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Survey of Mineral Resources in South Australian and Victorian Tailings Dumps

by

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INTRODUCTION

This Report completes the series of reports covering an investigation into elements present in some of the larger tailings dumps in Australia.

A preliminary literature survey indicated that it was unlikely that dumps in South Australia or Victoria would contain much of interest, and it was subsequently decided that field work was not justified. Instead, leaseholders, Exploration Companies and State Mines Departments were invited to submit samples for analysis, and provide data for inclusion in the survey. A period of over twelve months having elapsed with only limited response to this request, this report has been prepared to conclude the survey in these two states.

SOUTH AUSTRALIAN DUMPS

A survey of State Mines Department and other publications suggested that appreciable quantities of tailings material would have been produced during mining operations at Waukeringa and Ediacara; copper mines at various locations including Wallaroo and Moonta; State Batteries; gold mines in the Adelaide hills and Uranium mining at Radium Hill. A summary of the information collected is set out in the following paragraphs.

WAUKERINGA

Operations at this gold mining area north of Yunta are reported in Campana and King, 1958 at page 126. The main production occured during the period 1872-1889 when ore of 17 dwt. per ton grade was treated and tailings, probably in excess of 50,000 tons, accumulated. Abell and Gartrell, 1937, reported unfavourable results in tests on the cyanidation of this material. The tailings were strongly acid and water washing, though effective in reducing the lime requirement from 370 lb. per ton to 25lb per ton led to a loss of 20% of the contained gold. Cyanide consumption was also high and water washing and additions of lead acetate produced little effect on this. Concentraton by tabling produced a low grade concentrate with poor recovery.

Samples for the present survey were supplied by the leaseholder, Mr. W.S. Edwards from North and South-east Dumps. They were subject to spectrographic analysis and tests for sulphur, selenium and radioactivity along the lines of the tests carried out previously on tailings samples.

Results of these tests for the two samples numbered 67/24/002 and 67/24/003 respectively are listed in Table 1. Copper, lead, zinc , arsenic and cobalt are the only metallic elements of note, and even the most abundant of these is only at 0.03%. Gold was not detected because of the limited sensitivity of the method for this element. The high sulphur content of the samples (11.3% and 10.0%) is not surprising in view of the high acidity reported by Abell and Gartrell.

EDIACARA

Nixon, 1963, reports on the geology and past history of this lead mining area. Production recorded is very small and any tailings and slag accumulations are unlikely to be large enough to warrant further consideration here.

BLINMAN

A treatment plant operated at the Blinman Copper Mine during the period 1882-1884 and for a period from 1888. Dumps of "skimps" or tailings sands (6,000 tons at 3% Cu) and slimes (4,800 tons at 3.7% Cu) remain from these operations. There is also approximately 63,000 tons of slag containing 0.6%Cu and 5,000 tons containing 1.7% Cu remaining from smelting operations, according to the South Australian Mines Department (S.A.M.D., 1966).

Gartrell and Blaskett, 1943, reported on the result of metallurgical test work on the sand and slime dumps. The principal mineral in the tailings appeared to be dolomite (74%) and any low grade concentrate would be highly basic and unattractive to smelters. The sands did not respond well to gravity concentration methods or flotation. Recoveries and concentrate grades were both low. The poor results were due to the presence of one third of the copper in the oxidised form. The slimes were too fine for the application of gravity methods and being even more oxidised than the sands the response to flotation was even poorer.

The geological background to this deposit is discussed in Coats , 1964, while Dickinson, 1944 (a) gives some historical detail.

KAPUNDA

The geological background and history of this copper mining area is given in Dickinson 1944 (b). More recent work has been carried out by Mines Exploration Pty. Ltd., who forwarded a sample representing about 15,000 tons of material apparently remaining after treatment in the leaching plant built in 1866. Approximately 50 separate samples were taken from the upper, middle and lower portions of the dump after digging below the surface layers. These individual samples were combined and quartered down to produce the final sample.

The sample was numbered 67/24/007; the test results appear in full on table 1. Copper was reported as being in the "heavy trace" range of 0.1%-1% and this agrees with the assay of 0.3% supplied by the company for this sample. The uranium content was slightly above normal at 0.003% U_3O_8.

The South Australian Mines Department reports the largest dump of material at Kapunda as 5,000 tons at 0.38% copper (S.A.M.D. 1966 and Armstrong 1941 (b)). The total tonnage - 6,000 tons according to the Mines Department or 15,000 tons estimated by the company, is not large enough to have any economic value apart from possible processing in connection with some scheme for a revival of mining and treatment in the area as a whole.

