

METALLURGICAL REPORT

NO 62

TREATMENT OF MT. SERLE BARYTES

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TREATMENT OF MT. SERLE BARYTES

SUMMARY

1. A sample of barytes assaying approximately 80 per cent BaSO_4 was treated by flotation.
2. Recoveries of over 90 per cent were obtained, with a product assaying 98 per cent BaSO_4 .
3. A plant to treat 30 tons per day would cost approximately £45,000
4. The cost of ground barytes in bags delivered in Adelaide is estimated at £15 per ton.

SAMPLE

Three samples representing first grade, second grade and new lode ore were taken by the Assistant State mining Engineer and Mr. J. E. Ridgeway, Geologist.

The samples were assayed with the following results:-

TABLE NO 1.

Analysis of Samples

Sample	% BaSO_4	% SiO_2
1st Grade	86.7	12.72
2nd Grade	77.1	21.72
New Lode	78.7	19.44

Rock specimens from each sample were submitted to the Petrologist who reported that, in all specimens, quartz is the principal impurity. It has replaced the barytes and preserved its texture in pseudomorphous form. The quartz occurs as discontinuous veinlets, irregular masses and fine disseminated particles. There are minor amounts of clay and limonite.

The freeing of grains is not so much a problem as the disseminated minute inclusions of clays limonite and quartz. These inclusions are of the order of two microns and less.

BENEFICIATION

Early tests with gravity concentration methods confirmed the petrological examination which indicated that gravity concentration would not be successful due to the necessity for fine grinding to liberate minute inclusions of gangue minerals.

Two possible , methods of flotation were investigated:-

- (1) Flotation of quartz
- (2) Flotation of barytes

Best recovery was obtained with the former and highest grade with the latter.

Flotation of Quartz

On first and second grade ore between 91 per cent and 92 per cent recovery of barytes was obtained. Barytes products assayed 98.6 per cent and 95.9 per cent BaSO_4 and 1.2 per cent and 3.4 per cent SiO_2 respectively. With new lode ore, recovery and grade were poorer. 83.7 per cent of the barytes was recovered in a concentrate assaying 91.0 per cent BaSO_4 and 7.9 per cent SiO_2 . It is considered, better results could be obtained on the latter ore with finer grinding.

Reagents used in the above tests were as follows:

Amine 220	1 lb/ton
Hydrochloric acid	0.8 lb/ton
Copper sulphate	0.7 lb/ton
Caustic soda	1 lb/ ton

Flotation of Barytes

Assuming fifty per cent of the middling product is recovered as finished concentrate seventy five per cent of the barytes is recovered from each of the three ores in a concentrate averaging 98.5 per cent BaSO_4 and 1.3 per cent SiO_2 . In batch tests conducted 15 percent to 20 per cent of the barytes were in the middling product.

A number of various reagent combinations were tried some of which are reported. Reagents which gave good results are as follows:

Sodium Silicate 2lb/ton

Sodium Oleate 0.5 lb/ton

Oleic acid 1 lb/ton

Details of Flotation Tests

Samples of ore weighing 500 grms. were ground in the laboratory porcelain pebble mill at 60 percent solids to 90 per cent minus 200 mesh. Pulp was transferred to a flotation machine, diluted to 25 per cent. solids and flotation carried out after conditioning for a few minutes with various reagents.

Details of reagents used and results of quartz flotation are shown in Tables 2 and 3, and of barytes flotation in Table 4 and 5.

In the barytes flotation test on new lode ore, the sample was ground to 95 percent minus 200 mesh. The grade of concentrate is appreciably higher than that produced by flotation of quartz from less finely ground ore.

