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THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE BASIN OF THE YUKON RIVER IN CANADA.

By J. B. TYRRELL, M.A., B.Sc., F.G.S.

(Read at the Society's Hall, Edinburgh, January 8th; also in Dundee, January 9th, and Aberdeen, January 10th.)

IN the extreme north-western part of the continent of America, as far removed as possible from the early settlements on the Atlantic sea-board, the mighty Yukon rolls for 2000 miles northward and then westward, between cloud-capped mountains and through extensive flowery plains, to discharge its waters into Behring Sea. For numberless ages it has flowed through this beautiful, but lonely and silent wilderness, unvisited by any save a few of the animals of the Pleistocene Period, among them the mammoth and the wide-browed bison, who wandered along its banks, and called to their fellows across its quiet pools; and when these had disappeared, by the shy moose, at present the giant of the Canadian forest, and the vigilant caribou. In pursuit of the latter, a few men, as wild as these wild animals themselves, were roaming here and there over the hills and valleys.

The country might have remained almost unknown for many years to come, until the tide of European civilisation, advancing from east and south, had flowed quietly and slowly over it, had not the discovery of rich gold mines caused a rush of population to that distant land, to form a centre of human activity and progress, from which civilisation may radiate in all directions.

SIZE AND POSITION.

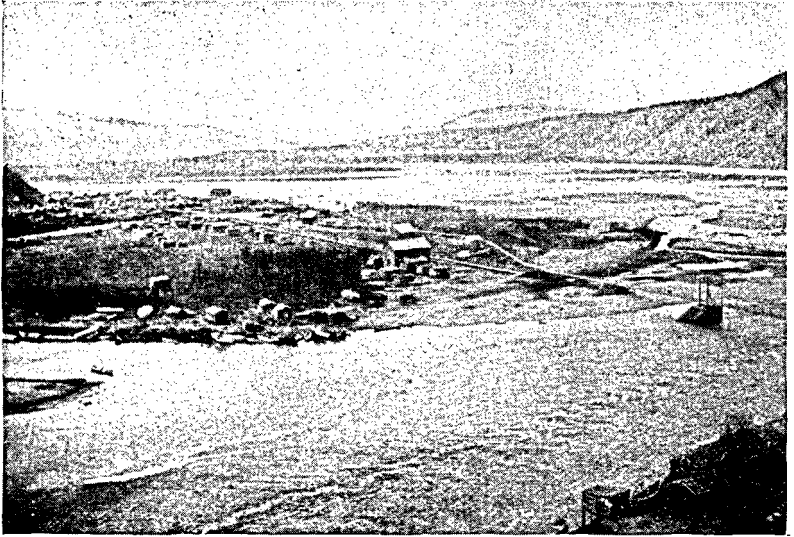
The Yukon river rises within the Dominion of Canada, and for rather more than a third of its length flows through British territory, its lower

reaches, for nearly two-thirds of its length, being within the United States territory of Alaska.

This evening my remarks will be confined to that portion of the Yukon basin which is entirely within the Dominion of Canada.¹

It lies between W. long. 129° and 141° , and between N. lat. 59° and $64^{\circ} 41'$. It forms an irregular area with a greatest length, in a north-westerly and south-easterly direction, of 500 miles, a greatest width of 420 miles, and a total area of 123,500 square miles.²

It is thus slightly larger than Great Britain and Ireland, Austria, Hungary, or the province of Manitoba, and is almost exactly the size of Norway.



Valley of the Yukon river as seen from the hill behind Dawson. The Klondike river in the foreground.

Lying as it does between N. lat. 59° and $64^{\circ} 41'$, it occupies a somewhat similar position on the western side of America to that occupied by the central portion of Sweden on the western side of Europe.

BOUNDARIES.

It is bounded on the south-west by the range of lofty, snow-capped mountains which reach from the coast of the Pacific Ocean inland for

¹ For the latest information about the adjacent territory of Alaska, I would refer to a brochure (with ten maps), recently published by the United States Geological Survey, entitled, *Maps and Descriptions of Routes of Exploration in Alaska in 1893*.

² To this should be added an area of 24,000 square miles in the basin of the Porcupine river, one of the northerly tributaries of the Yukon; but as the Porcupine basin is almost cut off from the basin of the Upper Yukon by a spur of the mountains from the east, and is connected closely with the basin of the Lower Yukon in Alaska, it will not be considered here.

from 70 to 100 miles, and terminate towards the north-west in the St. Elias Alps, among which are the highest and greatest mountain peaks in North America. As the name St. Elias is of distinctly local significance, I have elsewhere proposed to apply the general name Chilcat mountains to this range, which rises steeply from the coast, and within a few miles forms a watershed between the short rapid streams that flow into the Pacific and the streams that flow northward across the great interior plateau to the Yukon river and finally empty into Behring Sea. These Chilcat mountains have a roughly serrated outline, with peaks rising from 8000 to 19,500 feet above the sea, while in many of the intervening valleys rest great glaciers, which in places join together and form vast fields of snow and ice. As I stood on the summit of Mount Malony, one of the highest peaks, rising on the bank of a branch of White river, and looked away southward towards the Pacific, I saw a vast field of snow stretched out before me, through which rose dark, massive, craggy summits, and as the clouds rolled along, and heaved, and fell, I got one short glimpse of St. Elias itself. Possibly we were the first white men to see this mountain from the landward side, and, at all events, whether we were or not, the sight of this extensive mountainous region, throwing out numberless glaciers both to the south and to the north, both towards the sea and away from it, was a most instructive one. It was so very suggestive of the conditions which had prevailed at an earlier time, when the Glacial Epoch held the region in its icy grasp, and when the fields of snow and ice were very much more extensive than they are at present.

From the crest of the Chilcat range the country descends to the interior table-land, which has been called by Mr. Brooks of the United States Geological Survey, the Yukon plateau.

