

1898.
NEW ZEALAND.

GEOLOGICAL EXPLORATIONS

MADE DURING 1897-98.

Presented to both Houses of the General Assembly by command of His Excellency.

Mr. ALEXANDER MCKAY, Government Geologist, to the UNDER-SECRETARY for MINES.

2nd June, 1898.

SIR,—

During the year 1897-98 I made in the Middle and North Islands the various examinations specified as under:—

In the Middle Island,—

1. An examination of Kirwan's Hill and the district east of the sources of Boatman's Creek, between Larry's Creek and the source of the north branch of the Inangahua River.

2. The valley of Boatman's Creek and the adjacent hill slopes from the gorge above Caplestone to a mile below the township.

In the North Island,—

1. An examination of the copper lodes occurring within the Pupuki watershed, Whangaroa County.

2. An examination of the prospects of finding coal in the hills south of Scoria Flat, Kawakawa, Bay of Islands County.

3. An examination of part of the Mangakirikiri Valley, with reference to the occurrence of mercury-ore (cinnabar) in the Kauaeranga Valley, Thames County.

4. The continuation of the work of the past year with respect to the geology of the Cape Colville Peninsula: Firstly, by an examination of country from the plain west of Karangahake, east-north-east to the coast-line a little north of Waihi; and, secondly, an examination of the Thames Goldfield between Hape and Tararu Creeks. On the first five localities I have the honour to report as fully as the case in each instance seemed to require. With respect to the work done in Ohinemuri and Thames Counties, the necessity of the preparation of rock specimens and slices for microscopical determination, which work cannot be effected for some time, makes it advisable to give a preliminary report, which, in the meantime, will deal with general results, in anticipation of the more detailed descriptions that are to follow.

I have, &c.,

ALEXANDER MCKAY,
Government Geologist.

The Under-Secretary, Mines Department.

REPORT ON THE AURIFEROUS ROCKS OF THE WESTERN SLOPES OF THE VICTORIA MOUNTAINS, NELSON.

THE discovery on the northern slopes of Kirwan's Hill of a considerable area over which are strewn a covering of loose blocks of auriferous quartz has led during the past season, 1896-97, to a great amount of prospecting there, in the immediate vicinity and over the surrounding district. The result has been the discovery of numerous reefs of quartz within the area lying between the upper part of Larry's Creek and the upper part of the Waitahu, or north branch of the Inangahua River.

The district is mountainous, most of the reefs being exposed at and somewhat higher than 4,000 ft. above the sea, and forms a flanking range parallel to the Victoria Mountains, but separated therefrom by the deep valley of the Waitahu; while to the north this range is separated from the southern end of the Brunner Mountains by the deep gorge of Larry's Creek.

The auriferous rocks covering the greater part of the area belong to the Maitai series of the New Zealand Geological Survey classification, regarded as belonging to the Carboniferous period.

and are identical with the auriferous rocks of Reefton and the district thence south to Big River; also, with the auriferous rocks of the middle part of Boatman's Creek. The deeper-seated rocks exposed along the gorge of Larry's Creek are mica-schists, resting on granitic gneiss, while to the south-east of Kirwan's Hill there is a development of Cretaceous rocks, comprising coarse breccia, conglomerates, quartz-grits, sandstones, and shales with coal; and these rocks are largely developed to the south and south-west of the auriferous area of Kirwan's Hill.

To the westward the auriferous area of Kirwan's Hill is separated from the better-known area of the middle part of Boatman's Creek by a belt of dark intrusive hornblende rock and an ill-defined area of coal-measures, deeply involved amongst the other older and younger rocks.

Being difficult of access thereto, and surrounded on all sides by non-auriferous rocks, it was not till the season of 1896-97 that any important discovery was made. Mr. Kirwan, the discoverer of the area of loose blocks of auriferous quartz, arriving at his conclusion by experience of what occurs in the Reefton and Rainy Creek districts, regarded the near vicinity of an outlier of the coal formation as a favourable indication for the occurrence of gold-bearing reefs in the slate country, and was thus led to make an examination of the ground in the vicinity of the hill formed of coal-bearing rocks—that furthest towards the source of the Waitahu lies to the south-east of Kirwan's Hill—with the result that on the slope of the hill opposite Coal Hill the field of loose quartz was found, and the discovery of the reefs *in situ* to the west and north was made shortly afterwards.

During the season of 1896-97 little effective work in the way of opening out the different reefs was done, and during the present season, 1897-98, although strenuous efforts have been made to trace the source of the rich gold-bearing boulders of the quartz field, these as yet have been unavailing.

Of the reefs found, none of them as yet afford prospects of gold equal to what are to be obtained from the loose quartz on the northern slopes of Kirwan's Hill. This loose quartz occurs in blocks of all sizes, up to masses 2 to 3 tons in weight, and thickly covers the surface over an area of 10 or 12 chains in length, and an average width of between 4 and 5 chains. The quartz is chiefly, if not wholly, confined to the surface, although masses of the wrecked hill-slope do here and there show portions of reefs held within walls of sandstone and slate rock, identical with the general formation of Kirwan's Hill and the country eastward to Caplestone.*

Towards the lower end of the quartz-covered area, and where the loose quartz was richest in gold, a tunnel has been driven west into the hill, in the hope that by this means solid ground might be reached, and the lode from which the richer quartz has been derived would thus be discovered. At a distance of 150 ft. from where started this tunnel failed to pass through the broken country, and discontinued during the winter months; work on this was not continued when prospecting commenced towards the end of November last year. It therefore failed in the object for which it was driven, and, what was very remarkable, scarce a fragment of quartz was found in the rubbly material excavated from more than a few feet below the surface.

At the present time, at the opposite or northern end of the field of quartz, a shaft is being sunk to prove the depth to the solid rock, and this shows the same remarkable absence of quartz from all but the surface of the *débris*-covered mountain-slope. This shaft when visited had reached a depth of 35 ft., and had not passed through the broken angular material met with in the tunnel lower down the slope of the hill.

On the north-eastern part of Kirwan's Hill, and in the ridge thence going east and north-east to connect with Trig Hill, there are numerous reefs that strike south-south-east and dip east-north-east at high angles, and thus should pass but a little to the eastward of the field of loose quartz on the southern slope of Kirwan's Hill. It must, however, be noted that in the north and north-west higher part of the hill no notable discovery of quartz has been made (none were reported to me), and westward, along the road leading to the upper part of Boatman's Creek and Caplestone, in the side cuttings of the road, rarely is a piece of quartz to be met with.

All the lodes of quartz found are poor in gold in comparison with the richer of the loose blocks of the quartz-covered surface on Kirwan's Hill, and some there are who refer the source of the gold-bearing stone to a locality at a distance from where they now lie, and consider that the juxtaposition of the reefs *in situ* and the field of loose quartz is merely accidental. After due consideration of this matter I have come to the conclusion that the loose quartz is derived from lodes in the immediate vicinity, and the evidence in support of this conclusion is sufficient.

Wherever the matrix adheres to the quartz, this, as forming part of the foot- or hanging-wall of the original lode, is of the same character as the foot- and hanging-walls of the lodes that have been discovered. The quartz also in character closely agrees with that of the lodes *in situ* that have been discovered, and the correspondence is complete in all except the amount of gold obtainable from the loose and solid stone.

