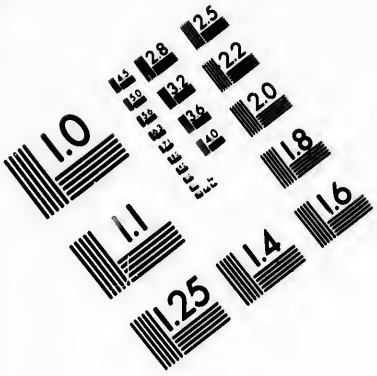

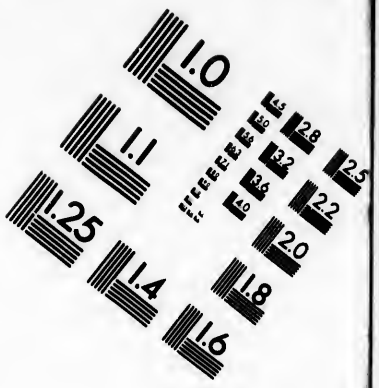

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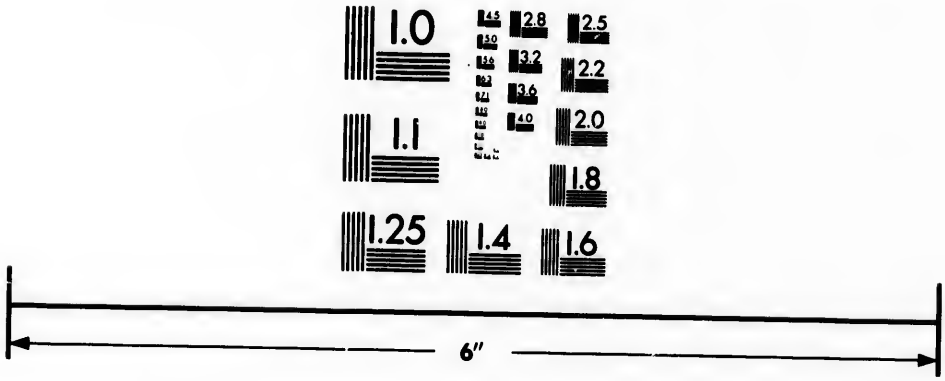

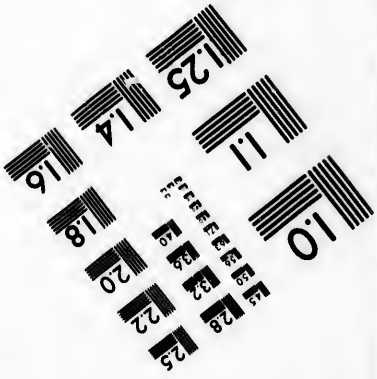

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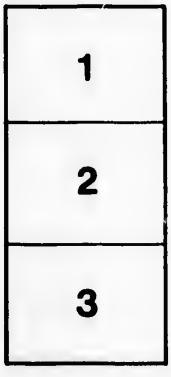

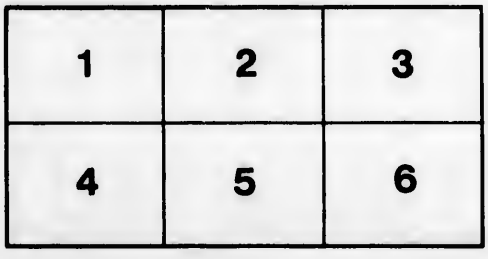

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D.B. Dowling

With compliments of
J.B. Tyrrell.

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NORTH-WEST TERRITORIES OF CANADA.

[*Extracted from the* GEOLOGICAL MAGAZINE, September, 1894.]

London: KEGAN PAUL, TRENCH, TRÜBNER & Co., Ld., Paternoster House, Charing Cross Road, W.C.

[*Extracted from the* Geological Magazine, Decade IV. Vol. I. No. 363, p. 394, September, 1894.]

Notes on the Pleistocene of the North-West Territories of Canada, North-West and West of Hudson Bay.[1]

By J. Burr Tyrrell, M.A., B.Sc., F.G.S.

In the extreme northernmost part of Canada, lying between North Latitudes 56° and 68° and West Longitudes 88° and 112°, is an area of about 400,000 square miles, which had up to the past two years remained geologically unexplored.

