

laboratory; and the best tables and facilities are reserved for any of this class who may select Annisquam in order to pursue their work in any special department, whether botanical or zoölogical. For the four years the average attendance has been sixteen. Last year there were, in all, fifteen, but at no one time more than twelve. There are comfortable accommodations for about eighteen persons when all the seats are filled, and this is considered the extreme limit in numbers at any one time.

The students come from all parts of the country east of the Rocky Mountains. Professor Hyatt is the director, and has one assistant; and neither receives any remuneration for his special services. A building specially constructed for a laboratory is much needed, as well as a steam-launch in which to make surface-towings, — a class of work little carried on in our waters, but the value of which should not be underrated. For the successful maintenance of this laboratory, it should possess a regular fund; for some fear exists that the Woman's association may at an early date withdraw its support. This would be sincerely regretted; for the Annisquam laboratory has marked out for itself a course, which, with proper support, will result in great advantage to American science. As it is, the ladies of the Boston association may well be proud of their beginning, and they may be sure that they receive the thanks of a large class of students who have profited by their venture.

THE HUDSON-BAY EXPEDITION OF 1884.

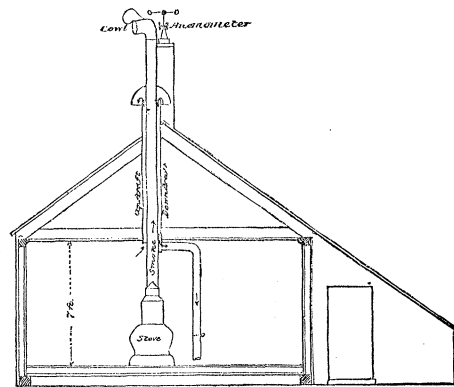
WITH Manitoba, and the Canadian North-west beyond it, promising to become a vast wheat-producing country, a convenient outlet for surplus grain is most important. Taking Winnipeg as the converging point of all grain to be shipped, we find that the distance to Montreal by the shortest road, the soon-to-be-opened Canadian Pacific railway, will be fourteen hundred and thirty miles, and thence by water to Liverpool, *via* Cape Race, twenty-nine hundred and ninety miles; while if that large inland sea, Hudson Bay, could be utilized as part of a continuous water route to Europe, it would involve only seven hundred miles of rail transport to York Factory, and twenty-nine hundred and forty-one miles of water to Liverpool.

That the bay and strait are navigable to a limited extent is proved not only by the voyage of the intrepid navigator who bequeathed his name to them and left his body on their shores, but by the fact that the Hudson-Bay company has had ships sailing from England to York Factory annually for a great num-

ber of years, to take in all the supplies required in its western trade. But the voyages of these vessels, entering the bay only once a year, at the most favorable season, could throw little light upon the extreme duration of navigation; nor could American whalers entering the bay add much to our information, as they winter and pursue their avocation usually altogether too far to the northward.

The desire for further information on this important subject culminated in the appointment of a committee of investigation by the Canadian house of commons during its last session, and the appointment of an expedition under the command of Lieut. A. R. Gordon, a retired naval officer, and assistant director of the Dominion meteorological service. The plan adopted was to establish on the shores of the strait six observing-stations, — one on each side of the outer entrance, two similarly situated at the inner entrance, and the third pair dividing the distance between these, as stated briefly in No. 78 of *Science*.

A Newfoundland sealing-steamer, the Neptune, was chartered to convey the expedition; and, on the outward voyage, four stations were located: *viz.*, at Port Burwell, on the north-western shore of Cape Chudleigh, at the entrance to Ungava Bay; at Ashe-



SECTION OF OBSERVERS' HUT.

Inlet, near North Bluff, on the island called by Lieut. Schwatka Turenne Island; at Stupart's Bay, about three miles away from the strait, along the north-west coast of Prince of Wales Sound; and at Port DeBoucherville, on Nottingham Island, near its most southerly point. Each of the stations was named after the observer stationed there. The steamer then ran across Hudson Bay to its north-west angle, and visited the whalers' harbor on Marble Island, where a letter was found from Capt. Fisher, of the whaling-bark George and Mary, dated the 7th of August, stating that they had experienced a very cold winter and spring, with the thermometer four degrees below zero on the 23d of May; that the ship had got out of her winter quarters on the 7th of June, but had been unable to get up the Welcome or to the east shore in consequence of ice.

