GEOLOGICAL SURVEY OF CANADA

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REPORT

ON THE

UPPER STEWART RIVER REGION

YUKON

BY

J. KEELE

OTTAWA

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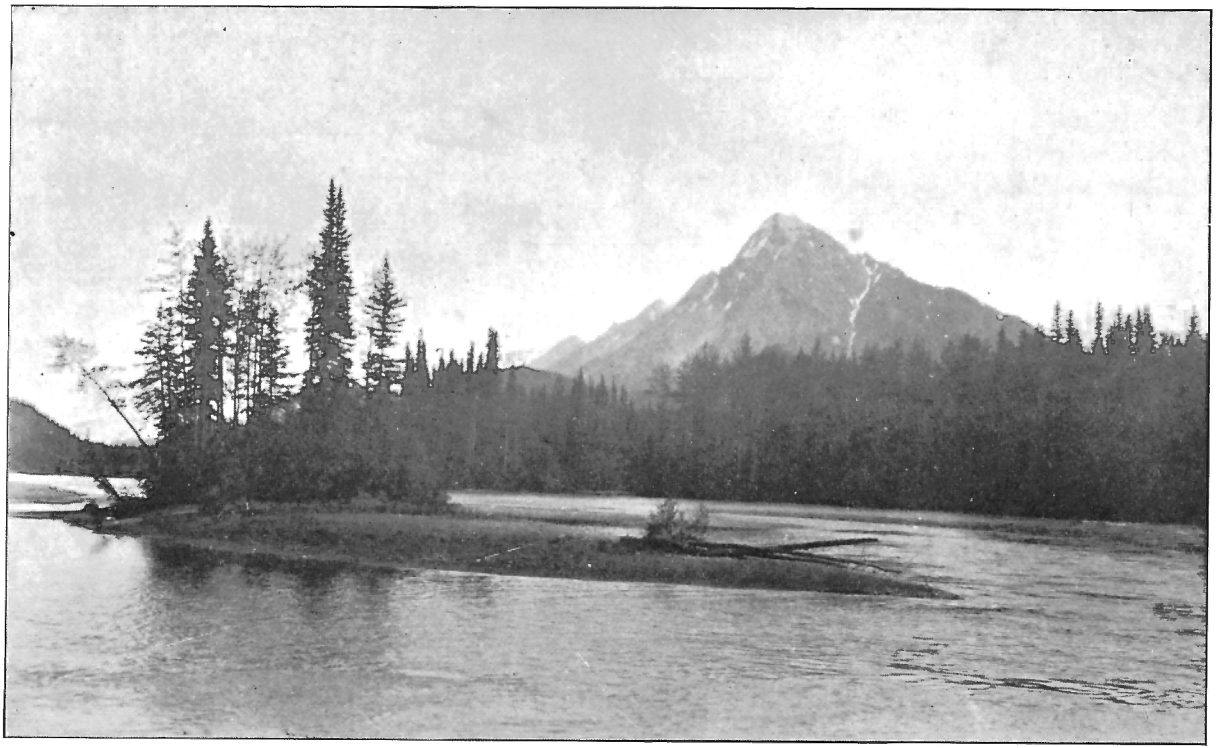


MOUNT ORTELL, LOOKING EAST FROM THE STEWART RIVER.

To Dr. ROBERT BELL,

Acting Director, Geological Survey of Canada.

SIR,—I have the honour to submit the enclosed report on my explorations on the upper waters of the Stewart river and some of its tributaries. A map to accompany the report and a few photographs to illustrate the natural features are included.

I have the honour to be, sir,

Your obedient servant,

J. KEELE.

OTTAWA, April, 1906.

CONTENTS.

THE

UPPER STEWART RIVER REGION.

INTRODUCTION.

The Stewart river, one of the principal tributaries of the Yukon, drains an extensive region lying between the basin of the Pelly river to the south, and that of the Peel river to the north. It rises in the Pacific-Arctic watershed ranges and flows in a general westerly direction toward the Yukon valley. It is navigable throughout the season for river steamers as far as Frazer falls, a distance of 200 miles from the Yukon.

EARLY BAR MINING.

The Stewart was one of the first rivers in the Yukon territory to attract the attention of miners. In the year 1883 and for several years following gold was found in paying quantities on the bars along the lower portion of the river..

No bar mining of any account is now carried on, but an occasional miner spends the latter portion of the season when the water is low "rocking" on some of the numerous bars between Mayo river and Lake creek. The expert in this kind of mining is always sure of at least a grub stake. In 1900 Mr. R. G. McConnell made an examination of the Stewart river as far as Frazer falls. There are no previous records of the river above this point and very little appears to have been known about it previous to 1898. During this and the following year several prospectors crossed the divide from the Mackenzie side and descended the Stewart to the Yukon. In the same years large parties of gold seekers ascended the river, but very few of them went beyond Frazer falls as the reports brought down were not encouraging.

In 1895 coarse gold was first discovered on the streams tributary to the Stewart, and from that time until the present time new discoveries of placer gold of more or less importance have been made each year. The Clear Creek and the Duncan Creek mining districts were established and included all the streams tributary to the Stewart as far east as the Mayo river and its branches.

Although some of the creeks in these districts were rich in placer gold the average remuneration was small. The difficulties and expense of mining and transport, and the inexperience of many of the miners have hitherto tended to keep down the profits and to discourage prospecting.

The area, however, in which it might reasonably be expected to find placer gold is large, and, with cheaper supplies and a better knowledge of the methods of mining best suited to the conditions,

future developments and an extension of the productive ground may be looked forward to, as much of the region is yet unprospected.

This report deals with the upper portion of the Stewart river and the adjoining territory, including a part of the country immediately east of the Duncan Creek mining district.

A report by the writer on the latter area is given in the Summary Report of the Geological Survey for the year 1904.

GENERAL DESCRIPTION OF REGION.

STEWART RIVER.

