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R.683. Analysis of sediment samples from Macquarie Harbour.

P.L. James
H.K. Wellington
D. Clements

Three samples were obtained from S.R.M. Harvey during drilling investigations of the unconsolidated sediment in Macquarie Harbour. The aim of the investigation was to determine the valuable metals present, undertake some studies on their recovery in concentrates, and assess the possible usage of residues for brick manufacture.

Descriptions and locations of the samples were as follows:

Reg. No.	*Harvey No.*	*Description*
740477	HOLB 321	Northern half of Harbour, top 4 metres.
740630	HOLB 324	Southern half of Harbour, top 4 metres.
740854	HOLB 329	Sulphide rich top layer of sediments.

Metallurgical work was undertaken only on the sulphide rich sample (740854).

The samples were received in a very wet condition and for sampling purposes the semi-plastic material was dispersed into a thick pulp by addition of water and a small amount of calgon in a 10 kg flotation machine. Suitably sized samples were withdrawn by syphoning from the agitated pulp.

Assays of head samples

Item	*740477*	*740630*	*740854*
	g/t	*g/t*	*g/t*
Cu	210	22	880
Zn	160	150	220
Pb	27	14	68
Co	17	<13	∿80
Mo	21	17	40
U_3O_8	19	19	<16
Br	140	150	< 5
I	<9	<9	<12
Ni	25	39	
As	40	26	
B	33	28	
Au			nil
Ag	<0.5	<0.5	trace
			%
Fe			9.1
S			4.7
SiO_2			70.4

SIZING ANALYSIS

A sizing analysis of sample 740854 was done by wet and dry screening and by cyclosizing of the -38 μm material.

Table 1. SIZING ANALYSIS OF SAMPLE 740854.

Fraction	% Mass	Cu %	Zn %	Fe %	S %	Ba %	Pb ppm	Co ppm	Mo ppm	U_3O_8 ppm	% Distribution Cu	Zn	Pb
+150 µm +75 µm	0.1 16.1	0.08	0.02	4.0	0.40	0.19	44	<5	25	39	16.1	16.0	8.3
+53 µm	21.8	0.08	0.02	7.4	2.8	0.35	44	<5	35	27	21.5	22.0	11.1
+45 µm	5.9	0.10	0.03	11.8	7.6	0.65	60	<5	32	<18	7.3	9.0	4.1
+38 µm	9.0	0.10	0.03	13.9	8.9	0.73	60	<5	34	<18	11.1	13.5	6.3
C/S1	1.0	0.28	0.03	42.7	44.4	2.2	244	<5	<4	<18	3.5	1.5	2.8
C/S2	1.9	0.24	0.04	36.1	31.6	2.7	147	<5	<4	<18	5.7	3.5	3.2
C/S3	8.4	0.08	0.02	12.8	8.1	0.85	67	<5	49	<18	8.3	8.5	6.5
C/S4	8.2	0.06	0.02	10.5	5.4	0.67	68	<5	52	<18	6.1	8.0	6.5
C/S5	4.4	0.06	0.03	10.5	4.5	0.66	78	<5	55	<18	3.2	6.5	4.0
O/F	23.2	0.06	0.10	6.3	1.7	0.62	175	<5	25	<18	17.2	11.5	47.2
Composite Head	100.0	0.08	0.02	9.1	4.7	-	86	<5	40	<16	100.0	100.0	100.0

Cyclosizing temperature: 5°C.

CONCENTRATION BY FROTH FLOTATION

An attempt was made to concentrate the copper and zinc by flotation. The method employed was to make a bulk sulphide concentrate which was then suitably conditioned for the selective flotation of copper and zinc sulphides.

Test conditions

	Reagent		*g/t*
Bulk sulphide flotation	Copper sulphate		500
	Sodium ethyl xanthate		250
	Potassium amyl xanthate		250
	Sulphuric acid (to pH 4.5)		
	Teric 401 (frother) approx.		5
	Conditioning time	5 minutes	
	Flotation time	15 minutes	
Copper flotation	Lime (to pH 10.0)		
	Sodium cyanide		25
	Aerofloat 238		50
	Teric 401		∿2.5
	Conditioning time	5 minutes	
	Flotation time	10 minutes	
Zinc flotation	Copper sulphate		50
	Aerofloat 15		50
	pH 9.0		
	Conditioning time	5 minutes	
	Flotation time	10 minutes	

Test results

		Assays (%)			*% Distribution*		
Product	*% Mass*	*Cu*	*Pb*	*Zn*	*Cu*	*Pb*	*Zn*
Copper concentrate	0.7	1.8	0.05	0.18	10.1	5.5	3.8
Zinc concentrate	1.6	0.78	0.03	0.06	10.1	6.8	3.0
Zinc tailing	9.8	0.43	0.02	0.05	33.9	27.4	14.6
Composite bulk sulphide concentrate	12.1	0.56	0.02	0.06	54.1	39.7	21.4
Bulk FT	87.9	0.065	0.005	0.03	45.9	60.3	78.6
Composite Head	100.0	0.12	0.007	0.03	100.0	100.0	100.0

CERAMIC TESTS

This work was limited to brick manufacturing tests, and the material investigated was the relatively sulphide free bulk sulphide tailing from the flotation testing.

The test pieces were made by semi-dry pressing at 8-10% moisture. The green bricks were very fragile and required careful handling to avoid damage.

Firing took place at 1000°C, with 4 hours soaking at this temperature.

The fired products were easily abraded and showed little physical strength. Shrinkage in both drying and firing was minimal and no significant bonding accurred.

The material has not apparent use for ceramic purposes.

SUMMARY

The sizing analysis of the material in which both screening and hydraulic methods were employed shows no significant concentration of valuable metals in any particular size range except C/S1 and C/S2. There is some concentration of copper in these two fractions but this represents only about 8% of the total copper. There is also a slight concentration of U_3O_8 in the +53 µm material but the level does not appear to be significant.

The results indicate that concentration by screening and/or hydraulic cycloning would not be effective.

Bulk sulphide flotation has resulted in a significant concentration of copper in the concentrate assaying 0.56% Cu and containing 54.1% of the total copper. However, selective flotation by well established methods, failed to effect any significant improvement in grade of concentrate (Cu concentrate assayed 1.8% Cu), and recovery deteriorated to 10%.

It is doubtful whether regrinding before selective flotation or leaching of the bulk concentrate would be economically viable and these aspects were not investigated.

Brickmaking tests on the flotation residue indicated that the material would be unacceptable for this purpose.

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