grand and comprehensive views of the ice itself, and the geographical and topographical changes produced by its action in the form of local and distinct glaciers, flowing river-like, from the mountains to the sea, and as a broad, undulating mantle crawling over all the landscape unhalting, unresting through unnumbered centuries; crushing and grinding and spreading soil-beds far and near to be warmed and fertilized by the sun, fashioning the features of mountain and plain, extending the domain of the sea, separating continents, dotting new coasts with islands, and fringing them with deep unreaching fiords, and impressing its peculiar style of sculpture on all the regions over which it passes.

A general exploration of the mountain ranges of the Pacific coast shows that there are about sixty-five small residual glaciers on the Sierra Nevada of California, between latitude  $36^{\circ} 30'$  and  $39^{\circ}$ , distributed singly or in small groups on the north sides of the highest peaks at an elevation of about from 11,000 to 12,000 feet above the level of the sea, representatives of the grand glaciers that once covered all the range. More than two thirds of these lie between latitude  $37^{\circ}$  and  $38^{\circ}$  and form the highest sources of the San Joaquin, Tuolumne, Merced, and Owens Rivers.

Mount Shasta, near the northern boundary of California, has a few shrinking glacier remnants, the largest about 3 miles in length. Northward, through Oregon and Washington Territory, groups of active glaciers still exist on all the highest mountains—Mounts Jefferson, Adams, Saint Helens, Hood, Rainier, Baker, and others; one of the largest of the Rainier group descending

nearly to the level of the sea, and pouring a stream opaque with Glacial mud into the head of Puget Sound.

On through British Columbia and Southeastern Alaska the broad sustained mountain chain extending along the coast is generally glacier-bearing. The upper branches of nearly every one of the main cañons are occupied by glaciers, which gradually increase in size and descend lower until the lofty region between Mount Fairweather and Mount Saint Elias is reached, where a considerable number discharge into the waters of the ocean.

This is the region of greatest glacial abundance on the west side of the continent, while to the north of latitude  $62^{\circ}$  few, if any, glaciers remain in existence, the ground being comparatively low and the annual snowfall light.

Between latitude  $56^{\circ}$  and  $60^{\circ}$  there are probably more than five thousand glaciers, great and small, hundreds of the largest size descending through the forests nearly to the level of the sea, though, as far as my own observation has reached, not more than twenty-five discharge into the sea.

All the long, high-walled fiords into which these great glaciers of the first class flow are of course crowded with icebergs of every conceivable form, which are detached at intervals of a few minutes, but these are small as compared with those of Greenland, and only a few escape from the intricate labyrinth of channels with which this portion of the coast is fringed into the open ocean. Nearly all of them are washed and drifted back and forth by wind and tide until finally melted by the sun and the copious warm rains of summer.

The southmost of the glaciers that reach the sea occupies a narrow fiord about 20 miles to the northwest of the mouth of the Stikine River, in latitude  $56^{\circ} 50'$ . It is called "Hutli," or Thunder Bay, by the natives, from the noise made by the icebergs in rising and falling from the inflowing glacier. About one degree farther north there are four at the heads of branches of Holkam Bay, at the head of Takon Inlet one, and at the head and around the sides of a large bay trending in a general northerly direction from Cross Sound, first explored by Mr. Young and myself, there are no less than five of these complete glaciers reaching tide-water, the largest of which is of colossal size, having upwards of a hundred tributaries and a width of trunk below the confluence of the main tributaries of from 3 to 8 miles. Between the west side of this icy bay and the ocean all the ground, high and low, with the exception of the summits of the mountain peaks, is covered by a mantle of ice from 1,000 to 3,000 feet thick, which discharges to the eastward and westward through many distinct mouths.

This ice-sheet, together with the multitude of distinct glaciers that load the lofty mountains of the coast, evidently once formed part of one grand continuous ice-sheet that flowed over all the region hereabouts, extending southward as far as the Straits of Juan de Fuca, for all the islands of the Alexander Archipelago, great and small, as well as the headlands and promontories of the mainland, are seen to have forms of greatest strength with reference to the action of a vast press of over-sweeping ice, and their surfaces have a smooth, rounded, over-rubbed appearance, generally free from angles. The marvelous labyrinth of canals, channels, straits, passages, sounds, &c., between the islands manifest, in their forms and trends and general characteristics, the same subordination to the grinding action of a continuous ice-sheet, and differ from the islands as to their origin only in being portions of the general pre-Glacial margin of the continent, more deeply eroded, and, therefore, covered with the ocean waters, which flowed into them as the ice was melted out of them.

That the dominion of the sea is being extended over the land by the wearing away of its shores is well known, but in these northern regions the coast rocks have been so short a time exposed to wave-action they are but little wasted as yet, the extension of the sea effected by its own action in post-Glacial time in this region being probably less than the millionth part of that effected by glacial action during the last Glacial period.

