

of wind, or current, or of both combined. It is in fact extraordinarily sensitive to these two agents. A pack of ice, for example, which when viewed from the crow's nest extends on all sides to the horizon, and which is so tightly run together as completely to block any advance, may in the course of a few hours, owing to a turn of tide, run abroad sufficiently to allow of the ship's proceeding with scarcely any delay. Hudson Strait is unfortunately the home of tidal currents and races which while nearly always rapid are so uncertain both as to set and velocity as to render difficult if not impossible any precise determination of general ice movements. This, however, is certain that along the north shore of the Strait there are extremely rapid tidal currents which, judging by the observed motion of ice-bergs, show a resultant set to westward. On the south shore, on the other hand, the resultant set of the tidal currents is to the eastward. As is quite to be expected, when the Strait is completely covered by field ice the latter is found to be slackest in mid-channel, since there the current is least. The disposition of the ice when the Strait is not completely covered, and therefore also the direction of its motion, depends largely upon the prevailing winds—the ice being found on the south or north shore according as the winds have been northerly or southerly. The well-known fact that the field ice as a whole has a resultant eastward drift and ultimately finds its way into the Atlantic, may therefore be readily ascribed to the marked preponderance, in that region, of northerly winds.

TO these currents in the Strait itself must be added another, the *Arctic* current—of prime importance in the discussion of ice movements. This current, which sweeps continually across the eastern entrance to the Strait with a southerly set of about a mile an hour, carries with it during the summer months enormous quantities of pack ice, as well as ice-bergs, which it draws for the most part from Davis Strait, but which may be considerably augmented by the east Greenland pack—the latter sweeping round Cape Farewell up the southwestern shore of Greenland and then joining the Baffins Bay ice which is carried south by the Arctic current.

The presence during June and July of the Arctic field ice off the entrance to Hudson Strait, adds very materially to the complexity of the ice movements in the Strait itself. Owing, namely, to the prevalence in that neighbourhood of eddies and tidal races there are nearly always present between the Button Islands and Resolution Island large areas of this Arctic current ice. If an easterly gale has been blowing this condition is greatly aggravated, and the ice may be tightly run together for thirty or forty miles off the entrance. The significance to navigation of this state of affairs lies not only in the danger of a vessel's being crushed by the rafting and impact of this heavy ice, but also in its effect upon the field ice in the Strait itself. This effect consists in the *blocking up* of the only exit for the ice which was formed in Hudson Bay and Strait, and which would otherwise have been clear of the Strait in June or July. The Strait is in consequence bottled up, as it were, and the date at which navigation becomes feasible proportionately delayed.

THIS date, indeed, cannot be fixed with precision. The conditions by which it is determined—prevailing winds, severity of the preceding winter, extent of the Davis Strait ice, etc.—are all variable and cannot be predicted with even approximate accuracy. As a general rule it may be assumed that the Strait will not be even moderately free from ice until early in August. Steamers, it is true, have pushed through the Strait early in July, but the delays in most cases have been so serious as to render a passage at this time unprofitable if not dangerous.

The experience of the *Arctic* during the summer of 1912 may be referred to in illustration of this point. Arriving off the Button Islands on the fifteenth of July she was immediately beset in heavy field ice. A slacking of the ice at turn of tide enabled her commander to push on a short distance into the Strait, but pack ice was again met in large quantity and it was only at rare intervals that the ship could be worked to westward. This condition prevailed right to the western entrance of the Strait, where she arrived on July 28th—having taken nearly a fortnight to cover a distance which would have been an easy two days' run on open water.

Nevertheless, during July, which is the warmest month in the year, the ice melts rapidly and by the middle of August has as a rule nearly all disappeared. That this disappearance is not by any means certain, however, may be made clear by a

few examples. In August, 1884, the *Neptune*, a steamer especially reinforced for ice work, was passing through Hudson Strait. Lieut. A. R. Gordon, who was in command, states in his official report that he met field ice on the eleventh, off the Lower Savage Islands, and from that date to the end of August was working his way toward Nottingham Island at the western end of the Strait through heavy field ice. This ice, he adds, would have compelled an iron freighter to go dead slow. On arriving at the island he found the ice quite impassable. Looking from the top of a high hill he could see nothing but a vast ice field extending in every direction. This he found to be from fifteen to forty feet in thickness. On attempting to work through it he broke the propeller of his ship and was forced to wait until the ice slackened before continuing his voyage. This was the condition of the Strait on August 30th, the time of the year when navigation in Hudson Strait is to be regarded as least dangerous. Ice such as this would, of course, be disastrous to an iron ship built on the lines of a modern freighter.