Attempt has been made to explain the presence of the loose quartz on the south-east slope of Kirwan's Hill by supposing that a reef having a low angle of dip occupied practically the surface of the hill-slope, and that by a series of slips this and the foot-wall of the same to an indefinite depth became shattered, leaving the quartz still on the surface of the broken ground.

This supposition of a lode having a low angle of dip stretching across the southern face of Kirwan's Hill is improbable, because of necessity it would have to intersect the southern continuation of the lodes in the near vicinity and the northern part of the field, and, whether dipping to the east, west, or south, the effect would be equal to a sheet of quartz stretched across or through the other reefs. This would reasonably involve the supposition that two systems of fissures filled with

* Since this was written further prospecting has revealed the existence, more to the north, of a stratum of quartz boulders, overlain by a thickness of ordinary slate and sandstone rubble. This lies to the eastward of the two principal prospecting-drives, and contrasts remarkably with the western area of broken country, over which all the loose quartz was at or near the surface.

auriferous quartz are present, but of this there is no evidence here at Boatman's, nor at Reefton, and I cannot adopt the theory.

It has already been said that all the rock of Kirwan's Hill and the adjacent ranges to the north and north-east are slates and sandstones belonging to the Maitai series, of Carboniferous age, and that outside of this area eastward beyond the Waitahu the rocks of the Victoria Mountains are granitic gneiss, with belts and bands of mica-schist. From the absence of any such rocks amongst the *débris* covering the slope of Kirwan's Hill it is very unlikely that the loose quartz on the southern slope of the hill has been derived from the granitic region to the eastward, nor could the quartz material have come from the westward without being accompanied by granite from the conglomerates at the base of the coal-measures in that direction, and of other different and characteristic rocks lying in that direction.

The rich quartz that is found on the surface of the Lord Brassey Claim has therefore in all probability been derived from a lode not now seen at the surface, and which will most likely be found running along the western boundary of the claim mentioned. More to the westward for a considerable distance there is little indication of the presence of quartz reefs.

The Carboniferous rocks and the lodes which they contain belong to the eastern division of the auriferous rocks stretching along the east side of the Inangahua and Little Grey Valleys from Larry's Creek to Blackwater. This eastern division contains the lodes worked in the vicinity of the sources of Rainy Creek, and thence to Big River, and in some parts are characterized by comparatively thin veins of quartz rich in gold, as on the eastern slope of Merrijigs Hill. The slates and sandstones between the Waitahu and Larry's Creek extend considerably east of the boundary hitherto assigned to this formation, and towards the upper part of Larry's Creek there is a large area over which prospecting might be carried on with a fair show of success.

REPORT ON THE AURIFEROUS CHARACTER OF BOATMAN'S CREEK, INANGAHUA VALLEY.

SIR,—

Wellington, 31st December, 1898.

In accordance with your instructions dated the 17th December last, in which I was directed to report on the geological features of the valley of Boatman's Creek, between Cronadon and Caplestone, I have made the examinations required, and have the honour to submit the following report relating to the district above referred to:—

REPORT.

Boatman's Creek between its main source and where it falls into the Inangahua River drains across a variety of formations, almost all of which have been proved to contain auriferous reefs or deposits of alluvial gold. Its valley, more especially in the middle and upper parts, has been deeply excavated in an auriferous country carrying reefs, while below Caplestone, where the width of the low grounds of the valley is greater, coal-bearing strata and gravels of later date are the only rocks.

Boatman's Creek has been worked for gold from Caplestone upwards to the junction of the two main branches of the principal stream, and Little Boatman's Creek has been worked to its source in Specimen Hill. The amount of alluvial gold that has been obtained from this part of the watershed has been considerable.

At Caplestone the slates and sandstones forming the Maitai series, and which constitute the formation in which lie the auriferous reefs of the district, are overlain by Cretaceo-tertiary rocks, comprising coarse conglomerates, gritty sandstone, and shales with coal-seams. The conglomerates and grits of this series are to some extent gold-bearing, though perhaps to a less degree than are the same beds within the watersheds of the Waitahu and the south branch of the Inangahua. Yet on being cut through and carried away by the action of the creek they must have yielded a considerable amount of gold, that may in part be looked for in the gravels that form the flats of the lower valley. At the lower end of the township the coal-bearing series is followed by heavy deposits of conglomerate and coarse gravels, locally known as "Old-man bottom." These gravels form hills on both sides of the valley to within a short distance of Cronadon, and over a width of from a quarter to half a mile, and to a depth varying from 200 ft. to 400 ft., they have been removed in the formation of the creek valley.

Gold occurs in the lower beds of the "Old-man bottom," and again in a horizon about 60 ft. higher in the series, and further down the valley on Boardman's property at a third and yet higher horizon. The recent alluvial deposits along the valley below Caplestone should therefore contain gold, derived—first, from reefs in the slates and sandstones of the Maitai series; second, from the base of the coal-formation; and, third, from two or three horizons in the "Old-man bottom." And it is only on account of the comparative depth and wet character of the ground to be proved that gold-workings have not been essayed in the lower part of the valley, west of where the coal-bearing rocks disappear under the gravels of the "Old-man bottom."

That much gold has been liberated from the slate-formation the richness of the reefs worked and being worked is evidence sufficient. That gold also has been derived from the lower beds of the coal-bearing series there is also evidence, and yet more so it is clear that large quantities of gold have been liberated from the gravels of the "Old-man bottom" and should now lie along the bed and banks of Boatman's Creek. This may all the more confidently be presumed from the former presence of rich alluvial workings in the parallel streams to the north and to the south in part tributaries of Boatman's Creek. It is true that these streams are not of equal volume and do not cut so far back into the slate country to the east of the coal-bearing rocks, but this would only tend to show that the gravels of the "Old-man bottom" have been the principal source of gold-supply to such creeks as the lower part of Italian Gully and Frying-pan Creek.

The question of the auriferous character of the gravels of the "Old-man bottom" has been dealt with in the report containing the description of the blocks reserved for mining purposes (Mines Reports, 1896, C.-9); and Block LIII., within which is situated the part of Boatman's Creek forming the subject of this report, is described at page 4 of the report in question (*q.v.*)

That portion of the valley of Boatman's Creek which is under consideration has a creek channel of moderate width, in and along which lies a considerable amount of drift timber. The banks are bare of timber, but a few feet from the stream the flats have till recently been covered with bush and stumps and dead timber, the presence of which may to some extent interfere with the working of the flats.

As bearing on the matter of this report might be raised the question, much discussed by miners on the West Coast, as to whether the gravels of the "Old-man bottom" carry appreciable quantities of gold or no. This has been dealt with sufficiently in the introduction to the description of the blocks reserved for mining purposes above cited, and in the reports for the year 1895, for which see Mines Reports, 1895, C.-13, "On the Geology of the South-west Part of Nelson and the Northern Part of the Westland District."

The Under-Secretary for Mines.

ALEXANDER MCKAY,
Government Geologist.

REPORT ON THE COPPER DEPOSITS OF OMAUNU No. 2, WHANGAROA COUNTY.

ABOUT the beginning of February, 1898, an examination was made of the copper deposits at Omaunu No. 2, Whangaroa County, on which the presence of copper-ore was first ascertained in 1892.