Table Number Two

Reagents for Quartz Flotation

Reagents lb/ton	Test 1 1st Grade	Test 2 1st Grade	Test 3 1st Grade	Test 4 1st Grade	Test 5 2nd Grade	Test 6 New Lode
Amine 220	1.0	1.0	1.0	1.0	1.0	1.0
CuSO	-	-	-	0.7	0.7	0.7
HCl	-	0.5	1.0	0.8	0.8	0.8
NaOH	-	-	1.0	1.0	1.0	1.0

TABLE No. 3

Results of Quartz Flotation

Test	Flotation Tailing			Flotation Concentrate BaSO ₄		
	% Weight	%BaSO ₄	%SiO ₂	%BaSO ₄	%SiO ₂	%Recovery
1	86.6	92.3	7.5	53.3	44.8	91.8
2	83.6	95.5	4.1	41.1	58.0	92.4
3	89.0	91.6	8.5	37.9	59.9	95.7
4	79.5	98.6	1.2	34.4	62.3	91.7
5	71.9	95.9	3.4	21.8	75.3	91.9
6	69.5	91.0	7.9	50.0	56.8	83.7

TABLE No 4

Reagents for Barytes Flotation

Reagents lb/ton	Test 1 1st Grade	Test 2. 1st Grade	Test 3 2nd Grade	Test 4 2nd Grade	Test 5. New lode
Soda ash	1.5	-	1.5	-	-
Sodium silicate	1.0	0.5	2.0	1.0	2.0
Calgon	0.25	-	0.25	-	-
Tera sodium pyrosphate	2.0	1.25	-	-	-
Fuel oil	0.5	-	0.25	-	-
Quebraco	0.65	-	0.3	-	-
Frother B23	-	0.1	-	-	-
Caustic soda	-	-	-	1.0	1
Sodium eleate	-	-	-	1.0	0.5
Oleic acid	2.5	0.5	2.6	0.15	1.0

Table No. 5

Results of Barytes Flotation

Test	Flotation Concentrate			Flotation Tailing		BaSO ₄
	%Weight	%BaSO ₄	%SiO ₂	%BaSO ₄	%SiO ₂	% Recovery
1	65.4	98.8	1.5	61.9	37.1	75.1
2	33.9	97.4	2.2	77.6	20.9	38.8 *
	16.5 *	89.8	8.9			17.1 *
3	47.3	98.7	0.9	35.3	64.5	61.5 *
	19.4 *	90.0	9.4			23.1 *
5	34.9	98.8	0.7	39.3	60.2	46.0 *
	13.5	88.5	11.0			15.9
5	51.3	97.9	1.5	55.5	44.3	66.9 *
	14.3	78.0	22.2			15.2

* Middling

Barytes Specification

The flotation product would have two possible uses, which would both have to be proved by trial.

The specific gravity of the product is sufficiently high for drilling mud, but the residual silica is higher than the limit of 0.5 per cent usually specified. Because of the extreme fineness of the silica it may have very slight abrasive action, and therefore be of little importance.

The analysis of the product is suitable for paint pigment. The degree of "whiteness" is usually the main selling factor with pigment, and this material should be satisfactory. There may be some interference from the flotation reagents. A small amount of sodium cleate etc. can usually be tolerated.

ESTIMATES OF COST

1. Capital Cost

A flow sheet is attached showing the units of equipment required, with sizes of the main items necessary to treat thirty tons per day. Cost of the plant excluding power generation would be approximately £45,000.

2. Operating Cost per Ton of Ore

Labour	£2-0-0
Power (at 2½ pence per unit)	10-0
Reagents flotation of quartz	3-0
12/10 or flotation of barytes	
Maintenance Supplies	5-0
Operating Supplies	<u>8-0</u>
	<u>£3-6-0</u>

3. Cost per Ton of Product

From one ton of ore is recovered 75 per cent by weight when quartz is floated or 55 percent by weight when barytes is floated. Allowing for a mining cost of £2-10-0 per ton of ore, and transported to , say, Port Augusta (mill site) of £1-10-0 per ton of ore, the cost of flotation concentrate at Port Augusta would be as follows:

