

Metallurgical Test Work
of Gold Tailings at
Mathinna, N.E. Tasmania.
MLS 32M/81 & 30M/74

84-2280.
Restricted.

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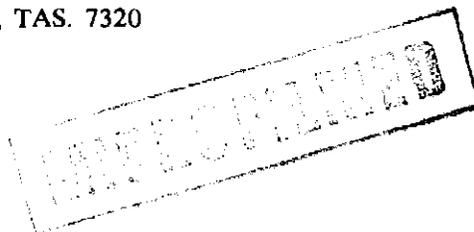
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26 September, 1983

The Managing Director,
Tasminex N.L.,
230 Mount Road,
UPPER BURNIE 7320

ATTENTION: Messrs Boland and Charlton .

Dear Sirs,

re: Metallurgical Testwork on Gold Tailings at Mathinna,
North East Tasmania

The head assay analysis of the two Mathinna samples has been completed. The results are enclosed.

The gold assay of the residue sample (0.26 ppm) is lower than previous analysis and will be resampled and assayed. The mineralogical report on these samples is still awaited. Bottle Roll leach tests will commence on these samples to investigate the ore response to cyanidation.

Yours faithfully,

D. J. Stribley,
Development Metallurgist.

*Checked
20/9/83*

HEAD ASSAY ANALYSIS OF MATHINNA TAILINGS

ELEMENTAL

	SAND TALINGS NO. 7365	RESIDUE NO. 7366
Ag ppm *	15.9	14.6
Au ppm *	1.45	0.28
As %	0.26	0.26
Mo ppm	<5.0	10.0
Ni ppm	75.0	40.0
Pb ppm	150.0	200.0
S %	0.10	0.14
Sb ppm	<5.0	<5.0
Sr ppm	75.0	150.0
V ppm	60.0	90.0
Zn ppm	175.0	210.0
Zr ppm	75.0	100.0
B	830.0 ppm	0.23%
As %	0.28	0.28
Be ppm	<5.0	<5.0
Bi ppm	<5.0	5.0
Cd ppm	10.0	10.0
Co ppm	10.0	15.0
Cr ppm	50.0	60.0
Cu ppm	80.0	75.0
Hg ppm	<10.0	<10.0
Li ppm	35.0	40.0

* Assays by fire assay method

All other assays by ICP

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HEAD ASSAY ANALYSIS OF MATHINNA TAILINGS

WHOLE ROCK ANALYSIS

	SAND TAILINGS	RESIDUE
SiO ₂ %	86.3	81.5
Al ₂ O ₃ %	5.91	9.73
TiO ₂ %	0.30	0.52
Fe ₂ O ₃ %	2.54	3.59
MnO %	0.05	0.06
MgO %	0.44	0.69
CaO %	0.07	0.17
Na ₂ O %	0.16	0.16
K ₂ O %	1.27	2.08
P ₂ O %	0.60	0.30
C %	0.60	0.30
Te ppm	<50.00	50.00

Date 21 OCTOBER, 1983 Ref 30.6.4
 To S. S. Meik From D. J. Stribley
 At Burnie At Burnie
 Copies to GCT, ~~Mr E. Charlton-Tasminex~~ Keep

Subject Mathinna Testwork

As part of the current Mathinna project it was requested that values for the bulk density of the two Mathinna tailings samples be determined. The values obtained at CMS for bulk density and % moisture are given in the table below together with values determined during earlier investigations.

	<u>SAND</u>	<u>RESIDUE</u>
HUGHES (1948)(Tons/m ³)	2.16 ^{2.2} _{1.73}	1.86 ✓
DALY (1981)	1.44	1.73
CMS (1983)	1.59	1.59
% Moisture	12.5	8.9

After reviewing the literature it is apparent that none of the estimates of the tonnage of the dumps have taken into consideration the moisture content of the material.

Total Mass (tonnes) = Total Volume (M³) x bulk density x % Solids.

CMS has calculated the moisture content to be approximately 9-12%. This would be a conservative estimate. If moisture content has not been considered the total tonnage and hence gold value could be overestimated by a factor of 10-15% ?