Continuing her voyage, the Neptune visited Fort

Churchill, where arrangements were made with one of the Hudson-Bay company's officers for taking auxiliary observations; thence to York Factory, where, in consequence of shoal water, the steamer was obliged to anchor eighteen miles from the post, — a fact likely to prevent this most important station of the Hudson-Bay company from attaining commercial importance. At this place there has been for some years an observer in connection with the meteorological service, and nothing more was required than comparison and adjustment of instruments. From York Factory the return trip was begun on the 12th of September, and a fifth station was established on the south-western extremity of Digges Island, where a good harbor, named Port Laperrière, opposite to, and forty-five miles from, Port De-Boucherville, was found. The vast stretches of ice encountered in this end of the strait point to these two stations as of the highest importance. There remained now but one station to establish, which had been intended for Resolution Island or the lower Savage Islands. On both trips this neighborhood was carefully examined, but no harbor could be found; and the station was consequently fixed

at Skynner's Cove, on the north side of the entrance to Nachvak Bay, — a position apparently not calculated to aid materially the objects of the expedition.

At each of the six stations an officer is in charge, with two assistants. For their accommodation a hut sixteen by twenty feet, divided into three rooms, with a porch and storehouse attached as a lean-to, was erected. It has double walls of board, with an outer and inner air-space formed by a sheathing of tarred paper; and it is intended to further protect it from cold by covering it outside with sods or grass, and, over all, with snow. For heating, a base-burner cooking-stove, with twenty tons of anthracite coal, is provided; and the smoke-flue of galvanized iron is ingeniously designed, not only to guard against fire, the misfortune most to be dreaded, but to provide, as well, an up-draught for foul, and down-draught for pure air, if required. Only twelve months' provisions were left; but they were selected as preventives of scurvy, and to give the greatest possible variety of nutritive food.

Meteorological observations are to be taken regularly throughout the year, at four-hour intervals, three of these times being synchronous with the series taken by the regular observers of the meteorological service.

After each observation, during daylight, the strait is to be examined with the telescope, and a record of its state written down *at the time*, including direction, and, when possible, velocity of tide, movements of any ice, and whether much broken up, solid field, etc. Each day the time and height of high and low water are to be observed, and, during the open season, the character of the tide noted for two days before, and three days after, the full and change of the moon. Detailed instructions for making these observations, and checking the zero-mark on the tidal-post, were given the officers.

In the official journal which is to be kept must be also entered any thing observed regarding the migrations of birds, seals, and walruses, the movements of fish, etc., and the growth of grasses, as well as the result of observations on the disputed question of the depth to which water will freeze during an arctic winter.

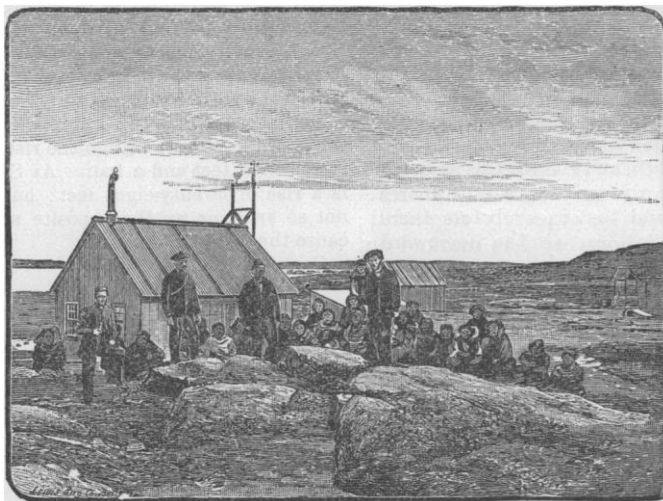
At Mr. Stupart's station, in addition to the work at the other

posts, special observations of magnetic phenomena are to be taken, for which a suitable building is provided.

In working through the strait, especially towards its western end, the ordinary compass was so sluggish as to be almost useless, and in this contingency the Sir William Thomson compass card was found to work admirably.

No icebergs were met, nor were reports obtained of their occurrence, in the bay. In the strait a large number were seen, principally along the north shore, where many were stranded in the coves; but some were met with in mid-channel. Of those seen in the eastern end of the strait, some had undoubtedly come in from Davis Strait, passing between Resolution Island and East Bluff; but all of those met to the westward had come from Fox Channel, or perhaps from the still more remote waters connecting with it, all of which have a southerly current.

Observations made by Mr. Ashe from his station on Turenne Island showed that a berg coming in



OBSERVERS' STATION AT STUPART'S BAY.

sight from the westward would pass out of view of his station to the eastward in from three to four tides, this indicating an easterly set of upwards of ten miles a day.

The icebergs seen from the Neptune in Hudson Strait in August and September were not more numerous, and would form no greater barrier to navigation, than those often met with off the Strait of Belle Isle, where, and off the Labrador coast north of it, a great number were encountered on the outward voyage of the Neptune.