The Stewart river above the Frazer falls drains an area of about 12,000 square miles. During its course through this region it receives four important tributaries, the principal one being the Hess river, or South branch of the Stewart, which enters from the east at a distance of fifty-five miles from the foot of Frazer falls, following the windings of the river. Twenty eight miles farther Lansing river also enters from the east.

Ladue river enters from the west at a distance of thirty-two miles above Lansing, and about seven miles farther on Beaver river enters from the same direction.

The headwaters of the Stewart river and its branches have their source either in the Ogilvie range to the north or in the Selwyn range to the east.

These two mountain chains form the watershed between the Yukon and Mackenzie drainage basins in this region.

The entire drainage basin of the Stewart is of a mountainous character, and although much of the upland country in the area is composed of rounded and wooded hills, or low ridges, there are also high detached ranges or single isolated groups of mountains with peaks which measure from 6,000 to 7,400 feet above sea level, or quite as high as the more prominent peaks in the watershed ranges.

This mountainous region is traversed in several directions by a system of wide interlocking valleys, mostly occupied by the river and its principal branches. The present drainage is often confused and interrupted by former glacial action, or other causes, and it is not uncommon to find that streams have migrated from one old valley to another by means of a channel of comparatively recent origin. The smaller streams at the headwaters issue from the mountains in narrow rock-walled valleys. These streams are very swift and carry a large burden of debris. In flood time, when swollen with the melting of snow on the summits, they become formidable torrents.

Evidences of a former glacial period are met with in varions portions of the area, and the valley slopes exhibit the usual characteristic topography which results from the smoothing action of an ice sheet.

Cañon near mouth of Hess River.

At Frazer falls the Stewart river flows through a gorge three-eighths of a mile long, with a fall of about forty feet in this distance; it is really a rapid, as the grade is fairly uniform. Above this gorge the river still occupies a narrow channel bordered by rock benches, and three short rapids, due to the rock barriers, occur at intervals. Three-quarters of a mile above the upper rapid and six miles from the foot of Frazer falls, Nogold creek enters the Stewart from the west. This is a winding stream with slow current, and a width at the mouth of about seventy five feet. At this point the Stewart river turns at right angles to its former course and enters a wide valley extending northeast and southwest.

This valley joins the present valley of the Stewart below the mouth of Mayo river; it is three miles wide across the bottom and contains a great number of small lakes scattered over the flats adjoining the river. It is bordered by hills having long easy slopes to a general elevation of about 2,500 feet above the flats.

The river appears to have no definite channel in this valley bottom, and, during flood time, when the discharge of water and the speed of the current are greatly increased, it meanders almost uncontrolled by banks, doing considerable damage to the forest growth along its margins and on the islands in mid-stream. When the greater curves swing across the valley, the river sometimes impinges against cut banks about 120 feet high, composed of gravel, sand, silt and clay, or against low rock terraces.

HESS RIVER.

The Hess river joins the Stewart from the southeast in a low basin formed by the junction of the two wide valleys of those streams. This river appears to be almost as large as the Stewart. Its drainage basin lies between those of the Macmillan and Lansing rivers, and extends to the Mackenzie river watershed, a distance of over 100 miles from its mouth. At the mouth of the Lansing river the Stewart turns to the northwest and flows across a basin-shaped depression which extends for a distance of about twenty miles on each side of the river, while Lansing river, coming from the northeast, occupies what appears to be the continuation of the Stewart valley.

LANSING RIVER.

Lansing river, about 200 feet wide at its mouth, has a very swift current throughout its entire course, and is not navigable. It heads in some high mountain groups to the east, and flows almost parallel to that portion of the Stewart above Beaver river.

The Lansing mountains, one of the most striking individual groups in the region, are situated south of the Lansing river and about fifteen miles east of the Stewart. These mountains rise abruptly from a wide basin; their summits are a group of rugged peaks, the highest of which

rises to 7,400 feet above sea level or about 5,500 feet above the Stewart river.

At one and a quarter miles above Lansing river the Stewart emerges from a cañon with walls about 100 feet high. The length of the river course through this cañon is seven miles, the channel is tortuous and the current not much swifter than in the wider portion of the river below. It is easily ascended at low or medium stages of water.

LADUE RIVER.

The Ladue river which enters the Stewart from the west is an exceedingly crooked stream, flowing with a sluggish current in a wide valley. Its main branch heads in a mountain group twenty miles northwest of its mouth, but the river channel has a length of over 100 miles between those points.

Although the Ladue river flows in a wide flat-bottomed valley of slight grade for the greater part of its course, this valley is bordered by mountain groups rising abruptly to a height of from 2,500 to 3,000 feet above the river. In its lower course it flows across the basin which extends to Lansing river.

The Stewart bends sharply to a northeasterly direction at the north of the Ladue river and, about seven miles farther, the Beaver river enters from the west.

The Stewart and Beaver rivers join from opposite directions in a wide crescent-shaped valley which borders the southern edge of the watershed range. North of the junction of the two rivers the mountains rise about 3,500 feet above the valley bottom, but to the south the valley opens out into a wide depression containing a few rolling and wooded ridges.

Ten miles from the mouth of the Beaver, Nadaleen, or Boswell river, enters the Stewart from the mountains to the northward. This is a clear rapid stream about 150 feet wide and two to three feet deep. The Stewart river at this point cuts through a heavy deposit of old river gravels overlain by boulder clay. This deposit which is from seventy-five to 100 feet thick extends across the valley and the material still acts to some extent as a dam, for below this point the river has a current of about six miles an hour, while above it there is scarcely any perceptible current at all, the river meandering between low mud banks and resembling a series of oxbow lakes for a distance of twenty-eight miles. About ten miles above this still water portion rock terraces from twenty to forty feet high occur for some distance up stream along the water edge. The valley becomes constricted at this locality, and the Tasin mountains rise abruptly on the south of the river where hitherto were only low ridges of a few hundred feet elevation. The northern front of the Tasin mountains extends along

