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ALFRED GREENFIELD, Provincial Secretary.

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THE following Report is published for general information.

ALFRED GREENFIELD,
Provincial Secretary.

PRELIMINARY REPORT ON THE GEOLOGY
OF THE NELSON AND COLLINGWOOD
DISTRICTS.

By E. H. DAVIS.

Nelson District.

In making my observations on the mineral belt which lies to the east of the town of Nelson, three main sections were open to me as indicated in my instructions, viz.:—the valleys of the Maitai and Roding Rivers, and the Dun Mountain tramway; these I supplemented by sections run in right lines across the country, so as to connect my main lines of section; these supplementary lines were, from the Maungatapu on the

north branch of the Maitai, over the Dun Mountain to the head of the south branch of the same river, thence over the shoulder of the Wooded Peak to the tramway, and so down into the valley of the Roding River; from the top of the Dun Mountain down Windtrap Gully to the Maitai; from the Heads of the Pelorus, by Mount Morrison, to the Roding River; and lastly, from the Lower Maitai, through Long Gully, up Brook-street Valley, past Jenkins's Coalmine and Poor Man's Valley, over Richmond Hill to the old chrome-mine, three miles to the south of Stratford's in Aniseed Valley.

The fundamental rock of the district is the Maitai slate of Hochstetter, which is very much disturbed, and presents a large syndinal curve, having a north-east axis; the south-east flank of the slates rests on a heavy mass of hydromagnesian rocks, which pass gradually into anhydrous olivine; these rocks are probably all products of metamorphism, and not of true eruptive origin, as stated by Hochstetter,* and it is abundantly evident that they owe their present relative elevation to the denudation of the surrounding formations, and

* Hochstetter's New Zealand, p. 58.

not to their own eruption. This mass of serpentinous rock is traversed by dykes of true plutonic rocks, some of which do not even yet reach the surface except in the beds of the streams; the north-west flank rests on a dyke of porphyritic diorite, which is distinct in mineral character from the Dun Mountain metamorphic series. With regard to the time at which the metamorphism of the Dun Mountain group took place, except in a general way that it was subsequent to the Nianic period, we have no direct means of determining, nor yet as to the amount of denudation which has taken place since such metamorphism was effected; these questions can only be solved when an accurate survey of the whole district is accomplished.

Nelson has several times been flattered with delusive promises of great mineral wealth existing in "The Dun Mountain," and even in the face of past experience, many still hold to the opinion that at some time large deposits of copper and chrome ore will be discovered in the immediate vicinity of the old trials; I am afraid I can hold out no such hopes. After carefully examining the whole of the old workings, and entering all that I possibly could, I was convinced that any mining researches in that locality would prove futile, ending only in disappointment and loss.

It is a well known fact that native copper, chalcopyrite, fahluz, and malachite have been found in the serpentine, on the south-east side of the Wooded Peak (now called Big Twin), and also in Windtrap Gully; these were accompanied by silicates of copper, both diopside and crysocola, which, from their bright blue and green colors, make a great display, even when in very small quantities. These silicates may be traced from one trial working to another in a straight line (of course allowing for the rise and fall of the surface) along the side of the hill, as far as the junction of the south branch of the Maitai and the Windtrap Gully, a distance of nearly two miles; but this must not be construed into an indication that any important quantity of ore exists in the serpentine. I found this line to be parallel to the course of an elvan dyke (one of those before mentioned as not reaching the surface), which is found in Roding River, and also in the Maitai; in both these places the water has cut through 12 or 14 feet from its top. The annexed sketch shows how completely the serpentine covers it, also the flat top of the dyke; the elvanite is cleaved in flatish wedge-shaped layers, and in the Maitai is slightly bent over to the south; this cleavage is evidently due to great pressure after cooling, and it is a legitimate inference that the same cause would produce a line of fracture in the serpentine, especially if contraction were the motive power, when the serpentine would break over the hard unyielding elvan.