Traces of the ancient glaciers made during the period of greater extension abound on the California Sierra as far south as latitude  $36^{\circ}$ . Even the most evanescent of them, the polished surfaces, are still found, in a marvelously perfect state of preservation, on the upper half of the middle portion of the range, occurring in irregular patches, some of which are several acres in extent, and, though they have been subjected to the weather with all its storms for thousands of

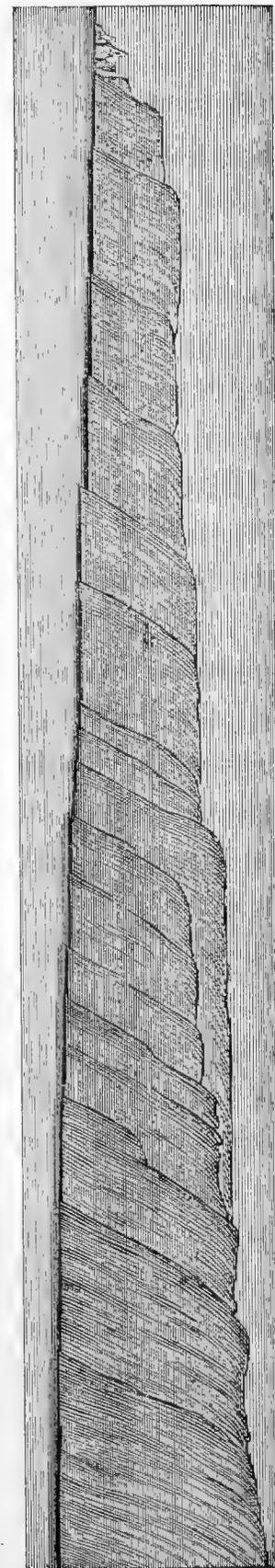
years, their mechanical excellence is such that they reflect the sunbeams like glass, and attract the attention of every observer. The most perfect of these shining pavements lie at an elevation of about 7,000 to 8,000 feet above the level of the sea, where the rock is close-grained, silicious granite, though small fading patches may be found at from 3,000 to 5,000 feet elevation on the driest and most enduring portions of vertical walls, where there is protection from the drip and friction of water; also on compact swelling bosses partially protected by a covering of boulders.

On the north half of the Sierra the striated and polished surfaces are rarely found, not only because this portion of the chain is lower, but on account of the surface rocks being chiefly porous lavas subject to rapid waste. The moraines, also, though well preserved on the south half of the range, seem to be nearly wanting over a considerable portion of the north half, but the material of which they were composed is found in abundance, scattered and disintegrated, until its glacial origin is not obvious to the unskilled observer.

A similar blurred condition of the superficial records obtains throughout most of Oregon, Washington Territory, British Columbia, and Alaska, due in great part to the action of excessive moisture. Even in Southeastern Alaska, where the most extensive glaciers still exist, the more evanescent of the traces of their former greater extension, though comparatively recent, are more obscure than those of the ancient glaciers of California, where the climate is drier and the rocks more resisting. We are prepared, therefore, to find the finer lines of the glacial record dim or obliterated altogether in the Arctic regions, where the ground is mostly low and the action of frost moisture specially destructive.

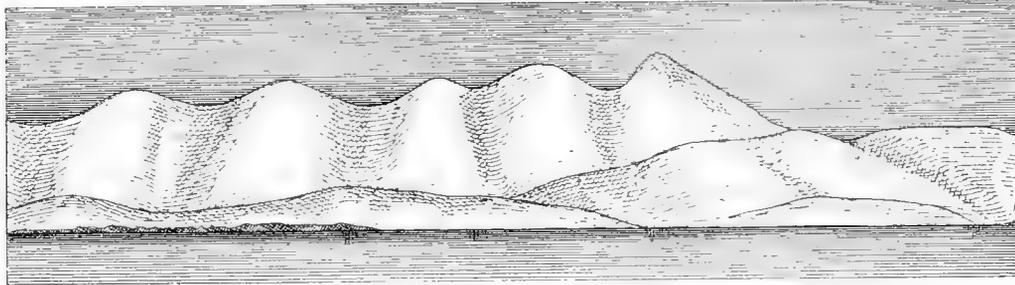
The Aleutian chain of islands sweeps westward in a regular curve nearly a thousand miles long from the Alaska Peninsula toward Kamtchatka, nearly uniting the American and Asiatic continents. A very short geological time ago, just before the coming on of the glacial winter, the union of the two continents was probably complete. The entire chain appears to be simply a degraded portion of the North Pacific pre-Glacial coast mountains, with its foot-hills and lowest portions of the connecting ridges between the peaks a few feet under water, the submerged ridges forming the passes between the islands as they exist to day, while the broad plain to the north of the chain is now covered by the shallow waters of the Bering Sea.

Now the evidence seems everywhere complete that this segregating degradation has been effected almost wholly by glacial action. Yet, strange to say, it is held by most observers who have made brief visits to different portions of the chain that each island is a distinct volcanic upheaval, but little changed since the period of emergence from the sea, an impression made no doubt by the volcanic character of most of the rocks, ancient and recent, of which they are composed, and by the many extinct or feebly active volcanoes occurring here and there along the summits of the highest masses. But, on the contrary, all the evidence we have seen goes to show that the amount of glacial denudation these rocks have undergone is very great, so great



NEAR THE SOUTHWEST EXTREMITY OF SAINT LAWRENCE ISLAND. ILLUSTRATING EFFECTS OF ICE-SHEET.

that, with the exception of the recent craters, almost every existing feature is distinctly Glacial. The comparative featureless pre-Glacial rocks have been heavily sculptured and fashioned into the endless variety they now present of peak and ridge, valley and fiord and clustering islets, harmoniously correlated in accordance with glacial law.



OVERSWEPT MOUNTAINS, WITH PARALLEL VALLEYS AND RIDGES, FROM 20 MILES NORTHWEST OF EAST CAPE.