To the east and north-east the Yukon basin is bounded by a range of high, rugged mountains, which is evidently a northern continuation of one of the ranges that farther south are grouped together under the rather indefinite name "Rocky mountains." Of this portion of the range very little is known. Last summer it was crossed in several places by a number of prospecting parties on their way from Edmonton, by the Mackenzie river, to the Klondike goldfields. From these parties some information as to the position of the mountains was obtained, but beyond the general statement that no gold could be found in them, little or nothing could be learned of their character. Unlike the Chilcat range near the coast, this range would seem to be quite free from glaciers, though from the higher elevations near Dawson snow can be seen on the highest peaks throughout the summer. The summits have probable elevations of between 5000 and 8000 feet above the sea.

TOPOGRAPHY.

The Yukon plateau, lying between these two ranges of mountains, is not by any means a level plain, but is rather a widespreading area of rounded mountains with a general relief of from two to three thousand feet, the summits being roughly at the same general elevation. As seen from these summits, the country stretches away in numberless billowy hills, crest beyond crest, as far as the eye can reach, or until the view is

cut off by the higher and more rugged peaks of the Chilcat or Rocky mountains. The hills, or knobs, have no kind of definite linear arrangement. They present the characteristics of having been moulded into their present shapes by atmospheric denudation and stream erosion from a pre-existing plain, though this plain itself, being underlain by rocks which have been much crumpled, and are of very different degrees of hardness, may have had an irregular surface. Remnants of this plain are seen on the tops of the hills and on the crests of the ridges at an average elevation of about 4000 feet above the sea, while some of the higher mountains, like Mount Malony on Nisling river, and the Dome at the head of Hunker creek, rise as higher points above it.



Valley of the Klondike river as seen from the hill behind Dawson.

As the Yukon plateau is thus a great, deeply eroded plain, it presents the characteristics of such a plain in marked degree: wide valleys traverse it from side to side or from end to end, deep lateral valleys join these main arteries, and harder and more resistant areas have formed central masses, from which valleys radiate in all directions to finally join the main arteries. One of these main valleys extends from the head of the Lynn canal, up the Chilcat river, across the summit of the Chilcat mountains at an approximate elevation of 2600 feet, down the Alsek river, up the Klukshu river to Klukshu lake, across a low plain to Dezedeash lake, down the Kaskawulch river to Aishihik river, up the Aishihik river, past Aishihik lake, across a swampy flat to Nisling river, down the Nisling river to White river, and down White river to the Yukon river. Perhaps it is a continuation of the same great valley in which the Yukon river flows just above Dawson, and which at Dawson continues eastward up what is now the valley of Klondike river. Below Dawson the Yukon flows in a narrower valley to the mouth of Forty-

Mile river, and then that main valley continues up Forty-Mile river. In fact, I consider that the Yukon valley for fifty miles below Dawson is the lower part of the original Forty-Mile valley, which joined the Yukon-Klondike valley at Dawson. Many other large valleys doubtless traverse the country, but as yet they have not been traced out.

As the region would appear to have been unequally depressed and elevated since these great valleys were originally formed or outlined, the large streams do not necessarily follow them continuously, but, as I have shown to have been the case with the Yukon river near Dawson, they may cut out of one valley into another.

The direction in which the water flowed in these old valleys when they were formed, or rather when they were the main arteries for the drainage of the whole country, has as yet not been determined, but it would seem not improbable that it was generally towards the Pacific Ocean, and that the valleys are genetically connected with the deep fiords which indent the coast, the flow of water southward having been broken and stopped by the geologically late elevation of the Chilcat range of mountains, which gave the whole land a gentle slope towards the north. Further investigation will doubtless bring together much valuable information on this interesting subject.

Among the smaller areas, with radiating drainage, none are of more immediate interest or are better known than the Klondike gold-bearing district, in which the valleys diverge outwards in all directions from a high central point, which is known as the Dome, and finally open into the Klondike valley on the one side, or into the Yukon valley on the other.

The Yukon basin may be divided into two great divisions by a line which is more or less roughly parallel with the general trend of the Chilcat mountains. This line is the northern limit to which the country was generally glaciated during the Glacial Epoch. North of it the drainage is very perfect, the streams have a fairly regular current, being very rarely interrupted by rapids or falls, and lakes, as far as I am aware, are entirely absent. Recent terraces are not found at any very great heights above the sea, the highest observed, viz., some of those in the vicinity of Dawson, having a greatest elevation of about 1700 feet. They are either rock-cut or are formed of coarse sand and gravel, which have been well rounded and smoothed by stream and wave action. They would seem to have been formed on the shore of the ocean during a subsidence of the land, or possibly in a great lake formed by a differential elevation of the land when the drainage was assuming its present character. These terraces will again be mentioned under the head of "Geology."

South of the line of general glaciation, and within the region which was more or less completely covered by a vast *mer de glace*, or sheet of snow and ice, which stretched northward from the Chilcat mountains during the Glacial Period, the drainage is relatively very imperfect. Lakes occupy the bottoms of many of the valleys and depressions, the streams are in places sluggish, and in places are broken by swift rapids, for, since the ice withdrew from this lower country to the higher parts

of the mountains, the streams have not had time to clear their courses of all obstructions and to assume a quiet, regular flow. Recent terraces are present up to great elevations above the sea, some of them along the north side of the Chilcat range in the vicinity of the Dalton trail having elevations more than 5000 feet. These terraces are for the most part formed by deposits of light grey silt or rock flour, which has been laid down over the glacial till, and is consequently somewhat later than it in age. In general character this silt is very similar to the white sediment brought down from the mountains by glacial streams at the present time, and it would appear to have been deposited near the mouths of small glacial streams where they flowed into lakes dammed back by glaciers, or against the sides of the large glaciers themselves. These



Small steamer on the Lewes river.

terraces, though so numerous and well marked on the landward side of the mountains, seem to be utterly wanting on their seaward side, for I could find no traces of them in the valleys of the Skagway or Chilcat rivers.

HYDROGRAPHY.

The Yukon river which, with its branches, unwaters the whole of the Yukon plateau, rises in a number of streams and lakes in the northern portion of British Columbia. These discharge or flow northward and gradually come together to form the Lewes and Pelly rivers, which in their turn unite opposite Fort Selkirk, in N. lat. $62^{\circ} 47' 12''$, to form one stream which is known as the Yukon from that point to the shore of Behring Sea. The total length of the Lewes-Yukon river, from the village of Bennett, at the head of Lake Bennett, to Behring Sea,

according to the latest report of the United States Geological Survey, is 1865 miles. That portion of the river in Canada, between Fort Selkirk and the international boundary-line, has a length of 265 miles. The Lewes-Yukon river is navigable throughout, from its source to its mouth, for light draft stern-wheel steamers, except for a short distance at White Horse rapids and Miles cañon.