In hard compact rocks this would have formed a fissure, and perhaps ultimately a mineral vein, but not so in serpentine, which gives way in a multitude of small cracks and joints, through a given width; in this case it is 4 or 5 feet; these cracks would then become the outlet for water which might find its way up from below, and if this water held copper or iron salts in solution it would inevitably deposit some or all on the serpentine in exceedingly thin films, and as the stone would break at these places it would be almost impossible to tell its real value until analysed. The fact that

the water from the serpentine does hold copper in solution is proved by the floor and stones in one of the old drives being thickly coated with silicate of copper, also by the water from another drive producing all the symptoms of metallic poisoning on both myself and assistant. I am fully convinced that there is a deposit of copper ore somewhere in the district, but the serpentine so completely obliterates all indications of its locality, that it is difficult to come to any conclusion; the only way to search for it is either to go right away from the serpentine, or else to take advantage of the natural cuttings formed by the rivers, to get as near to the base of the serpentine and olivine formation as possible. The place I should choose for a trial would be a point in the Roding River bearing S. 50° W. from Coad's Mine, where a gossan may be seen running parallel to and in contact with a hard porphyritic dyke, which presents the same appearance as that previously mentioned; the course is N. and S., dip 88° E.; but, instead of driving towards the Wooded Peak, a southerly direction ought to be taken, so that if possible the point where this dyke intersects another, which occurs about three-quarters of a mile farther up the stream, might be reached. It is true that there are no superficial indications in this direction; but I have before shown that they are valueless in serpentine, and therefore their absence is of no consequence, especially as the presumptive evidence is good. From the tenor of the foregoing remarks it will be apparent that I do not consider that the property of the Dun Mountain Company would pay for further explorations; a few pieces of ore might and probably would be found, but there could be no certainty about it. I do not know of any copper lodes in serpentine which are really worth working, for, although immense returns may be obtained one month, many years may elapse before any farther profit is made.

CHROME.

All the chrome workings having fallen in and the men who worked in them dispersed, I could not get any very definite information respecting the manner in which the chrome ore occurred; it appears however to have been between the serpentine and hornblend rock when of first-rate quality, the commoner being in the serpentine; there is a little still left about the outcrops of the old workings; but I was assured by the present manager to the Company that there was none left underground. The way that both this and the copper occur is very common on the outskirts of a mineral country, and may be taken as a good indication that mineral wealth does exist in the Province, probably near the junction of the true igneous rocks and the palæozoic slates.

GOLD.

Until the analysis of the various rocks are completed it is premature to express any decided opinion on the prospect of payable goldreefs being found in the immediate neighborhood of Nelson, but, judging from lithological characters and structure, the Roding River rocks are strictly analogous to the auriferous ones of Gympie Creek, specimens of which were presented to the Colonial Museum by Mr. T. R. Hackett. In a report furnished to the Queensland Government, Mr. Hackett, in speaking of the auriferous belt, says,†

†Geological and Mining Report on the Gympie Creek Gold-fields, 1869.

"This belt or zone consists of a series of strata, of greenstone shale, and slate rocks, differing in mineral composition and texture, but exclusively of a basic variety of rock." He also states that this belt is skirted by a series of highly metamorphic rock, in which no gold has yet been found, although many reefs have been explored. Copper ores are also found in some of the reefs, and in others the quartz is partly replaced by calcespar, sometimes wholly so; in either case the gold diminishes as the calcespar increases. These extracts irresistibly remind one of the Nelson formations, greenstone and slate, copper ores, metamorphic rocks, and lastly, as if to complete the parallel, in the Maitai all the quartz veins contain calcite in more or less abundance, some of the veins being almost entirely composed of that mineral, while in the Roding they are nearly all pure quartz. The place previously indicated as being worth a trial for copper also corresponds in almost every particular with Mr. Daintree's descriptions of the reefs in Gilbert Ranges Goldfields.† In speaking of the dykes or elvan courses he says: "It is at the point of intersection of such rocks that the most mineralization has taken place, quartz-reefs abound, and specular iron, copper and lead ores occur." In the lower part of the belt, which I consider to most nearly correspond with the Gympie Creek formation, I observed three separate springs, the water from which as it oozed out of the crevices of the slate had a most intolerable stench of sulphuretted hydrogen, I would therefore caution prospectors and others not to trust to amalgamation only in testing any quartz from this locality.