In 1892 the Director of the Geological Survey of Canada sent the writer to explore the country north of Churchill River, and south-west of Lake Athabasca; in 1893 the exploration was continued northward, along the north shore of Athabasca Lake, travelling from the east end of Lake Athabasca across the country in canoes to the west end of Chesterfield Inlet, and thence continuing in canoes along the shores of Hudson Bay almost to Churchill, from which place an overland journey was made to Winnipeg, Manitoba.

The south-western half of the country traversed in these two summers is more or less thickly covered with coniferous forest, while the north-eastern half is devoid of trees, and is generally covered with stunted grasses or lichens.

North of Churchill River the country is underlain by red and grey Laurentian granites and gneisses, with a fairly persistent strike in a south-westerly direction.

South of Lake Athabasca and Black River these Laurentian rocks are overlain by horizontal red sandstones and conglomerates, occasionally cut by trap dykes, which probably represent the Kewenawan sandstones of Lake Superior, and are therefore of Cambrian age, though no fossils were found in them. Athabasca, Black, Wollaston, and Cree Lakes lie along the line of contact of these sandstones and the underlying Archæan rocks.

The north shore of Lake Athabasca is composed of Laurentian gneiss, and Huronian quartzite, conglomerates, and schists, which in one place were found to be associated with a large deposit of hæmatite. The country crossed from Lake Athabasca to Doobaunt Lake is underlain by Laurentian gneiss, which, however, is often hidden by extensive deposits of Boulder-clay.

In one locality a small outline of unaltered fossiliferous Ordovician limestone was found, very similar in character to the white limestone of the Winnipeg Basin.

On Doobaunt Lake the Kewenawan sandstones and conglomerates were again discovered, and the country lying between this lake and the head of Chesterfield Inlet was found to be largely underlain by these rocks. The north side of Chesterfield Inlet is generally red and grey Laurentian gneiss, while the greater part of the shore of Hudson Bay for 150 miles south of the Inlet is composed of green Huronian schists cut by many quartz veins, and sprinkled through with particles of copper pyrites.

The whole of this region shows abundant evidence of having been comparatively recently covered with a mantle of ice, and even

[1] Published by permission of the Director of the Geological Survey of Canada.

to the present time Doobaunt Lake, the largest of the many hitherto unexplored lakes through which we passed, lying in North Latitude 63° and West Longitude 102°, and with an elevation of about 500 feet above the sea, seems to be always more or less completely covered with ice, for during the ten days which we spent on it—from August 7th to August 17th—we were obliged to travel in a narrow lane of water between the solid ice covering the main body of the lake and the shore, and in two places this channel was blocked by the ice resting against the beach.

In general physical features the "Barren Lands" often closely resemble the great plains west of Manitoba along the line of the Canadian Pacific Railway, being undulating grass-covered country, underlain by Till more or less thickly studded with boulders; but a hard granite knoll projecting here and there serves to remind one that the Till is not here resting on soft cretaceous shales and sandstones, and at once accounts for the much greater abundance of boulders.

In some places the surface is composed entirely of large subangular boulders, without any matrix of sand or clay, while the shores of Chesterfield Inlet, and part of the north-west coast of Hudson Bay, are bold and rocky.