Copper was first discovered in a small creek, which, from the trig. hill (Maunga-meme) overlooking the lower Kaeo Valley, drains south-west into the Upper Pupuki. The outcrop consists of a series of pyritous boulders forming a bar and rapid in the bed of the stream. Since the discovery a mineral lease of 100 acres has been secured by Messrs. Bell and Houston; and subsequently an endeavour has been made to ascertain the size and direction of the lode, and whether or not other lodes exist on the same property. Other leases have been granted; and at the time when the district was visited prospecting was being carried on on two or more of these, and has resulted in the discovery of at least a second lode of considerable size.

The rocks of the district consist of Palæozoic slates and sandstones, with which serpentines are associated within the area over which the copper-lodes have been found. More to the south-west, in the Upper Pupuki and Kaeo Rivers, diorite intrusions are plentiful, and the whole forms part of a belt of mineralised country that extends from Puhupuhi in the south to the north of Doubtless Bay, Mangonui.

At the point where copper-ore was first discovered on Omaunu Block, in the bed of the creek, some endeavour has been made to ascertain the size and direction of the reef, and the character of the rocks with which it is associated. A shaft was sunk on the east bank of the creek close to the outcrop of the lode as seen in the bed of the creek, but this was beyond the outcrop, and, the dip of the lode being north, the rocks on the foot-wall side of the lode were cut into, and no lode of any kind were met with in a depth of 30 ft. A drive was made in a north-west direction till the line of creek-channel was driven across at a point where ore showed vertically over the drive; but, the drive being nearly in the direction or strike of the lode, this, as far as carried, continued in the foot-wall, and failed to show the presence of ore. The original outcrop in the creek-bed showed as a mass of angular blocks that crossed the creek apparently in a west-north-west direction, or nearly at right angles to its course, and which continued up and down the creek some 10 ft. or 12 ft., and constituted the bed of a miniature rapid thus formed.

The ore at the surface consisted mainly of iron-pyrites, but many of the blocks, on being broken into, showed the presence of yellow copper-ore of good quality, and the sample originally taken and tested at the Colonial Laboratory, Wellington, yielded over 30 per cent. of copper.

To lay bare the outcrop the loose blocks in the creek were removed, and all loose material from the foot-wall side of the lode to where it began to be confined by the hanging-wall, but no attempt was made to trace the ore underfoot where so covered in the direction of its dip. On the west side of the creek a pit was sunk close alongside the outcropping ore, but this again was in the foot-wall of the lode, and was not so disposed as to prove anything respecting the lode itself. On both sides the copper-ore has a tenacious clay of a blue colour, which must be regarded as lying between the walls proper. The lode itself is mullocky, and quartz is almost absent.

The rocks exposed in the shaft and drive, and developed on the foot-wall side of the lode, are sandstones and shales of a type such as characterizes the young Secondary rocks of the district, and are like the rocks of the Pupuki Lower Valley, and calcareous in character. The nature of the hanging-wall outside the "pug band" has not yet been definitely ascertained. On this side there is, and apparently over the pug band of the hanging-wall, a thick band of iron-gossan, which, though completely oxidized, still seems to indicate a massive body of pyritous ore which has yet to be cut into and explored. A pavement of boulders of volcanic rock is met with in the bed and banks of the creek, and for 5 or 6 chains higher up than the outcrop of ore the nature of the rocks cannot be ascertained till some distance away from the creek. Further towards its source the banks of the creek show rocks *in situ*, which, however, are decomposed, and a little higher up, at the waterfall, pass into the serpentine. In these rocks copper-ore again appears, some large blocks occurring in the bed of the creek, and others appear in the right bank (which, however, appears at this place to be slipped ground), while at the foot of the waterfall cliff a considerable block of ore lies wedged in a fissure of a rock at that place. From the few facts that could be observed at and near the waterfall it may be concluded that the direction of the ore band must be nearly east and west,

and, as boulders of ore were reported to occur in a branch of the creek east of the waterfall, the east line across the intervening spurs was followed, and—perhaps but a coincidence—this crossed within a chain of where the ore boulders were met with in the branch creek. This determination had to be accepted, there being no better means possible, short of some time and considerable labour. Following down the branch creek (Frenchman's) to the first-described and more important outcrop with the compass, an endeavour was made to follow from that a west line through the bush to the southern boundary of the claim. This resulted also in the line passing within about 2 chains from where an outcrop of ore is reported on outside the claim. This seemed to confirm the supposition that the lodes strike east and west magnetic; but on returning to the main outcrop the conclusion was arrived at that probably the true bearing is more to the north, as indicated by the direction of the outcrop in the creek-bed and of the gossan outcrop on each bank of the creek. There is reason, therefore, to believe that the true course of the lode is from between west-north-west and north-west to the opposite point in a south-east direction. In the opposite direction the lodes should pass into claim No. 3, east of and adjacent to the Prospectors' and Prospectors' No. 2.

Owing in part to the scattered condition of the vein-stuff and mullocky walls as far as seen, but yet more to the mistake made in sinking and driving in and along the foot-wall rocks, an impression prevails that the ore seen at the surface, and as far as proved at the principal outcrop, is only a slip from a lode *in situ* higher up the creek, which has yet to be discovered. In order to arrive at a conclusion with respect to this matter the prospectors had some further work done while these examinations were being made. A trench north along the bed of the creek was made, and when the ore disappeared underfoot a hole was sunk to prove its presence under the supposed hanging-wall of pug-clay, first at about 1 ft. below the level of the outcrop, and at a further distance at a greater depth of some 2 ft. 6 in. Next it was directed that the trench should be continued in the direction of the dip, and a hole sunk in a position at which some 10 ft. or 12 ft. of rock should be passed through before reaching the upper surface of the ore. So far as at the time could be seen, there is every probability of the ore being in place, while yet it is possible it may not be. Even then, should the latter contingency be the case, the lode *in situ* cannot be far to seek, since it must be somewhere in the distance between the principal outcrop and the waterfall, some 6 chains higher up the creek. I could not estimate correctly the thickness of the ore band, but thought it must be at least 6 ft.

The quality of the ore improved as cover made on the hanging-wall side, but, as poor and high-class ore has been obtained from the very surface, it is a general improvement in the bulk of the ore that is to be looked for and expected. No samples were taken for assay, because sufficient from near the surface had already been taken and reported upon, giving returns up to 34 per cent. of copper, and it is from greater depths that a general average should be obtained.

Since the above was written prospecting has been carried on, which, on the adjacent claim to the eastward, has resulted in the discovery of a heavy lode striking in the direction of the serpentine cliff at the waterfall, and, on the Prospectors' Claim, of a second lode about 90 ft. higher up the creek than the original outcrop. Prospecting at the waterfall has not resulted in the discovery of a solid lode of ore, despite the presence of blocks of copper-ore in the bed and banks of the creek at that place.

It is as yet too early to pronounce an opinion as to the value of the different properties on which copper has been found further than that they are well worthy of being vigorously prospected, and in this connection it may be pointed out that the position of the lodes and facilities for reaching a shipping-place in Whangaroa Harbour are such as to add materially to the value of these properties in comparison with localities where such mines and indications of copper are elsewhere found in New Zealand.