Collingwood District.

Immediately on leaving the town of Collingwood a large tract of alluvial ground is entered on, which stretches away some eight or nine miles in a south-westerly direction, this plain is bounded on the north-west by the Aorere River, on the north by the sea, and on the east by the Te Para Para; towards the south-west the drift deposit of which it is composed ends on the slopes of slate and schistose hills near Bedstead Gully, &c. The most striking features about this flat land are the succession of terraces by which it rises as it recedes further inland, and also a few islands of limestone and schistose rocks, which here and there rise up above the level of the surrounding drift. The drift is composed almost entirely of quartzite, quartz, and schist in rolled pieces; but in a few instances I noticed the presence of subangular fragments. Gold may be found in all parts of the drift, but only in payable quantities in a few localities; which appear to me to be those places where the materials have been resorted, and the gold concentrated by the action of running water, subsequently to their original deposition.

One of the most remunerative diggings ever discovered in this system of drift was that on Appoo's Flat, where at one time upwards of 300 diggers were employed, and all doing well; from what little information I could gather, it appears that as soon as ever the yield of gold fell off, the men gave up their claims and went to the West Coast, the consequence is that while the best of the ground has been worked, there

still remains a great deal untouched which would pay a moderate dividend for working. At present the flat is quite deserted, except for one "hatter," who seems to work a few hours a day, and says that he can do very well as long as he remains a "hatter," i.e. without any mates.

The wash-dirt in this particular place consists of brilliant white quartz, and quartzite with ferruginous stains. About the middle of Appoo's Flat a shaft was sunk, 120 feet in depth, some men in the neighborhood told me that it bottomed the drift and found that it rested on limestone, others again assert that the bottom of the drift was not reached, both however agree in stating that there was no water to contend against, and they agree about the depth.

The junction of the schistose slate and limestone must be somewhere under Appoo's Flat, for on passing up the gully quartzite and quartzose schist are encountered, striking nearly north and south, the latter carrying numerous quartz veins. The bed rock of the upper part of Appoo's Gully is a crystalline limestone, which is overlaid near the Parapara by a half decomposed granite, the strike of the limestone is north and south, the granite seems to make to the east near Ernest's Saddle. The schist and quartzite which are found in the lower part of the gully continue to the north in a line parallel to Glengyle Gully, forming the hills on its western side, to the south they continue past the head of Lightband's Gully, through the Pioneer Company's ground, and are found again in Coles' Gully; the limestone evidently rests on this in isolated patches. In Bedstead Gully a blue altered slate is found under the schistose rocks, it crops out to the surface near the outlet of Coles' Gully, it can be traced up Bedstead and over into Gully.

It is certain that there are no rocks in their normal condition within a considerable area on the eastern side of the Aorere River, except perhaps parts of the limestone. That there must be an immense area of metamorphic rocks is evidenced by the extraordinary accumulations of drift, composed entirely of pebbles and boulders derived from that description of rocks.

ALLUVIAL WORKINGS.

A few parties are still engaged in the different gullies, on this class of diggings, who as a rule are earning a living, but very few are doing more; some of the best claims are Lightband's, Hit or Miss, and the Glengyle. The Glengyle has been steadily worked for a number of years by the same party, who seem to have unlimited faith in its capabilities, as for the last two or three years they have been engaged in removing the debris from a slip which filled the whole of their workings, and has almost entirely prevented them from getting any gold during that period; they hope however to be able to resume operations some time this summer. The gold occurs in four distinct beds, the lowest of which is generally the richest, the order of these four beds is, 1st, blue mullocky wash-dirt; 2nd, cream-colored gravel; 3rd, finer dirt with red gravel; 4th, rough dirt rich in gold; underneath this is sand and river detritus with no gold, the bedding is pretty regular east and west.