BURRA

Dickinson 1942 (a) gives some of the geological and historical background to this copper mining area. Gravity concentrating machinery was installed in the period 1867-1869 and used on lower grade material mined by open cut until the mine closed in 1877. Most of the 200,000 tons averaging 1.17% Cu in dumps mentioned in S.A.M.D. 1966 is low grade ore rather than treatment plant tailings. Of a total of 700,000 tons of material mined, 479,000 tons were removed during the open cut operation mentioned above when 20,000 tons of dressed ore were produced. Johnson, 1963, also discussss the geology of the deposits.

This area has also been the subject of a recent investigation by Mines Exploration Pty. Ltd. and they forwarded a composite sample (67/24/008) made up as described for the Kapunda sample. Test results are listed in Table 1. Copper in the "minor range (1%-10%) agrees with the figure of 2.75% supplied by the company for the sample. It should be noted that this sample refers only to 20,000 tons of tailing type material identified by the company and not to the 200,000 tons in all kinds of dumps. Here again the tonnage of tailings is too small to be of much interest by itself, but would be relevant in the context of any future plan to revive mining and treatment in the area.

WALLAROO AND MOONTA

Dickinson 1942 (b) summarizes the extent of mining activity in this area in the period 1860-1923. Crude ore averaged 3½%Cu and at the Wallaroo Mines group near Kadina about 3½ million tons were mined and concentrated to about 9% Cu before despatch to the smelters. At the Moonta Mines group near Moonta 2¾ million tons were mined and concentrated to about 14% Cu before despatch.

Smith, 1953 describes metallurgical test work on the Wallaroo Mines dumps which were estimated at a total of 666,476 tons with an average grade of 0.63% copper. One dump of 40,000 tons was as high as 1.75% Cu, and a bulk sample from this dump was chosen for test work. Examination of this sample showed that about 36% of the copper was present in the oxidised form and that 74% was in -325 mesh particles. These two facts resulted in a limited recovery by flotation under the best conditions of 68% in a concentrate grade of 6.7% copper.

Test work in 1953 was also carried out on a sample from the largest dump containing almost 450,000 tons of tailings. Maximum recovery by flotation after regrinding was 48.6% in a concentrate grade of 5.9% Cu.

The South Australian Mines Department also reported the presence of a slag dump at Wallaroo estimated at 1.2 million tons containing 0.59% Cu - (S.A.M.D. 1966).

Investigations into recovery of values in the Moonta Mines tailings dumps were reported in the South Australian Mining Review (S.A.M.R. 1951). During the period 1925-1943 sands in this area were leached using sea water. 1.2 million tons containing 0.16% recoverable copper remained in 4 dumps in 1951, but tests indicated that it could not be economically recovered at that time. It is reported that much of this material has since been removed for road surfacing in the area.

CALLINGTON - KANMANTOO

A number of copper mines were opened in this area, but they were mostly very small. Hand picked ore appears to have been sold or smelted locally; there do not appear to be any dumps of tailings material. Armstrong, 1941, reports the presence of slag dumps estimated at 4,000 tons containing 0.5% copper at the Bremer mine and 5,500 tons at 0.7% copper in the Kanmantoo/Dawesley area.

STATE BATTERIES

A table appearing regularly in the South Australian Mining Review reporting cumulative tonnages treated at State Batteries was terminated in 1955 (S.A.M.R. 1955). At this time the figures for the main centres were as follows:- Mt. Torrens 24,060, Peterborough 11,889, Mongolata 7,480, Tarcoola 32,987 and Glenloth 3,699. These tonnages resulting from gold treatment operators do not warrant further consideration in the present survey.

ADELAIDE HILLS

There have been a number of small gold producers in the Adelaide Hills, but it would appear that in few cases did tonnages treated reach 20,000 tons. Among the more important localities were Reefton Heights and Deloraine. The tonnages are too small to warrant further consideration here.

RADIUM HILL

Tailings from the treatment plant at the mine were confined to three dumps known as Nos. 1,2, and 3. The South Australian Mines Department sampled No.1 dump on a grid pattern by boreholes and an exhaustive laboratory and pilot scale programme of tests was carried out at the Australian Mineral Development Laboratories.