The principal tributaries of the Yukon river in that portion of Canada now under consideration, with their approximate lengths, are as follows:—

	Miles.		Miles.
Lewes, . . .	390	Teslin, . . .	160
Big Salmon, . . .	170	Nordenskiold, . . .	130
Pelly, . . .	?	M'Millan, . . .	?
White, . . .	200	Stewart, . . .	?
Klondike, . . .	150	Forty-Mile, . . .	150

Lewes river rises in a number of long, irregular lakes fed by rivulets, some of which take their rise close to the very summit of the Chilcat mountains, while others gush from the feet of glaciers that move down their northern slopes. In the Chilcoot and White passes, the summits of which are respectively 3500 and 2866 feet above the sea, brooks rise within 18 miles of tide water in Lynn canal, and flow northward to Lake Bennett and the Yukon river, so short and steep is the slope on one side of the watershed, and so gradual is the slope on the other side. The largest and most important of the lakes discharging into the Lewes river are—Bennett, Atlin, Tagish, Marsh, and Labarge.

Teslin river and Teslin lake together have a length of 160 miles, and flow in a very direct north-westerly course to join the Lewes river 30 miles below the foot of Lake Labarge. It is navigable for very light shaft steamers at high stages of the water. The lake has a length of 60 miles, a width of 1 to 2 miles, and a depth of about 400 feet. The Nisutlin river, a stream from 200 to 400 feet in width, flows into the east side of this lake. It rises in the high mountains near the headwaters of the Liard river, and is from 150 to 200 miles in length.

Big Salmon river is a rapid shallow stream 100 to 300 feet in width, and 170 miles in length.

Nordenskiold river averages 100 feet wide near its mouth, and is about 130 miles long. It rises in Hutchi lake, which lies in the bottom of a wide, grassy valley, and flows northward, joining the Lewes river 20 miles above Five Finger rapids. The sides of its valley are, for the most part, gently sloping, and scarped banks are but seldom seen. The river may be ascended or descended in canoes, but is too small and crooked for steamboats.

Pelly river, with its tributary the M'Millan river, rises in the high, rugged mountains at the head of the Liard river, and after a general north-westerly course joins the Lewes river at Selkirk, where the confluent streams form the Yukon river. It is navigable for a long distance by light draft steamers.

White river rises in Alaska on the north side of St. Elias group of

mountains, and flows at first eastward, across the international boundary, and then northward to join the Yukon 85 miles below Selkirk. Its waters are so heavily loaded with white mud or silt, doubtless carried down from the glaciers at its source, that after its junction with the Yukon it renders the waters of that stream quite white and opaque with mud. It has a total length of about 200 miles. It is entirely too swift and shallow for steamboats to navigate.

Stewart river flows into the Yukon from the east, 10 miles below the mouth of White river. It rises in the Rocky mountains near the head-waters of the Peel and Gravel rivers, and flows at first swiftly and then with a quieter current through extensive wooded or grassy plains. Except for one break at Fraser rapids, where the water flows swiftly over a rough ledge of schistose rock, the river is navigable almost from its source to its mouth by small stern-wheeled steamers.



Gold Commissioner's office in Dawson.

Klondike river rises in several small streams, which flow from the south-western face of the spur of the Rocky mountains that projects in towards the Yukon. It is a beautiful clear stream about 150 miles long, and 100 to 200 feet wide at its mouth.

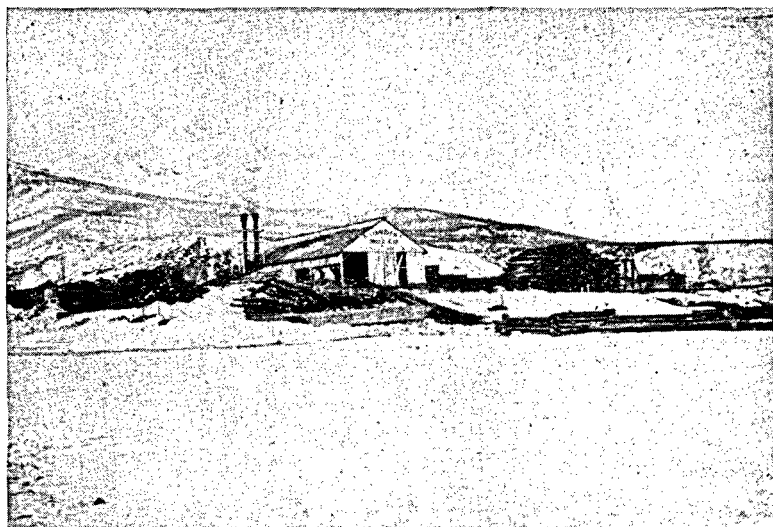
Forty-Mile river rises in the rather high, but wooded mountains of the Ketchumstock range, in Alaska, and taking a general north-easterly course for about 150 miles, flows into the Yukon river 40 miles above where that stream crosses the international boundary-line. That portion of it within the Dominion of Canada is only 23 miles in length. It is a rapid stream of clear water, averaging, near its mouth, 100 to 120 feet in width, and with a depth of from 1 to 3 feet, and it flows in an extensive valley from 300 to 500 in depth.

Neither of these last two streams is navigable by boats larger than canoes or small bateaux, which can be propelled against the stream with poles, or hauled along with lines from the banks.

GEOLOGY.

The geology of the Yukon district is only just beginning to be understood, though the characters of some of the rocks underlying parts of the country have been known since Dr. Dawson and Mr. M'Connell made their expedition through it in 1887.