On Mount Makushin, whose summit reaches an elevation of about 9,000 feet above the sea, several small glaciers still exist, while others yet smaller may be hidden in the basins of other mountains not yet explored. The summit of Makushin at the time our observations were made was capped with heavy clouds, and from beneath these the glaciers were seen descending imposingly into the open sunshine to within 1,000 or 1,500 feet of the sea level, the largest perhaps about 6 miles in length. After the clouds cleared away the summit was seen to be heavily capped with ice, leaving only the crumbling edges of the dividing ridges and subordinate peaks free. The lower slopes of the mountain and the wide valleys proceeding from the glaciers present testimony of every kind to show that these glaciers now lingering on the summit once flowed directly into the sea; and the adjacent mountains also, though now mostly free from ice, are covered with Glacial markings, extending over all the low grounds about their bases and the shores of the fiords, and over many of the rocks now under water. But besides this evidence of recent local Glacial abundance, we find traces of far grander Glacial conditions on the heavily abraded rocks along the shores of the passes separating the islands, and also in the low wide-bottomed valleys extending in a direction parallel with the passes across the islands, indicating the movement of a vast ice-sheet from the north over the ground now covered by Bering Sea.

The amount of degradation this island region has undergone is only partially manifested by the crumbling, sharpened condition of the ridges and peaks, the abraded surfaces that have been overswept, and by the extent of the valleys and fiords, and the gaps between the mountains and islands.

That these valleys, fiords, gorges, and gaps, great and small, are not a result of local subsidences and upheavals, but of the removal of the material that once filled them, is shown by the broken condition and the similarity of the physical structure and composition of their contiguous sides, just as the correspondence between the tiers of masonry on either side of a broken gap in a wall shows that the missing blocks required to fill it up have been removed.

The chief agents of erosion and transportation are water and ice, each being regarded as the more influential by different observers, though the phenomena to which they give rise are widely different. All geologists recognize the fact that glaciers wear away the rocks over which they move, but great vagueness prevails as to the size of the fragments of erosion, and the way they are detached and removed; and if possible still greater vagueness prevails as to the forms and characteristics in general of the mountains, hills, rocks, valleys, &c., resulting from this erosion.

Towards the end of summer, when the snow is melted from the lower portions of the glaciers, particles of dust and sand may be seen scattered over their surfaces, together with angular masses of rocks, derived from the shattered storm-beaten cliffs above their fountains. The separation of these masses, which vary greatly in size, is due only in part to the action of the glacier, though they are all transported on its surface like floating drift on a river, and deposited together in moraines. The winds supply a portion of the sand and dust, some of the larger fragments are

set free by the action of frost, rains, and general weathering agents, considerable quantities are swept down in avalanches of snow where the inclination of the slopes is favorable to their action, and shaken down by earthquake shocks, while the glacier itself plays an important part in the production of these superficial effects by undermining the cliffs from whence the fragments fall.

But in all moraines boulders and small dust particles may be recognized as not having been thus derived from the weathered cliffs and dividing ridges projecting above the glaciers, but from the rocks past which and over which the glaciers flow. The streams which drain glaciers are always turbid with finely-ground mud particles worn off the bed rocks by a sliding motion, accompanied by great pressure, giving rise to polished surfaces, and keeping up a waste that never for a moment ceases while the glacier exists.

Moreover, boulders are found possessing characteristic that enable the observer to follow their trails and discover the positions of the channels whence they came. Accordingly, an abrupt transition is here discovered from the polished and plain portions of the channels to the more or less angular and fractured portions, showing that glaciers degrade the rocks over which they pass in at least two different ways, by grinding them into mud, and by crushing, breaking, and splitting them into a coarse detritus of chips and boulders, the forms and sizes of which being in great part determined by the divisional planes the rocks possess, and the intensity and direction of application of the force brought to bear on them, while the quantity of this coarser material remaining in the channels along the lines of dispersal and the probable rate of movement of the glaciers that quarried and transported it, form data from which some approximation to the rate of this method of degradation may be reached.

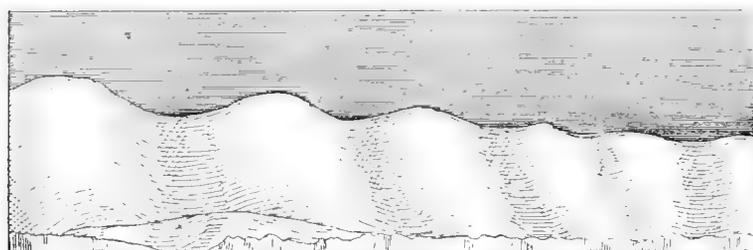
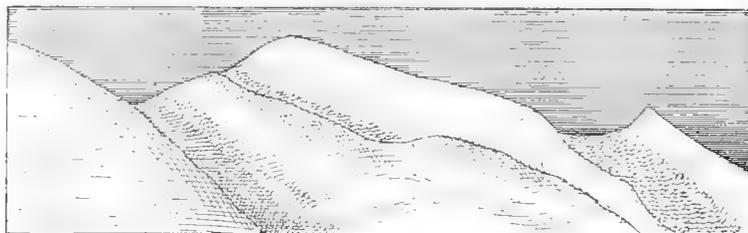
The amount of influence exerted on the Aleutian region by running water in its various forms, and by the winds, avalanches, and the atmosphere in degrading and fashioning the surface subsequent to the melting of the ice is as yet scarcely appreciable in general views, for the time it has been exposed to the action of these forces is comparatively short, while the scored and polished remnants of the glacial surface that have survived their wasting action, and which are still only a few inches above the level of the general surface, show how little post-Glacial degradation has been accomplished.