1. Quartz flotation £10-7-0
2. Barytes Flotation £13-3-0

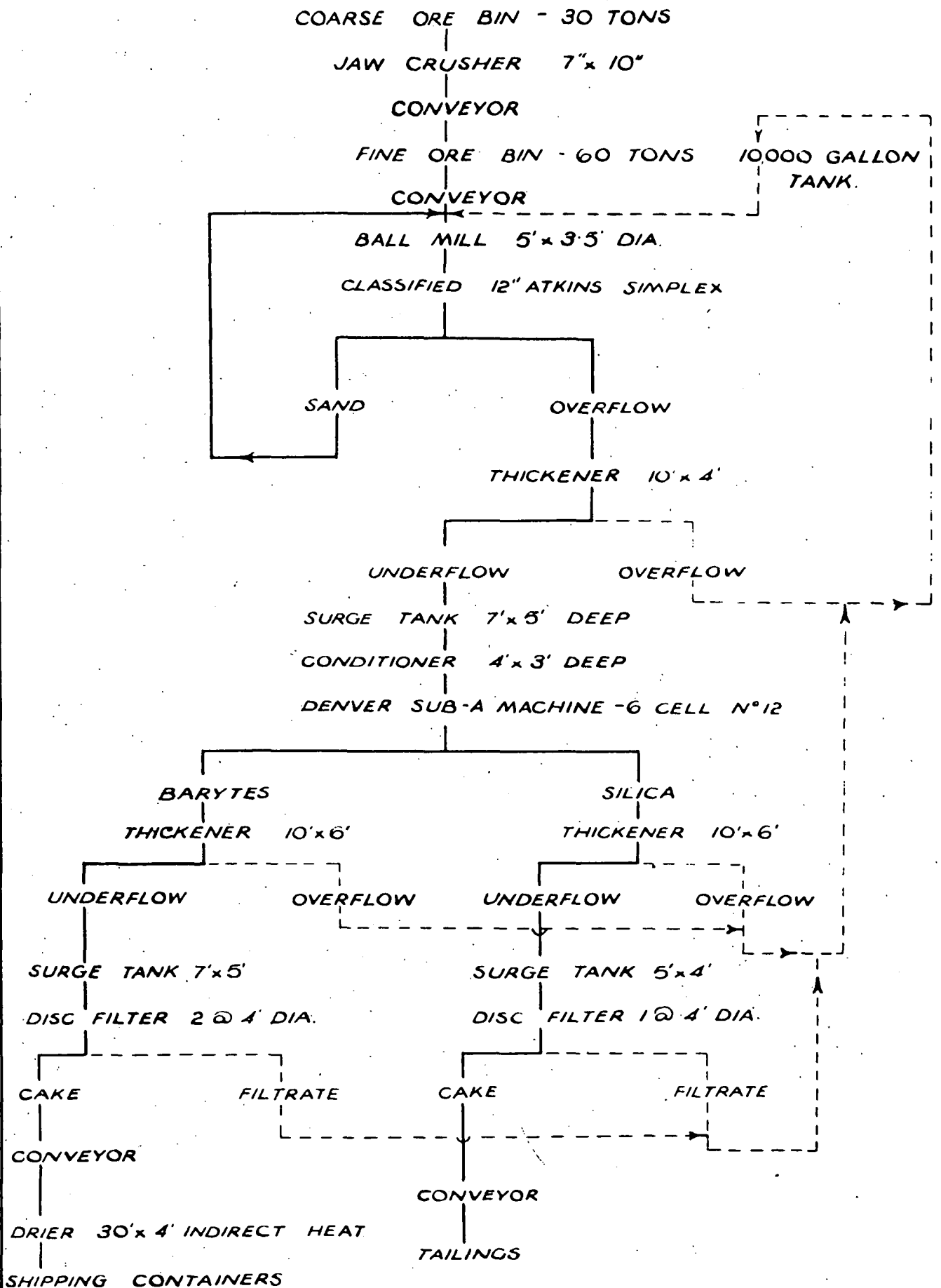
Assuming that flotation of quartz is adopted.

Mining, Milling and Transport of ore	£10- 7-0
Transport of concentrate to Adelaide	3-10-0
Depreciation of Plant - ten per cent	16-0
Interest on Capital - five per cent	<u>8-0</u>
Cost per ton of product.	<u>£15- 1-0</u>

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PROPOSED FLOTATION FLOW SHEET



S.A. DEPARTMENT OF MINES

Approved	Passed	Drn	METALLURGICAL REPORT N°62	D.M.	Scale
		Tcd C.J.	TREATMENT OF	Ray	
		Ckd	MT. SERLE BARYTES		
Director		Exo			Date 23-12-53