Mr. Spur and others of the United States geologists have recorded a basal granite as occurring on the Tanana and White rivers, but up to the present I have not seen any granite, which I could distinctly identify as being basal rather than eruptive. Among the oldest rocks in the



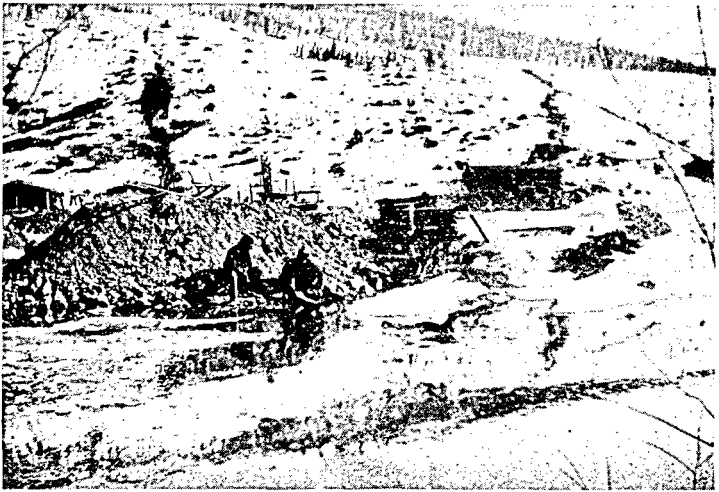
Sawmill at Dawson.

country are undoubtedly the light green chloritic and micaceous schists, which underlie most of the gold-bearing region south-east of Dawson, and which have been called by Professor Nordenskiöld, the Eldorado Schists. They are cut by many dykes and masses of dark basic eruptives, by some dykes of light-coloured acid eruptives, by some large masses and dykes of reddish porphyritic granite, and by wide veins and narrow stringers of white quartz. Associated with these schists, but probably overlying them, are outcrops of graphitic schist and beds of limestone. Similar dark-coloured schists, though not by any means always graphitic, associated with beds of limestone, now everywhere more or less crystalline, occur over a very wide area. They form the country rock along the Forty-Mile river, as far as I examined it, which was up to the mouth of Franklin gulch.

Similar schists and lime stones are also found along the Dalton trail from the head of the Nisling river for a considerable distance southward. These are cut and broken by an elongated mass of porphyrite or rhyolite which extends in a north-westerly and south-easterly direction, and forms some of the highest peaks in the interior country, and they are also cut by masses of reddish granite.

The dark green schists and slates which rest upon and overlie the central granite of the Chilcat range of mountains are also not improbably of the same age.

Overlying the schists and limestones are thick-bedded conglomerates and dark clay shales, holding thin beds of coal and numerous remains of plants, probably of Cretaceous age.



Early spring at Bonanza Creek. Panning the gravel in order to estimate its value.

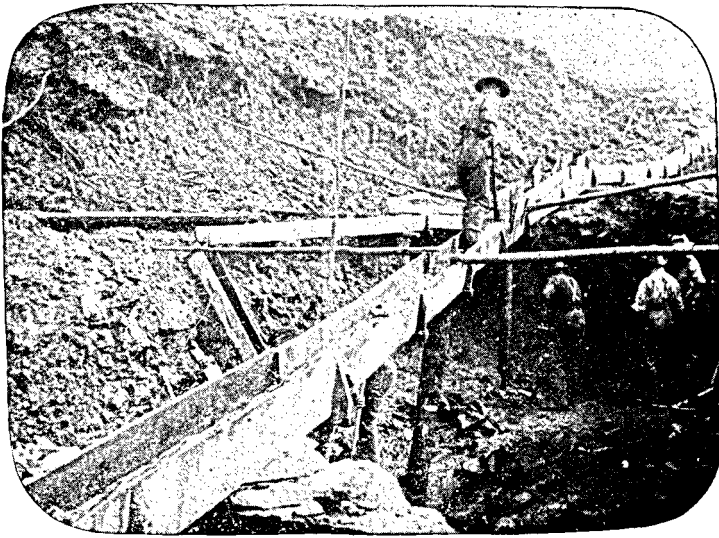
Light grey sandstones very similar to the Laramie sandstones of the plains east of the Rocky mountains, and like them, containing beds of lignitic coal, were seen to outcrop on Chandindu river about 20 miles north of Dawson City.

Within the glaciated area the bottoms and lower parts of the sides of the valleys are covered with a considerable thickness of unassorted sandy clay or till holding many glaciated pebbles and boulders, having evidently been formed as a ground-moraine beneath the glacier or glaciers, which extended northward from the Chilcat mountains for a couple of hundred miles into the interior. Overlying the till are many recent terrace deposits of sand and silt, apparently laid down in ancient glacial lakes. In both the till and the overlying terrace-deposits, when these are in the vicinity of the highly altered Palæozoic Schists, gold is occasionally found in small quantities, but up to the present no rich diggings have been found in these deposits.

North of the generally glaciated region my study of the terrace-deposits has been almost exclusively confined to the Klondike district proper, so I may give a brief description of the conditions as they exist there, and of the causes which led to those conditions.

The Cretaceous rocks seen on Chandindu river are crushed and broken, so that they have shared to some extent, at least, in the disturbances that have affected the earlier rocks.

After the close of the Cretaceous Period the country was depressed about 4000 feet below its present level, and the vast denudation plain was formed which can now be traced over the summits of the hills and



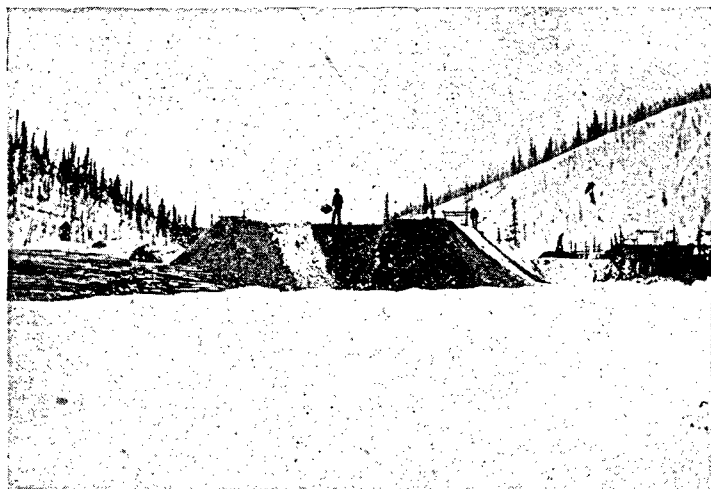
Gold-mining on Eldorado Creek.

crests of the Yukon plateau. How long the region remained submerged is uncertain, but at some time during the Tertiary Period the land was raised, and the surface was carved by atmospheric and stream agencies into the rounded hills and wide, gently sloping valleys that now give the whole country its general contour. But the valleys were not at first cut down to their present depth. In the wide valley of the Klondike river the rock terrace 350 feet above Dawson represents the original floor of the valley when that valley was formed to its present width.

