DEPARTMENT OF MINES
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ESTIMATE OF MINING COSTS.

S.A. BARYTES - ORAPARINNA.

by

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Introduction.

The following estimates are made after consideration of the joint report of Messrs. A.B. Black and A.S. Lewis, and of the metallurgical report of Mr. N. Jackson, and of the present condition of the mine.

Messrs. Black and Lewis have made recommendations for a considerable amount of necessary development. Their estimates of costs are accepted for the purpose of this report.

Mr. N. Jackson has reported on the metallurgical side, and has based his estimates of costs on an annual output of 10,000 tons. Mining costs are therefore based on this figure.

Assumptions.

Although there is a large quantity of broken ore in stopes, much is not available for the follwoing reasons:

(a) There has been slabbing from the walls and the box type chutes render it practically impossible on the present set up, except at h high cost, to handle this mullock and draw the ore.

(b) It will be necessary to pass ore from the 1B lode above the D fault through one of the stopes, and Messrs. Black and Lewis have recommended that no ore be drawn from this section, so that the ore will rill to the level.

It has therefore been assumed that there is no broken ore to be drawn from stopes.

Development has been assumed to be 50 per cent in ore averaging four feet in width, and that all this ore will be amenable for treatment.

It is also assumed that

(a) There is sufficient air to work six machines.

(b) The treatment plant will not be located at the mine.

(c) Stoping costs are for No. 2 level. Stoping on No. 1 level would cost more for double handling of ore.

(d) Plant and buildings at mine valued at £20,000.

Tonnages per Shift.

The figure of 10,000 tons per year on a fifty week year represents 200 tons per week, and on a five day week, two shift basis, is equivalent to 20 tons per shift. In driving, a cut per shift should be attained, giving an advance of four feet. Assuming an average lode width of four feet, and a height of seven feet for the drive, a factor of eight feet per ton (in situ), one cut should break.

$\frac{4 \times 4 \times 7}{8} \div 14$ tons - 3.6 tons per foot, say, 3 tons.

In winzing, two feet per shift should be attained, and on a similar basis to driving should gain.

$\frac{6 \times 4 \times 2}{8} = 6$ tons per shift = 3 tons per foot.

In shrinkage stoping, which has been adopted at the mine, only one-third of the ore broken is immediately available for milling, the other two-thirds being tied up until the stope is beaten out. The expectation of broken ore per machine shift would be ten tons, of which 31/3 tons would be immediately available.

Proportion of Development Ore to Ore from Stopes

To carry out Messrs. Black and Lewis' programme, it is assumed that a minimum of two machines should be employed on driving, and one machine on winzing.

The two drive faces and one winzer face would produce a total of 30 tons per shift. This, however, assumes that all faces will be in ore of a width of four feet.

As the lodes pinch at intervals, amd some development will be in country rock, it should be safe to assume that 50 per cent of the development would be in ore, that is, the ore obtained from the development would be 15 tons per shift. It would thus be necessary to obtain a further five tons of ore per shift from stoping. At the present time there is only one face available for stoping, and while this could accomodate two machines it would be in the interests of safety to employ only

one. The available output from one machine would therefore be three to four tons, leaving a balance of one to two tons which could be salvaged from some of the stopes. In actual practice, however, stope preparation closely follows development, and it is most likely that more than the required make up would be available from this machine.

Costs.

The programme laid out by Messrs. Black and Lewis is expected to take 18 months.

Driving costs are estimated at £17-10-0 per foot. Winzing costs are estimated at £21-10-0 per foot. These figures are inclusive of all service and administration charges, etc., at the mine.

The tonnage per shift of barytes as estimated in the previous paragraph is 15 tons, made up as follows.

12 tons from advance of eight feet in drives.

3 tons from advance of two feet in winze.

Cost of eight feet of driving		£140
Cost of two feet of winzing		£ 43
	Total	£183
Cost of 15 tons	£183	
Cost of 1 ton	12-4-0	

As all service and administration charges, etc., have been included in the footage estimates, the only extra charges for the additional tonnage required are labour and explosives.

Then one miner at £2-13-3 and a trucker at £2-11-5 per shift would break and handle ten tons. Add 2/6 per ton for explosives, then the cost for ten tons would be £6-9-8, say, £6-10-0, and cost of one ton would be 13/-.

Then

15 tons cost	£183-0-0
5 tons cost	£ 3-5-0
	186-5-0
1 ton cost	9-6-3

Thus, to fulfil the development programme of Messrs. Black and

Lewis, the actual cost of ore at the adit portal would be £9-6-3 per ton.

The location of the treatment plant at Port Augusta with rail and carting costs of £3 per ton, justifies the retention of the picking belt would be necessary. One man could pick up to six tons per day of mullock at a wages cost of £2-12-0 per shift. Thus to pick six tons of mullock per shift would save £18 per ton in freight and carting without considering the saving in grinding and milling costs. The £18 - £2-12-0 an actual saving of £15-8-0 per shift The 20 tons per day of barytes would thus have to carry to cost of 52 shillings, equal to 2/7 per ton.

Two men would be required to

(a) Truck ore from portal bin, and lower trucks down the haulage.

(b) Tip the trucks into the bin at the bottom of the haulage.

This would not be a full-time job, but the men would be necessary, and could be used on other service work, and could do the extra trucking to make 20 tons per day of ore.