On the other hand, the quantity of material quarried and carried away by the force of ice in the process of bringing the region into its present condition can hardly be overestimated; for, with the exception of the recent volcanic cones, almost every noticeable feature, great and small, has evidently been ground down into the form of greatest strength in relation to the stress of over-sweeping floods of ice. And that these present features are not the pre-Glacial features merely smoothed and polished and otherwise superficially altered, but an entirely new set sculptured from a surface comparatively featureless, is manifested by the relationship existing between the spaces that separate them and the glacier fountains. The greater the valley or hollow of any sort, the greater the snow-collecting basin above it whence flowed the ice that created it, not a fiord or valley being found that does not conduct to fountains of vanished or residual glaciers corresponding with it in size and position as cause and effect.

And, furthermore, that the courses of the present valleys were not determined by the streams of water now occupying them, nor by pre-Glacial streams, but by the glaciers of the last or of some former Glacial period, is shown by the fact that the directions of the trends of all these valleys, however variable, are resultants of the forces of the main trunk glaciers that filled them and their inflowing tributary glaciers, the wriggling fortuitous trends of valleys formed by the action of water being essentially different from those formed by ice; and therefore not liable to be confounded. Neither can we suppose pre-existing fissures or local subsidences to have exercised any primary determining influence, there being no conceivable coincidence between the trends of fissures and subsidences and the specific trends of ice-created valleys and basins in general, nor between the position and direction of extension of these hypothetical fissures and subsidences and foldings and the positions of ice-fountains.

It appears, therefore, in summing up the results of our observations here that a few active glaciers still exist on the highest mountain of Ounalaska; that the ancient glaciers, in their sheeted and distinct conditions, embraced all the Aleutian region, and sculptured its pre-Glacial

mountain range, extending along the North Pacific coast, into its present condition as a chain of islands.



OVERSWEEPED GLACIAL VALLEYS AND RIDGES ON SAINT LAWRENCE ISLAND.

The Pribylov Group, Saint Paul, Saint George,<sup>1</sup> Walrus, and Otter Islands appear in general views from the sea as mere storm-beaten remnants of a once continuous land, wasted into bluffs around their shores by the action of the waves, and all their upper surfaces planed down by a heavy oversweeping ice-sheet, and slightly roughened here and there with low ridges and hillocks that alternate with shallow valleys. None of their features, as far as I could discover without opportunity for close observation, showed any trace of local glaciation or of volcanic action subsequent to the period of universal glaciation.

Saint Lawrence Island, the largest in Bering Sea, is situated at a distance of about 120 miles off the mouths of the Yukon and 40 miles from the nearest point on the coast of Siberia. It is about 100 miles long from east to west, 15 miles in average width, and is chiefly composed of various kinds of granite, slate, and lava.

The highest portion along the middle is diversified with groups of volcanic cones, some of which are of considerable size and clearly post-Glacial in age, presenting well-defined craters and regular slopes down to the base, though I saw no evidence of their having poured forth streams of molten lava over the adjacent rocks since the close of the Glacial period; for, with the exception

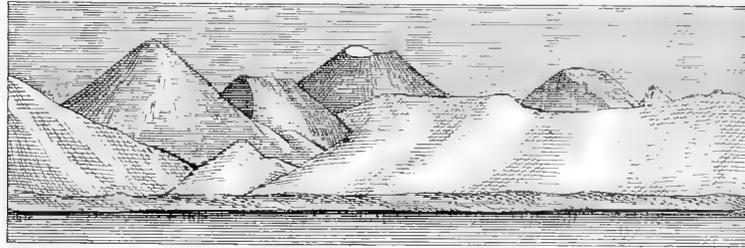


BED OF LOCAL GLACIER, SAINT LAWRENCE ISLAND.

of the ground occupied by the cones, all the surface is marked with glacial inscriptions of the most telling kind—moraines, erratic boulders, *roches moutonnées*, in great abundance and variety as to

size, and alternating ridges and valleys with wide U-shaped cross-sections, and with nearly parallel trends across the island in a general north to south direction, some of them extending from shore to shore, and all showing a true subordination to the grinding, furrowing action of a broad over-sweeping ice-sheet.

Some of the widest gap-like valleys have been eroded nearly to the level of the sea, indicating that if the ice action had gone on much longer the present single island would have been eroded into a group of small ones; or the entire mass of the island would have been degraded beneath the sea level, obliterating it from the landscape to be in part restored perhaps by the antagonistic elevating action of the post-Glacial volcanoes now occupying the middle portion.



VOLCANIC CONES ON SAINT LAWRENCE ISLAND.

The action of local glaciers has been comparatively light, not enough to greatly obscure or interrupt the overmastering effects of the ice-sheet, though they have given marked character to the sculpture of some of the higher portions of the island not covered by volcanic cones.

The two Diomedé Islands and Fairway Rock are mostly residual masses of granite brought into relief and separated from one another and from the general mass of the continent by the action of ice in removing the missing material, while the islands remain because of their superior power of resistance to the universal degrading force.

That they are remnants of a once continuous land now separated by Bering Strait is indicated by the relative condition of the sides of the islands and of the continuous shoulders of the continents, Cape East and Cape Prince of Wales, while the general configuration of the islands shows that they have been subjected to glaciation of the most comprehensive kind, leaving them as *roches moutonnées* on a grand scale.

