

OS 108
1/2

REPORT ON THE PANDORA COPPER MINE.

Geological Surveyor's Office, Launceston, 11th July, 1893.

SIR,

IN pursuance of your instructions of the 27th June last, I visited and examined the Pandora Copper Mine on the 30th ultimo, and have now the honour to submit my Report thereon.

The mine is situated in the Parish of Winkleigh, County of Devon, on a small branch of Saxon's Creek, and is about three miles to the north-west from the township of Frankford. It is situated in the north-west angle of Mineral Section No. 1039-87M, held under lease by Mr. Myles Mahony, and I understand that mining rights are also held by the same proprietary over the adjacent 45½ acre freehold block belonging to Mr. F. Robinson. Several other mineral leases were formerly held in the vicinity, but have now become void and forfeited.

The mine is near the southern extremity of a stretch of country composed of older Palæozoic schists, slates, and metamorphic sandstones, which extends N.N.W. to Badger Head, a distance of from 13 to 14 miles, and N.E. to the Beaconsfield goldfield. I cannot say that the old rocks throughout this area all belong to one geological formation, but it seems most probable that they do. Round Frankford the older strata are overlaid by Permo-Carboniferous beds, sandstones, mudstones, and shales containing marine fossils, and these have been much broken by dykes and intrusive masses of diabase greenstone. Traces of Tertiary gravels and soft ferruginous sandstones are also observable at various points in the District.

Several years ago a shaft was sunk near the beach near Badger Head in search of copper, and veins of cupriferous minerals have been found, it is said, in several places throughout the District, but the Pandora Mine appears to have had the best prospects of any, and to have excited most attention. A small streamlet runs north-westerly through Section 1039-87M, and through Robinson's 45½ acre freehold block to the north west of it, and in the bed of this several quartz veins traversing the schists and sandstones have been discovered. I did not see all of these, as the creek has now become very much grown over with dense scrub, but, according to information given me none were large or showed any copper ore except the one upon which the principal workings have been made. This is seen in the east bank of the creek almost on the boundary between the two sections named. A drive has been made to the N.E., a distance of about 104 feet, with several branches. At the mouth a flat vein of ferruginous ruggy quartz is seen, but is very irregular, having apparently no defined course or underlay. All along the tunnel and its branches we find similar irregular flat veins, sometimes up to 4 feet in thickness, but generally smaller; they consist of quartz full of cavities filled with oxide of iron and also containing copper pyrites. The cavities are evidently spaces from which copper pyrites have been dissolved out. About 30 feet from the entrance to the tunnel a strong-looking vein of quartz crosses the drive running to the N.N.E., but when this is followed some 13 feet it is found to have become small and flat. At 82 feet in, two drives go off from the adit, one running about S.E., and the other a little south of east: the former is along the best defined vein of ore seen in the mine, which it follows for about 40 feet, when it again becomes small and flat, and dips underfoot. Near the end of this drive a winze has been sunk on the vein, and some good ore is said to have been extracted. The underlay is very flat and to the south west: it is said that some driving was done from the bottom of this winze towards the south-east, but as it was full of water I could not see this. Opposite the winze a drive runs about 18 feet to the N.E. and meets the other branch drive from the main adit, which is then continued eastward some 30 or 40 feet, but this part was inaccessible at the time of my visit. Another winze was sunk close to the end of the connecting drive and some good ore was extracted, but the very irregular character of the veins is evident when I say that though the two winzes mentioned are only some 16 feet apart, the long axis of the second one is almost at right angles to that of the first, and the underlay of the vein is to the north-west. It is quite impossible to say really what is the course of the vein or the direction of its underlay, though the latter appears to be on the whole rather westward than eastward. The country rock throughout the drives appears to be much broken and often contains quartz veins, and we cannot yet decide whether there is only one main flat-lying vein with numerous feeders and droppers and itself much contorted, or whether there is a large broken lode-mass consisting of disturbed country rock, in the crevices of which irregular strings and veins of quartz and ore have been deposited. A small shaft which was sunk less than a chain to the south-east of the tunnel mouth passed through barren rock for some 26 feet before coming on quartz and ore at about the same level as where they are got in the tunnel, which would favour the idea that there is a flat lode, but, on the other hand, the country schist on the west side of the creek seems very solid and undisturbed. If any more work is done on this mine the shaft should be sunk deeper, and cross-cuts driven from it to prove the nature of the lode: if it is a flat vein the shaft will soon pass through it into little disturbed country rock, but if the ore is in strings through a large broken lode-mass the shaft and crosscuts will soon reveal the fact, and give a chance of estimating whether ore is present in payable quantities. If the vein is flat and irregular in its underlay, as in the present workings, I do not think there is any chance of the mine being worked profitably, as the mining costs would necessarily be very heavy, and very much better ore than any yet seen in it would be required to cover them; but, in the other case, it might prove that the quartz veins would form into a more solid lode body, and that mining might be a commercial success.

