The Brazeau Ice-Field

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Slave lake, and then towards the Rockies; but west of Lake Winnipeg we have about 400,000 square miles of as fine wheat lands as there are in the world, which give just twice the crop per acre of the lands of the United States, and when I tell you the wheat crop of the United States is raised on 100,000 square miles of land, and here there are 400,000 square miles, you may well understand that Great Britain ought to get her bread stuffs from her own territory if she be a wise nation. I have tried to give you a little idea of the practical value of this splendid paper to which we have been listening, and thank you very much for your kind attention.

The PRESIDENT: We have listened to a most interesting paper, and also to a very valuable discussion. I think we must all feel admiration for the perseverance and ability with which Prof. Norman Collie has, during four successive expeditions, first explored this very difficult mountain region from a geographical point of view, and then has filled up all the topographical details by ascending lofty and difficult mountain peaks, by traversing very dangerous icefields, and by discovering at least one important pass. You will, I feel sure, pass the vote of thanks which I now propose to Prof. Norman Collie, by acclamation.

THE BRAZEAU ICE-FIELD.

By Prof. A. P. COLEMAN, Ph.D., Toronto University.

DURING the month of August last summer, a brief trip was made to some hitherto unvisited valleys to the north-east of the region mapped by Wilcox* and Collie† in the Rocky Mountains, and about 50 miles of new trail were explored and mapped. The party consisted of Mr. L. Q. Coleman, his wife, Mr. Proctor Burwash, and myself, with four riding-ponies and as many for packing. As on former journeys, we travelled without guides or professional packers. Since my last journey in 1893 all the expeditions which have gone into the Canadian Rockies have made Laggan their starting-point, but we followed our former route, starting from Morley just east of the mountains, and making use of the trail made by the Mountain Stonies in their northern hunting trips. The route is longer, but the trail has certain advantages, since it is well beaten, has a drier climate than trails nearer the watershed, and presents a greater variety of scenery, including bits of prairie and foothills, park-like valleys near the "gaps" in the mountains, and a gradually increasing boldness of the mountain forms as one approaches the heart of the great range.

In the nine years since we had used the trail before some changes had taken place. In parts it had grown decidedly longer by the falling of dead trees, which the Indian philosophically goes round instead of using his dull axe upon them. A marked climatic change was indicated

* 'The Rockies of Canada.' 1900.

† *Geographical Journal*, vol. xvii. p. 332.

by the much more powerful cutting of the streams, which had often destroyed the old trail, and had even chosen new channels through the woods, undermining the trees and making wild confusion of their tangled trunks. For several years the rainfall of Alberta has been much above the average, setting springs and streams flowing in what were formerly dry "coulees." It can hardly be expected that this abundant rainfall will be permanent, however. Our month was marvellously fine for the mountains, only one day being lost by rain, a record which may be contrasted with Collie's experience of continuous rain on the Columbia side of the mountains two years before.

As the earlier part of our route has been described before,* nothing further need be said of it, except to mention the unusual height of the Saskatchewan on August 11, when we crossed it. We found fifteen lodges of Stony Indians camped on the Kootenay plains near the foot of Sentinel mountain, but on the wrong side of the great river, which had not yet been fordable. As we passed they were just breaking camp in picturesque confusion, dogs barking, women taking down the canvas from the conical frame of poles, and looking up piebald or buckskin ponies to pack their household gods upon, and men putting their saddles on riding-ponies. After shaking hands with my old friend Jimmy Jacob, we secured Sampson Beaver to guide us over the ford, his sister, Becky, a bright-faced girl who talked some English, bestriding her horse and coming along as interpreter.

The river can only be forded where split up into numerous channels by low wooded islands, and before leading us over Sampson tried the ford himself, partially stripped so as to swim with his horse when he lost his course in the muddy water. He was a very lively and graceful bronze statue as he made his way across, but quite belied his name as far as physique was concerned.

Coming back, he led the way, and our band followed with no mishap, except that a pack-pony, edging too much down-stream, got into deep water and had to swim.