Traces of local glaciation were discovered on the largest of the three, but the efforts produced by this cause are of course comparatively slight when the size of the island is taken into consideration, while the action of excessive moisture in the form of almost constant fogs and rains throughout the summer months, combined with frost and thaw, has effected a considerable amount of denudation, manifested by groups of crumbling pinnacles occurring here and there on the summit.

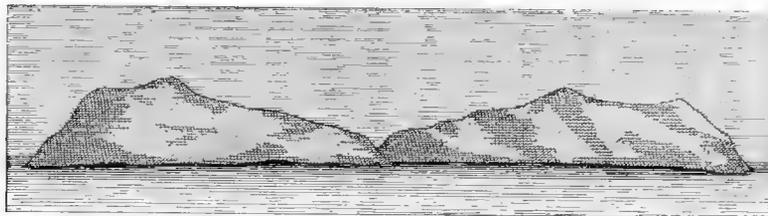
Sledge, King's, and Herald Islands are evidently of similar origin, bearing the same glacial traces, and varying chiefly in the amount of post-Glacial waste they have suffered, and in the consequent degree of clearness of the testimony they present.

During our visit to Herald Island an exceptionally favorable opportunity offered as to the time of year, state of the weather, &c., for observation.

Kellett, who first discovered the island and landed on it under adverse circumstances, describes it as an inaccessible rock. The sides are indeed precipitous in the main, but mountaineers would find many slopes and gullies by which the summit would be easily attained. We landed on the southwest side, opposite the mouth of a small valley, the bed of a vanished glacier. A short gully which conducts from the water's edge to the mouth of the valley proper is very steep, and at the time of our visit was blocked with compacted snow, in which steps had to be cut, but beyond this no difficulty was encountered, the ice having graded a fine broad way to the summit. Thence following the highest ground nearly to the northwestern extremity, we obtained views of most of the surface. The highest point was found to be about 1,200 feet above the sea. This point is about  $1\frac{1}{2}$  miles from the northwest end of the island, and  $4\frac{1}{2}$  miles from the

southeast, thus making the island about 6 miles long, the average width being about 2 miles. Near the middle of the island there is a low gap, where the width is only about half a mile, and the height of the summit of this portion of the watershed between the two sides is only about 250 feet. The entire island as far as seen is a mass of granite, with the exception of a patch of metamorphic slates near the middle, and no doubt owes its existence with so considerable a height to the superior resistance it offered to the degrading action of ice, traces of which are presented in the general *moutonnée* form of the island, and in the smooth parallel ridges and valleys trending north and south. These evidently have not been determined as to size, form, position, or the direction of their trends by subsidences, upheavals, foldings, or any structural peculiarity of the rocks in which they have been eroded, but simply by the mechanical force of an oversweeping, all-embracing ice-sheet.

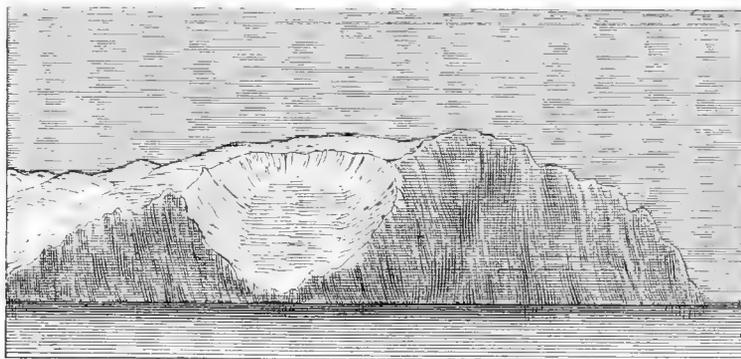
The effects of local glaciers are seen in short valleys of considerable depth as compared with the area from which their fountain snows were derived. We noticed four of these valleys that had been occupied by residual glaciers; and on the hardest and most enduring of the upswelling rock bosses several patches of the ancient scored and polished surface were discovered, still in a good state of preservation. That these local glaciers have but recently vanished is indicated by the raw appearance of the surface of their beds, while one small glacier remnant occupying a sheltered hollow and possessing a well-characterized terminal moraine seems to be still feebly active in the last stage of decadence.



HERALD ISLAND.

This small granite island standing solitary in the Polar Ocean we regard as one of the most interesting and significant of the monuments of geographical change effected by universal glaciation.

Our stay on Wrangel Island was too short to admit of more than a hasty examination of a few square miles of surface near the eastern extremity. The rock formation is a close-grained clay slate, cleaving freely into thin flakes, with occasional compact metamorphic masses rising above the general surface or forming cliffs along the shore. The soil about the banks of a river of considerable size that enters the ocean here has evidently been derived in the main from the underlying



BED OF SMALL RESIDUAL GLACIER ON SAINT LAWRENCE ISLAND.

slates, indicating a rapid weathering of the surface. A few small deposits of moraine material were discovered containing traveled boulders of quartz and granite, no doubt from the mountains

in which the river takes its rise; while the valley now occupied by the river manifests its glacial origin in its form and trends, the small portion in the middle eroded by the river itself being clearly distinguished by its abrupt angular sides, which contrast sharply with the glacial outlines.