ALEXANDER MCKAY,

Government Geologist.

REPORT ON FURTHER PROSPECTING FOR COAL AT KAWAKAWA, BAY OF ISLANDS COUNTY.

By ALEXANDER MCKAY, F.G.S.

I HAVE the honour to report that, as directed by the Hon. the Minister of Mines, on the 8th and 9th February, 1898, I examined various parts of the Kawakawa Coalfield, with the view of determining the probability of coal being reached by the further prosecution of Boreholes Nos. 1 and 2 in course of being sunk by the Russell Syndicate (Limited).

I readily arrived at the conclusion that there is little likelihood of either the one or the other of the boreholes being within a very considerable distance of the coal horizon; but of the two, No. 1 bore, situated most to the north, and near the border of Scoria Flat, is in all respects the most favourably placed, and the sinking of this might be prosecuted to a successful issue. The coal-measures probably underlie the rocks that as yet have been encountered, these being Pliocene rocks flanking the lower hills on the southern side of Scoria Flat, and developed elsewhere in other parts of the district as strata distinctly unconformable to the coal-bearing series. These not having been passed through the borehole so far as this has been carried proves nothing with respect to the extension of coal westward that has not already been ascertained.

The position of the borehole is nearly in the line of dip of the seam worked at Kawakawa, and in this respect has been judiciously chosen, and without question the underlying coal-measures could be reached and passed through. The evidence, however, is not in favour of a workable seam of coal being found provided the formation was pierced to the Palæozoic rocks on which the coal-measures rest, and the probabilities are that the present company, with limited means at their dis-

posals, would be unable to put down the borehole to the depth required, which would not be less than, and might considerably exceed, 1,000 ft. of boring. But, without taking this fact into consideration, the improbability of finding a workable seam in any case compelled me to advise the discontinuance of the borehole.

There are ample facts contained in the various reports on the geology of the Kawakawa Coal-field showing the improbability of being able to reach coal at depths less than 1,000 ft. at any point to the west of the Waiharakeke Swamp, on the east side of which the deepest borehole put down by the Bay of Islands Coal Company reached to 680 ft. before touching the slate-rock. To the immediate westward of the swamp, owing to the direction and amount of dip of the strata, and the presence of beds yet higher in the series, nothing short of 1,000 ft. of boring would be required to pass through the coal-measures; and as the present borehole, No. 1, is situated fully half a mile further to the west, without having regard of the presence of a younger unconformable formation from the datum line of sea-level, much more than 1,000 ft. of sinking would be required to reach the coal, which in all cases forms the bottom bed of the series, with only a few feet of clay underlying. This is inevitable unless a reversal of the dip takes place, and on the western side of the syncline thus formed, the shorn coal-measures would expose lower and yet lower beds as the section was followed towards the west.

All the evidence collected leads to the conclusion that, as affecting the coal-measures, no such reversal of dip does take place, and that the strata presently being bored in, dipping to the north and north-east, form no part of the coal-bearing series. Yet, allowing that the site of the bore may be on the crown of a denuded anticline, the greenish marly clays passed through must represent the calcareous greensands that are seen on the range further south, and a very great thickness of strata, more than 1,000 ft., would have to be passed through, if the different beds are of normal thickness, before reaching the coal.

Former examinations of a more extended character have shown that west of the Waiharakeke Swamp, on Turntable Hill near Pakaraka, in Morgan's Bush, and wherever the base of the coal-bearing formation can be reached, the evidences of coal occurring as workable seams has always been of a negative character. And, as in the furthest west of the borings made by the Bay of Islands Coal Company the seam was unworkably thin, there is little hope that it thickens to a workable seam at the present No. 1 borehole and again wholly thins out before reaching Turntable Hill.

It is somewhat remarkable that all efforts to find coal at Waiomio and outside the Bay of Islands Coal Company's property have failed, while at the same time there was no mistake as to the identity of the strata tested with the coal-measures of Kawakawa. And, seeking for an explanation of this, as early as 1884 I came to the conclusion that the principal productive part of the field lay to the eastward of Kawakawa, and has since its deposit been almost wholly removed by denudation. Further west and north-west the land-surface preceding the coal-period was too rapidly submerged by the encroachment of the sea, and, therefore, all the beds of the series above the very lowest are marine. This is proved at Kawakawa, where the seam of coal worked was, at many places, directly overlain by a bed of shells of marine species, and, where this was not, a covering of greensand, equally marine, succeeded the coal.

Aware of these discouraging facts, I still thought it was possible to find coal on the western margin of the company's property at Kawakawa, and for some distance up Scoria Flat, and at Waiomio favoured the putting down of a borehole to test the measures there: thinking in the latter case that where a thick seam was absent from the eastern out-crop of the beds that here conditions might be reversed, and that the feeble indications of coal showing on the east margin of the basin might improve as these were followed to the dip westward. The results of the bore put down by the Bay of Islands Coal Company were undecisive, and it yet remains to be seen whether workable coal exists in the upper basin of Waiomio Creek. Coal is reported present in the hills to the westward, but I have not been to the locality nor seen samples of the same.

I have examined the Kawakawa River above Scoria Flat, nearly to its source, and in the several places where coal might be expected none appears. On Turntable Hill, in Morgan's Bush, and at Pakaraka, the evidence is everywhere unfavourable.

To sum up and conclude from the facts above stated, it would appear that there is but little prospect of finding a workable seam of coal within a moderate distance of the Kawakawa workings, either to the west, south-west, or the south, and by a continuance of Borehole No. 1, being put down by the Russell Syndicate (Limited), the finding of coal is a problem of doubtful issue.

As regards Borehole No. 2, the prospects are equally unfavourable, and the evidence to show this, being similar and in great part the same as stated above, need not be repeated here.

REPORT ON THE TE PUKE GOLDFIELD, TAURANGA COUNTY.

By ALEXANDER MCKAY, F.G.S., Government Geologist.

Wellington, 9th June, 1898.

THE country forming the lower grounds between Tauranga Harbour and the main range to the westward from near Captain Stewart's and Hikurangi at first is rhyolite *débris*, from the area of rhyolite of which Hikurangi is the culminating peak.

Further south pumiceous sands and clays form the country along the seaboard back to the mountain-range, composed of andesic materials; but until reaching about half-way from Katikati to Tauranga the pumiceous matter is not coarser than sand, and gives clear evidence of having been stratified under water—probably an extension of the Bay of Plenty. Three miles south of Katikati

a considerable stream flows from the mountain-range north-east into the Katikati arm of Tauranga Harbour, and the gravels of this divide the stratified pumiceous sands and clays to the north from the larger area of the same rocks that lie to the south. The main range south of Thompson's Track, after forming a massive mountain, descends to lower heights, and to the south and south-east forms hills separated by deep gullies, constituting a country not high, but somewhat broken. The western border of this forms a deep scarp descending to the level of the plain along which flows the Waihou or Thames River. The pumiceous deposits seen along the road from Katikati to Tauranga evidently reach on to this hilly area, and as followed south towards Tauranga become coarser in character, pieces of pumice and fine gravel of pumice being seen in most of the road-cuttings that reach to a moderate depth from the surface. This state of things continues to Tauranga, when andesitic rocks appear on the north side of this part of the harbour, and in the high hill on the east side of the entrance.