The dumps averaged 0.8 lb U_3O_8 per ton and contained approximately 100,000 tons of material. Other dumps contained unmeasured quantities of material known to be of lower grade. The best results from testing No. 1 dump sample were concentrates of 8.68 - 15.3 lb U_3O_8 per ton with a recovery of 65% after 3 stages of recleaning. Details of the tests are recorded in unpublished Amdel reports by Hosking and Moscovits, 1960 and Sheridan and Hosking, 1960.

VICTORIAN DUMPS

Although substantial quantities of material would have been produced during the course of many years gold mining in Victoria, considerable quantities have been discharged directly into creeks, or used since for filling, road construction and other purposes.

The Victorian Department of Mines were invited to submit samples for analysis in the survey, but at the time of writing none had been received.

Companies active in prospecting and exploration were also approached, but generally did not find any material suitable for the Survey.

Unfortunately a sample of tailings from the Bethanga mine near Albury forwarded by Mines Exploration Pty. Ltd. failed to arrive and was not tested. Some idea of the character of this material may be obtained from Woodcock, 1962. No details as to the size of the dump tested were given but total tailings in the area were estimated at 60,000 tons. The main mineral mined was gold, complicated by the presence of sulphides. Watson, 1942 described the treatment plant then operating on a somewhat similar ore at Talgarno (see Vincent 1942).

CHEWTON

Wattle Gully Gold Mines N.L. supplied samples of dump material and reported that there were an estimated 262,000 tons of battery tailings on the mine, together with 146,000 tons in a dump from the currently operating flotation treatment plant and 6,200 tons of residues from treatment of the flotation concentrates. These samples were numbered 67/24/005, 6 and 7 and results of analysis are listed on Table 1. Concentration of arsenic, lanthanum and cerium in the concentrate cyanidation residues are noteworthy, though probably not of economic interest.

Woodcock, 1963, reported on the cyanidation of tailings from the battery previously operated and concluded that a high recovery was possible with low reagent consumption and contact time. However, head values of the samples supplied were all below 1.1 dwt/ton.

CONCLUSION

None of the dumps sampled were themselves likely to be of economic interest, but in the event of a rise in the price of gold, some tailings retreatment might be worth while where metallurgical requirements are such that costs will be low.

REFERENCES

ABELL L.M. and GARTRELl, H.W.	1937	Tailing from the Victoria and Alma Mine, Waukeringa, South Australia. S. Aust. Min. Rev. 66, 55.
ARMSTRONG, A.T.,	1941(a)	Copper slag dumps, Hundred of Kanmantoo. Ibid. 74, 50-51
ARMSTRONG, A.T.,	1941(b)	Kapunda copper mine. Ibid 75, 51-52.
CAMPANA, B. and KING, D.	1958	Regional geology and mineral resources of the Olary Province. Geol. Surv. S. Aust. Bull. 34, 126.
COATS, R.P.	1964	The geology and mineralization of the Blinman Dome diapir Geol. Surv. S. Aust.Report of Investigation 26.
DICKINSON, S.B.	1942(a)	The structural control of ore desposition in some South Australian copperfields, No.1. Geol. Surv. S. Aust. Bull. 20, 66-78.
DICKINSON, S.B.	1942(b)	Idem. Ibid 7-39.
DICKINSON, S.B.	1944(a)	The structural control of ore deposition in some South Australian copperfields No.2. Ibid 21, 28-40.
DICKINSON, S.B.	1944(b)	Idem. Ibid 6-27.
GARTRELL, H.W. and BLASKETT, D.R.	1943	Blinman copper mine dumps. S. Aust. Min. Rev. 76, 58-64
HOSKING, P.K., and MOSCOVITS, E.E.	1960	Radium Hill tailings dumps. AMDEL 40. Unpub. Rpt. Rpt. BK. 51/113.