In general views obtained in sailing along the southern coast the phenomena presented seemed essentially the same as have been described elsewhere, hills, valleys, and sculptured peaks, testifying in all their main trends and contours to the action of ice. A range of mountains of moderate height extends from one extremity of the island to the other, a distance of about 65 miles, the highest point as measured by Lieutenant Berry being 2,500 feet above the sea.

All the coast region of Siberia that came under our observation, from the Gulf of Anadyr to North Cape, presents traces in great abundance and variety of universal as well as local glaciation more or less clear and telling.

Between Plover and Saint Lawrence Bays, where the mountains attain their greatest elevation and where local glaciation has been heaviest, the coast is lacerated with deep fiords, on the lofty granite walls of which the glacial records are in many places well preserved, and offer evidence that could hardly be overlooked by the most careless observer.

Our first general views of this region were obtained on June 7, when it was yet winter, and the landscape was covered with snow down to the water's edge. After several days of storm the clouds lifted, exposing the heavily abraded fronts of outstanding cliffs; then the smooth over-swept ridges and slopes at the base of the mountains came in sight, and one angular peak after another until a continuous range 40 to 50 miles long could be seen from one stand-point. Many of the peaks are fluted with the narrow channels of avalanches, and hollowed with *névé* amphitheaters of great beauty of form, while long withdrawing fiords and valleys may be traced back into the recesses of the highest groups, once the beds of glaciers that flowed in imposing ranks to the sea.

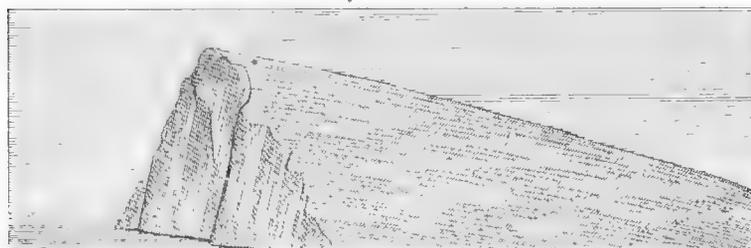
Plover Bay, which was examined in detail, may be taken as a good representative of the fiords of this portion of the coast. The walls rise to an average height of about 2,000 feet, and present a severely desolate and bedraggled appearance, owing to the crumbling condition of the rocks, which in most places are being rapidly disintegrated, loading the slopes with loose, shifting detritus wherever the angle is low enough to allow it to come to rest. When examined closely, however, this loose material is found to be of no great depth. The solid rock comes to the surface in many places, and on the most enduring portions rounded glaciated surfaces are still found grooved, scratched, and polished in small patches from near the sea level up to a height of a thousand feet or more.

Large taluses with their bases under the water occur on both sides of the fiord in front of the side cañons that partially separate the main mountain masses that form the walls. These taluses are composed in great part of moraine material, brought down by avalanches of snow from the terminal moraines of small vanished glaciers that lie at a height of from 1,000 to 5,000 feet, in recesses where the snow accumulated from the surrounding slopes, and where sheltered from the direct action of the sun the glaciers lingered longest. These recent moraines are formed of several concentric masses shoved together, showing that the glaciers to which they belonged melted and receded gradually, with slight fluctuations of level and rate of decadence, in accordance with conditions of snow-fall, temperature, &c., like those of lower latitudes.

When the main central glacier that filled the fiord was in its prime as a distinct glacier it measured about 30 miles in length and from 5 to 6 miles in width and was from 2,000 to 3,000 feet in depth. It then had at least five main tributaries, which, as the trunk melted, became independent glaciers; and, again, as the trunks of these main tributaries melted their smaller tributaries, numbering about seventy-five, and from less than a mile to several miles in length, lingered probably for centuries in the high, cool fountains. These also, as far as we have seen, have vanished, though possibly some wasting remnant may still exist in the highest and best-protected recesses about the head of the fiord.

Along the coast, a distance of 15 or 20 miles to the eastward and southward of the mouth of Metchigme Bay, interesting deposits occur of roughly-stratified glacial detritus in the form of sand, gravel, and boulders. They rise from the shore in raw, wave-washed bluffs about 40

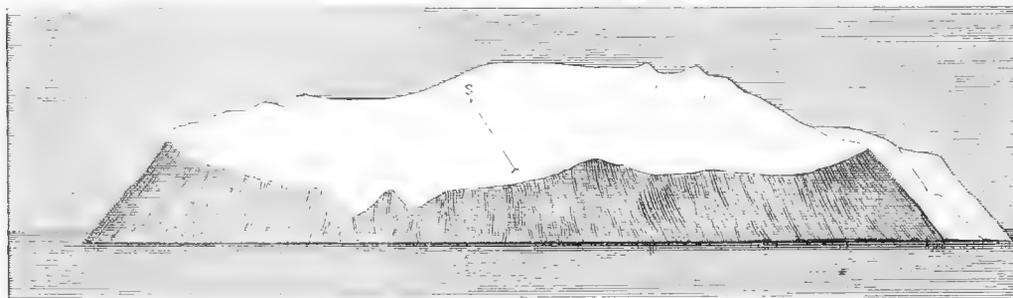
feet high and extend to the base of the mountains as a gently-inclined plain, with a width in some places of 2 or 3 miles.



GRANITE ROCKS ON THE SOUTH SIDE OF SAINT LAWRENCE ISLAND, SHOWING EFFECTS OF OVERSWEEPING ACTION OF ICE-SHEET.

