

MOUNT BONNIE MINE

VISIT BY MR. E. MARMION 090 212925

18/9/84 to 3/10/84.

The following Goldroom treatment methods were outlined by E. Marmion during his visit to Mount Bonnie Mine.

1. Treatment of Copper Bullions.

This method is used to remove excess copper from bullion before shipment to the mint. The first step is to granulate the bullion. This is done by melting in the barring furnace and slowly pouring the molten bullion into a drum filled with water. The water in the drum is stirred before pouring the molten bullion to prevent any explosions. If the water stops swirling the pouring is stopped and the water stirred again.

The granulated bullion is then recovered and dried. It is then mixed in a 3:1 weight of bullion to weight of sulphur ratio and placed in an appropriate crucible (A60). The mixture is then heated slowly until the sulphur starts to burn with a blue flame. When the flame is about 100mm to 150mm the burner is turned off and the mixture allowed to re-act. The re-action usually takes 15 to 30 minutes. Once the blue flame stops the re-action has finished and the burner is started.

The mixture is then melted, although some dross will remain on the surface of the molten mixture. This is then poured into a conical mould and any dross left in the pot scraped out. On solidification a gold/silver button should have settled below a copper matte. These are normally easily separated if allowed to cool overnight. The matte and dross are usually disposed of by feeding into the milling circuit.

2. Treatment of Copper Mattes containing Gold and Silver.

Mattes containing significant amounts of gold and silver are treated by fusion with iron.

The matte is melted in a crucible and iron is then added. 31.25g of iron is used for each kilogram of matte. The best iron to use is fusion welding rods that have a low melting point. The required weight of iron is hammered flat and added to the molten matte. The matte is then well stirred (usually with an iron bar) until the iron wire has melted. This is usually felt on the iron bar when stirring. When the iron has melted the mixture is poured into a conical mould and allowed to solidify. The resultant bullion button can be easily separated from the matte when it has cooled.

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3. Use of Sodium Nitrate instead of Nitric Acid during Precipitate Clean-up.

The use of sodium nitrate instead of nitric acid was suggested. This has the advantage of being easier to transport and handle.

The method used is to proceed as normal with the sulphuric acid additions until that reaction stops. The sodium nitrate is then added by a suitable scoop and reacts to produce crude nitric acid. This reacts to give the same reaction as nitric acid. The end point of the reaction is the same. i.e. When the froth formed becomes unstable and collapses, the reaction is assumed to be essentially finished. Normally $\frac{1}{2}$ to 1 hour digestion period is allowed to complete any further reaction. Assuming all of the NO_3 in the sodium nitrate reacts to form acid, then 1 kg of sodium nitrate will be equivalent to 0.56 l of nitric acid.

The addition of Teepol or similar detergents can be used to control excessive foaming and prevent "boiling over" in the acid tank. 50 to 100 ml of detergent suppresses foaming very quickly. This should only be used if "boiling Over" is likely because it can mask the end point of the reaction.

4. Salt Additions after Aciding.

To precipitate silver dissolved during aciding, sodium chloride is added after aciding. The silver is precipitated as silver chloride and is usually seen as a white or grey colouring in the acid tank. The amount of salt required can be easily checked by filtering some of the acidified slurry and adding salt to the filtrate. If the filtrate goes cloudy then more salt is required.

All solutions after acid and salt additions should be assayed for gold and silver because if the nitric acid reaction has been carried past the end point, aqua regia is formed when the salt is added and gold is taken into solution. The dissolved gold can be lowered by additions of zinc dust until an acceptable level is reached.

5. Smelting of High Silver Chloride Precipitates.

Due to the high losses of silver, mainly as molten silver chloride, the following procedures were adopted to keep these losses to a minimum.

The charge for smelting was fluxed with borax and soda ash to make up 25% each of the weight of wet precipitate. i.e. 4 wet precipitate 1 borax, 1 soda ash. This is charged to the furnaces and smelted. When the salts in the charge become fluid, iron is added to the furnace using 10 g of iron to 1 kg of wet precipitate. This is allowed to react (usually 1 to 2 hours) and the slag is then checked for silver chloride by washing an iron bar in the slag. If there are traces of silver on the bar, then the reaction is still proceeding.

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If no iron can be seen when the furnace is rolled, then further additions of iron are required. If no traces of silver are present on the iron bar the salt phase is ready to be tapped.

When the iron has finished reacting, usually indicated by the increase in white fume given off by the furnace, the salt phase in the slag is tapped off. This salt phase should be red brown in colour when cold and dissolve slowly in water, leaving a white precipitate. Any slag tapped is usually black or dark brown.

After the salt phase has been tapped approximately 2 kg of borax is added to the furnace and the bullion run down until it is ready to pour.

When the salt phase is steel grey in colour there is probably a high proportion of silver chloride in it. This should be assayed and re-smelted if necessary, using a mixture of 3 parts slag to 1 part soda ash and the addition of 10 g iron to 1 kg of slag when the salt phase is molten.