JOHNSON, W.	1963	A re-interpretation of the Burra Burracopper deposits Proc. Aust. Inst. Min. Metall. 206, 63-92.
NIXON, L.G.	1963	The Ediacara mineral field. Ibid 93-112.
S.A.M.D.	1966	Mine and tailings dumps in South Australia. Unpul. Rpt. D.M. 1289/60.
S.A.M.R.	1951	Moonta tailings dumps - copper extraction investigation S. Aust. Min. Rev. 94 9-10.
S.A.M.R.	1955	Tonnages treated at state Batteries. Ibid. 103, 16.
SHERIDAN, D.G. and HOSKING, P.K.	1960	Re-treatment of Radium Hill tailings dumps, second report, pilot plant tests. AMDEL 64 Unpub. Rpt. Rpt Bk 51/114.
SMITH, A.D.	1953	Wallaroo slime dumps. S. Aust. Min. Rev. 99, 220-221.
VINCENT, F.W.	1942	Notes from the Beachworth Mining District. Min. geol Jnl. 2, 325.
WATSON, J.C.	1942	Treatment of refactory arsencial ore at Talgarno Ibid. 2, 319-323.
WOODCOCK, J.T.	1962	Treatment of calcine dump from Bethanga, Victoria. CSIRO-Univ. Melb. Ore Dressing Investigations 629.
WOODCOCK, J.T.	1963	Cyanidation of battery tailings from Wattle Gully Gold Mines N.L., Chewton, Victoria. Ibid. 640.

TABLE 1

SURVEY OF MINERAL RESOURCES IN TAILINGS - DETAILED RESULTS VICTORIA AND SOUTH AUSTRALIA

Sample Location and Mark.	Quantitative Analysis by Emission Spectroscopy - %.					Semi - Quantitative Analysis by Emission Spectroscopy - %	Chemical Analysis.		Radio-activity % U_3O_8 equivalent.	Estimate of Tonnage in Dump.	Date Sampled & Remarks.
	Minor 10 - 1	Heavy Trace 1.0 - 0.1.	Trace 0.1 - 0.01	Faint Trace 0.01 - 0.001	Very Faint Trace (a) 0.001 - 0.0001		S-%	Se-ppm			
Waukeringa - North Dump - 67/24/002 (b)			Cu, As, Mn, Rb, P, Ba, Y.	Pb, Zn, Co, Sr, B, Zr.	Ni, Ag, Cr, V, W, Be, MO, Ga, Ge, Nb, Li, Sc, La, Ce, Sn.	Mn, 0.06%, As 0.03% Cu 0.01%.	11.3	8	0.001	50,000	8/2/67
Waukeringa - South East Dump. 67/24/003 (b)			As, Mn, Rb, Ba, P, Y.,	Cu, Zn, Co, Sr, B, Zr.	Pb, Ni, Ag, Cr, V, W, Be, Mo, Ga, Ge, Nb, Li, Sc, La, Ce, Sn.	Mn, 0.05%, As 0.015%, Rb 0.015%.	10.0	2	0.001		8/2/67
Wattle Gully Gold Mines Flotation Tailings 67/24/004 (b)			As, Mn, Rb, Ba, P	Zn, Ni, Cr, V, Nb, Li, Sr, B, Zr, Sc.	Cu, Pb, Co, Sn, Ag, W, Be, Mo, Ga, Ge, La, Y, Ce.	As, 0.04%, Rb 0.03%.	0.1	2	0.001	146,000	10/2/67
Wattle Gully Gold Mines, Concentrate Cyanidation Residues 67/24/005 (b)	As		Cu, Pb, Zn, Co, Ni, Mn, Rb, Ce, Ba, Zr, La, Y.	Cr, V, W, Ga, Li, Sr, B, Sc.	Sn, Ag, Be, Mo, Ge, Nb, P.	As 10%, Ni 0.03%, La 0.03%, Ce 0.07%	17.9	30	0.003	6,200	10/2/67
Wattle Gully Gold Mines, Battery Tailings 67/24/006 (b)			As, Ba, P, La, Y.	Pb, Zn, Cr, V, Mn, Rb, Li, Sr, Zr, Sc.	Cu, Co, Ni, Sn, Ag, W, Be, Mo, Ga, Ge, Nb, B, Ce.	As 0.025%, Y 0.02%, La 0.015%.	0.09	2	0.002	262,000	10/2/67
Mines Exploration Pty. Ltd. - Kapunda Dump 67/24/007	Na,K,Mg, Fe.	Cu,Ti,Al, Ca.	Li, Rb, Cr, V, Ba, P.	Co, Ni, Mo, Ga, As, B.	Pb, Sn, Bi, Ag, [illegible], Be, Ge, Mn, Sr.		1.50	2	0.003	15,000	1/6/67
Mines Exploration Pty. Ltd. - Burra Dump. 67/24/008.	Na,K,Cu, Ca,Mg,Fe.	Al.	Li, Rb,Cr, V, Ti, Ba, P.	Mo, Ga, As, Mn, Sr, B.	Pb, Co, Ni, Sn, Bi, Ag, Ge.		0.075	2	0.002	20,000	1/6/67

(a) Includes elements detected, but below the threshold for semi quantitative determination.