Similar morainal deposits were also observed on the American coast at Golovin Bay, Kotzebue Sound, Cape Prince of Wales, and elsewhere. At Cape Prince of Wales the formation rises in successive well-defined terraces.

The peninsula, the extremity of which forms East Cape, trends nearly in an easterly direction from the mainland, and consequently occupies a specially telling position with reference to ice moving from the northward. I was therefore eager to examine it and see what testimony it might have to offer. We landed during favorable weather on the south side at a small Eskimo village built on a rough moraine, and pushed on direct to the summit of the watershed, from which good general views of nearly all the surface of the peninsula were obtained.



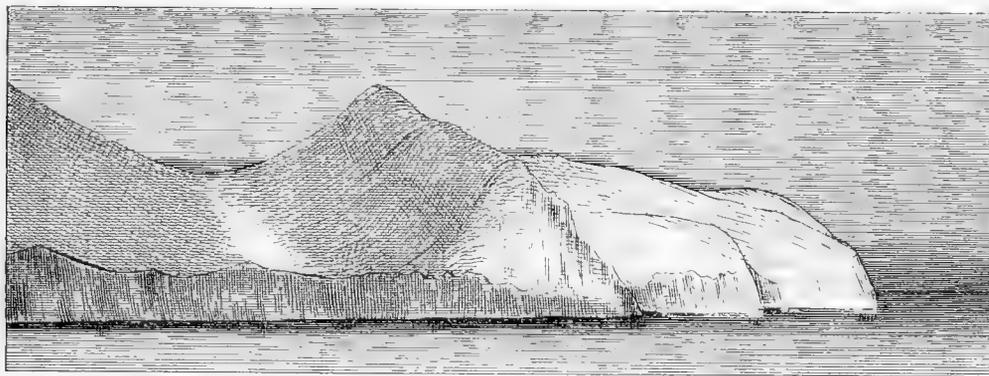
WEST DIOMEDE ISLAND, FROM THE NORTH.

The dividing ridge along the high eastern portion is traversed by a telling series of parallel grooves and small valleys trending north and south approximately, the curves on the north commencing nearly at the water's edge, while the south side is more or less precipitous. The culminating point of the elevated eastern portion of the peninsula is about 2,500 feet high; and has been cut off from the mainland and added as another island to the Diomedé group, the wide gap of low ground connecting it with the adjacent mountainous portion of the mainland being only a few feet above tide-water. Out in the midst of this low, flat region smooth upswelling *roches moutonnées* were discovered here and there like groups of small islands, with trends and contours emphatically Glacial, all telling the action of a universal abrading ice-sheet moving southward.

Hence along the coast to Cape North, which is the limit of our observations in this direction, the same class of ice phenomena was discovered—moraine material, washed and reformed, *moutonnée* masses of the harder rocks standing like islands in the low, mossy tundra, and traveled boulders and pebbles lying stranded on the summits of rocky headlands.

These enduring monuments are particularly abundant and significant in the neighborhood of Cape Wankarem, where the granite is more compact and resisting than is commonly found in the Arctic regions we have visited, and consequently has longer retained the more evanescent of the glacial markings. Cape Wankarem is a narrow, flat topped, residual mass of this enduring granite, on the summit of which two patches of the original polished surface were discovered that still retain the fine striae and many erratic boulders of slate, quartz, and various kinds of lava, which, from the configuration and geographical position of the cape with reference to the surrounding region, could not have been brought to their present resting-places by any local glacier.

Cape Serdze is another of these residual island masses, brought into relief by general glacial denudation, manifesting its origin in every feature, and corroborating the testimony given at Cape Wankarem and elsewhere in the most emphatic manner.



EAST CAPE (FROM THE SOUTH).

All the sections of the tundra seen either on the Siberian or Alaskan coast lead towards the conclusion that the ground is Glacial, reformed under the action of running water derived in broad, shallow currents from the melting receding edge of the ice-sheet, and also in some measure from ice left on the high lands after the main ice sheet had been withdrawn; for these low, flat deposits differ in no particular of form or composition that we have been able to detect from those still in process of formation in front of the large receding glaciers of Southeastern Alaska. On many of the so-called "mud-flats" extending from the snouts of glaciers that have receded a few miles from the shore, mosses and lichens and other kinds of tundra vegetation are being gradually acquired, and when thus clothed these patches of tundra are not to be distinguished from the extensive deposits about the shores of the Arctic regions.

The phenomena observed on the American coast from Saint Michael's to Point Barrow differ in no essential particular from what have been described on the opposite shores of Siberia.

Moraines more or less wasted, and reformations of moraine material, smooth overswept ridges with Glacial trends and the corresponding valleys, *roches moutonnées*, and the fountain amphitheaters of local glaciers were observed almost everywhere on the mountainous portions of the coast, though in general more deeply weathered, owing mainly to the occurrence of less resisting rocks, limestones, sandstones, and porous lavas, &c.