The change in moisture content and degree of compactness are the two main reasons for the variation in bulk density measurements that have been recorded.


D. J. STRIBLEY

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File No. 30.6.4

19 December 1983

The Managing Director,
Tasminex N.L.,
BURNIE. 7320

ATTENTION: Mr R. M. Boland and Mr E. Charlton

Dear Sirs,

The suitability of cyanide leaching to the Mathinna tailings materials has been reassessed by performing six bottle roll tests on the 2 samples. The conditions for each test were as follows :-

- Test A : Mathinna sand tailings - no grind
- B : Mathinna sand tailings - ground to -75um
- C : Mathinna sand tailings - ground to -75um with
activated carbon addition
- D : Mathinna residue tailings - no grind
- E : Mathinna residue tailings - ground to -75um
- F : Mathinna residue tailings - ground to -75um with
activated carbon addition

In all tests 200 gms of tailings was leached with a 0.25% NaCN solution at a pH of 10.0. Leaching continued for a 72 hour period with analysis of liquor and residue after 24, 48 and 72 hours. Assays for Au and Ag were performed by AMDEL, feed and final residues were performed in duplicate.

The test results are shown in the table enclosed and indicate recoveries based on both solution assays and residue assays. The recovery based on the carbon extraction stage in tests C & F is also given. The variation in quoted recoveries is an indication of difficulties associated with sampling and assaying of precious metal samples.

D. J. Stribley,
Development Metallurgist.

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unpaired
-75u -75u with residue

RESULTS FROM BOTTLE ROLL LEACH TESTS ON MATHINNA SAMPLES

	<i>Sand</i>			<i>Residue</i>		
	A	B	C	D	E	F
<u>ASSAY (AU ppm)</u>						
<u>HEAD</u>						
a	1.2	1.8		0.7	0.8	
b	1.5	1.6		0.6	0.8	
Ave	1.35	1.7 →		0.65	0.8 →	
<u>RESIDUE</u>						
after 24 hours	1.1	0.9	0.9	0.5	0.6	0.5
48 hours	0.8	0.8	0.8	0.5	0.5	0.5
72 hours a	0.7	1.0	0.8	0.8	0.5	0.4
b	0.7	1.0	0.8	0.75	0.5	0.45
<u>SOLUTION</u>						
after 24 hours	0.21	0.25	0.01	0.13	0.14	0.01
48 hours	0.30	0.39	0.01	0.17	0.17	0.01
72 hours	0.30	0.41	0.01	0.17	0.18	0.01
<u>CHARCOAL</u>						
			7.1			3.7
<u>RECOVERY %</u>						
Based on Residues (72 hours)	48	41	53	0(?)	38	44
Based on Solutions (72 hours)	41	45	-	48	42	-
Based on Charcoal			42			46

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FILE NO: 30.6.4

21 December 1983

The Managing Director,
Tasminex N.L.,
19 Marine Terrace,
BURNIE 7320

ATTENTION: Messrs Boland and Charlton

Dear Sirs,

You now have the results from the recent bottle roll leach tests to determine the response of the Mathinna tailings material to cyanide. These preliminary tests suggested that the recovery of gold from the samples received would be in the range 45-50%. They also indicated that grinding the feed to pass 75 microns did not give better recoveries.

With the limited information that we have available to us regarding the ore body we are not in a position to recommend or advise you further on the potential of the deposit.

The recoveries that have been achieved in this latest set of results would appear to be bottom line figures when compared to other investigations reported in the literature. As the tests were of a preliminary nature and only involved straight cyanide leaching in bottle roll experiments we would propose to perform further tests to verify these results. These tests would involve agitated beaker tests using feed pre-aerated with lime, leaching with cyanide under controlled conditions with addition of oxidising agents. If recoveries from these tests show any improvement, column leach tests would commence to determine the response of the material to this type of test and thus simulate a heap leaching operation.

The above proposals were agreed to at our meeting on the 19th December and unless otherwise notified we will proceed with the required tests in mid January 1984.

