Section 1—Ore Dressing Investigations

by W. St.C. Manson, P. L. James and H. K. Wellington

TR9-144-146 R. 421/10

20. GRAVITY CONCENTRATION OF A BULK SAMPLE FROM MOUNT CLEVELAND

Sample

The sample is composed from crushed diamond drill cores from the Mt Cleveland Prospect and is described fully in Ore Dressing Investigation R.421 (Manson *et al.*, 1964).

Investigation

This investigation is designed to determine the maximum recovery of tin obtainable in a low grade cassiterite-sulphide concentrate by progressive stages of gravity concentration with grinding of coarse tailings between each concentration stage.

Previous investigations have discussed the fine nature of the cassiterite in this ore, and in this test no tailings have been discarded at a size coarser than minus 200 mesh B.S.S.

The procedure adopted may be summarized as follows:—

1. The minus 8 mesh ore was stage ball mill ground to minus 60 mesh and sized on a 200 mesh screen.

2. The plus and minus 200 mesh fractions were then tabled separately; the minus 200 mesh tailing was discarded as a final table tailing.

3. The minus 60 mesh plus 200 mesh tailing was stage ground to minus 100 mesh, sized on a 200 mesh screen and the fractions tabled as before.

4. The minus 100 mesh and plus 200 mesh tailing was stage ground to minus 150 mesh, sized plus and minus 200 mesh and tabled as before.

5. The minus 150 mesh plus 200 mesh tailing was stage ground to minus 200 mesh and tabled.

6. The total minus 200 mesh table tailings were divided in two and concentrated on a tailing deck by two procedures.

(*a*) *Without further grinding.* Deck slope: 2 inch to 1 foot, feed rate: 1 gallon per minute per foot width of deck, feed pulp density: approximately 15 per cent solids.

(*b*) *After grinding to a nominal minus* 40 *micron size by* ball milling and hydraulic classification. Deck slope: 2 inches to 1 foot, feed rate: 1 gallon per minute per foot width of deck, feed pulp density: approximately 10 per cent solids.

7. In each case the low grade tilting deck concentrate was upgraded by careful tabling to approximate the grade in the composite concentrate obtained by tabling operations down to minus 200 mesh size.

All stage grinding was carried out using short time intervals to minimize the production of fines.

Summary

1. Gravity concentration by progressive stages with grinding of tailings between stages as outlined above permits of high recoveries of tin in low grade concentrates. A recovery of 80.9 per cent in the concentrate assaying 4.12 per cent tin has been obtained by tabling alone down to minus 200 mesh and compares fairly closely with the result obtained in Investigation R.421/9 (recovery: 83.5, concentrate grade: 3.38 per cent tin).

2. Retreatment of table tailings on tilting decks with upgrading of deck concentrate shows a significant increase in recovery from 80.9 per cent to 85 per cent.

3. Inclusion of the total tilting deck concentrate (no upgrading) with the table concentrates shows recoveries of 87.6 per cent but concentrate grade is depreciated to 3.2 per cent tin.

4. Regrinding of minus 200 mesh table tailings prior to concentration by tilting decks gives no gain in overall recovery.

Tabulated Results

1. TABLE CONCENTRATION TO MINUS 200 MESH SIZE

Product.	Per Cent		Tin Distribution	
	Weight	Tin	Per Cent	Per Cent Cum.
Initial grind—				
— 60 + 200 mesh conc.	15.82	2.84	43.2	....
— 200 mesh conc.	3.31	8.69	27.6	70.8
1st Regrind—				
— 100 + 200 mesh conc.	0.31	8.58	2.6	....
— 200 mesh conc.	0.44	8.45	3.6	77.0
2nd Regrind—				
— 150 + 200 mesh conc.	0.12	6.53	0.7	....
— 200 mesh conc.	0.31	7.35	2.2	79.9
3rd Regrind—				
— 200 mesh conc.	0.12	8.71	1.0	80.9
Comp. Table Conc.	20.43	4.12	80.9	80.9
— 200 mesh Table Tailing	79.57	0.25	19.1	100.0
Composite ore	100.00	1.04	100.0	....

2. TILTING DECK CONCENTRATION OF MINUS 200 MESH TABLE TAILING

(a) No further grinding

Deck Conc.—Table Conc.	0.66	6.34	3.9	....
Deck Conc.—Table Tail	8.35	0.34	2.7	....
Comp. Deck Conc.	9.01	0.78	6.6	6.6
Deck Tail	70.56	0.19	12.5	19.1
Comp. — 200 mesh Table Tailing	79.57	0.26	19.1	....

(*b*) *After grinding to minus* 40 *microns*

Deck Conc.—Table Conc.	0.91	4.99	4.3	....
Deck Conc.—Table Tail.	7.10	0.35	2.4	....
Comp. Deck Conc.	8.01	0.87	6.7	6.7
Deck Tail	71.56	0.18	12.4	19.1
Comp. — 200 mesh Table Tailing	79.57	0.25	19.1	....

3. OVERALL CONCENTRATION—TABLE AND TILTING DECK

(*a*) *Without further grinding of minus* 200 *mesh table tailing*

Product	Per Cent Weight	Per Cent Tin	Tin Distribution Per Cent
Table Concs. to minus 200 mesh	20.43	4.12	80.9
Deck Conc.—Table Conc.	0.66	6.34	3.9
Total gravity concs.	21.09	4.19	84.8

(*b*) *After grinding the minus* 200 *mesh tailing to minus* 40 *microns*

Table Concs. to minus 200 mesh	20.43	4.12	80.9
Deck Conc.—Table Conc.	0.91	4.99	4.3
Total gravity Concs.	21.34	4.16	85.2

Inclusion of the whole tilting deck concentrate (i.e. without upgrading by tabling) gives the following results:

in the case of (*a*)			
Total gravity concs.	29.44	3.10	87.6
in the case of (*b*)			
Total gravity concs.	28.44	3.21	87.6

Reference

MANSON, W. St.C., LIDDY, J. and JAMES, P. L., 1964.—R.421: Concentration of a bulk sample from Mount Cleveland, Tasmania. *Tech. Rep. Dep. Min. Tas.*, 8, 158-179.