

“(2.) Experiments with samples of raw ore tailings after treatment :—

Value of Raw Ore.	Ordinary Solution.	Extra Solution.	Copper-sulphate Solution, and then adding Sodium- hyposulphite.
13·4oz. ...	12·9oz. ...	10·2oz. ...	7·0oz.
18·2oz. ...	15·3oz. ...	12·4oz. ...	7·0oz.
16·3oz. ...	16·2oz. ...	10·4oz. ...	7·8oz.

“(3.) Experiments with samples of raw ore treated at present by the Patio process :—

“Value of raw ore, 12·15oz. silver per ton.

“Tailings, 7·5oz., after treatment with ordinary solution.

“Tailings, 4·62oz., after treatment with extra solution.

“Tailings, 2·85oz., after treatment with copper-sulphate solution and then adding sodium-sulphite.

“There is also a marked difference in treating ores that have been roasted with salt, as the following experiment will show :—

“(4.) Experiments with ores that have been roasted with salt and were treated by barrel amalgamation, extracting about 65 per cent. of the silver.

“Value of ore, 14·3oz. silver per ton.

“Tailings, 4·86oz., after lixiviation with ordinary solution.

“Tailings, 4·86oz., after lixiviation with extra solution.

“Tailings, 2·19oz., after treatment with copper-sulphate solution and then adding sodium-hyposulphite.

“All these experiments were laboratory tests only, but there is no doubt but the results will be practically the same on a large scale. For quantities of chemicals and the *modus operandi* used in these tests see ‘Laboratory Work.’

“*Constitution of Lixiviation Solution before Precipitation.*—The lixiviation solution may hold outside of silver and gold the following elements that play an important part in precipitation—namely, copper, lead, antimony, arsenic, and calcium. Neither iron, zinc, nor manganese, can be present if the first wash-water has been properly applied.

“Copper is derived from the extra solution from cupreous-chloride in roasted ores and from copper-carbonate in raw ores. Lead is introduced through lead-sulphate in raw and roasted ores. Antimony and arsenic are derived from antimonates and arsenates in roasted ores. Calcium comes from calcium-sulphate, and caustic lime from roasted ores, and gypsum in raw ores. Although the quantity of the loose metals in the lixiviation solution rarely exceeds a few pounds per ton of ore, the value of the precipitated sulphides in precious metals may nevertheless be therefore diminished to a considerable extent.

“*Precipitation of Lead.*—The precipitation of lead with sodium-carbonate solution is very easily effected, and the precipitate settles in a short time. The necessary stirring is done with a piece of hard wood. Care should be taken not to add an excess of soda. Although the presence of the reagent in the hyposulphite solution is not injurious to the extraction of the silver in lixiviation, it can easily be seen that should it become necessary to neutralise any caustic soda in the solution, the consumption of sulphuric acid would be increased by neutralising sodium-carbonate also. The clear solution is decanted into the silver precipitating-tank, while the lead-carbonate is allowed to accumulate from several charges before it is taken to the filter-press. The lead-carbonate is very pure, containing no other base metals, and assays only from $\frac{1}{2}$ oz. to $\frac{3}{4}$ oz. of silver to the ton. Should lime be present in the solution, the precipitate will be contaminated by calcium-carbonate. In practice, less than 1lb. of soda is consumed in precipitating 1lb. of lead, or $1\frac{1}{3}$ lb. of lead-carbonate.

“Although lead-sulphate is more easily soluble in warm than in cold hyposulphite solution, and although the concentration of the latter increases its solvent energy for lead, the differences in the amount of lead dissolved are practically not very great, whether the solution has been used warm or cold, or whether it has been somewhat more or less concentrated. Neither does a large amount of lead-sulphate in the ore affect a final result materially, since it is by no means all dissolved. The amount of lead that finds its way into the lixiviation solution rarely exceeds 5lb. per ton of ore. Of course it is, as a rule, desirable to reduce the quantity of lead dissolved as much as possible without diminishing the extraction of the silver. The separate precipitation of the lead as carbonate from the lixiviation solution is always a matter of economy, and may be even a source of profit, provided the amount realised from the sale of the lead-carbonate exceeds the cost of the soda consumed. That the precipitation of lead with soda is always economical can easily be seen, since the lead would have to be precipitated otherwise with sodium-sulphide, a reagent much more costly than soda. Besides this, the amount realised from the sale of the lead-carbonate is a clear gain.

“*The Precipitation of Silver.*—This part of the process is very easily executed. It is hardly necessary to mention that the solution should be well stirred with a piece of hard wood while sodium-sulphide is added, and that this reagent should not be used in excess. In case this has been done by inadvertence, more fresh lixiviation solution from one of the vats must be added. Hence the precipitating-tanks should not be filled too much. It is far better to leave a slight quantity of silver in the solution, and not precipitate the last trace of it.

“If the solution contains lime which has not been previously parted by soda, the precipitation of lead having been found necessary, an insoluble calcium-monosulphide may be precipitated, and may contaminate the precious sulphides. In this case, however, the light yellow calcium-sulphide does not appear until all the sulphides of silver, gold, and copper have fallen out. In order to recognise the end of the reaction with more accuracy, it is to be recommended to take a test-tube full of clean solution; precipitate the lime first with soda, and then add sodium-sulphide; the reaction is then not obscured by the yellow calcium-monosulphide.