Ordinary field-ice was met with off North Bluff, on the 11th of August, which, though it would have compelled an ordinary iron steamer to go dead slow, gave no trouble to the Neptune; the mate on watch running the ship at full speed between the pans, rarely touching one of them. In Ashe Inlet the ice came in with the flood-tide, and set so fast that the Eskimo were able to walk off to the ship, a distance of three-quarters of a mile. Similar ice was found on the south shore, opposite, but none in the middle of the strait so far east. In proceeding from this point to Salisbury Island, long strings of ice were frequently seen; but, as their direction was parallel to the course, the vessel coasted round them. The Eskimo reported that they had never seen the ice hang to the shores so late in the season, and that at all points there were unusually great quantities. On the homeward voyage none of this field-ice was seen.

Off Nottingham Island the ice got so heavy and close, that the attempt to force the ship through it was given up, after one blade of the propeller had been broken off, — an accident that entailed a delay of three days to fit in a new fan. In this ice, too, were seen four vessels, fast in the channel to the southward; one of them being the outgoing Hudson-Bay company's vessel, and another an American whaling-schooner. This ice was of an altogether different type from that hitherto met. Some of it, left dry at low water, was over forty feet in thickness, — not field-ice, thickened by the piling of pan on pan, but a solid blue sheet of ice, which had evidently been frozen just as it was found. The average thickness of the ice passed through, in the neighborhood of Port De-Boucherville, was upwards of fifteen feet.

From the reports of the Hudson-Bay company's ships, the evidence of Capt. Fisher's letter above quoted, and the experience of the Eskimo encountered, the conclusion is reached that 1883 and 1884 were exceptionally severe seasons, and the navigation more than ordinarily interrupted by ice; but the average of many years' observations at Fort Churchill, the only known harbor on the west coast of the bay, shows that the middle of June and the middle of November would be the extreme limits of time during which approach to that coast would be possible; and these limits agree closely with those of the open season in Nachvak harbor, on the Atlantic coast.

If the Neptune had been running direct from Cape Chudleigh to Churchill, instead of coasting, it is considered that she would not have been delayed by ice more than forty-eight hours; but no ordinary

iron steamship, built as a modern freight-boat is, could have got through the heavier ice met, without incurring serious risk, if not actual disaster.

From the resident factor at Churchill it was learned that the bay never freezes so far out but that clear water can be seen. From the greater heat of the water, the absence of icebergs at all seasons, and the absence of field-ice on the voyage, even at Chesterfield Inlet, in the extreme north-west corner of the bay, it is evident that the bay itself is navigable for a much longer period each season than the strait.

Some high tides and heavy currents were noticed. During two days in which the Neptune was lying-to off Cape Chudleigh, in fog, she was set forty miles to the southward, which indicates the necessity for caution in approaching the strait in thick weather. At Port Burwell the rise of spring tides is nineteen feet, with a current of about four knots in Grey Strait, which causes, when the wind is adverse, an ugly sea. At Ashe's Inlet there is a rise of thirty-two feet, with a strong tide-race, and a current sometimes reaching six knots within three miles of the shore. At Fort Chimo the rise of spring tides is thirty-eight feet and a half. At Stupart's Bay there is a rise of twenty-eight feet; but the currents are not so swift as on the opposite shore, probably because the water is shallower.

Complete meteorological observations were taken on board the Neptune during the voyage, which when afterwards compared with those taken during the same period at Belle Isle, — a station of the meteorological service in the regular summer trade route between Quebec and Europe, — showed that during August and September the weather of Hudson Strait, so far as affects navigation, compared favorably with that of the Strait of Belle Isle; there being eleven heavy gales at the latter place against three in the former, as well as more than double the amount of fog.

Lieut. Gordon, in concluding his report, urges, that, as observations of one year will probably not give a fair average, the stations should be continued for a second year, and two or three of them even for a third year; that next year's expedition should leave Halifax by the middle of May, and relieve the stations, or, if the ice prevented this, the ship should push on and investigate once for all the condition of the ice in the strait and bay in the early part of the season. If the stations could be relieved, an effort should be made to reach Churchill by the opening of navigation there, — about the 15th of June; then a running survey should be made on the east coast, some deep-sea dredging and sounding done, and beacons erected on the low-lying shores of Mansfield and Southampton islands. This would allow the ship to reach the strait again by the middle of August, when any spare time could be employed in surveying it more accurately; or as an alternative, the fishing, especially the whaling in Rowe's Welcome, which is becoming of some importance, might be investigated with a view to proper regulation of the trade.

WM. P. ANDERSON.



CHART
showing the track of the
"S.S. Neptune"
HUDSON'S BAY EXPEDITION
1884.

PUBLISHED BY THE
 Department of Marine
 OTTAWA-CANADA
 1885.