The conditions that prevail in this and similar valleys at the present time are as follows:—

The deepest part of the valley may be half a mile or more in width. In the Yukon valley near Dawson there is a well-defined terrace at an elevation of 200 feet above Dawson, but in the valley of the lower Klondike, except at its mouth, this terrace appears to be wanting, and instead there is a strong gravel terrace at an elevation of 625 feet above Dawson, resting on a bed-rock terrace beneath it at an elevation of 350

feet above Dawson. The sides of the valley, up to the summit of this gravel terrace, are steep, and occasionally show rocky cliffs, while above the gravel terraces the slopes are very gentle up to the crests of the surrounding hills, so gentle in fact that it is usually difficult to determine, from the surface configuration alone, the line of the back of the terrace. This terrace is composed of sand and well-rounded gravel lying quite horizontally, which varies greatly in depth, in one place being found to have a depth of 275 feet, while in other places, and especially up the valleys of the tributary streams, it becomes gradually thinner. The lower portion of this gravel is usually whitish, and many of the pebbles are of white vein quartz, while its upper portion is yellower in colour and does not contain so large a percentage of quartz pebbles. When gold is present it is almost invariably found in the lower whitish gravel. As far as I am aware no fossils of any kind have been found in this terrace gravel. Above the level of this gravel-terrace, except in the bottoms of of



Dumps of gold-bearing gravel piled up in winter.

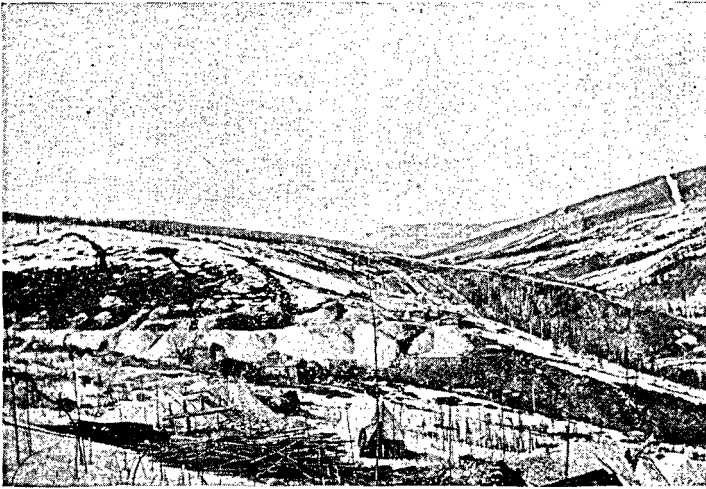
little valleys, no rounded or washed gravel has been found, and the whole country is covered, often to a depth of many feet, with decomposed rock in place.

In the bottoms of the valleys there is also a deposit of rounded gravel usually from 10 to 20 feet in thickness. In this are found many trunks and fragments of spruce-trees, tusks of mammoths, and bones of bison latifrons, rangifer caribou, etc.

In the bottom of the valley of Bonanza creek, at the mouth of Skookum gulch, glacial striæ were beautifully shown on some harder parts of the underlying rock, after the overlying ground had been removed. From these striæ, as well as from the positions of some of the terraces terminating abruptly upwards in the valleys as if they had been formed in front of a wall of ice which has since disappeared, I consider

that small local glaciers have existed in some of the northern-sloping valleys during the Glacial Period, when the country a hundred miles farther south was covered with a sheet of ice.

The sequence of events, after the great valleys had been cut down to the level of the higher rock terraces, would seem to have been as follows:—The country, in the northern portion of the Yukon plateau at all events, was depressed about 1700 feet below its present level, and the valleys were filled with gravel up to the tops of the present high terraces, the lower whitish gravel being possibly formed as a stream-deposit before the land was depressed to its greatest extent, the overlying yellower gravel being laid down as a delta formation over it. The country was then raised from the south-west, stream erosion again became very active, and the valleys were cut down far below their original floors, not, as a rule, across their whole widths, but along their northern and eastern sides,



Bench claims at the mouth of Monte Christo Gulch.

while terraces were left along their southern and western sides. At the same time small local glaciers were probably formed in the higher portions of some of the valleys.

It is possible that these deeper parts of the valleys were formed, or outlined by an elevation previous to the last great depression of the land, but as yet I have not been able to find positive evidence that such was the case. If such an elevation did occur we may expect to find deep channels or portions of channels, below the base levels of the ancient valleys, from which the gravel has not since been removed by erosion.

The valleys were cut down to rock floors which are almost everywhere below the bottoms of the present valleys, and a geologically recent slight decrease in grade has permitted gravel from 10 to 20 feet in thickness to accumulate in the bottoms of these valleys.

MINERALS.

For a number of years past gold has been washed from the sand bars on the Yukon river and on many of its tributaries, but it was not until 1896, when the rich diggings on Bonanza creek were discovered, that general attention was directed towards the Yukon district as a mining country. The total output of the Klondike district in the following year was about £500,000; in 1898 it was £2,000,000, and in 1899 £3,500,000, making a total of £6,000,000 in the first three years after discovery, while last year about £200,000 was recovered from the Atlin district, at the extreme southern limit of the Yukon basin.

As yet whatever gold has been found in payable quantities has been found in the bottoms of the valleys, or on terraces along the sides of these valleys. No rich quartz veins have been found, but it is in the highest degree probable that, where gold is found scattered in such abundance through the alluvial deposits, the veins or stringers from which it has been derived will be discovered, and that some of these veins or stringers, or aggregations of them, will be sufficiently rich to pay a profit over working expenses for extracting the gold.