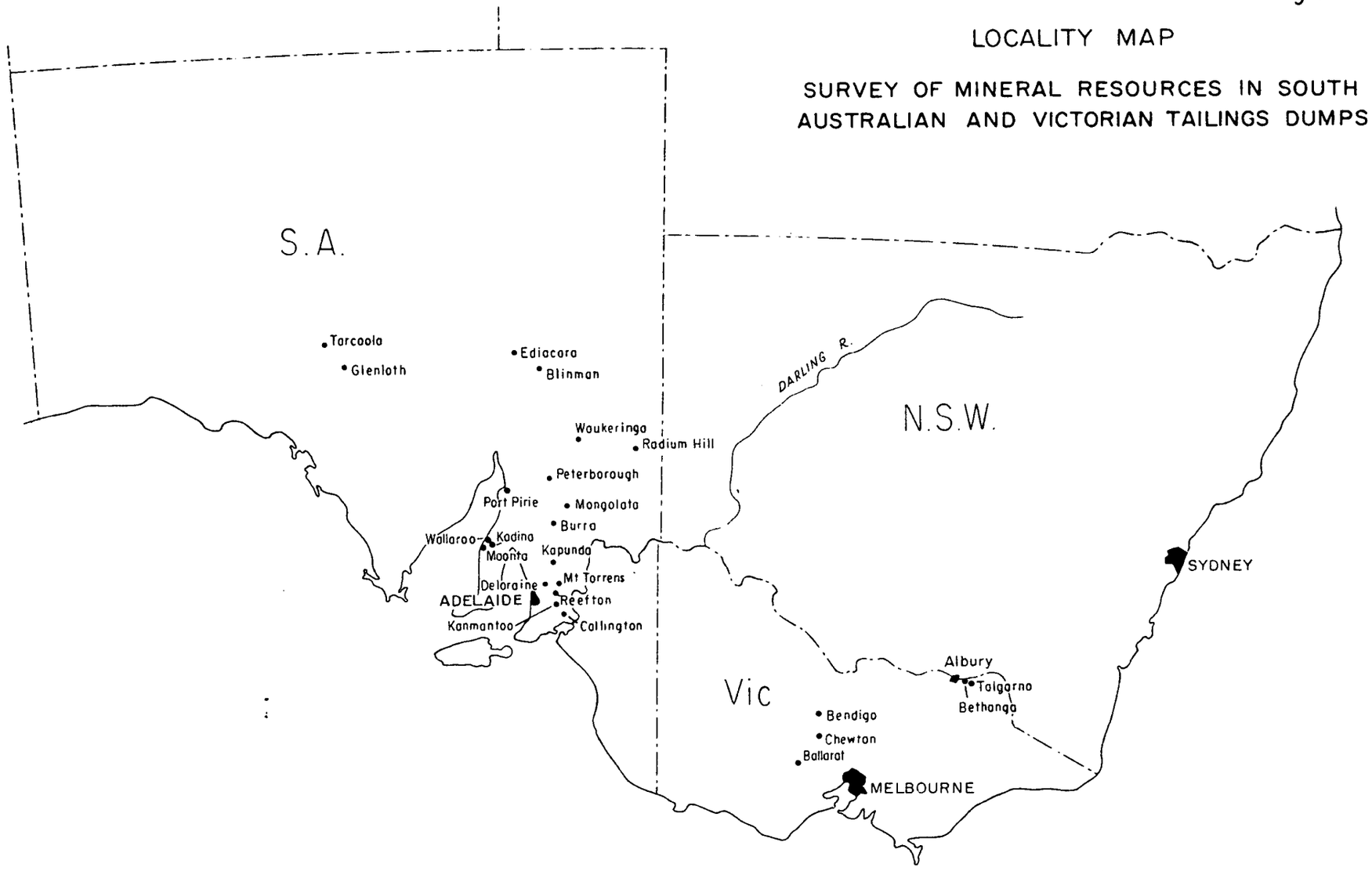
(b) Not detected : Cd, Au, In, Pd, Sb, Ta, Os, Ir, Pt, Rh, Ru, Te, Tl, Cs.

TRIMMING MARGIN

Fig. 1

LOCALITY MAP

SURVEY OF MINERAL RESOURCES IN SOUTH AUSTRALIAN AND VICTORIAN TAILINGS DUMPS



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