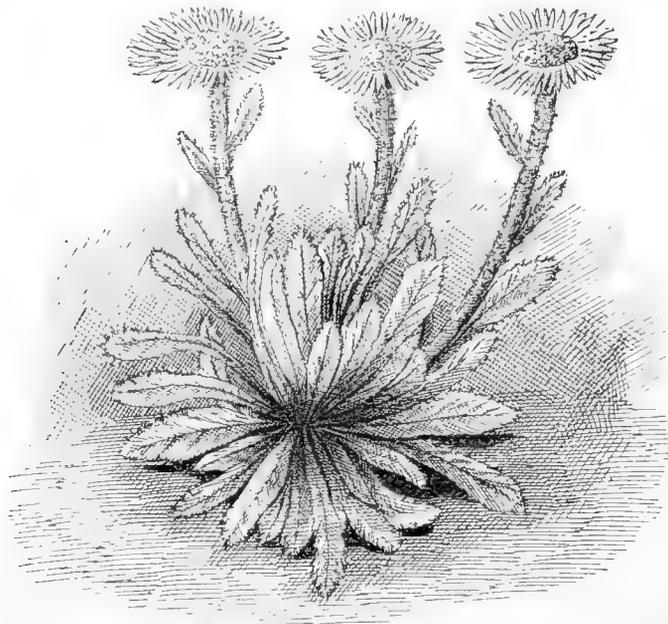


KING'S ISLAND.

A number of well-characterized moraines so situated with reference to topographical conditions as to have escaped destructive washing were noticed near Cape Lisburne, and moraine deposits of great extent at Kotzebue Sound and Golovin Bay, of which many fine sections were exposed.

At the latter locality, judging from the comparatively fresh appearance of the rock surfaces and deposits around the head of the bay, and the height and extent of the ice-fountains, the glacier that discharged here was probably the last to vanish from the American shore of Bering Sea.

As to the thickness attained by the ice-sheet over the regions we have been examining during the period of greatest Glacial development, we have seen that it passed heavily over the islands of Bering Sea and the adjacent mountains on either side, especially at East Cape and Cape Prince of Wales, at a height of 2,500 feet or more above the bottom of Bering Sea and Strait, the average depth of water here being about 150 feet. And though the lowest portion of the land beneath the ice may have been degraded to a considerable depth subsequent to the time these



ERIGERON MUIRII, GRAY (n. sp.).

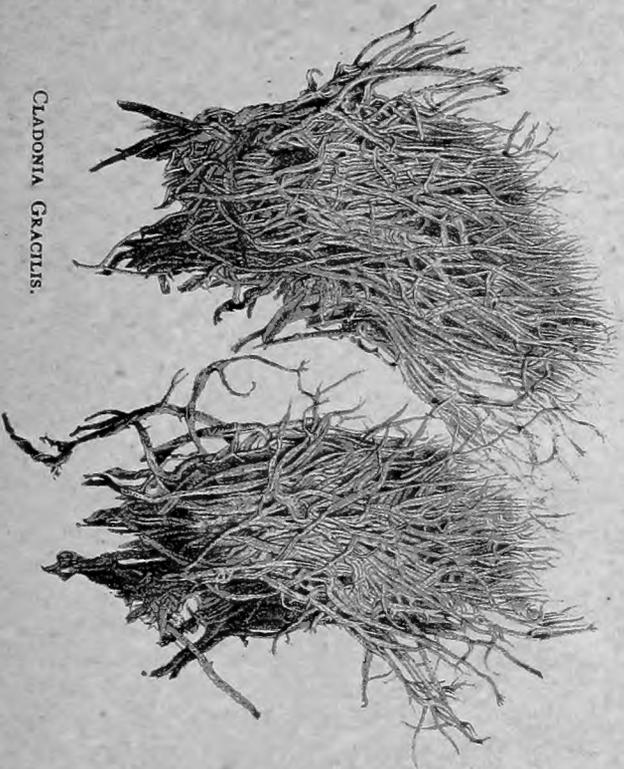
highest portions were left bare, on the other hand the level of the ice must have been considerably higher than the summits over which it passed, inasmuch as they give evidence of having been



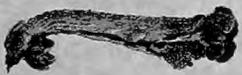
CLADONIA UNCIALIS.



CLADONIA RANGIFERINA.



CLADONIA GRACILIS.



CLADONIA CORNUCOPOIDES.



heavily abraded. It appears, therefore, that the thickness of the ice-sheet throughout a considerable portion of its history was not less than 2,500 feet and probably more, over the northern portion of the region now covered by Bering Sea and part of the Arctic Ocean.

Now, in view of this colossal ice-flood grinding on throughout the hundreds of thousands of years of the Glacial period, the excavation of the shallow basins of Bering Sea and Strait and Arctic Ocean must be taken as only a small part of the erosion effected; for so shallow are these waters, were the tallest sequoias planted on the bottom where soundings have been made, their tops would rise in most places 100 feet or more above the surface. The Plover Bay glacier, as we have shown, eroded the granite in the formation of its channel to a depth of not less than 2,000 feet, and the amount of erosion effected by the ice-sheet was probably much greater.

We might go on multiplying evidence, but enough, we think, has been already presented to show—

(1) That the regions under discussion were covered with a mantle of ice, which pursued a general southerly direction, and discharged into the Pacific Ocean south of the Aleutian Islands.

(2) That after the close of the period of universal glaciation, the mountains along the coasts of Bering Sea and the Arctic Ocean were loaded with distinct glaciers, many of which have but recently vanished.

(3) That the sculpture of the region in general, with all its main distinguishing features, is due to Glacial action.

(4) That the basins of Bering Sea and Strait and of the adjacent portion of the Arctic Ocean are simply those portions of the bed of the ice-sheet which were eroded to a moderate depth beneath the level of the sea, and over which the ocean waters were gradually extended as the ice-sheet was withdrawn, thus separating the continents of Asia and America, at the close of the Glacial period.