the valley for about twenty miles eastward. Mount Ortell, situated at their eastern extremity, is one of the prominent peaks of this region. It rises to a height of about 4,700 feet above the river or 7,000 feet above sea level. Beyond the Tasin mountains the valley becomes wide again, the rock terraces disappear, the river breaks up into a number of channels in a wide gravel flood plain and has a current of about twelve miles an hour. At a distance of 100 miles from the Beaver river the Stewart turns to the northeast and enters a narrower valley than formerly, situated between mountain groups. At a distance of twenty miles in a northerly direction from this point lies a lake about six miles long, called by the Indians Ella-tsi-tuo ; it is the head of one of the branches of Snake river flowing into the Peel. The Indians when journeying from the Stewart to the Mackenzie generally follow the Lansing valley and a valley which skirts the eastern end of the Tasin mountains ; cross the Stewart to this lake, and thence to Fort Good Hope crossing the Arctic Red river en route. Time did not permit of an examination of the river beyond this point. It is said to extend about twenty miles farther east, and to have its source in a basin containing numerous small lakes and bordered by mountains. Lansing and Hess rivers, and a branch of the Gravel river which flows into the Mackenzie, also have their source in this locality.

On July 6 while passing the mouth of the Beaver river it was noticed that the Stewart discharges about twice as much water as the former. The water of the Stewart was very swift and muddy and crowded the clear water of the Beaver against the western bank. On July 22 the discharge of the Stewart had diminished while the Beaver maintained the same flow as formerly. At this date the Beaver river was 210 feet wide, its greatest depth about seven feet, with a current of four miles an hour. On August 18 water was at a low stage in both streams, and their discharge was about equal.

BEAVER AND RACKLA RIVERS.

The Beaver river occupies the same valley as the Stewart, and has a northwesterly direction for a distance of about thirty miles in a straight line from the mouth, or forty-five miles following the windings of the river.

The valley and the river both turn at a right angle at this point, but at a distance of eight miles to the north they resume their former direction.

At a distance of twenty-five miles from the mouth of the Beaver, following the windings of the river, Rackla river, an important tributary, enters from the northeast. The river occupies a wide valley for about fifteen miles. The main valley then branches into three tributary valleys. The valley which enters from the west is a continuation of the upper Beaver valley, and is occupied by a series of lakes from

two to three miles long. The other two valleys are occupied by branches of Rackla river, the one extending to the northeast being the continuation of the main valley. This valley leads with an easy grade to a low divide called Bonnet Plume pass, north of which is found the headwaters of the Wind river, which flows into the Peel. A short distance below the forks, Rackla river flows through a narrow twisted cañon, and below this rock terraces occur at intervals along the stream for a distance of about five miles. In the upper valleys the streams meander over flood plains or in marshy ground through numbers of small lakes or ponds.

Above the mouth of Rackla river there is a stretch of fourteen miles of slack water, probably due to the fan of wash gravels which the Rackla carries down faster than the Beaver can remove it. At the square turn of the Beaver, twenty miles beyond the mouth of Rackla river, a small creek enters from the southwest and drains a wide valley containing a great number of small lakes. These lakes are nearly all connected by streams as far as the McQuesten lakes, a distance of about twenty miles from the Beaver river. By making a few short portages a canoe or small boat can be taken over this route to the McQuesten and thence to the Stewart river. Above the square turn the Beaver river is an exceedingly swift stream, and at low water is not navigable owing to the numerous channels over which the water is disturbed. Craine creek enters from the north about twenty-five miles farther. The valley of this stream was followed by Mr. Camsell of the Geological Survey on his journey to the Wind and Peel rivers.

The Beaver river was not examined beyond this point, but it appears to be fed by small streams issuing from the Ogilvie range. At some distance farther west these streams turn to the southwest and form the headwaters of one of the branches of the Klondike river.

OGILVIE RANGE.

The Ogilvie range, which lies on the watershed between the Stewart and Peel rivers, has a width in this locality of about fifty miles, and extends from the valley of the Beaver river almost to the mouth of Little Wind river to the north. The northern edge of the Ogilvie range marks the termination of the mountainous region on the Peel River basin, and is followed by a low dissected plateau which lowers by successive steps to the Arctic coastal plain.

Flanking mountain groups extend southward and eastward from the Beaver river for a distance of forty miles. To the eastward the Ogilvie range is separated from the Selwyn range by the comparatively low divide between the Stewart and the Gravel rivers.

Over the whole extent of this elevated region the most general accordance of summit level would appear to occur at about 6,000 feet above sea level.

Of the several prominent peaks which rise above this level none are higher than 7,500 feet.

YUKON PLATEAU.

To the southwest these mountain groups front upon the region known as the Yukon plateau which has a general elevation of 5,000 feet in this vicinity, sloping to about 4,000 feet at the Yukon basin.

The topographic relations of these mountains is extremely intricate and would require several seasons' observations over a more extended area in order to correlate the region physiographically with the provinces to the south and west.

Orographically the two principal mountain ranges are analagous to the Rocky Mountain system of British Columbia, as the lowlands bordering these mountains on the north and east correspond to the great plains east of that province.

The variation in the topography of the different mountain groups depends largely on the character and structure of the rock formations from which they are built. The highest portions of the Selwyn range being composed of tilted quartzites and agglomerates, or of granite, are as a rule bolder and more rugged than the crests of the southern face of the Ogilvie range which are built up principally of limestone.

The mountains south of the Beaver river, composed principally of crystalline schist, present a more regular and rounded outline, due no doubt to their earlier date of uplift and having been subjected to erosive agencies for a much longer period than either of the watershed ranges. The highest portion of these mountains is generally composed of intrusive diorite masses which have resisted weathering more successfully than the schist by which they are surrounded.

Although the principal valleys have a southwesterly direction, the drainage does not always select that course, but makes very wide detours at several points. Only a portion of the main drainage ways is in accord with the strike or trend of the rocks and the detours are generally made transverse or across the strike.

All the rock formations have jointage planes more or less well developed, along which the rock breaks down more readily. The direction of the dominant jointing and the dip of planes varies somewhat in the different formations.

