

1878.

NEW ZEALAND.

D'URVILLE ISLAND COPPER ORE DEPOSITS

(REPORT ON THE).

Presented to both Houses of the General Assembly by Command of His Excellency

Dr. HECTOR to the HON. COLONIAL SECRETARY.

SIR,

Wellington, 29th August, 1878.

I have the honor to forward the report of the Assistant Geologist on the deposits of copper ore, which are now being worked in D'Urville Island.

Specimens of this ore were sent to this department for analysis in June last, but at the request of the prospectors the inspection of the locality was deferred until some work had been done towards the exploration of the lodes.

Copper ore occurring in serpentine rock, as is the case in this instance, is usually found only in irregular patches and not in defined lodes, so that Mr. Cox was specially instructed to note the extent and relative arrangement of the various outcrops. From his report, it appears evident that the ore follows the usual rule and is distributed in "bunches" or lenticular masses, but in this case the bunches seem to have a very massive development and are likely to afford ore in remunerative quantity.

The chief ore of copper found is the red oxide or cuprite, which if pure would yield on reduction 89 per cent. of the metal; but the ore is largely mixed with gangue or lode rock, chiefly hypersthene, so that the average yield will be much lower than for picked samples.

The samples formerly submitted and those now brought by Mr. Cox, are fair average samples, and their analysis is tabulated as follows, together with the result of analysis of samples of ore of the same class and from the same formation, discovered in May last by Mr. Newport in the upper part of the Maitai Valley at the base of the Dun Mountain.

1. D'URVILLE ISLAND.

Samples received from Prospectors.

	Per Centage of Copper.
1. Ore and gangue ...	17.46
2. Ore finely dressed ...	25.15
3. Ore picked, free from rocky gangue	40.25

Samples collected by Mr. Cox.

1. Ore from outcrop No. 2 ...	24.86
2. Ore from No. 1 shaft ..	16.49

2. Dun Mountain.

Samples received from Mr. Newport.

1.	18.20
2.	13.10
3.	17.60
4.	25.40

The general average of the above would give a yield of about 22 tons of copper to the 100 tons of ore as mined.

Similar copper ores are now smelted in New South Wales, the latest official notice available showing the produce for 1876 to have been 3,106 tons of copper, valued at £243,142, or at the rate of £78 per ton.

Taking this and the foregoing estimate, the average value of the D'Urville Island, ore would be about £17 per ton, less the expense of mining, shipping, and smelting.

The Hon. the Colonial Secretary,
Wellington.

I have &c.,
JAMES HECTOR.

REPORT ON D'URVILLE ISLAND COPPER MINE BY S. HERBERT COX, F.C.S., F.G.S.
ASSISTANT GEOLOGIST.

Mr. S. HERBERT COX to DIRECTOR of the GEOLOGICAL SURVEY.

DEAR SIR,

Wellington, August 27th, 1878.

I have the honor to inform you, that, in accordance with your instructions of the 22nd instant, I have examined the deposits of copper in D'Urville Island, to work which a company has recently been formed—the results of my observations are as follows:—

The mine is situated at the Southern end of D'Urville Island, the copper occurring in a belt of serpentine, which may be traced from the Dun Mountain at Nelson to the Croixelles and again throughout the length of D'Urville Island.

This belt of serpentine is in contact with certain coarse-grained green sandstones, and banded slates, of the Maitai series, in which veins of quartz, with nests of pyrites occur, the strike of the slates being about N.N.E.

It must not be imagined that the occurrence of copper on D'Urville Island is a new discovery, for as early as 1859 Dr. V. Hochstetter in a lecture on the Geology of Nelson, says, in speaking of the Dun Mountain, and the mineral belt generally:

"In Croixelles, and in current Basin, where copper mining operations have been carried on, the indications were very obscure, and the result has proved that there is no reasonable ground to expect a profitable copper mine there. More promising specimens of copper ore have been obtained from D'Urville's Island. The character of the ores met with there is quite the same as in the Dun Mountain."

With reference to the present aspect of affairs at D'Urville Island:—

Outcrops of cuprite, coated with malachite and azurite, have been traced at intervals over a distance of 900 yards or thereabouts, in a N.E. and S.W. direction, these outcrops generally occurring on a bare ridge of serpentine which is about the centre line of the piece of ground which has been leased from the Maoris for mining operations.

The outcrops, and the various points at which prospecting operations have been undertaken can be referred with greatest ease to the manager's house, which is situated on the ridge just mentioned, about 300 yards to the North of the centre of the lease.