Our course now turned up Cataract river, following a poor trail seldom trodden of late years, scrambling down into canyons to cross tributary streams, but usually keeping on the rough talus slopes of the mountains, or along moraines hundreds of feet above the boiling river. The fine doublefold of Sentinel mountain stood just opposite us, and on ahead were splendid cathedral-shaped mountains, the most prominent of which we named Minster mountain. This peak is well seen from the prairie land of the Kootenay plains.

Instead of following up the west fork of Cataract river leading to Cataract pass, we took the north-west one through a wide unexplored

* *Geographical Journal*, vol. v., "Mount Brown and the Sources of the Athabasca," pp. 53-60.

valley, intending, if possible, to follow it to its head, and then seek a new pass to the Brazeau. Remnants of a very old trail showed that the valley had been entered by Indians, and teepee poles rotting on the ground at two points where there was some grass indicated their halting-places.

The trail can be followed only for short distances, and a good deal of chopping was needed to open a way for ponies, while at one place we had to lead them among the boulders along the edge of the river, here a raging torrent. To the north-east the valley was walled by an unbroken range of highly tilted mountains like a steep slate roof; but to the south-west the cathedral type prevailed with a gentler dip.

FOOTHILLS, LITTLE RED RIVER.

For 10 miles the valley is straight, following the strike of the mountains, but it then curves to the west, and the river splits into small creeks. Here we scrambled up a steep-wooded slope, and camped at 7200 feet, not far below timber-line. On the brow of a hill overlooking the valley and opening out a wide mountain view, we found several great springs gushing out and forming thick beds of travertine.

My brother climbed the mountain to the north-west, finding it to be 9000 feet high, naming it Mount Frances; and later we explored the main stream in the valley, following it up through a chain of lakes, the lowest at 7000 feet with forest-covered shores, then a very striking waterfall and a lake at 7500 feet, completely rock-enclosed, and fed by streams from a glacier a few hundred feet higher. Making our way around the cirque-like valley over very rough talus, we found another lake to the south-east just above tree-line, the most striking of them all, with blue-green water and a cliff 1500 feet high on one side. The lakes, though only three-quarters of a mile long, are as magnificent in their

way as Lake Louise near Laggan. All but the lowest one occupy rock-basins hollowed by small glaciers when the snow-line was lower than now.

Following a small stream north-west from the camp with our ponies next day, we soon rose above timber-line on our way to the lowest yoke of the mountain wall between the Cataract valley and the Brazeau. Though the rough small stones, uncovered with vegetation for the most part, annoyed our unshod ponies, we presently came to the foot of the ridge, and then scrambled up the slaty talus slope to its summit, where we had to decide whether to risk the unknown descent to the Brazeau or turn back the way we had come. The elevation of the yoke is 8600 feet, nearly 1000 feet above the highest pass we had crossed with ponies hitherto, and there was no sign of a trail suggesting that Indians had gone that way before.

From the ridge we had a glorious view of the mountains around, most of them from 9000 to 11,000 feet high, and carrying small glaciers; of the densely wooded valley of the Brazeau, which flowed about 2 miles off, but nearly 3000 feet below; and of Brazeau lake and the great glacier beyond it gleaming in the distance, the goal that we had set before ourselves in the beginning.

We quickly decided to risk the descent, and soon our ponies were slipping and stumbling down the steep slope, partly over soft snow-fields, but often over loose *débris* which rolled and slid beneath them. Reaching the valley of a snow-fed stream, we had rather better going, until this cut its bed down into a canyon, and finally plunged over a vertical fall of 100 feet or more. After trying in vain to pick a trail over the mountain, we at last led our tired and footsore ponies down the bed of the torrent, almost to the edge of the fall, and then made them scramble up to the right, where a small shelf gave a foothold to a few trees. From this it was easy to reach the forest slope, and as darkness fell we pitched our camp among the spruces, glad to have conquered, but not anxious to go back over the route again.