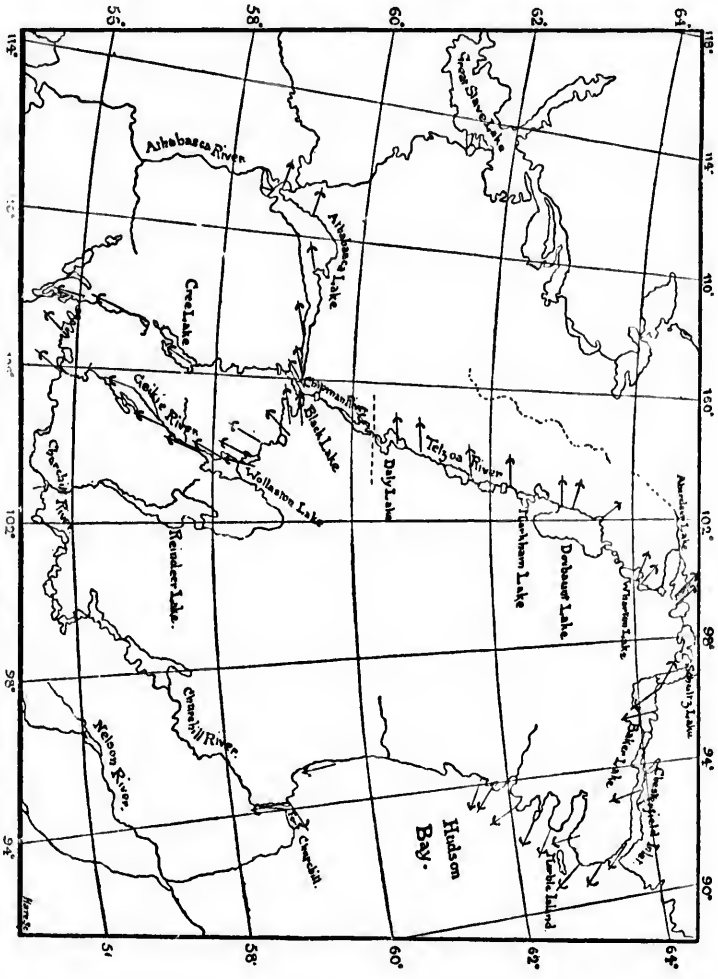
A particularly noticeable feature of the "Barren Lands" is the absence of valleys for the rivers. The Telzoa River, probably the largest stream in all that country, is, through the greater part of its course from Daly Lake to the head of Chesterfield Inlet, merely a succession of lakes of larger or smaller size, lying in original depressions in the Till or rock, connected by stretches of rapid water flowing in one or more shallow, tortuous, and often ill-defined channels frequently choked with boulders. Although the long winter and the ever-frozen ground would prevent very rapid erosion, it is evident that this river has been but a short time cutting out its channel.

Throughout the whole region the rock has everywhere been strongly glaciated, leaving the exposed portions rounded and often polished and striated. Most of the prominent knolls show clearly the direction of glaciation by the rounded stoss and broken lee sides, but in cases where two or three different glaciers have scored records on the small rocky knolls, all sides may be well smoothed, rounded, and scored.

The accompanying map shows the general directions in which the glacial grooves and striæ are trending, deduced from several hundred observations. As is there shown, the direction of glacial movement on the upper Churchill River is south or a little west of south, or parallel to the long axis of the lake; on Chipman River and the head of Telzoa River south-west; on Doobaunt Lake and the river in its vicinity west. Some of these last striations are crossed by an earlier set of striæ coming from the north.

On Telzoa River, between Doobaunt and Baker Lakes, the direction of striation is north-westward, the course being clearly shown by the stoss and lee surfaces, boulder trains, and the

crescentic cross-fractures in the grooves. At the west end of Baker Lake the north-westerly striation is crossed by what appears to be a local glaciation from the north, but this southward moving glacier soon obliterated all traces of the north-westerly one, and then the trend of the glaciation is found to be down Chesterfield Inlet, which



Map of the North-West Territories of Canada, explored by J. B. Tyrrell in 1892 and 1893. The arrows indicate the general direction in which the glacial grooves and striæ are trending.

is a rocky fiord with a depth varying from twenty-five to forty fathoms. The north-west coast of Hudson Bay, for 150 miles south of Chesterfield Inlet, is bold and rocky, and the hard Huronian rocks of which it is chiefly composed everywhere show well-defined glacial markings which have a general direction about S. 50° E. or directly out into the bay. Near the mouth of Egg River a boss of

coarse red granite on the shore is polished and scored with glacial markings trending southward. At Fort Churchill the low granite knolls, and the high bare rounded hills of green feldspathic quartzite, are scored by three sets of striæ, the two most recent of which are very distinct, while the earliest, wherever seen, is rather obscure. This latter trends N. 80° E. (or S. 70° W. ?), and is not improbably merely an early variation of the next, which trends N. 55° E. This set of grooves and striæ is very strongly marked on all the southern and south-western slopes, against which the glacier pressed heavily on its way down the valley of the Churchill River to Hudson Bay, but the eastern sides of the hills show comparatively few traces of this glaciation.

Crescentric cross-fractures are common in the grooves, and these all lie with their concave sides towards the north-east, or towards the point of the compass to which the glacier moved. The most recent set of striæ is found on the summits and northern sides of the hills, and points southward, the striæ being found to vary from S. 5° W. to S. 10° E.

From the above record of striæ it will be seen that one of the great gathering grounds for the snow of the Glacial period in North America was a comparatively short distance west of the northern portion of Hudson Bay, and from that centre or gathering ground the ice flowed not only towards the Arctic Ocean and Hudson Bay, but it extended a long distance westward towards the Mackenzie River, and southward towards the great plains, while Hudson Bay was probably then to a great extent open water. From it the moisture would be derived which fell as snow near its western shore.