Copper.—Native copper is known to have been obtained by the Indians from alluvial sands and gravels near the head-waters of White river, probably from both Canadian and United States territory. In 1898 several prospecting parties went out to look for the sources of this copper, but, as far as I can learn, without much success.

Copper ore is also reported as occurring in the rocks west of the White Horse rapids on the Lewis river, and some beautiful large specimens of bornite were shown me from near Rainy Hollow on the Dalton trail; but this locality, though within Canadian territory, is not strictly within the Yukon basin.

Lead.—Small lumps of galena were found in the dark grey plumbaginous schists near the mouth of Forty-Mile river.

Coal.—A low grade coal or lignite has been found in a number of places in the country, underlain by Cretaceous rocks, lying to the north and north-east of Dawson. Last summer a considerable quantity was mined on Coal creek, a tributary of the Yukon river below Forty-Mile river, and was brought up to Dawson. It seemed to bear transportation fairly well, and will doubtless furnish a very valuable supply of fuel.

FLORA.

Throughout the Yukon basin the timber-line has a general elevation of from 3500 to 4500 feet above the sea, the former being about the elevation in the Klondike district, while it rises to the latter height in many places along the Dalton trail. On the islands, and intervalles in the bottoms of the valleys, as well as in many of the gullies on the hillsides, white spruce (*Picea alba*) is often found up to twenty inches or even more in diameter, and with good tall trunks, so that three logs, twelve feet long and at least twelve inches in diameter, can be cut from a tree. On the Klondike river, and on Bonanza and Hunker creeks, such timber is growing in considerable abundance. Along the banks of the

streams balsam poplar (*Populus balsamifera*) is often found of large size. On the more imperfectly drained places in the intervalles, and on most of the hillsides, black spruce (*Picea nigra*) is usually growing with an average thickness of about six inches. It furnishes the principal supply of fuel used in the mines. With it canoe birch (*Betula papyrifera*) is growing to about the same size, while many of the drier benches are covered with small aspens (*Populus tremuloides*). The western jackpine (*Pinus Murrayana*) is found on some of the drier benches as far north as Five-fingers rapids on the Yukon river.



Trail through the forest near Bonanza Creek.

On the 30th of April of last year I made the following note in my notebook: "Walked up to the hill behind the town (Dawson) and found a large number of purple anemones (*Anemone patens*, var. *Nuttalliana*) in bloom. Mr. Cran, manager of the Bank of British North America, informs me that he collected them on the 21st inst., and that he saw them with others on the 16th inst." Next day, the 1st of May, I made the following notes: "Walked to the hill across the Yukon. On the sunny hillside many of the aspens are in flower, while the catkins are out on the birches, alders, and willows. Anemones are in great profusion, and *Saxifraga reflexa*? is beginning to open. The sage-bushes are soft and green, and the

buds on the rose-bushes are reddening, ready to burst." May 14th: "The anemones are fading, but many other plants are beginning to shoot up. A pretty blue flower (*Polymonium humile*, var. *pulchellum*) is in bloom in a few places, and *Shepherdia Canadensis* is in full flower."

As yet very little attention has been given to gardening or agriculture, but excellent potatoes are grown both at Selkirk and Forty-Mile, and both at the latter place and at Dawson there are beautiful gardens in which are growing spinach, lettuce, cabbage, common and China kale, radishes, carrots, turnips, beets, and potatoes.

During the past summer I made a small and very imperfect collection of plants from the bottoms of the valleys, and from the lower hillsides in the Klondike district. Professor John Macoun, of the Geological Survey of Canada, kindly determined them for me. From this list some idea will be formed of the plant life of the district.

LIST OF PLANTS COLLECTED IN THE KLONDIKE DISTRICT IN
THE SPRING AND SUMMER OF 1899.¹

<i>Anemone patens</i> , Linn., var. <i>Nuttalliana</i> , Gray.	<i>Astragalus alpinus</i> , Linn.
<i>Anemone parviflora</i> , Michx.	<i>Astragalus frigidus</i> , var. <i>littoralis</i> , Watson.
<i>Anemone Richardsonii</i> , Hook.	<i>Oxytropis Lamberti</i> , Pursh.
<i>Ranunculus multifidus</i> , Pursh, var. (?)	<i>Hedysiarum boreale</i> , Nutt.
<i>Ranunculus Lapponicus</i> , Linn.	<i>Spiraea betulifolia</i> , Pallas.
<i>Aquilegia brevistyla</i> , Hook.	<i>Rubus arcticus</i> , var. <i>grandiflorus</i> , Ledeb.
<i>Delphinium scopulorum</i> , Gray.	<i>Potentilla Pennsylvanica</i> , var. <i>strigosa</i> , Pursh. (?)
<i>Aconitum delphinifolium</i> , DC.	<i>Potentilla nivea</i> , Linn.
<i>Papaver nudicaule</i> , Linn.	<i>Potentilla fruticosa</i> , Linn.
<i>Corydalis glauca</i> , Pursh.	<i>Potentilla anserina</i> , Linn.
<i>Corydalis aurea</i> , Willd.	<i>Poterium Sitchense</i> , Watson.
<i>Nasturtium palustre</i> , DC. var. <i>hispidum</i> , Fisch. and Mey.	<i>Rosa acicularis</i> , Link.
<i>Arabis Holboellii</i> , Hornem.	<i>Saxifraga reflexa</i> , Hook.
<i>Arabis lyrata</i> , var. <i>occidentalis</i> , Wat.	<i>Saxifraga heterantha</i> , Hook.
<i>Barbarea vulgaris</i> , var. <i>arcuata</i> , Hook.	<i>Saxifraga tricuspidata</i> , Retz.
<i>Erysimum cheiranthoides</i> , Linn.	<i>Chrysosplenium alternifolium</i> , Linn.
<i>Erysimum parviflorum</i> , Nutt.	<i>Parnassia palustris</i> , Linn.
<i>Erysimum</i> , Sp.	<i>Ribes rubrum</i> , Linn.
<i>Brassica Sinapistrum</i> , Boiss.	<i>Ribes Hudsonianum</i> , Richards.
<i>Draba incana</i> , DC.	<i>Epilobium angustifolium</i> , Linn.
<i>Lychnis triflora</i> , var. <i>Dawsoni</i> , Robinson.	<i>Silenum Dawsoni</i> , Coult. and Rose.
<i>Cerastium maximum</i> , Linn.	<i>Cornus Canadensis</i> , Linn.
<i>Arenaria capillaris</i> , var. <i>formosa</i> , Fisch.	<i>Linnæa borealis</i> , Gronov.
<i>Arenaria lateriflora</i> , Linn.	<i>Viburnum parviflorum</i> , Pylaie.
<i>Arenaria physodes</i> , DC.	<i>Galium trifidum</i> , Linn.
<i>Stellaria borealis</i> , Bigel.	<i>Galium boreale</i> , Linn.
<i>Lupinus arcticus</i> , Watson.	<i>Valeriana sylvatica</i> , Watson.
	<i>Solidago multiradiata</i> , Ait.