In a rough way some of the interstream areas correspond in plan to the shape of one of the single blocks of rock that compose it.

CLIMATE.

The Stewart river generally opens and is clear of ice between May 10 and 15, and becomes frozen over by the end of October.

Although there is a high average rainfall in some seasons, the summers in this region are generally fine, the weather sometimes being hot.

During the summer of 1905 no frost occurred between May 25 and August 26, and the snow had almost entirely disappeared from the mountains on the first of August.

The long hours of daylight are favourable for abundant vegetation and the floors and slopes of the valleys are all well covered with a forest growth.

TREES.

The principal forest trees are white and black spruce, balsam, poplar and birch. The limit to which trees grow on the mountain slopes varies from 1,800 feet to 2,800 feet above the river.

The white spruce is the most valuable tree and furnishes good timber for building and mining purposes. The best groves of this tree are found on the islands or on the alluvial flats along the river, but good specimens occur in scattered groups on the slopes to a height of 2,000 feet above the river in the lower valleys.

There is a marked deterioration both in the size and appearance of the spruce as the more northerly branches of the river are approached.

The balsam fir occurs only on the valley slopes mixed with spruce, beginning at an elevation of about 1,200 feet above the river, and continuing upward to the limit of trees. On the slopes of the Ogilvie range, however, the balsam disappears entirely, its northern limit in this area being about the forks of Rackla river.

The black pine (*Pinus Murrayana*) was observed only at one locality. On the south side of the Stewart, near the mouth of the Hess river, there is an extensive grove of this tree growing on a wide gravel terrace about 300 feet above the river. The trees are small, few of them exceeding nine inches in diameter.

Along the banks of the streams there is a thick growth of willow and alder, and for some distance above the tree line dwarf birch and moss cover the mountain ridges.

The greater portion of the forest growth on the slopes bordering the Stewart between the Frazer falls and Lansing river was destroyed by fire in the year 1898. This immense loss was due to the carelessness of some of the numerous gold seekers who entered the country during that year.

VEGETABLES AND FRUIT.

At the mouth of Lansing river in a garden cultivated by Mr. Braine very fine vegetables are produced, including every variety grown in the neighbourhood of Dawson.

The small wild fruits such as the raspberry, blueberry, cranberry and red and black currants grow in great profusion and to a large size.

GAME AND FISH.

The large game of this region includes bear of several species, wolves and wolverine, moose mountain caribou and mountain sheep. The principal animals trapped for fur are the lynx, fox, beaver, marten, otter and mink.

The rivers and lakes are well stocked with salmon trout, whitefish, pike and grayling, and all the ordinary northern waterfowl are abundant.

The salmon on their way from the sea to the spawning grounds ascend the Stewart river in large numbers. Only the more vigorous fish are able to ascend the Frazer falls, but several are caught by the Indians at Lansing and salmon were seen as high as fifty miles up the Beaver river. At the mouth of Lansing river Messrs. Frank Braine and Percival Nash have established a trading post, and a small band of Indians live close by in cabins. Several Indians from Fort Good Hope on the Mackenzie river make regular journeys to this point, trapping and hunting along the route. A few white men make a regular business of trapping on the Hess river and its branches.

This region offers a great field for the sportsman and explorer, most of the country between the Stewart and Pelly headwaters and the Mackenzie being quite unknown.

Suitable boats or canoes can be poled or tracked on the main rivers well up into the watershed ranges. Several of the higher mountain groups offering sufficient inducements to the mountain climber and huntsman are situated within a day's journey from the river.

The scenery is very fine, the mountains gain impressiveness from their situation in low wide valleys, and their colouring is rich and varied. Some of the valley bottoms seen from a height have an extraordinary appearance, suggesting a mosaic floor in which the pattern is worked out by the bright surfaces of the countless lakes and ponds and the narrow dark-green land areas separating them.

GENERAL GEOLOGY.

The geological information was gathered principally during the progress of the topographical work and although the areal distribution of the rocks was obtained in a general way it is of necessity incomplete aud lacking in detail.

The important task of determining the sequence of the strata which are represented in a new area such as this is attended by many diffi-

culties. Only by close and detailed studies over a region where the rocks have been much disturbed can the succession be definitely established, and this class of work has not yet begun in the Yukon territory. The work previously done has been on detached areas, the surveys being of a reconnaissance or exploratory character. The results thus obtained have never been correlated in a satisfactory manner as the apparent absence of fossils in some of the areas leaves only the unreliable connecting link of lithologic resemblance.

GEOLOGICAL FORMATIONS.

A provisional classification for the purpose of description is given as follows, beginning with the oldest formation.

Pre-Devonian. The group of various schists, quartzites and crystalline limestones in the area south of the Beaver river.

Devonian—The limestones, ferruginous slates and quartzites of the Ogilvie range. An account of some fossils found in these rocks is given in Mr. Camsell's report on the Wind and Peel rivers.

Upper Palaeozoic—A large mass of white bedded crystalline limestone, forming the greater portion of a mountain group situated north of the Beaver and west of Rackla river.

Triassic—The rocks exposed along the Stewart river and bordering mountains, extending northward and eastward from the vicinity of Lansing river.