Two men to handle 20 tons at £2-12-0 = £5-4-0

Cost per ton 5-4

Then cost to bin = £9-6-3 + 2/7 + 5/4 = £9-14-2

Cost of Development as a Charge on Ore Developed.

In practice, the cost of developing a block of ore is a charge on the ore developed. Again using Messrs. Black and Lewis' estimates.

200 feet of driving in ore at £17-10-0 = £3,500

300 feet of winzing in ore at £21-10-0 = £6,450

£9,950

This would, if in ore, develop a block 200 feet in length by 150 feet deep, and if ore was exposed on the level above would be "Proved" ore. Leaving 22 feet. above the level and assuming a width

of four feet of ore then

$\frac{200 \times 128 \times 4}{8}$ would equal 12,800 tons, or

approximately 15/6 per ton.

However, No. 2 level is only 100 feet below No. 1, and a possible 200 feet of length in the new lode would only develop

$\frac{200 \times 78 \times 4}{8}$ = 7,800 tons at a cost of 20/- per ton.

Thus the development charge will vary according to the lift between levels. To be on the conservative side the figure of 20/- per ton will be used.

Stope preparation is estimated by S.A. Barytes at £2 per foot of lateral development. Converting this to a cost per ton on the basis of the last calculation would give £400 on 7,800 tons, equivalent to, say, 1/- per ton.

Then development and stope preparation would be equivalent to 21/- per ton.

Ore at bin would cost an additional 7/11 per ton, say, 8/-

Total 29/- per ton.

Stoping.

For a production of 20 tons per shift delivered to mine entrance and disregarding ant ore from development ends, 60 tons per shift would have to be broken, requiring six machines.

On a wages basis, this would mean six miners at £2-13-3 = £16 per shift.

Then

Cost for one ton would be	S.	D.
explosives	2	6
air and water	5	6
timbering	2	0
rock drills and steel	1	6
ventilation		6
supervision	6	0
	23	4

	S.	D.	S.	D.
Brought forward			23	4
Add overhead				
Head office charges	4	0		
Depreciation	2	0		
Mess house etc.	4	0		
Pay roll tax	1	0		
Holiday pay		8		
Accident Insurance		10	12	6
Development and stope preparation			2	0
			56	10

Trucking Costs.

Under usual shrinkage conditions and chinaman chutes, the duty of 20 tons per shift would be within the capacity of one trucker. However, there would be times with the present chute design when a trucker would be luck to get ten tons per shift. For this reason, ten tons has been taken as the norm. The box type chutes should be immediately altered to "chinaman" chutes to decrease the trucking cost.

2 truckers at £2-11-5 = £5-2-10 for 20 tons.			
1 ton would cost	5-3		
Add sorting and handling	7-11	13	2
		70	0

The cost, then, of delivering to the mine bin would be 70/- per ton.

To accomplish this, however, would involve the expenditure of a much larger sum tied up in broken ore in the stope.

Taking a block $\frac{200 \times 78 \times 4}{8}$ of 7,800 tons for an example. Then to deliver 2,,680 tons to the bins would necessitate the expenditure of 7,800 x 56/10 = £22,165, plus 2,680 tons x 13/2 = £1,764-6-10, a total of £23,929-6-8. Thus the Company would have to find £23,929 to deliver 2,680 tons to the bin, equivalent to £8-18-6 per ton.

From an accounting point of view there should be an interest charge on the cost of breaking the ore tied up in the stopes, but

this item will not be included here.

When the mine is at last worked out all this tied up ore is theoretically available at a cost of trucking only.

Balanced Mining.

All mines operating on the shrinkage system have to go through the two stages discussed. It is usually the object of the management to have several beaten out stopes filled up with broken ore as soon as possible. When this happy stage is reached the breaking of ore can then be slackened off to keep pace with production, in the case of this mine requiring a production of 20 tons per shift, 20 tons only would be required to be broken, other machines being on development.

The cost per ton would be as follows:

To break 20 tons per shift requires two miners.

Two miners at £2-13-3 £5-6-6

	S.	D.	S.	D.
One ton would cost	5	4		
Add explosives	2	6		
Timbering	2	0		
Rock drills	1	6		
Ventilation		6		
Half supervision	3	0	14	0
Brought forward	S.	D.	S.	D.
			14	10
Add half overhead	6	3		
Development and stope preparation	21	0		
Trucking	5	3		
Sorting and handling	7	11	40	5
			55	3

The mine being in an isolated position and lacking amenities, has difficulty in attracting and retaining good men, and the labour turnover is high. Costs have been based, on the average man and conditionally on full time being worked. Costs will rise if the mine

is undermanned, which condition is unfortunately quite common. Contract mining should reduce cost.

Conclusions.

The cost per ton of development ore will be in the e vicinity of £9 - 14 - 2 per ton.

The charge per ton against ore blocked out ready for stoping would be 21/- per ton.

Until at least one stope is beaten out and ready for complete shrinking, the Company will have to furnish the cash equivalent of £8-18-6 per ton of ore delivered ex mine.

When the stage of balanced stoping is reached the cost will be approximately 55/3 per ton.

When all available ore is stoped out, the broken ore in stopes can be delivered ex mine at trucking, sorting, and handling costs, approximately 13/- to 14/- per ton.

Development, stoping, and trucking costs could be reduced with miners and truckers on a contract basis.

Costs above have been estimated in three stages, It will be found in practice that these stages overlap.

3.8.55. INSPECTOR OF MINES AND QUARRIES.