¹ Reprinted from the *Ottawa Naturalist* for December 1899.

- Solidago multiradiata*, var. *scopulorum*, Gray.
Aster Sibiricus, Fisch.
Erigeron acris, Linn.
Achillea millefolium, Linn.
Artemisia vulgaris, Linn., var. *Tilesii*, Ledeb.
Petasites sagittata, Gray.
Arnica alpina, Murr.
Campanula uniflora, Linn.
Campanula rotundifolia, var. *Alaskana*, Gray.
Vaccinium cespitosum, Michx.
Vaccinium Vitis-Idæa, Linn.
Arctostaphylos alpina, Spreng.
Arctostaphylos Uva-ursi, Spreng.
Cassandra calyculata, Don.
Andromeda polifolia, Linn.
Ledum palustre, Linn.
Ledum latifolium, Ait.
Pyrola rotundifolia, Linn.
Moneses uniflora, Gray.
Allotropa virgata, Torr and Gr.
Androsace septentrionalis, Linn.
Gentiana Amarella, var. *acuta*, Hook.
Polemonium humile, var. *pulchellum*, Gray.
Mertensia paniculata, Don.
Pentstemon cristatus, Nutt.
Castilleja pallida, Kunth.
Pedicularis euphrasioides, Stephan.
Dracocephalum parviflorum, Nutt.
Chenopodium capitatum, Benth. and Hook.
Polygonum alpinum, Linn.
Shepherdia Canadensis, Nutt.
Comandra livida, Richardson
Betula papyrifera, Michx.
Betula glandulosa, Michx.
Alnus incana, Willd (?)
Salix arctica, R. Br.
Salix Scouleriana, Bebb.
Salix reticulata, Linn.
- Salix*— (?)
Salix— (?)
Populus tremuloides, Michx.
Empetrum nigrum, Linn.
Juniperus communis, Linn.
Pinus Murrayana, Balfour.
Picea nigra, Link.
Picea alba (?)
Corallorhiza innata, R. Br.
Calypso borealis, Salisb.
Allium Schœnoprasum, Linn.
Zygadenus elegans, Pursh.
Eriophorum capitatum, Host.
Carex Pyrenaica, Wahl.
Carex invisâ, Bailey.
Carex— (?)
Carex concinna, R. Br.
Deyeuxia purpurascens, Kunth.
Poa pratensis, Linn.
Equisetum arvense, Linn.
Pellæa gracilis, Hook.
Phegopteris Dryopteris, Fée.
Aspidium fragrans, Swartz.
Cystopteris fragilis, Bernh.
Cystopteris montana, Bernh.
Woodsia glabella, R. Br.
Woodsia hyperborea, R. Br.
Lycopodium obscurum, Linn.
Lycopodium annotinum, Linn., var. *pungens*, Spreng.
Lycopodium complanatum, Linn.
Polytrichum juniperinum, Willd.
Marchantia polymorpha, Düm.
Cetraria juniperina, var. *pinastri*, Ach.
Usnea Barbata, var. *dasy-poga*, Fr.
Alectoria jubata, var. *implexa*, Fr.
Peltigera aphthosa, (L.) Hoffm.
Cladonia gracilis, var. *hybrida*, Schær.
Cladonia rangiferina, var. *sylvatica*, Linn.
Cladonia deformis, (L.) Hoffm.
Cladonia cornucopioides, (L.) Fr.

The above plants were all collected in the bottoms, or at no great height up the sides of the valleys, at approximate elevations of between 1000 and 1500 feet above sea-level. The principal locality visited on the Klondike river was a gravel hillside, sloping towards the south, within a short distance of the town of Dawson. Another locality was a rocky hill, also facing the south, a couple of miles farther up the valley. The localities on Bonanza and Hunker creeks were either on the swampy flats

or on the swampy hillsides. Chandindu river was visited once, on June 13th, and the plants, as labelled, were collected either on the wide swampy flat in the bottom of the valley, on a grassy hillside on the north side of the valley, or on a sandy bar at the mouth of the river where it joins the Yukon river. Forty-Mile river was visited for a few days between July 29th and August 8th, and the plants were collected close to the banks of the river as we ascended and descended in a canoe.

FAUNA.

In the gold-bearing gravels in the bottoms of the valleys tusks of mammoths (*Euelephas primigenius*), horns and skulls of buffalo (*Bison latifrons*?), horns of caribou (*Rangifer caribou*?), and bones of several other species of large animals are often found, but the mammoth and the wide-horned buffalo are now extinct.



Indians travelling in winter with dogs.

Moose (*Alces Americanus*) are abundant in all the unsettled parts of the country, or where the miners and prospectors have not killed them off. Their shed horns may be seen lying in profusion among the willows and dwarf birches on the summits of the ridges. Caribou (*Rangifer Grœnlandicus*) are reported to cross parts of the country in great numbers on their annual migrations to and from the shores of the Arctic Ocean. Mountain sheep (*Ovis Dalli*) and mountain goats are found in the mountains. Bears, wolves, otter, marten, and lynx undoubtedly exist in small numbers, but are very seldom seen. The red squirrel (*Sciurus Hudsonius*?) lives everywhere among the spruce woods, and a spermophile (*Spermophilus Parryi*) is found in great numbers on the drier benches in the southern part of the district.

Of birds, the raven (*Corvus Corax*), the Canada jay (*Perisoreus*

Canadensis), and a small red-poll winter in the country, while many other birds live in the country, or pass over it on their way to their nesting-grounds farther north.