We were still 1500 feet above the ford of the Brazeau, near its forks, but two hours of steep descent among the trees brought us to the trail along the valley, the best beaten highway since leaving the Saskatchewan. Even here fallen timber gave us great trouble, but at last we reached the ford at 5830 feet, and turned up the valley of the north fork of the Brazeau to the lake of the same name. The trail is in better condition from the forks to the lake, and for 5 miles along the lake-shore than elsewhere; but from the delta of the north fork at the upper end of the lake, the trail is faint and hard to follow. Keeping to the left side of the valley, we came to a full stop about 6 miles up, a huge moraine of blocks of limestone as large as a cottage lying right across the valley. We were still several miles from the glacier, and it was necessary to get nearer it if possible.

At last a vague track was found among the boulders leading over the moraine, and beyond it an enchanting little valley with half a mile of prairie for the horses, thick groves of rather stunted spruces for fuel, and as a water-supply a clear stream leaping into the valley in a lofty waterfall, and ending in a pond without a visible outlet. Doubtless the pond drains through the moraine to the river below.

Our moraine camp was at about 7000 feet in what was probably the ancient river-valley before the moraine crossed it. Since that event the river has broken its way through, and cut an almost impassable canyon half a mile to the south. From this beautiful camp we had a broad view of the ice-field 4 miles to the north-west, and laid our plans for an attack upon it next day.

BRAZEAU SNOW-FIELD, FROM MORaine CAMP.

We were rather late starting in the morning, having lost time in improvising alpenstocks from small spruces and steel nails, so that by the time the valley had been skirted and a rocky ascent climbed to the edge of the nearest glacier it was nine o'clock, and the sun was already strong. On our way we passed a very desolate lake half a mile long. The ice-field is broken by a long and very precipitous mountain ridge, the foot of which we decided to follow on our way up. The going was good for a mile on the bare glacier until the snow was reached, when the slope became steep, and the soft snow made very heavy walking. Tiring of this, we tried the mountain-side, but, after wasting some time, found it impracticable, and returned to the snow. At one o'clock we reached the top of the ridge which nearly cuts the snow-field in two, and found ourselves 10,000 feet above sea-level. The highest point of the mountain rose less than a mile to the north-west, but in very forbidding cliffs, so it was decided to attack it by a slope of snow on the south side. At our present elevation the snow was harder than

before, and the walking was fairly good, though we had to make a circuit round some large crevasses. Soon the slope became steeper, so that footholds were hard to make, and the surface, softened in the sun, begun to slip in great sheets beneath us, threatening to sweep us with it. Halting on some projecting rocks at 10,550 feet, we considered the situation, and concluded regretfully that further climbing was too dangerous to be risked. A clinometer reading from our earlier halt makes the top of Brazeau mountain, as it may be called, more than 11,000 feet, so that we were still several hundred feet below the top when we turned back.

From our perch on the rocks there was a magnificent view of the central Rockies, including the Columbia ice-field, and the bearings of a number of points were taken; but there were very few summits rising prominently above the rest, and we could not be sure of the mountains marked by Collie 20 miles to the south.

Immediately below us we had the Brazeau snow-field, 8 miles in length and 4 in breadth, rising into two white mounds towards the south, and sinking away to dirty surfaces of ice in the valleys to the east, followed by muddy torrents forming the headwaters of Brazeau river. Toward the north there was a profound and desolate valley, whose outlet we could not see, and to the west the green valley of Poboktan or Owl creek, a tributary of the Sunwapta, the eastern branch of Athabasca river. The Brazeau snow-field sends most of its drainage into the Saskatchewan and Hudson bay, but part into the Athabasca and the Arctic ocean.

The mountains toward the east were somewhat lower than toward the south and west, but almost every peak in sight carried snow-fields and glaciers; none of them, however, except in the far south, as large as the one we had traversed.

Glissading on the steeper slopes and wading through the soft snow on gentler parts, we made haste to reach camp before nightfall, but had one mishap before leaving the snow-field. I was in the lead, following our morning's footprints somewhat carelessly, when I plunged through the snow into a wide crevasse which we had crossed on the snow-bridge going up. Fortunately, my alpenstock crossed the chasm as I fell, partly supporting me, and my brother and Mr. Burwash tightened the rope and quickly helped me out of my uncomfortable position.