About 110 yards to the N.N.E from this point, a rock occurs, apparently as large boulders in the serpentine, containing small patches of native copper with silicates and carbonates on the outside of the boulder.

This rock occurs at several places where the copper has been opened upon, but never in such great force as at this point.

About 40 yards below the hut, bearing S.S.E., another outcrop of ore occurs, about $1\frac{1}{2}$ feet thick.

A trench or underhand stope is being made on this outcrop; the results seem favourable.

Cuprite is found here, but at the time of my visit *copper glance* yielding 24.86 per cent. of copper appeared to be the most general mineral, and Mr. Skey has since assayed specimens of this for silver, and informs me that a very little occurs in the ore, but not sufficient to prove of any value.

About 210 yards from the hut, in a S.30.W. direction, a shaft has been sunk to a depth of 35 feet; this is known as No. 1, or Redwood's shaft.

At the present time *cuprite* and *copper glance* are being obtained from the bottom of this shaft, and a tunnel is being driven to the Southward in the direction that the ore band takes.

About 25 yards from No. 1 shaft an underhand stope has been commenced on a band of *cuprite* which cropped out at the surface, but was wedged out at a very short distance down, by a parting, which, on being broken through shewed another rich deposit of copper, the two bands thus found appearing to lie between well defined walls of rock, from which the ore readily separated.

This lower patch of ore, at the time I arrived at the mine, had just been struck, and by the time I left the island, had widened out to about six feet, the ore yielding by analysis 16.49 per cent of copper from a fair average sample.

No. 2 Shaft has been sunk at a distance of 250 yards from No. 1 shaft, and bears S.W. from the hut. It is 30 feet deep.

At the surface, I am informed that a band of ore $3\frac{1}{2}$ feet thick occurred, which at a depth of eight feet was pinched out by a black compact serpentinous rock, and after sinking for another 10 feet, following the parting in this rock, that another patch of ore was found, the band of ore being $2\frac{1}{2}$ feet wide, but divided by a band of serpentine breccia; the walls, however, seem well defined.

No. 3 Shaft bears S.50.W. from the hut, and is about 200 yards from shaft No. 2. This shaft is only 12 feet deep, but carries ore to the bottom, the ore band being from $1\frac{1}{2}$ to 2 feet in thickness and very solid.

Another small shaft 7 feet deep, has been sunk near this, the ore being as good here as in the other localities.

A tunnel has been entered on the North-West side of the ridge on which the ore outcrops occur and has been driven for a distance of 135 feet in the direction of No. 1 shaft. This tunnel is entered at an elevation of 52 feet below the mouth of No. 1 shaft and at a distance of about 123 feet from the mouth of it, so that it would appear to have passed below the general run of the ore band. In summarising the results, I shall have occasion to refer to this.

SUMMARY.

It will be seen from the above notes that outcrops of ore have been traced, at intervals, for a distance of about 900 yards along the surface, in a S.W. and N.E. direction, and that four small shafts have been sunk to prove the ore at different points. These shafts do not appear to me to be on the same band of ore, but on at least three different ones, and I think it is probable that there is yet another.

The surface prospecting has been attended with exceptionally good results, rich deposits of ore being traced for a considerable distance, and, visiting the mine when I did, one could not but form a favourable opinion of the mineral wealth occurring on D'Urville Island.

At the present time the prospects of the mine look most encouraging, and had it not been that the tunnel which I have previously mentioned had been put in, one might have been led to form a most extravagant idea of the wealth which would accrue to the shareholders in the speculation; but this tunnel proves, what has frequently been demonstrated elsewhere, that ore deposits in serpentine are not as continuous and well defined as the poorer lodes which occur in sedimentary deposits.

Thus we see that at a depth of 35 feet in No. 1 shaft, rich ore is being raised, while at 52 feet a tunnel has been put in crossing the course of the ore, without intersecting it at all.

This fact points strongly to the necessity of keeping exploratory workings well ahead, a well established rule in all mining of metalliferous deposits, but one which requires even closer attention in such cases as the present where the ore is very irregular, occurring in bunches, and patches, which are in themselves very rich, but which are wedged out and disappear as rapidly as they widen out when first struck. It was to a large extent the neglect of this which caused the failure of the Dun Mountain mine, in which the ore was found under similar conditions, and I am induced by a fear that the shareholders in the D'Urville Island copper mine will commit a similar indiscretion to insist somewhat strongly on this point.