To the south-west from Tauranga the country is comparatively low for a considerable distance, and in this direction the pumiceous rocks continue further than was determinable, and divide the block of mountains lying towards Te Puke from the southern continuation of the Cape Colville Peninsula Ranges and the high levels west of the Tauranga-Rotorua Road, which have already been mentioned.

There is thus a complete separation of the two areas of auriferous rock, and the popular idea that the Te Puke Goldfield is connected with, and forms but the southern continuation of, the Hauraki Goldfields is not supported by the facts above stated.

Leaving Tauranga, the stratified pumiceous rocks continue to a distance of six or seven miles on the road to Te Puke, and there give place to brecciated rocks of a dark colour and more distinctly rhyolitic type. These are seen at various points along the road, and, becoming massive developments, form rounded hills of considerable height, and the northern part of the mountainous country that continues to and beyond the Te Puke Goldfield. These rocks form the eastern lower slopes of the mountain-range, and are deeply cut into by the stream surrounding Fleming's Hill to the south and east, and continue in a south direction beyond the limits of the auriferous rocks terminating near Gibraltar Rocks, which (though not visited) are evidently rhyolite.

The rocks containing the auriferous reefs are decomposed andesites, that are not only highly decomposed along the walls of the lodes in Fleming's Hill, but everywhere where openings have been made. Less than a mile to the north the creeks draining from this part show the presence of dark andesites undecomposed, although at the Sisters Claim the rocks forming the banks of the stream are highly decomposed. To the south and south-west there is every appearance of these rocks being cut off by rhyolites within a distance of two miles. To the north the auriferous rocks apparently extend fully three miles, while to the westward they reach the water-divide of the higher range, and descend some distance the western side of the range: how far has not been ascertained.

Reefs of quartz form at least two or three distinct lines in Fleming's Hill, and where opened out show a very considerable thickness of quartz, usually exceeding 20 ft. The quartz is of a light-grey colour generally, but at one place it is dark from the presence of sulphide of iron. Near the surface it has the appearance of having been deposited by the agency of hot water, and in the lower levels of the eastern lode banded spongy and solid grey or creamy quartz is met with in different parts of the same intersection of the lode.

Highly-mineralised stone was only seen at one place on the west side of the hill, and apparently away from the main outcrop on this side of the hill. The stone generally resembles that of the Waihi Mine, Waihi, and, like it, is undoubtedly due to hydro-thermal agencies, but, as on Martha Hill so here, there is no evidence of sinter deposited at the surface. This, if it ever existed, has been removed by denudation, and only the channels filled with quartz, by which such reached the surface, together with the highly decomposed surrounding country, testify to the nature of the action by which the ore-bodies were formed. The curly, twisted, agate-like quartz of the higher levels of the Waihi Mine does not appear abundant on the Te Puke field, and this, on consideration, seems to be the main difference in a mere comparison of the quartz.

As regards the amount of gold present in the stone, the analysis made by the owners is the only source of information. A large number of samples would be required to determine the average yield per ton, and the time at my disposal did not suffice for the making of such a collection of specimens. The returns of samples tested seem to indicate that in different parts the stone varies in value, but is scarcely ever wanting in gold, and it is confidently expected that larger parcels, when treated, will prove the paying character of the ore.

On the Sisters Claim there has not been sufficient work done to prove the size of the lode or the value of the ore; but the indications clearly pointed to the presence of a lode of at least moderate size, and a sample analysed, taken from a lode cut in one of the drives, was reported to us as having afforded what may be considered an excellent return. This, however, does not seem to have been verified by the obtaining and testing of further samples.

I was shown a sample of alluvial gold which was obtained on the slope of the range north of the Sisters Claim. This was in the possession of Mr. Griffiths, of Tauranga. It consisted of a few pieces of coarse nuggety gold, of apparently considerably greater purity than the reef-gold of the neighbourhood, and, from the position pointed out as that from whence it came, it would appear that it cannot be referred to any alluvial deposit covering the low grounds and belonging to the recent period, or from a modern wash in the bed of a mountain creek. It is said to come from a bed of pipeclay exposed in the spur of the range about two miles north of Fleming's Hill, and future examination will be required to determine the true nature of the deposit in which the gold is found.*

* Since the above was in type samples have reached Wellington that show the auriferous material to be mainly or wholly volcanic, and partly rounded by action of water.—A. McKAY, 4th October, 1898.

REPORT ON THE OCCURRENCE OF CINNABAR IN THE KAUAERANGA VALLEY, THAMES COUNTY.

By ALEXANDER MCKAY, F.G.S., Government Geologist.

Wellington, 9th June, 1898.

CINNABAR occurs in the Valley of the Kauaeranga about six miles from where the river enters the Firth of Thames at Shortland. The mercury-ore occurs within the valley of Mangakirikiri Creek, about a mile from where that joins the Kauaeranga, and is more particularly located along the south-west side of Otonui Creek, a tributary of the Mangakirikiri. Mercury-ore, as cinnabar, is found along the hill-slopes on the south-west bank of this creek over a distance east and west of about 6 chains, and from the crest of the ridge, 500 ft., to the level of the creek, which may be some 200 ft. above sea-level. The exact location is about a mile north-west of the Kauaeranga River, and the most westward and highest of the outcrops examined appears near the crest of the ridge at the height indicated, as a series of sinter blocks, so arranged that they appear to dip to the east and indicate the occurrence of a solid lode in the near neighbourhood; but as yet this supposititious lode has not been traced at this, the highest outcrop. Distinct traces of cinnabar are to be found here, both in the quartz blocks and in the country-rock upon which they rest, and to all appearances there is here the outcrop of a band or stratum of highly siliceous country, carrying a percentage of mercury-ore.

Two or three chains to the eastward, and at a slightly lower level, another outcrop of quartz, carrying cinnabar, occurs. This also strikes north and south, and dips to the east at angles varying from 40° to 48° . The stone is from 3 ft. to 4 ft. in thickness, and at various horizons, principally in the middle of the lode, carries medium to rich ore. Some work has been done at this place to expose the lode along its strike, which shows that both this and the higher outcrop is underlain by a grey rock, consisting mainly of feldspar, corresponding to the "kindly sandstone" of the miner; whilst in both cases the more siliceous deposit is overlain by breccias and tufaceous sandstone that are evidently of younger date.

Descending the slope east towards the Mangakirikiri Creek some 6 chains, a third exposure of quartz-rock carrying cinnabar is seen, which has been exposed at three places sufficiently to show that its extent is considerable. The ore at this place is more generally distributed throughout the stone than at either of the two localities mentioned as occurring higher up the slope of the hill, and from stone which at first sight shows little trace of the presence of cinnabar a fair prospect can be obtained by the rudest method of crushing and panning-off. Passing to the south-east along the middle slope of the hill a continuous exposure of quartz-rock is met with, which at several points shows the presence of cinnabar, and at one place there is a very considerable development of quartz-rock, forming a line of cliffs, which, though not closely examined, seemed likely to carry the ore of mercury, being similar to the outcrop already mentioned.