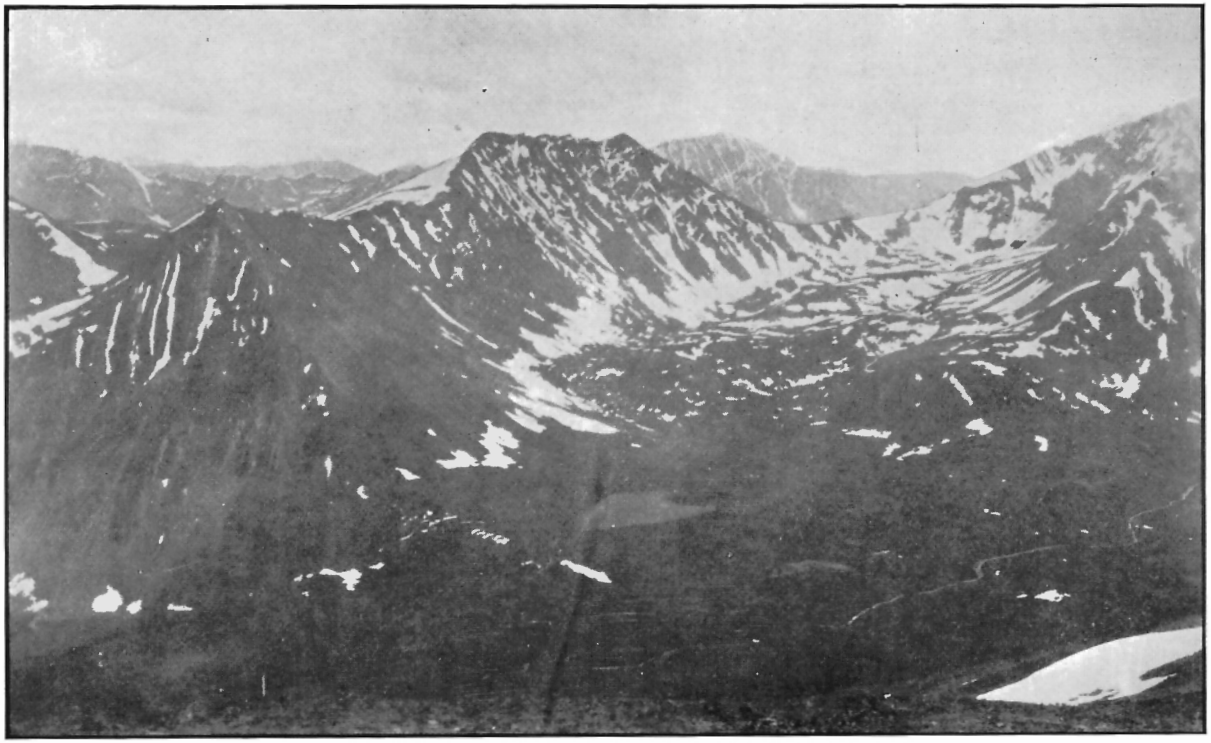
Concerning the rocks classed as Pre-Devonian it may be said that they possess the characteristics ascribed by Mr. McConnell to the group of rocks in the Klondike area which he calls the Nasina series. Rocks of this class outcrop at intervals along the lower portion of the Stewart river and they also form a considerable portion of the bedrock in the Duncan Creek district. Their age is undetermined, but in the area under consideration they are known to be older than Devonian, and may therefore be either lower Palaeozoic or Pre-Cambrian.

They consist, like the Nasina series, of ancient siliceous, argillaceous and calcareous sediments now altered into quartzites, mica schist and crystalline limestone. With these are associated green schists which represent in most cases basic eruptive rocks, principally diorites and diabases, intruded along the bedding planes of the older formation and subsequently sheared and altered.

Quartz porphyries reduced to a similar condition also form a portion of this series.

Rocks of Devonian age appear to compose the greater portion of the Ogilvie range.

Similar rocks occur to the eastward along the Mackenzie river. In the latter region the rocks are practically undisturbed. Whether the



VIEW ON TASIN MOUNTAINS LOOKING SOUTH.

continuity of the formation is preserved between these localities is not known.

The crystalline limestone, provisionally classed as Upper Palaeozoic, rests unconformably on the crystalline schists, while it is apparently overlain by Triassic rocks. No fossils were found, and the contact with the Devonian rocks to the north was not seen. A similar rock mass occurs on the Macmillan river which was classed as Carboniferous from the evidence of some fossil remains found in that locality.

This occurence also overlies crystalline schists unconformably and is followed by what are probably Mesozoic rocks.

The rocks grouped as Triassic are almost altogether of sedimentary origin. Thin bedding and diversity in the colour and composition of the beds are characteristic features. They have been greatly folded and crumpled in some localities, while in other places they are horizontal. Cleavage planes have been developed, and certain of the beds have undergone slight alteration during the processes of mountain building.

The rocks which underlie the eastern extremity of the area marked Trissaic on the accompanying map sheet are chiefly made up of sandstones, grits, red slates, limestone and some volcanics, while toward the western end shaly argillites with thin quartzite and limestone beds prevail. Beds similar to the latter also occur in the section to the west.

The evidence gathered from the study of a few fossils found in the area while not conclusive, is in favour of referring at least a portion of the series to the Triassic.

A group of rocks similar in many respects to the above occurs along the Macmillan river forty or fifty miles to the south, but the black chert beds found in that area are absent in the Stewart River series.

DISTRIBUTION OF ROCKS.

At Frazer falls the river cuts across hard quartzose greenish schists, apparently crushed eruptives alternating with bands of softer green chloritic schist, and slightly schistose grey quartzite.

Between Nogold creek and Hess river the country rock on both sides of the valley consists of greyish quartzite in which are included some green schists similar to those seen at the falls.

The quartzite in this locality varies in the degree to which it has been altered. The least altered portions are composed of fine rounded interlocking quartz grains in thick well jointed beds which bear evidence of their sedimentary character in the form of ripple marks and false bedding. When fragments are broken off, the fresh surface

shows occasional specks of mica, but a schistose structure is only poorly developed. On the other hand this rock grades into an extremely schistose phase consisting of alternate thin layers of silvery mica and elongated quartz grains.

Most of the intrusive rocks that are interbanded with the quartz schists have become so altered, and secondary minerals prevail to such an extent in their composition, that it is difficult to determine what the original source of the rock has been. In the field they are nearly always well defined owing to their usual dark green colour, different texture, and the fairly sharp dividing line between them and the quartzites, but in some cases they have undergone metamorphism along with their containing rocks to such a degree that it is impossible to separate them.