King and dog salmon ascend the Yukon river and many of its tributaries, and are caught in large numbers opposite the town of Dawson and elsewhere. They furnish an important local source of food-supply. Graylings, up to one foot or rather more in length, are caught in Klondike river and in many other of the clearer streams.

The natives, who are sparsely scattered over the country, and who formerly lived by hunting and fishing, belong to the Athabaskan or Tinne stock.

I cannot dismiss this subject without saying a word about the mosquitoes, as they have been represented as one of the greatest hardships to be endured in the Yukon country. On the swampy land in eastern Canada, and around the shores of Hudson Bay, they indeed seriously interfere with the comfort of living during the early summer, but through the two summers that I have spent in the Yukon district there was only one night when I was seriously annoyed by these pests, and that night I was camped on a low, willow-covered island in the Yukon river. On the gold-bearing creeks, if they ever existed, they have now almost entirely disappeared.

Of domesticated animals, dogs, both native and introduced, the latter being of all kinds, from the St. Bernard to the bull pug, are much used to haul loads over the snow and ice in winter, and sometimes to carry loads on their backs over the narrow trails in summer. They live and thrive splendidly.

Horses were first used in the district by Messrs. Glave and Dalton about 1891, and were found to thrive well on the native grasses. In the last couple of years great numbers of horses have been brought into the country. Last winter a large band of horses belonging to the Canadian North-west Mounted Police was allowed to run loose over the hills and valleys near Tagish, without attention, and almost all of them were found in fairly good condition in the spring; another band roamed at will all winter near the mouth of the Nordenskiöld river, and was brought down to Dawson in the spring. It is also commonly stated, and I think correctly, that a horse, which in the autumn had been turned out to die, as the owner had no food to give it, passed the winter in the hills back of Dawson, and that in the spring it was again caught by the owner and put to work.

Mules and donkeys are also used in freighting supplies from Dawson to the mines.

Cattle have been brought in in large numbers, and last summer there were at least two dairy farms in the Klondike district supplying milk to Dawson.

CLIMATE.

The climate of the Yukon basin is dry, with, as a rule, but slight diurnal variations in temperature. The annual precipitation is from ten to twelve inches, most of which falls in the autumn and early winter.

High winds are rarely known, the highest wind recorded in Dawson in February last being only ten miles an hour. The thermometer varies from 90° F. in summer down to -50° in winter, but in the dry calm air no inconvenience is ever felt from this low temperature. A lady who lived in Dawson last winter informed me that not once last winter was she prevented by inclement weather from taking her regular constitutional walk of from two to four miles a day.

In speaking of the plants enumerated above, Professor Macoun says, "A mere glance at the following list will show that the spring and summer climate in the vicinity of Dawson is as mild as that many degrees farther south in eastern Canada; indeed the great majority of the plants found in meadows, bogs, woods, and river-bottoms grow within one hundred miles of Ottawa." These words are eloquent of the character of the summer climate, and I believe that every one who has



Stopping-place for travellers on Hunker Creek.

been in the Yukon district, and who has been warmly clothed and housed, and well fed, will agree with me in stating that the winter weather, too, is exceedingly pleasant and healthy.

TRANSPORTATION.

The means of access to, and communication with, that northern country are changing and improving so rapidly that what is said of it to-day will be obsolete to-morrow. Two years ago very few people had a correct idea of the easiest way of reaching the Klondike gold-diggings, and men started into the country by many different routes, among which were the Chilcoot pass, the White pass, the Chilcat pass and Dalton trail, the Copper river, the mouth of the Yukon river, the Stikene river, and the Edmonton route, which in its turn divided into many different

ways across the divide between the Mackenzie and the Yukon rivers, almost every pass across the mountains being tried from the Peace river northward to the Peel river. Some of these people reached Dawson quickly, while others kept straggling in throughout the whole of last summer, having been more, and often much more, than twelve months on the way.

Now there are just two routes in ordinary use, one by ocean-going steamers from the Pacific coast ports to St. Michaels, near the mouth of the Yukon river, and from there by powerful flat-bottomed steamers, many of which carry as much as five hundred tons, and have excellent passenger accommodation, for 1370 miles up the Yukon river to Dawson. This is the most economical way to bring in heavy freight, but on account of the longer time occupied on the journey, it is not used to any great extent for passenger traffic.

The other way is by ocean-going steamers from the Pacific coast ports, but chiefly from Seattle, Victoria, or Vancouver to Skagway, the average time occupied on the journey being from four to five days. At Skagway passengers take the White pass and the Yukon railway to Bennett, at the head of steamboat navigation on the Yukon river. Here large steamers are waiting to take them across the lakes and down the river to White Horse rapids, where they are taken on a horse tramway past the rapids to other steamers waiting below, which in their turn, after a journey of two or three days through some of the grandest scenery in the world, take them to Dawson, the metropolis of the gold-fields of the Klondike district. The journey in summer from Vancouver can be made in from seven to ten days. My partner, Mr. Green, made the journey from Ottawa to Dawson in fourteen days, only eleven of which were actually consumed in travel, while many others covered the distance in shorter time. At present the White pass and Yukon railway is being pushed on to White Horse rapids, and before the close of another year we hope to be able to travel to the Klondike district with only two breaks in the journey from Vancouver, namely from the boat to the train at Skagway, and afterwards from the train to the boat at White Horse rapids. Within a few years we may see a railway southward through British Columbia to connect with the great trans-continental line of the Canadian Pacific railway.

By way of the White pass mails reach the country and leave it about once a week in winter and summer, but for a few weeks in spring and autumn, while the ice is breaking up on the streams, and again when it is forming, the mails are irregular or discontinued. Now, however, a telegraph line is in operation between Skagway and Dawson, and though there is as yet no telegraphic communication between Vancouver and Skagway, the messages are forwarded by mail between these two places. On September 28th, the evening on which the line was opened, we had the pleasure of sending a message from Dawson to Ottawa, and it reached its destination in five days, and only the other day, while in Ireland, I received a telegraphic message from Dawson. Thus this most distant part of the North American continent is now brought into close touch with the very heart of European civilisation.