More to the east, masses of quartz are met with on the slope of the hill, and as loose boulders in the hollow forming the source of a small creek descending to the Mangakirikiri, and here also it was said prospects of cinnabar could be obtained from near the surface and the soil. Finally, near the crest of the ridge, the most easterly of the various prospecting-holes is situated. Here but little work has been done, not more than to prove the presence of the ore, and the quartz-matrix seems to be but feebly developed. Some 12 chains to the westward of this area good prospects of cinnabar, it is reported, can be washed from the soil, and that masses of quartz there occur similar to what appears within the area more particularly prospected and reported on.

Numbers of analyses have been made of the stone at the Thames School of Mines, giving results stated at from 2 to 25 per cent., from the least promising that showed cinnabar to the best that could be found. Some of the samples collected should exceed 25 per cent.; but such rich ore is limited, while, so far as there was opportunity for judging, there is a considerable amount of ore of medium richness. There is warranty for further opening up and developing the property, and as thermal deposits are at or near the surface, the ore-bodies are favourably placed for working.

The cinnabar deposit is likely to be confined to the limits of the property within which it occurs, there being little evidence of the occurrence of similar deposits to the west and south, while more to the north and north-north-west similar quartz deposits, so far as known, contain gold only.

GEOLOGICAL SURVEY OF CAPE COLVILLE PENINSULA: PROGRESS REPORT FOR THE YEAR 1897-98.

By ALEXANDER MCKAY, F.G.S., Government Geologist.

Wellington, 10th June, 1898.

LAST year a reconnaissance of the whole of the Peninsula was made, and the results of this have already been published.

During the present season work was commenced in the southern part of the field within the Ohinemuri County, and more particularly along a strip of country commencing on the western plain on the road from Paeroa to Te Aroha, and thence continued east-north-east across Karangahake, along the Ohinemuri Gorge to Owaharoa and the same line to Waihi and the seaboard on the east coast. Along this line a belt of country about a mile in width was more especially examined, and samples of the different rocks occurring generally and rarer rocks in particular localities were collected always in duplicate, and frequently, where of more than ordinary interest, several specimens were taken.

Beginning at the western end of the belt of country examined, the first rocks met with, forming the lower slopes of the Karangahake Range and the isolated range west of the coach-road from Paeroa to Karangahake, are dark augite andesites belonging to the Beeson's Island group: rocks that by most geologists who have studied the volcanic series of Cape Colville Peninsula are considered as belonging to the latter part of the Miocene Period. With these are often associated coarse angular agglomerate, almost without a finer ash-matrix, and breccias varying from medium to very coarse with ash-matrix. These rocks rise not more than 200 ft. on to the western slope of Karangahake Mountain and the spur therefrom that runs to the northward between the Ohinemuri valley and the western plain.

From beneath the Miocene rocks appear grey trachytic rocks that along the northern part of the belt reach to the crest of the ridge overlooking the Ohinemuri at Karangahake Township, and more to the south rise into and form the western higher spurs of Karangahake Mountain. On the western slope of the spur range and the mountain itself these rocks contain small reefs and leaders of quartz that since the first opening of the Ohinemuri Goldfields have been known to be auriferous, but as yet no successful workings in connection with them have been carried on. Eastward of these, and forming the high spur immediately north-west of the peak of Karangahake, acidic rocks as spherulitic rhyolite are developed, and in these, within the Talisman Extended Claim, are numerous small reefs and leaders of quartz that appear to be the southern extension of the Woodstock lode in the Woodstock United Claim.

This spherulitic rock continues to the north till, in the line of the Ohinemuri Gorge, it is met and overlain by dark augite andesites, the south prolongation of a development of such rocks to the north, or farther down the Ohinemuri Valley. Grey andesites underlie the Acidic rocks and near the surface have for the most part been by solution and leaching deprived of their hornblende minerals. And with these are associated beds of greenish breccia of medium coarseness and ashbeds, and these again are underlain by a great thickness of more or less altered andesite that contains the various reefs within the Woodstock United, Talisman, and Crown Mines. All these rocks appear on the east side of and form the mass of Karangahake Mountain. They belong to the eldest group of volcanic rocks—the Thames-Tokatea group—and east of the Ohinemuri and Waitewheta are arranged so as to dip at high angles to the westward. They are of interest and importance as containing the most valuable group of mines in the Middle and Lower Ohinemuri Valley.

From near the junction of the Waitewheta with the Ohinemuri, and on the west side of the valley, a columnar dyke of dark andesite strikes north along that side of the valley, and as far as the Crown Battery appears along two lines with a rib of greenish breccia rock between, belonging to the Thames-Tokatea group. This dyke, the only one in the Karangahake district, continues along the valley and channel of the river to Docherty's Creek, beyond which it passes through the ridge between the river and Mackaytown, and is not to be distinguished farther to the north.

In the south its columnar structure is very marked, but this beyond the Crown Battery becomes gradually less and less distinct till, where last seen above the ford of the Ohinemuri, this structure has totally disappeared.

Opposite the Crown Battery, on the right bank of the river, the rocks are greenish breccias, such as lie between the two branches of the columnar dyke of dark andesite, and these, though somewhat obscurely, can be traced west to the mouth of the Ohinemuri Gorge at Karangahake. Here a fault of considerable magnitude is present, which, striking south-east, has apparently displaced the country west of it to the south-east.

This fault is not identical with any of those found in the workings of the Woodstock Mine, or in the Crown Mine south of the Waitewheta, but lying to the east of these crosses the higher part of Tukane Hill within the north-eastern parts of those claims.

The Ohinemuri Gorge displays vertical cliffs of brownish decomposed andesite rising 300 ft. to 400 ft. in height on both sides of the gorge. On the north side Butler's Track is cut round the higher part of the cliff on that side, and the various exposures of rock made by road-cutting, both at the high and lower level of the present coach-road through the gorge, gives opportunity for examination of the rocks at various levels and horizons.

The rocks of this part are mainly altered andesites in which decomposition at and near the surface has altered most of the constituent minerals and given to the rocks a grey or rusty-brown colour.

A series of north and south joints traverse the rocks on both sides of the gorge, and at first sight give the impression that they have been tilted to a very high angle, and strike in the direction of the eastern slope of Karangahake Mountains. On Butler's Track it can be seen that the rocks dip to the south-east in the western part of the gorge and to the north-east in the middle higher part and western end of the gorge.

The various workings in the Woodstock Main Lode, or Ravenswood Claim, show the presence of considerable bodies of breccia and coarse ash-rock, and on Butler's Track there is a considerable thickness of crushed andesite again cemented to a solid rock that in cases might be mistaken for a true agglomerate. In the various mine-workings these rocks become greenish-grey in colour, but almost everywhere give evidence of alteration, more especially those parts that are solid lava flows.

These rocks terminate at the eastern end of the deeper part of the Ohinemuri Gorge: on the north side within the Shotover Claim and on the south side of the gorge east of the Ivanhoe Claim.

On account of their great interest as the oldest rocks of the southern goldfields of the peninsula, and their importance as gold-producing rocks, they were followed to the north along the range to the Rahu Saddle, where to the north-west and north-east they are overlain by the younger rocks of the Beeson's Island group.