This group of schists is continuous with those of the Duncan Creek mining district immediately west of this area. They extend northward to the Beaver river, and are found to the south at a few places on the Macmillan river. Their eastern limit is unknown. They are of economic importance in this region as these metamorphic sediments, when associated with basic igneous intrusions, generally contain auriferous veins and appear to be the source of placer gold.

About nine miles below Lansing river the schists are replaced by a series of much younger rocks. These consist of dark, fine-grained, carbonaceous, and greenish argillites, slightly altered, with grey shales, dark, impure limestone, and narrow bands of sandstone almost hardened to quartzite.

The attitude of the beds at this locality is vertical, but at their southern edge is a bed of conglomerate containing rounded and elongated pebbles which appear to be derived from the schists farther south, but the contact with them was not found.

These rocks are exposed at intervals along the Stewart river as far as Nadaleen river; they form benches about thirty feet high in the vicinity of Lansing river, and are the rock walls of the Seven-mile cañon. The prevailing strike of the rocks is east and west, and the attitudes of the beds vary from almost horizontal to vertical.

There is a good deal of minor crumpling and folding, and in some places small quartz veins and stringers intersect the beds.

About thirty miles above Nadaleen river several low rock terraces occur on the Stewart. The rocks of which they are composed consist of red and green slates, sandstones, grits or fine conglomerate, gray limestone, and shale. The sandstones and grits are very hard, and are composed mostly of quartz fragments with a siliceous cementing material.

TASIN MOUNTAINS.

On the slopes of the Tasin mountains to the south of the river a good section is exposed, having a thickness of at least 3,500 feet. Beds similar to those seen near Lansing river are represented in the section. The uppermost beds are the sandstones, and these beds form the rugged mountain peaks of this group. The strike of the series is in general northwest and southeast in this locality. They appear to form an anticline, with the river flowing in the axis of the fold. The dips of the beds on the valley slopes are not steep as a rule, and the series are traversed by a system of jointing, the dominant planes of which trend in a northerly direction.

These rocks extend eastward for a considerable distance, as the red slate beds which are such a conspicuous member of the formation could be traced on the mountain slopes.

North of the Stewart river the mountains are built of heavily bedded limestone overlying yellow weathering ferruginous slates, and rocks of this character appear to form the greater portion of the Ogilvie range.

Rocks similar to those first seen in the vicinity of Lansing river extend some distance up the Beaver river and to a point a few miles above the forks of Rackla river. The contact in this locality is faulted, the limestones and associated rocks of the Ogilvie range being overthrust on the argillites. In a bed of dark, impure limestone associated with the argillites and quartzites near the forks of Rackla river, some fossil remains were found which have been identified by Dr. Whiteaves, who reports the following forms and refers them to the Triassic, but at the same time states that the evidence in favour of that view is by no means conclusive.

Pelecypoda.—Some very imperfect remains of apparently four or five species, two of which have much the general appearance of *Monotis subcircularis* and *Halobia Lommelli.*

Cephalopoda.—Fragment of a small Ammonitoid shell, apparently rather similar to Arpadites, but which shows no trace of any of the sutural lines. There seem to have been two longitudinal keels and three longitudinal grooves on the venter, and the transverse ribs are slightly flexuous.

The schistose series first mentioned cross the Beaver river a short distance above the mouth of the Rackla river. In this locality the schists vary in appearace from those to the south, being of different texture and not so massive. Thinly laminated quartz schist, soft greenish chloritic schist, and dark mica schist, and some bands of grey crystalline limestone characterize this portion of the metamorphic

series. Small bodies and stringers of quartz are numerous in the schists along the south side of the Beaver River valley.

Between Rackla and Beaver rivers and north of the schistose area is an isolated mountain group composed almost entirely of white crystalline limestone which is not invaded by any other rock masses. This limestone contains some siliceous beds and patches and a few thin seams of siderite, but no traces of fossil remains could be found.

Between the limestone and the schists lies a thick bed of breccia containing some large fragments of grey crystalline limestone and dark mica-schist.

IGNEOUS ROCKS.

The unaltered igneous and volcanic rocks represented in this area occur in small detached and irregularly distributed masses.

The most important mass forms the central portion of the Lansing mountains, situated south of Lansing river and fifteen miles east of the Stewart.

The rock here consists of a coarse gray biotite-granite ; it is strongly jointed and weathered into conspicuous peaks of a rugged character, which contrast strongly with the smoothly rounded contour of the adjacent sedimentary rocks through which it intrudes. Another small area of granite of similar composition occurs south of Ladue river on the eastern slopes of the Gustavus mountains. This mass has apparently been exposed to erosion for a considerable period and presents smooth, gently rounded surfaces.

Small bodies of granite of apparently the same composition as the above occur to the west and south of this area. As a rule they occur in the form of stocks or cores in a mountain group. The contact between the granite and the sedimentary rocks is generally clear and well defined, the latter rocks being considerably hardened for some distance from the granite.

The remains of a dome structure in the bedded rocks surrounding the unroofed granite stocks is sometimes apparent.

On the mountains east of the Beaver river and north of the Stewart a series of diabase dikes cuts through the grey argillites. These dikes were traced from this point in a westerly direction for a distance of twelve miles ; they cross the Nadaleen river and reappear on the mountain group north of the mouth of the Beaver river. On the mountains the dikes form the crests of the ridges, with almost perpendicular faces toward the south.

Small bosses and dikes of diorite frequently occur intruded in the schists on the mountains south of the Beaver river. The highest peaks of these mountain groups is often composed of diorite.

Andesite tuffs, ash-rocks and other volcanics are found in small quantities associated with the red slates and sandstones.

GLACIATION.

All the valleys in this region are floored with deposits of drift composed of a variety of materials and laid down under different conditions. The rivers have cut trenches in and removed vast quantities of these deposits, but the depth of material still remaining is unknown. Large patches of loose material still adhere to the valley slopes to a height of 1500 feet above the river along its lower reaches, but in the upper valleys the drift mantle becomes thinner and does not appear to alter the pre-existing topography to any great extent.