The older geology of the country is known over such a small portion of the total area that it is impossible to draw any definite conclusions from the direction of transportation of boulders; but on the west shore of Hudson Bay the boulders were such as would be derived from the Laurentian, Huronian, and Keweenawan rocks to the west, and there were no signs of the limestones, etc., from the islands in the Arctic Ocean or Hudson Bay. On the Telzoa River the boulders showed no evidence of having been derived from the west coast of Hudson Bay.

Drumlins or ridges of Till are almost everywhere found in the less rocky areas. Eskers are also common, either rising in high narrow elongated hills, or running as long sandy ridges, keeping their courses, which are parallel to the glacial striæ, over hills and through valleys and lakes quite regardless of the surface contour of the country. In the more southern districts these are wooded with large white spruce, which rise conspicuously above the stunted black spruce on the surrounding low land.

After the ice receded from the lower country the land was about 400 feet below its present level. On the lower side of a long portage a short distance below Doobaunt Lake the first well-defined raised beach and terrace was seen, and from that point all the way down the river to Hudson Bay old strand lines could be seen on the sides of all the prominent hills.

A white quartzite hill on the east side of Wharton Lake has three distinct gravel terraces or shore-lines on its southern side at heights of 60, 105, and 130 feet above the water. At the east end of Aberdeen Lake scarps, gravel, terraces, and ridges extend up the side of some hills of Kewenawan conglomerate to the height of 290 feet, the total series here having the following heights in feet above the water in the lake: 290, 220, 180, 150, 105, 90, and 60. On the side of a quartzite hill at the east end of Schultz is a well-marked gravel beach which the aneroid showed to have a height of 260 feet above that lake, probably the same as the 220 feet beach on Aberdeen Lake.

Similar raised beaches are found in favourable localities all along the shore of Hudson Bay.

These beaches indicate a gradual, though probably intermittent, rise of the land towards, or after the close of, the Glacial period; and some, even among the oldest of them, look as new as if they had been formed but yesterday, but it would seem that at Fort Churchill, and probably along the rest of the coast, the land and sea have reached conditions of comparative equilibrium. Some evidence on this point was collected near Fort Churchill, and especially at Sloop's Cove, a little bay on the north side of the river, where the ships of the Hudson Bay Company used occasionally to winter about the middle of last century. This spot was visited on the 29th of October and the 2nd of November of last year. The ice was in it then up to the level of an average spring tide, which had occurred two days before our first visit.

The cove is forty paces wide and one hundred paces long, and on each side are smooth well-glaciated hills of green quartzite rising to about 25 feet above the ice. At the back is a grass-covered bar of sand and gravel, joining the two disconnected hills of rock, and separating the cove from a wide flat that is flooded at spring-tide. The height of the summit of this beach was seven feet and a half above the level of the ice, or about the level of extreme extraordinary high tides. On the smooth glaciated surface of the rock many names and dates have been cut, some of which are given below, with their heights above the level of the ice:—

Furnace and Discovery, 1741	3 ft. 3 in.
J. Horner, 1746	6 ft.
James Walker, May 25th, 1753	7 ft.
Guilford Long, May 27th, 1753	7 ft.

and many others.

The "Furnace" and "Discovery," two small ships sent to discover a North-west passage, spent the winter of 1741–42 in Sloop's Cove, and left for the north as soon as the ice broke up in the spring of the latter year. Probably the names were cut in the almost vertical face of the rock by some one of the crew on whose hands the long days of waiting in winter hung very heavily. They are almost as high as a man would naturally reach if he were seated on a box or keg on the ice at the foot of the rock. The dates May 25th and May 27th opposite the names of James Walker and Guilford Long

would show that these names were cut when the ice was still solid in the cove, for the ice does not break up in the river at Churchill until the middle of June. These names were apparently cut by men standing on the ice when it was about two feet higher than it was last November, or when it was covered with two feet of snow. Nine large iron rings had been set in the rock at heights varying from two feet and a half to seven feet above the ice, just where they would be convenient to tie a small ship to at present, for the cove could not be entered, except at high tide. One other ring is fifteen feet above the ice.

All these signs of the winter occupation of this cove a century and a half ago are such as might be made at the present time, and are quite inconsistent with the theory that the rise of the land which took place in post-Glacial times is still going on at a comparatively rapid rate.

Stephen Austin and Sons, Printers, Hertford.