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## TREATMENT OF PUHIPUHI SILVER ORES

(LETTER FROM MR. ALBERT BRUCE RESPECTING).

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

Mr. A. BRUCE to the Hon. R. SEDDON, M.H.R., Wellington.

SIR,—

Thames, 25th August, 1891.

Noticing in the *New Zealand Herald* that Mr. Thompson has given notice to ask if you will employ a competent expert from Australia or California to advise as to the proper mode of treating the Puhipuhi silver ores, I have presumed that you would be glad to receive some information on the subject other than that already in your possession, hence my writing to you.

In June, 1890, the Puhipuhi prospectors brought a parcel of ore to the school of mines for treatment, with the following result, as per copy of report furnished to the Prospectors Company:—

No. 1.—This was a parcel of 3,700lb. of ore from the winze, No. 3 reef. The stone consisted principally of hard, whitish-grey, amorphous quartz, streaked with wavy lines of bluish-grey argentite (silver sulphide), which is a free-milling ore. Small disseminated grains of ruby silver were occasionally but rarely seen. This ore showed an assay value of 53oz. 10dwt. of bullion—4·1 fine in gold, and 995·9 fine in silver—equal to £8 14s. 1d. per ton. One thousand eight hundred and twenty pounds were crushed wet, and 1,820lb. dry, yielding by raw-pan amalgamation with chemicals 75oz. bullion—3·2 fine in gold, and 769·8 fine in silver—equal to 45oz. per ton, representing a saving of 65 per cent. of the assay-value. The tailings showed an assay-value of 18s. per ton.

No. 2.—This was a parcel of 720lb. of ore from the winze, No. 3 reef, which showed an assay-value of 45oz. 7dwt. per ton, equal to £7 7s. 1d. per ton. It was dry-crushed and then subjected to a chloridising-roasting with 10 per cent. salt, and  $3\frac{1}{2}$  per cent.  $\text{FeSO}_4$ , the latter being added to make up for the deficiency of natural metallic sulphides in the ore: by hot-pan amalgamation with chemicals it yielded 12oz. 12dwt. bullion—996·1 fine in silver, and 3·9 fine in gold—equal to 39oz. 4dwt. per ton, representing a saving of 80 per cent. of assay-value. The tailings showed an assay-value of 16s. per ton.

No. 3.—This was a parcel of 2,530lb. of ore from No. 1 level, No. 3 reef. It was rusty-coloured and mullocky, in this differing from the ore from the winze, which was quite free from metallic oxide. It was crushed dry, and showed an assay-value of 32oz. 7dwt. per ton—996·9 fine in silver, 3·1 fine in gold—equal to £5 5s. 1d. per ton by hot-pan amalgamation. This parcel yielded 36oz. 5dwt. of bullion—25 fine in gold, and 799·5 fine in silver—equal to 32oz. 2dwt. per ton, representing a saving of 78·5 per cent. of the assay-value. The tailings from this test showed an assay-value of 18s. per ton.

The above tests are very satisfactory, and show sufficiently that the class of argentiferous ore represented by the samples treated at the school of mines can be successfully treated by dry crushing and raw-pan amalgamation with chemicals. With machinery specially adapted for dry crushing and water as the motive-power, the cost of treatment should not exceed £1 5s. per ton.

Chloridising-roasting may be expected to effect a saving of from 12 to 15 per cent. more than by raw amalgamation when working on a large scale, but with an ore of this grade it is evident that this extra saving would barely cover the extra loss incurred in washing, &c.

We also further advised them to crush their ore wet, but taking care that a proper system of pits for catching and settling the tailings were provided, together with a filter-system for catching the slimes; the tailings and slimes to be treated by pan-amalgamation.

As the percentage saved in treating the ore from the Comstock Lode, Nevada, was only from 65 to 75 per cent., I think you will agree with me that the Puhipuhi people have no cause to complain at the result they received from the school of mines, and, had they followed our advice and erected their machinery on the lines of our experimental plant, they would have been comparatively over their difficulties. Instead of doing so they have listened to the claptrap of would-be experts, and erected machinery that is of little or no use, and before the shareholders can expect any return for their outlay (that is provided the bullion is there) they must erect a battery comprising stamps, pans, and settlers. If they do so, and put a competent man in charge, they will get results equal to that gained in any part of America. As for getting an expert from Australia, the thing is

nonsense, as they treat no ore there by any other system except smelting. Some years ago the Waihi people sent over a parcel of ore to California, divided into three equal amounts, and distributed them to three different experts for treatment and report. The reports were placed at the disposal of the School of Mines Committee, and showed that no two of the three authorities agreed as to the method of treatment, and none of them returned as large a percentage as the Thames School of Mines. The Waihi people, like the Puhipuhi, deeming that the local talent was beneath their acceptance, also refused to take our advice, and erected expensive and complicated machinery, which they found totally unsuitable, and at last erected the class of machinery that we had at first demonstrated to them was the most suitable. Our experimental plant provided them with a pattern, which they refused to take, but their machinery is now identical with it.

The Puhipuhi people have never been quite satisfied with the school of mines in the line of assaying, because we did not give them a high percentage. We also, on every possible occasion, deprecated their running away with the false notion that a laboratory test was a correct guide as to the value of the ore. We pointed out that the way to arrive at this was to take regular samples every half hour of the ore as it passed through the batteries, &c. They appear, however, to stick to the old method of selecting a specimen, assaying it, and computing the value of the whole of the reef by it, and then express surprise that there should be such a difference between the laboratory test and the actual return; the silver volatilising by roasting, or, rather, drying the ore, is also "buncombe." I understand that one of the methods adopted by these amateurs in arriving at this conclusion was that they took a piece of stone, broke it through the middle, roasted one half, and then assayed it; the other half they assayed going a higher percentage than the half-roasted was put down to volatilisation by heat. Had these amateurs crushed the whole of the stone, and, after thoroughly mixing and dividing it, found a very perceptible difference, there might have been some reason in their conclusion. As it is, their conclusion is perfectly erroneous. We submitted samples of Puhipuhi ore to a white heat in a muffle furnace, and the loss only equalled 3 per cent.; the ore being crushed and passed through a sixty-mesh, left it in the best possible condition for volatilising.

You might refer Mr. Thompson to the school of mines report, and also to M. Eissler's "Metallurgy of Silver." After his perusal of the latter good practical work, and comparing it with the report, I think he will agree that we put the Puhipuhi people on the right track.

I have, &.,

ALBERT BRUCE.

The Hon. Mr. Seddon, M.H.R., Wellington.

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