Boulder clay or till, which is a direct ice deposit, occurs in large patches at several points along the Stewart river between Frazer falls and Nadaleen river, but none was observed above this point. The exposures of boulder clay, where cut into by the river, are at least 100 feet in thickness and present the usual steep faces with the upper portion carved into pinnacles and knots.

At the few points where the bottom of the thick sheets of boulder clay was observed they rest on low bed-rock benches, but on other points thin sheets of boulder clay overlie or are interstratified with sands or gravel, indicating reinvasions of the ice after the general withdrawal. Following the boulder clay on the downstream side there are generally found non-coherent and confused deposits consisting of boulders, gravel, sand and clay which appear to be morainal overwash.

Between these accumulations which may be terminal moraines, are found deposits of more or less evenly bedded materials varying in coarseness from fine silts to beds or layers composed of boulders.

Deposits of this character form the greater portion of the drift along the rivers, and on Ladue river they have a thickness of at least 250 feet.

No boulder clay was observed on the Ladue river or in the wide valley between the McQuesten lakes and the Beaver river, the latter valley being floored with fine river sand.

A thick deposit of plastic blue clay without pebbles occurs in the middle of the wide valley of the Stewart about thirty miles above Frazer falls, and a similar deposit was found underlying sand and gravel beds opposite the mouth of Hess river.

Some of the materials of the drift have been transported to points far distant from their source. The hematite and jaspilite pebbles which are caught in such abundance in the sluice boxes on all the creeks of the Duncan Creek mining district have their source somewhere between the headwaters of Rackla and Wind rivers. In this

case the drift has travelled for a distance of 100 miles or more. Pebbles from other rocks are known to have been borne over great distances, although the evidence is not always so unmistakable as in the case of the hematite pebbles, when attributing the distribution of certain portions of the drift to glacial movements.

Judging by the character of the drift deposits which have been described, and from observations made in other portions of the Yukon territory, it is evident that running water, still water and ice have all contributed directly towards their accumulation.

During the glacial epoch glaciers descended the Stewart valley from the elevated region around its upper waters. At the period of maximum accumulation the valleys were all filled with moving ice and only the upper portions of the higher mountain groups were uncovered.

The general level of the ice in that area was about 5,000 feet above sea level. In the vicinity of Frazer falls the ice reached a level of 4,000 feet and the westerly limit of glaciation occurs near the mouth of the McQuesten river. Although the ice sheet was thick enough to over-ride several of the ridges and lower mountains its movement appears to have been controlled to some extent by the topography, for at the few places where glacial groovings and striae were observed they indicated a movement in the direction of the principal valley.

The events of the glacial period have affected the topography of the Stewart River basin both by erosion and deposition. The hills were smoothed and rounded in outline and the valleys were widened by the removal of rock waste from their slopes, and this material was transported and irregularly deposited at certain localities where the margin of the ice sheet was constant for some length of time during its withdrawal.

In the higher mountain groups glacial activity continued and sent down ice through side valleys after the main valley glaciers had retreated. The river at several points has cut through mounds of unsorted drift which were probably the terminal moraines of these local glaciers. These local glaciers extending across the main valleys acted as obstructions to the drainage, and extensive lakes were formed into which the glacial streams washed their burden of debris, the coarser material being deposited near the point of discharge, and the finer material such as rock flour being carried farther before deposition.

ECONOMIC GEOLOGY.

That portion of the region which is best worthy of the attention of the miner in search of placer gold is the area situated east of Mayo lake and south of the Beaver river.

This area is underlain principally by schists of various origin and character which are intruded in places by igneous rocks, such as granite, diorite and diabase. The bed-rock of all the productive placer ground in the Yukon territory is of a similar character to the above.

On the accompanying map sheet a portion of the Duncan Creek district is shown and the geological relations between it and the new area to the east are laid down.

Colours of gold were obtained in the gravels of many of the small streams flowing over this area, but whether there is sufficient gold to pay for mining can only be determined by the usual process of reaching bed-rock.

Physical conditions on the Ladue river render it a singularly uninviting locality for the prospector. The river itself flows with a sluggish current in a wide flat-bottomed valley containing a great depth of mud, sand and fine gravel. Most of its tributary streams are small torrents heading in high mountain groups. South of the Ladue river in the area through which Rupe, Edwards and Nelson creeks flow, conditions appear to be more favourable for mining, for although some of these streams head in high domes, they mostly flow with easy grades between low, well-rounded ridges.

In the area between Hess river and Lansing river east of the Stewart at least four creeks flowing into those streams are known to yield coarse gold. This portion was not examined by the writer, but on Congdon creek, which comes into the Stewart from the east about six miles below Lansing, good prospects were obtained by one of the party in the surface gravels.

The same difficulties which attend mining in the Duncan district, such as underground water and large boulders in the creek bottom, may be expected in these areas.

Above the mouth of Mayo river the gravel bars on the Stewart, although slightly auriferous, do not yield gold in paying quantities. Beyond the mouth of the Beaver river the bars do not appear to be auriferous. The same may be said of the Beaver, and although fine gold was said to have been found in 1898 on the bars of Rackla river, its principal tributary, no colours could be obtained by the writer's party on that stream, but on a small stream nearly opposite the mouth of Rackla river coarse gold was obtained in the surface gravels.

No gold-bearing quartz has up to the present been discovered in this region. Small bodies and stringers of vein quartz are of common occurrence in the area of schistose rocks described above, but no trace of gold-bearing rock was seen on that portion of the area traversed.

A large body of quartz forming low rugged ridges crosses the

Stewart valley about eighteen miles below Lansing river. Another large body of quartz occurs on Rackla river, below the forks. These bodies are apparently barren of any mineralization.

The existence of large bodies of iron ore at the headwaters of the Wind and Bonnet Plume rivers has been known for some years. Outcrops of this ore were seen by a few of the gold-seekers who journeyed to the Yukon by this route. The drift from these bodies is widespread on the basin of both the Peel and Stewart rivers, being found all along the tributaries of the latter as far as the mouth of the McQuesten. In these localities the drift from the iron beds is only found during the processes of mining, as on account of its weight it sinks to bed-rock.