Most of the ore that has been extracted from the drives is still on the ground, though the very best of it has been picked out and sent away. What is left is mostly quartz with yellow copper pyrites, and vughs containing oxide of iron, resulting from the oxidation of pyrites. In the lowest parts of the mine the ore is said to have been more solid and less oxidised. It is clear that the cavities so common in the quartz have been formerly filled with pyrites, and it is therefore reasonable to think that the vesicular ore above the

water-level is not of so high an average value as will be found at greater depth, where there has been less chemical action. Nevertheless it appeared to me that there was not enough copper in the ore on an average to make it worth working unless there were a very large and easily mined mass of it. I did not take any bulk samples, being satisfied from ocular inspection that the ore was of low grade, but I should be much surprised if a fair bulk sample of the lode were to yield more than 3 or 4 per cent. of copper at the very most. Five tons of the best ore were sent in May, 1890, to the E. & A. Copper Company, Limited, at Port Adelaide, whose assay return was $7\frac{3}{4}$ per cent. of metallic copper. If this is all that was yielded by the picked ore, it is not to be expected that the bulk of the stuff from the mine will contain even half as much. Almost all the ore would have to be concentrated to get rid of the great excess of quartz, and the concentrates would have to be shipped to smelting works, as it would not be profitable for the owners to smelt on the spot unless the output of the mine were a great deal larger than there is any present warrant for hoping for. Now, if we take the cost of mining and concentrating at 30s. per ton of ore mined, and of freights to smelting works, smelting charges, smelting losses, agency, and all other charges at £4 a ton, both of which estimates are more favourable than could probably be obtained, and supposing the copper in the ore to be 5 per cent., and the concentrates to amount to 20 per cent. of the ore mined, we should find the expenses to exceed the value of the copper, thus:—

100 tons ore contain 5 tons copper, gross value at £44.....	= £220.	
Mining and concentrating 100 tons ore, at 30s.	= £150	} Total expenses,
Freights, smelting charges, and losses, 20 tons concentrates, at £4 =	£80	

In actual practice, I believe the loss on 5 per cent. ore would be even greater than that shown.

The future of the mine therefore depends on finding very much better average ore than any now in sight, so long as copper continues at or about its present value. Should the price of copper rise it might pay to work, but the tendency of improvements in copper smelting is towards lowering the value of the metal, and at present there seems no likelihood of a substantial rise in price for a long time to come.

There seems to me to be only one possible opening for the disposal of this ore at a profit, namely, selling it to the Mt. Lyell Co. for flux when their smelting works are in operation. The Mt. Lyell ore is very free from silica, and siliceous ores will be in request for mixing with it in order to get a good slag, and the Mt. Lyell works will therefore be able to smelt siliceous ores at a much lower cost than is usual. The freight on the ore from Port Sorell to Strahan should not be very considerable. The proprietors should keep this chance in mind if they decide to do anything more with the mine, and ascertain how cheaply they could get the ore landed at the smelting works, and on what terms they could get it treated. The concentration of the ore at the mine need not then be nearly so thorough as if silica were detrimental, but still it would have to be carried to a certain degree.

Should it turn out that the ore could be dealt with in this way, and should larger and better ore-bodies be found on opening up the mine, it would be necessary to construct a tramway from the mine to deep water at Port Sorell. There should be no engineering difficulties in doing so, as the mine is only about 750 feet above sea level, and the fall of the country is towards the port. The distance in a direct line is about eight miles, so the tramway would probably have to be from 10 to 12 miles long. There is good timber round the mine for mining purposes and construction of the tramway, and some revenue might be obtained from the latter for timber and agricultural products carried to the shipping-place. There would be some difficulty, I think, in getting enough water to supply power for driving concentrating machinery near the mine itself, but by going two or three miles towards Port Sorell for a mill-site it is probable that good water-power could be obtained from the Franklin River and its branches. This and the construction of the tramway should, however, receive detailed consideration before going to much expense over them, my judgment being simply formed on general grounds, from the lay of the country and the size of the streams seen.

For a copper mine to be payable nowadays it is necessary either that it should contain considerable quantities of very rich ore, or else, if the ore is of low grade, that it should yield large quantities of it, and have very good facilities for cheap mining and concentrating. The Pandora mine is neither rich nor on a large deposit of ore so far as yet seen, nor has it more than ordinary facilities for cheap handling of the stuff mined, while the flatness and irregularity of the veins are decidedly detrimental to cheap working; so, though there is of course the chance that further developments will show a much more favourable aspect of the case, I do not think there is much likelihood that it can be made to pay. There is certainly a good deal of copper about it, but I am very much afraid that there is only enough to keep people spending money on it without return.

I have the honour to be,

Sir,

Your obedient Servant,

A. MONTGOMERY, *M.A., Geological Surveyor.*

P.S.—13th July, 1893. Since writing the above I have received the result of the examination by the Government Analyst (Mr. W. F. Ward) of a small sample of the best ore I could pick from the ore-heaps at the Pandora mine, the object being to determine, not the average value of the ore, but the percentage of copper in the clean ore, as this mineral (copper pyrites) is liable at times to contain much iron pyrites, which lowers its metallic value. It was also desired to know if there was any gold or silver in the ore. The analysis showed traces of gold and silver, 23.5 per cent. of copper, and 16.4 per cent. of silica and matter insoluble in acids. The percentage of copper corresponds to 67.9 per cent. of chalcopyrite of typical composition in the ore, which, with 16.4 per cent. silica accounts for all but 15.7 per cent. of its weight, which was probably made up of oxide of iron and other constituents not determined by the analyst. The test shows that the ore is a very pure chalcopyrite, and that when freed from the quartz gangue by concentration it might be expected to assay about 30 per cent. of metallic copper. The presence of traces of gold and silver points to a possibility that the precious metals may be found in payable quantities when the lode is further developed; being in a known gold-bearing formation increases this chance.

The Secretary of Mines, Hobart.

A. MONTGOMERY.