Up to the present time no work has been done, which has been quite unprofitable, with the exception of what has lately been undertaken, viz., taking out by underhand stopes what ore exists close to the surface, and at the same time neglecting to push on the tutwork of the mine.

It must be remembered that every ounce of ore which is taken out in these underhand stopes, or got by what the miners call "tearing it out by the hair of the head," costs nearly three times as much to bring to grass as if it was obtained in the ordinary course of mining, and is only excusable under very special conditions, as for instance if it was necessary to obtain ore to load a vessel in a certain time.

The object at present is, I believe, to convince shareholders that a certain quantity is to be got and may possibly be a sufficient cause, but I would strongly urge, that so soon as possible this mode of proceeding be given up and the whole of the capital devoted to proving the mine, so as to insure the workings for some years ahead.

Without finding the least fault with the action which has heretofore been taken by the manager, who is fully alive to the necessity of such works as I propose, and who has carried on the work in as thorough a manner as possible and with the best possible results, I would urge, that, in the future, the following operations should be undertaken.

1. That shafts Nos. 1 and 2 be continued as long as ore is met with, and that when the ore is lost in the shaft that drives be put in along the course of the ore, to the North and South respectively, these drives being pushed forward simultaneously until it is shewn in which direction the deposits of ore are trending and then, that the drive which goes through the ore be continued until this is passed through.

2. Further sinking will then have to be undertaken, but before carrying down the main shafts, it will be better to sink a winze on the ore and prove what it is doing, as some guide will thus be gained by which the position of the next level may be determined.

3. Cross drives will also have to be put in, in every level, and any vein or indication of copper which may be found, carefully followed until it is known whether these lead to any rich deposit or not.

4. Surface prospecting cannot be over-rated in this mine, and small prospecting shafts, sunk on any surface outcrops which may be found, will well repay the cost of the work as giving definite indications of the nature and direction which the underground works will have to take.

5. A careful survey of these outcrops should be undertaken and their strikes noted and plotted on the plan, as there should not be the least doubt as to whether the bands of ore at the different outcrops form part of one continuous ore band, or are only parallel deposits in the same mineral belt.

6. For the purposes of ventilation it will be found necessary to connect the two shafts with a drive, or else run these drives out to the surface, but at the present time there is no necessity for this work to be undertaken, as very shortly No. 1 shaft can be readily connected with the tunnel which I have mentioned, and this would secure perfect ventilation for the time being.

In carrying on the exploratory workings which I have indicated above it would be well to keep the connection of these two shafts in mind, and as I do not think that the band of ore is the same in both shafts, any drive which is made to connect these two will necessarily prove a good deal of the intervening country.

The ore would eventually be shipped in a small bay which is immediately below the mine and from half mile to three-quarters mile distant from the line of outcrops of the ore. A valley falls for the whole of this distance, and along the siddings of the spurs, a tramway could readily be constructed, so as to terminate above shoots which would deliver the ore into the holds of vessels lying in the bay below.

The spurs which run down to this valley are serpentine, and in these the ore may be reasonably expected to occur, and so soon as the exploratory workings at the shafts, shall have shewn that the ore is persistent enough to warrant this work being undertaken, a drive should be put in through the first spur below the mine, which will act as an adit level and also as a way for the mineral to be brought to the surface since this will save the expense of drawing the ore to the top of the spur, to be simply sent down again.

The driving of this adit, and the construction of a tramway should be commenced together, but neither I would submit, should be undertaken until a considerable body of ore has been traced in the vicinity of the shaft in the manner I have indicated above.

I have thus gone somewhat into detail in pointing out what I consider to be the necessary operations to be undertaken for the development of the mine, not because I have any want of faith in the ability of the manager, Mr. Manton, who I believe would follow out the course I propose, without any suggestions on my part; but in order that it may be clearly understood by the shareholders what I consider the

proper course to pursue. In conclusion, I will only add, that I consider the prospects of the mine very satisfactory, the patches of ore (for I can hardly look upon these deposits as true lodes since the character of the ore bearing rock is in no way different from the surrounding country) being numerous and rich, and following direct lines of fissure in the serpentine, and that the work which has hitherto been expended on the mine has been well advised. I would also add, that I think the erection of smelting works on the island for the present would be extremely ill-advised with the ready sale for the ore, which can be obtained.

The only dressing which I would advocate, is to spall and carefully pick the ore before sending it to the market, and this work can be done as at other places, by unskilled labour under proper supervision.

The Director of the Geological Survey,
Wellington.

I have, &c.,
S. HERBERT COX.