The numerous reefs of quartz in this Karangahake area of the Thames-Tokatea group trend between north-north-west and north-north-east, and appear to converge to a point within the Hercules Claim towards its north-eastern part, where are three distinct yet closely associated hills showing massive developments of quartz that has evidently accumulated at the surface through the agency of thermal water forming hot springs. The range between the Rahu Saddle gives abundant evidence of quartz accumulated by the same agency, a triple line of such deposits appearing on the northern part of the range, the western of which should correspond with the Woodstock Main Reef on the claim of that name, and the eastern with the Welcome lode in the Crown Mines, the north continuation of which is through the Ivanhoe and Shotover Claims. The thermal and surface character of much of the quartz on the range north of the Ohinemuri Gorge is proved by the presence of plant-remains that occur abundantly in the bedding planes of the quartz rock. The thermal character of the quartz on Karangahake Mountain, in the southern end of this area, is abundantly evident, and as the thermal waters have burst through, altered, and charged with silica the Miocene mudstones of the Rahu Saddle, we have thus an evidence that some of the lodes of the Karangahake district were not formed till towards the close of that period.

About a mile east of Karangahake, and where the deeper part of the Ohinemuri Gorge terminates, the auriferous rocks of Karangahake belonging to the Thames-Tokatea group are overlain by those of the Beeson's Island group. Here the rocks of the younger group consist of breccia conglomerates, associated with massive beds of carbonaceous mudstones, dark or almost black in colour, but weathering light-grey. On the Rahu Saddle these rocks are altered, partly by the agency of hot water and also by a sheet of dark augite andesite that overlies them there. On the banks of the Ohinemuri the mudstones dipping to the eastward are followed by a considerable development of dark augitic andesite lava flows but little altered, followed by a rock of the same nature that has been much altered, with which is associated greenish breccias, and finally by another thick band of dark andesite that terminates the group within 150 yards of the mines at Owharoa.

So far there have been no quartz-reefs found in these rocks within the Ohinemuri Valley. On approaching the Owharoa mines they are much decomposed, and finally disappear below the trachytic and rhyolitic group, in which are developed the gold-bearing reefs at that place.

On the ridge of hills between Owharoa and the Waitewheta, above its gorge, the younger rhyolite formation is prolonged to the westward, so that there is but a narrow strip of the Beeson's Island rocks that there make the connection between the larger areas to the north and the south.

At Owharoa, in the direct line of section, at the pool in the river, about 100 yards below the main shaft being sunk by the Ohinemuri Syndicate, the decomposed upper part of the Beeson's Island group is followed by a light-grey felspar rock that on weathered surfaces and in the road-cuttings decomposes to a rusty-brown colour. This rock in itself is not decisive of the change that shortly takes place, but is totally unlike any of the rocks that further down the valley are referred to the Beeson's Island group, and agrees well with others yet to be described as part of the acidic rocks of Owharoa, and which, consisting mainly of crystallized felspar, have to be spoken of as felspar rock. The felspar rock of the pool is followed by a dark—almost black—rock, consisting mainly of hornblende with an abundance of small spherulite. This, again, in the workings of the Radical Mine is followed by grey felspar rock, with spherulitic structure frequently present. Further to the eastward the section at the surface is not clearly displayed, but the material mined in the sinking of the shaft on the Ohinemuri Syndicate's property and in the driving of the crosscut north-west therefrom is often spherulitic, while on the south-west side of the river, and a little more to the south-east, the rocks are overlain unconformably by a younger group of rhyolite rock that spreads itself widely over the Upper Ohinemuri Plain, and is lodged in a trough-like or V-shaped depression, probably produced by faulting, that runs parallel to the Ohinemuri River to and beyond the source of Waikino Creek, opposite the Victoria Battery.

There has been much speculation as to the nature of the rocks forming the walls of the auriferous reefs at Owharoa, and on the publication of my last year's report surprise in certain quarters was expressed that I should have considered them as belonging to the acidic group or rhyolite formation. This induced me to make a more than ordinarily careful examination of the locality during the present season, which has fully confirmed my determination of last year.

Spherulitic structure is not known in rocks of the andesic group throughout the peninsula, and, so far as can be gathered, in other countries where such rocks occur, this structure is rarely present, and hence has come to be regarded as a sufficient proof of the higher silicated volcanic rocks. In this respect the proofs are ample that the Owharoa rocks belong to the acidic group.* How far they are likely to correspond in time and character with the spherulitic rhyolite found on Karangahake Mountains, a close examination of the specimens collected (which has yet to be made) must show.

Over these Owharoa rocks come the rhyolites of the vicinity of Waikino and the Upper Ohinemuri Plain. These spread over the lower grounds to and beyond Waihi. A considerable variety of rocks occur in connection with this development of the acidic rocks, but the greater bulk consists of two rocks: First, a brecciated-looking rhyolite, which, however, appears to be the result of irregularity in cooling of the original lava stream; and secondly, overlying this, a grey-earthly cryptocrystalline rhyolite, seldom fluxional in structure, and often porphyritic with crystals of sanidine or blobs and crystals of quartz. These latter rocks sometimes appear as dyke-like masses bursting through the brecciated-looking rhyolite, and both extend to and beyond the Silverton Hills east of Waihi Township. They also reach up the Waitekauri, to within half a mile of the township; and there, at the base of the group, a stratum of pure pumice is developed.

* The percentage of silica in these rocks in all samples determined is above 66 per cent.

The auriferous rocks of the Waitekauri, of Martha Hill and the Silverton Hills, in the neighbourhood of Waihi, have been determined as belonging to the Kapanga group of volcanic rocks, and they certainly are quite distinct from the Thames-Tokatea group as developed in the Karangahake area. They more resemble the Beeson's Island group as developed in the southern part of the peninsula, the breccia ash-bed of the two being often very similar. The rocks of Waitekauri and Waihi consist essentially of dark augite andesites, somewhat prone to decomposition, associated with greenish-grey or light-grey breccia and ash-beds. In such rocks occur the Golden Cross Reef, Waitekauri, the Martha and Welcome lodes, Martha Hill, and in these also are situated the workings of the Waihi Grand Junction, Waihi West, Waihi Consols, and Waihi South Claims, in the immediate vicinity of Waihi.

On the Silverton Hills the Waihi Consolidated, Waihi-Silverton, Amaranth, and Union Claims are in the same rocks; and more to the eastward, in the Queen of Waihi Claim, the workings demonstrate the presence of a moderately-fine breccia such as appears in those of the Waihi Grand Junction.

In Martha Hill and over the Silverton Hills the various quartz lodes are clearly deposits in rents and fissures by thermal agency, and although on the Martha Hill there is no trace of sinter-quartz deposited at the surface, there cannot be a doubt but that such once was present. On the south-west part of the Silverton Hills there are great bodies of quartz of a flinty type, which might be regarded as having accumulated at and near the surface, such quartz containing much fossil wood and lesser plant-remains on the Ascot Claim and terrace east of Mackaytown.

As regards the permanence in depth of these lodes, the workings in the Waihi Claim on Martha Hill give every assurance that not only does the quartz live down to considerable depth, but that also the gold contents of the lode are not diminished in the lower part of the lodes.