After more than eight hours on the snow, we were glad to reach the rocks again near the end of the glaciers, and, passing the small lake, made our way to camp just at dusk, where a splendid dinner of mountain sheep awaited us.

On the following day I waded several of the glacial streams and climbed to the lowest col towards the south-west, so as to complete my map. The route included $1\frac{1}{2}$ mile of glacier and snow-field, and crossed a small nunatak, evidently not long free from *névé*, but lichens, mosses,

phloxes, daisy-like flowers, and a yellow composite are already growing on it. The col is at 9800 feet.

All the glacial tongues show signs of recession, a bare morainic belt reaching for a few hundred yards below; and the tree-covered moraine 4 miles away near our camp evidently indicates a much greater development of the ice some hundreds or thousands of years ago.

On our way back to Morley we followed up the west fork of Brazeau river and crossed Cataract pass, halting for a day to climb a mountain near the head of the pass, so as to complete our map of the region to the north-west. Our camp was at about 7000 feet, and the mountain, whose top is not more than three-quarters of a mile away, reaches above 10,000 feet. Unfortunately, an impassable cliff met us at 9830 feet on the west side

UP THE SASKATCHEWAN, FROM KOOTENAY PLAINS.

where we attacked it, and we were obliged to content ourselves with the view up and down the pass and across the opposite range toward the great snow-fields of the central Rockies. We named the point Mount Stewart, after our former companion, Prof. L. B. Stewart, who had prepared the original map of the region.

From Mount Stewart we made a start for home, with slow travelling on the bad trails to the Kootenay plains, but averaging 30 miles a day for the last four days, our ponies having by this time very light packs.

It is worthy of note that the mountain sheep, which have been little hunted of late years beyond the Saskatchewan, are becoming numerous and tame. We came within fifty yards of an old ram on the north-west fork of Cataract river, and had a close view of a flock of seven on our way up to the high pass toward the Brazeau. Another flock of five ambled away from us soon after we started our climb of Brazeau

mountain. Their khaki is splendid protection on rocky mountain-sides, but betrays them when feeding on green lower slopes.

In closing this paper, attention should be called to a statement made by Prof. Collie in the interesting account of his last work on the Columbia side of the Rocky mountains, that his previous explorations were on the *eastern* side of the Rockies.* In reality his excellent map covers only the central ranges, and there are several parallel ranges to the north-east, each somewhat lower than the former one, until the last, rising only to about 8000 feet, presents the great wall of rock toward the prairies from which the name Rocky mountains was derived. These north-eastern ranges have a width of 35 miles, as shown in the Brazeau valley, and include three or four ranges separated by lateral valleys to the north-east of Brazeau lake, the last point which he shows.

It is worthy of mention that on his map, as well as on the map published by Wilcox in his sumptuously illustrated 'Rockies of Canada,' through some oversight no credit is given for the parts taken from the map prepared by Mr. L. B. Stewart for my last paper,† though the whole of the region around Athabasca pass, Fortress lake, and the Brazeau and Cataract rivers has been copied from it, including passes and elevations. It is due to Mr. Stewart that his pioneer work should be recognized, when others who have done less work in the region are referred to as authorities.

I wish to say a word, also, in regard to nomenclature. The Canadian Pacific authorities have introduced the name Wapta for the Kicking Horse river, apparently unaware that Wapta is simply the Stony word for "river" in general, and should not be applied specifically to one of the minor rivers of the region. Collie has employed the name also for an ice-field near the source of one fork of the river. Finally, Wilcox uses the name Whirlpool river for the Sunwapta, or east branch of the Athabasca. As the same name has long been applied to a tributary coming into the Athabasca from the Committee's Punch-bowl to the south-west, it is evident that the new use of the name can only make confusion.

TRAVELS ON THE BOUNDARIES OF BOLIVIA AND ARGENTINA.

By Baron ERLAND NORDENSKIÖLD.

THE boundary between Bolivia and Argentina is remarkable for its great diversity, as within a restricted sphere the traveller meets with vast tablelands, snow-clad fells, wild mountain valleys with luxuriant

* *Geographical Journal*, vol. xvii. p. 252.

† *Ibid.*, vol. v. No. 1.