Again, in 1885, Lieut. Gordon fared no better. Meeting the ice at the western entrance to the Strait he drifted about helpless from June 15th to July 6th, the ice on one occasion jamming so tightly as to break the iron stem-plate of his ship, with the result that when set free he was compelled to put back to St. John's for repairs. Returning on August 4th he found the Strait still full of ice, and had barely passed the entrance when he was beset and unable to make any advance. This continued from August 5th to August 11th, after which he was able to work his way to Ashe Inlet. On approaching the inlet, however, he again broke the propeller, and although this was repaired in a few hours he was held hard and fast in the ice from the 12th to the 21st of August, and finally gave up the attempt to enter the inlet. Here again it should be noted that navigation, in August, was practically impossible for a wooden steam ship built especially for ice work. What it would have been to an iron freighter, which is, of course, vastly inferior for this work, it is left to the reader to imagine.

These examples are of interest by way of illustrating the uncertainty of ice conditions in Hudson Strait, and more particularly of showing that the month of August, albeit in lesser degree than that of July, must be regarded as by no means exempt from dangers and delays to navigation.

IN September the ice conditions in Hudson Strait are as a rule decidedly less discouraging than those in July and August. The Straits and Bay ice can in general be expected to have nearly all disappeared—the presence of ice-bergs having always, of course, to be counted upon. Nevertheless, even in this month heavy "old" ice has been encountered at the western end of the Strait, Lieut. Gordon, for example, meeting loose ice in large quantity on September 7th, 1886. For the explanation of the presence of this ice we must turn for a moment to the consideration of the conditions obtaining in Fox Channel. Here the ice attains a much greater thickness than does the Strait and Bay ice, this being due, of course, to the additions of successive winters. Each summer some of this ice drifts southward, and can at almost all times be observed in greater or less quantities in or near the western end of the Strait. It usually begins to come down in force some time in September or October, being driven by the northerly and north-westerly gales which at that time become very frequent in the region of Hudson Strait. It is this ice which may be encountered early in September and which, in fact, has been met in large quantity as far east as Ashe Inlet during the month of August.

Not being the product of a single winter like that which forms in Hudson Bay and Strait and



FAR FROM THE BEATEN TRACKS OF TRAVEL.
Moravian Mission Village at Port Burwell, Ungava.



STEAMSHIP STANLEY IN SLACK ICE.
Until Ice Conditions Are Better Understood Steamship Tourist Traffic in Hudson Strait Will Not be Heavy.

which under ordinary circumstances presents no serious dangers to a reinforced vessel, this ice is made up of huge floes sometimes half a mile in diameter and ranging from ten to forty feet in thickness. It goes without saying that this ice offers at all times grave perils to navigation; the tidal currents off the Digges Islands, especially if combined with the northerly gales which prevail during the autumn months, rendering inevitable the tightening up and even rafting of the pans, with consequences disastrous to any vessel, no matter how strongly constructed, which is built on the lines of a modern freighter. The only type of vessel, in fact, which might be expected to survive being nipped by this ice would be one like the *Arctic*, the under-water lines of which are such as to transmit a lateral thrust upwards and thus to cause the ship to be lifted bodily out of the water.

Although even in September there is the probability of incursions of Fox Channel ice, it is more especially in October that this danger becomes imminent. To the risk of being crushed in the manner just described there is added a new danger—the likelihood of being *frozen in*. The mean temperature in October is considerably below the freezing point of salt water and in consequence young ice is constantly being formed. While this in itself offers no serious obstacles to a powerful steamer there is always the probability that the heavy Fox Channel ice will be cemented together by the formation of new ice between the pans. When thus rendered rigid by this natural cement the field is quite impassable, even by the most powerful ice-

(Concluded on page 21.)



WHERE MAN IS BUT A CASUAL DECORATION ON THE GREAT FACE OF NATURE.
Indian Hunters at Fort Churchill, One of the Possible Terminals for a Railway to Hudson's Bay. The Peculiar Head-cloths Are Veils to Screen Off Black Flies and Mosquitoes.