East and north-east of Waihi and the Silverton Hills, andesitic rock is found in Waihi Monument Hill. On the hills to the north and over the low ground south-west of Waihi Monument and east of Waihi Monument, for about two miles in a south direction, andesite is found on the coast-line. Otherwise the range of hills from which the east and north-east sources of the Ohinemuri drain are almost composed of spherulitic rhyolite, which, clearly younger than the andesitic rocks on which it rests, is yet evidently older than the earthy and fluxion rhyolites of the plain.

The auriferous quartz-lodes of this district, including Karangahake, Owharoa, and Waihi, are productive along a line or belt of country about a mile in width, to the north-east and south-west of which the lodes, if traceable, are not of a payable character. Whatever may be the meaning of this linear arrangement of the gold-mines of Karangahake, Owharoa, and Waihi, the fact is sufficiently remarkable, and remarkably agrees with a similar phenomenon in the Coromandel district in which a belt of productive country, about a mile in width, extends from Coromandel Wharf to the crest and eastern slopes of Tokatea Hill. Similar instances of the projection of auriferous belts of country, or of country carrying auriferous lodes, might be pointed to as occurring in other parts of the peninsula. These will be considered in a further report. Meanwhile, it is remarkable that these belts of auriferous country, in both the cases mentioned, and probably in all the others, run across the strike of the reefs, and where, as at the Thames, the strike of the reefs is north-east, the direction of the auriferous belt is south-south-east.

On the Thames Goldfield, between Tararu and Hape Creeks, the first work was to determine the position of the different rocks and the nature of these, whether as lava-streams, dyke intrusions, or fragmental ejecta.

The lowest rocks in the district are carboniferous slates and grey siliceous mudstones, sometimes regarded as felsite tuff. These rocks form Rocky Point, a little north of Waiohanga Creek, and also appear in the valley of Waiohanga Creek, 250 yards inland from the beach. There are no quartz-reefs in these rocks within the Thames Goldfield, and their chief interest is that as the oldest rocks they form the floor on which the volcanic rocks carrying auriferous quartz-reefs have accumulated.

Over these rocks succeed, towards the south, gritty sandstones, composed largely of grains of felspar, and frequently of small angular pieces of slate, which in character are similar or identical with what is seen underlying the felsite tuff at the north side of Rocky Point. It is very doubtful whether these rocks belong to the volcanic series, and that they are largely composed of broken crystals of felspar does not prove such a connection.

Above the sandstones and slaty breccias there is a grey andesite rock, which on the beach and in the adjacent hills to the mouth of Tararu Creek is succeeded by heavy accumulations of volcanic breccia. These rocks are known as the Tararu Breccias, and their position at the base of the Thames-Tokatea Group has been generally accepted. Sometimes they have been regarded as present in other parts of the field where breccia-bands appear, but of their occurrence in the central part of the Thames field or in Hape Creek there is no proof. The fact is, there are at least five or six heavy bands of coarse breccia-beds belonging to different horizons present on the field, and of these it is the Tararu Breccias that play the least important part.

The section along Tararu Creek shows five of these breccias that strike across the valley and trend through the hills in the direction of the auriferous area at the Thames.

The Tararu Breccias reach up the creek no further than the first crossing of the creek, south-west of which they should pass through Mr. Walker's grounds till obscured by the alluvial deposits forming the shingle-fan or delta of Tararu Creek. The second band of breccia reaches the coast at the north headland of the little bay into which falls Shellback Creek. The third, which is seen in Tararu Creek, at the first crossing above Tinker's Gully, strikes across the valley of Tinker's Gully to the ridge between that and the source of Shellback Creek, and thence passes into the valley of Moanatairi Creek, the lower part of this band crossing from thence into Waiotahi Creek by way of the east slope and higher part of Messenger's Hill. Thence to Una Hill the same breccias and ash-beds run along the east side of the Moanatairi Fault. In Tararu Creek there are yet two other breccia bands—one appearing at the junction of Ohio Creek

with the main stream strikes through the hills across the upper part of Tinker's to the Waiotahi, and is well seen on the new road, then to Punga Flat and Dixon's Hill. This crosses the watershed into that of Karaka Creek and also into that of Hape Creek, where, in the latter case, the breccias begin above the Anchor Claim and extend to near the forks of the creek. Yet another band of fragmental rock lies to the east and north before reaching the Lookout Rocks.

These various bands of fragmentary rocks are separated by four distinct flows of solid andesitic rock. The lowest of these is well seen between the first and second crossings, following up Tararu Creek; the second at and higher up the creek than the mouth of Tinker's Gully; the other two at and above the junction of Ohio Creek. Similar flows of andesitic rock can be traced in the southern part of the field, notably the cap of dark andesite found on the higher part of Una Hill, and the similar sheet of lava that caps the hill to the eastward. Both these sheets of dark andesite can be traced north across Karaka Creek and south into the Valley of Hape Creek.

The indurated and mineralised zone of the Look-out Rocks closes in an east direction the rocks of the Thames Goldfield; and, looked at as a whole, the arrangement of the rocks between the upper part of Tararu Creek and Hape Creek is a quaquaversal between north-east and south-east, the focus of which would be a little off-shore at Grahamstown.

Within the productive part of the Thames Goldfield proper, along Shellback Creek to Dixon's Hill, runs a nearly east-and-west lode bounding on the north the richer part of the field. At the southern boundary a nearly east-and-west reef runs along the north side of the valley of Hape Creek, and between these run numerous reefs having a general north-north-east to north-east direction, the Hague Smith reef, running a little to the west of north, being the most notable exception to this rule. The general dip of the lodes is to the westward at varying angles, with some exceptions also to this rule.

The field is divided into two very distinct parts by the occurrence of the Moanataiari Fault, which, with a downthrow on its western side, displaces the rocks, an amount which has not yet been definitely determined, but which is very considerable. The presence of this fault renders difficult the correlating of the reefs on each side of it, and any attempts which have been made with this object in view may be regarded as attempts merely.

Of the Collarbone Fault, first described by Mr. James Park, F.G.S., there is some doubt as to whether this affects the rocks to great depth from the surface, or whether it is continued north-east, as described by him, to Punga Flat, and thence into the Tararu Watershed. In the Upper Waiotahi Valley the Golden Age lode is indeed displaced by a fault of considerable magnitude, but there is no clear connection between this and the evidence of faulting between the Moanataiari Fault and the saddle at the head of Collarbone Gully.

The beach slide or fault, which follows the foot of the hill on the east side of Grahamstown and Shortland Flat as yet has not been shown to be a dislocation of the rocks with a downward displacement on the west side, but rather appears to be the result of the sinking of the land having a bold coast-line, and the infilling and natural reclamation of a portion of the submerged area, the line of contact forming the supposed fault.

The shoot of gold on the high levels east of the Moanataiari Fault declines at a low angle towards the south, and regarding the country west of the Moanataiari Fault, and the principal shoot of gold therein as having simply been displaced from this higher level to the eastward the outcrop of the shoot of gold on Kuranui Hill and in Hunt's creek as it is followed to the south declines at a higher angle than on the eastern side of the fault-line, and therefore we may assume that the displacement increases as the fault is followed southward.

During the season 850 full-sized specimens were collected from the rocks *in situ*, or from the tiphead of different mines in cases in which work was not being carried on in the mine.

The Under-Secretary, Mines Department, Wellington.

I have, &c.,

ALEXANDER MCKAY.

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