On Rackla river, however, which apparently heads near the source of the iron, large fragments are found on the surface.

The pebbles wherever found show an exceedingly fine-grained very compact hematite, some of which also contain thin bands of red jaspilite. Small boulders showing bands of pure ore four or five inches thick were found near the forks of Rackla river.

The presence of these ore bodies is an interesting fact, but in this region they are very unlikely to be numbered among the economic mineral resources of the territory from a commerical point of view.

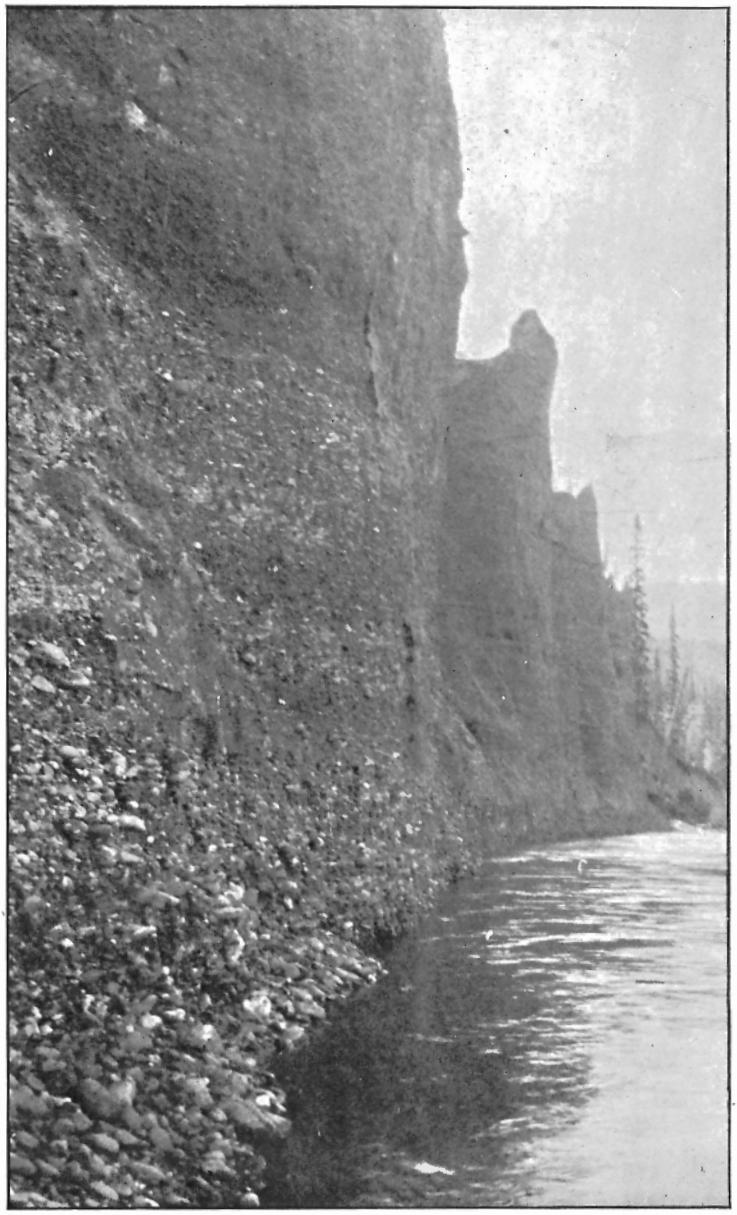
APPENDIX.

LIST OF BUTTERFLIES AND MOTHS COLLECTED IN THE YUKON TERRITORY BY J. KEELE, 1904-5.

Determined by James Fletcher, LL. D., F.R.S.C.

BUTTERFLIES.

Papilio machaon, var *aliaska*,	Mayo Lake.	
Colias occidentalis,	Mayo Lake,	Aug. 7.
Colias meadii,	"	"
Pieris bryroniae,	"	"
Argynnis eurynome,	"	"
Argynnis chaliclea,	"	
Argynnis frigga, var *saga*,		"
Phyciodes pratensis,	"	"
Lycaena antiacis,	"	July 28
Erebia epipsodea,	"	"



BANKS OF RIVER GRAVEL AND BOULDER CLAY ON STEWART RIVER OPPOSITE MOUTH OF NADALEEN RIVER.

Eurymus boothii. Curtis. Lansing river, June 24. Ladue river, July 4.

Eurymus paleano. L. Ladue river, July 4. Stewart river above Nadaleen and Frazer falls.

Eurymus occidentalis. Scudd. Beaver river, July 25.

Phyciodes pratensis. Behr. Stewart river above Nadaleen, July, 18. Ladue river, July 4.

Brenthis chariclea. Schneider. Ladue river, July 4. Slopes of Mount Ortell, July 16.

Erebia disa. Thun. var *mancinus,* D & H. Lansing river, June 24.

Erebia magdalena, strk. On mountain near forks of Rackla river, Aug. 2.

Œneis jutta, Hbn. Stewart river, June 22. Lansing river, June 24. Ladue river, July 4.

Coenonympha kodiak, Edw. Lansing river, June 24. Ladue river, July 4.

Everes amyntula, Bdv. Stewart river above Hess river, June 22.

Nomiades antiacis, Bdv. Lansing river, June 24. Ladue river, July 4.

Moths.

Plusia sackenii, Mayo lake, Aug. 7.

Metanema inatomaria, Mayo lake, Aug. 7.

Hyphoraia parthenos, Harr. Stewart river above Frazer falls, June 15.

Dyscia orciferata, Wlk. Lansing river, June 24.

Androloma mac-cullochii, Kirby. Slopes of Mount Ortell, July 16.

Metrocampa prægrandaria, Gn. Frazer falls, July 28.

Parasemia plantaginis, L. Lansing river, June 24.

Hymenoptera

Tenthredopsis evansiu. Lansing river, June 24.