The Hit or Miss claim on the north side of the saddle which divides Glengyle from Appoo's Gully, is very similar in character to Lightband's, which I

† Report on the Gilbert Ranges Goldfields by R. Daintree, Government Geologist, Northern Queensland, 1869.

shall next describe, this claim is the first I believe in which the method of hydraulic mining was adopted in its integrity, the same system is in use at the Glengyle claim, where they have 120 feet of pressure, and use 2½ inch nozzles with good effect.

Lightband's claim on the south, or Appoo's Gully side of the saddle, promises to turn out very rich wash-dirt, and the party are sparing neither trouble nor expense to enable them to thoroughly and systematically exhaust their ground; a shaft sunk 53 feet gives the subjoined sections:—

- | | | |
|---|--------|----------|
| 1. Yellow clay | | 15 feet. |
| 2. Loose sandy quartz drift showing the "color" | | 5 feet. |
| 3. Red wash-dirt | | 11 feet. |
| 4. Blue wash-dirt with blueish quartz, and rich in gold not bottomed at | | 27 feet. |

The bedding is westerly.

Golden Gully is, I believe, almost abandoned, but does not appear to have been thoroughly exhausted. Lightband's Gully is also deserted.

REEFS.

Only one reef has as yet been worked to any extent, so that it is very difficult to come to any definite conclusion regarding the ultimate prospects of the district; several have had a few days work expended on them but not sufficient to show the character of the reefs.

The Perseverance reef naturally takes precedence of all the others, as it is the only one which is at present yielding gold in notable quantities; it is situated at the head of Bedstead Gully, exactly on the junction of the crystalline rocks and the slate, the one forming the footwall the other the roof.

The reef, as shown in the accompanying sketch section, dips to the east, varying considerably in the thickness of quartz and the amount of dip. The fissure in which the quartz occurs has been caused by the movement of one or other of the two rocks, through a vertical space of 12 or 15 feet; this movement has been slightly diagonal, viz., 25 degrees to the south of vertical; it is self-evident that if one of two hard, rigid, mammillated surfaces, resting and fitting on each other, be caused to slide in any given direction, it must form a fissure of greater or less magnitude, according to the size of the mammillations. The vein itself is not one

continuous sheet of quartz, but consists of a quartz breccia, with a little slate and slate powder in it; and in one place, where the reef is little more than a quartz sand, gold may be washed out in an ordinary pan; very fine specimens are also sometimes found in the solid parts of the reef. The fissure or reef is cut off by a cross course of blue graphitic slate, which seems to turn it round completely on to itself again. This slate is quite different to that ordinarily found in Bedstead Gully, which does not contain graphite, and does not, to my knowledge, appear anywhere on the surface; it is so soft that it is extremely difficult to carry without being crushed to powder.

The other claims are hardly worth mentioning. The Masonic and Decimal are adjoining the Perseverance, but neither have yet done any work to prove their ground.

In Coles' Gully the Ophir and the Commercial attracted my attention; the former is situated near the head of the gully, and has a brown ochrey leader, running north 30 degrees west, dip east, nearly flat; the country is schistose slate, a few tons have been extracted, and sent to the Perseverance battery for trial, but they had not been crushed when I left. The Commercial, near the lower end of the gully, was opened on a mass of quartz, which was said to show gold; the quartz is hard and white, sometimes containing white mica; strike north, dip east.

There is one claim worthy of particular notice, as having been taken up to work for copper-ore. The lode is situated about half way between Appoo's and Bedstead Gullies, and may be traced on the outcrop for a considerable distance; a shaft has been sunk to a depth of 60 feet, and now the funds are exhausted and the work at a standstill. This is very much to be regretted, as the lode contains some fine specimens of chalcopryrite; and although the matrix is not such as usually carries ores of that class, it is remarkably promising, as the character of the lode is uniform, and as long as such is the case a rich course of ore might be cut at any moment, if this sett was in England or any other real mining country it would not be allowed to remain idle for a single day, no metalliferous lodes are uniform, for a few fathoms no ore is found and then a rich course is cut and so on, the manner in which the ore occurs in this lode gives every hope that it will make into bunches in different places though where it is impossible to indicate.

E. H. DAVIS.