The results will be reported in a similar format to that already advised, a summary of all the work performed on this project will be presented.

21 December 1983

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As previously mentioned we will be unable to give you any recommendations with regard to the potential of the deposit without access to much more detailed information. We would be happy to do this if you would like us to become more involved. In the meantime we look forward to completing the agreed tests.

Yours faithfully,

D. J. Stribley
D. J. Stribley,
Development Metallurgist

cc CS, KAF, ACG

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File No. 30.6.4

9 February 1984

The Managing Director,
Tasminex N.L.,
Marine Terrace,
BURNIE. 7320

ATTENTION: Mr R. M. Boland and Mr E. Charlton

Dear Sirs

A further assessment of Mathinna Tailings material has been performed using agitated beaker scale leach experiments with cyanide and strong oxidising conditions. A letter to you on the 21st December, 1983 described these experiments.

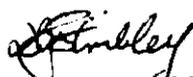
Four consecutive tests were conducted. The procedure for each test is shown in Table 1. The sample analysis and calculated recoveries are shown in Tables 2-5 for tests 1-4 respectively along with approximate NaCN consumption.

It should be noted that the tests were performed on -600um material (+600um material screened out prior to the tests). This was performed as tests had to be agitated in beakers with magnetic bar stirrers. The usual agitation equipment was occupied at the time. However, as the results show (size analysis table 6) an upgrading was achieved by removing the +600um material. The size analysis do provide interesting information on the distribution of gold with particle size in each sample.

The results from these latest tests appear to verify previous tests that the expected gold recovery from an agitated leach with cyanide would be in the range 40-50%. A heap leaching operation may not achieve these recoveries. Added to this is the high cyanide consumption (2-3 kg/tonne) which was apparent from the latest tests.

In our last communication with you, (Letter 21.12.83) we suggested that if reasonable recoveries were achieved we would pursue a larger column leach experiment with the Mathinna material. Do you now want us to continue with this testwork? Also do you want us to prepare a full report on our testwork or are the results summaries that we have submitted to you sufficient?

Yours faithfully,


D. J. Stribley,
Development Metallurgist.

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Att.

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TABLE 1: PROCEDURE FOR AGITATED LEACH TESTS

TEST 1	Preconditioned feed with lime for 1 hour. Leach with 0.25% NaCN solution for 48 hours at pH 10.0 and oxygen levels above 8.0 ppm - feed was sand tailing.
TEST 2	Preconditioned feed with lime for 1 hour. Leach with 0.25% NaCN solution for 48 hours at pH 10.0 and oxygen levels above 8.0 ppm - feed was residue tailing.
TEST 3	Preconditioned feed with lime for 1 hour. Leach with 0.25% NaCN solution for 48 hours at pH 10.0. Also added Pbo and KMnO_4 to maintain redox potential above 180 mV i.e. strong oxidising conditions - feed was sand tailing
TEST 4	As for test 3 except residue tailing

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ABERFOYLE METALLURGY - LEACH TEST SUMMARY

COST CODE 9.008..... JOB NO # 84/1B..... TEST NO # 1..... DATE 11 / 1 / 8
 TEST TYPE: Agitated ~~Bucket~~ ~~Rolls~~ ~~Pach~~..... VESSEL..... CONNICAL FLASK.....

SAMPLE AND LEACHING DATA:

SAMPLE ORIGIN..... MATHINNA-SAND TAIL..... PRE CONDITIONING HOURS..... 1.....
 SIZE RANGE..... 100% -600um..... LEACHING HOURS..... 48.....
 WT% SOLIDS..... 30%..... NACN CONSUMPTION KG/T..... 3.0.....

SAMPLE ANALYSIS:

	<u>Ag</u>	<u>Au</u>	1	2	Ave
HEAD	1.9	1.9	1.9
FINAL RESIDUE	1.0	1.3	1.15
FINAL SOLUTION	0.75		
CALC. HEAD			2.85

EXTRACTION %:

CALC. ON :

	<u>Ag</u>	<u>Au</u>
(a) Head & Residue	39.5
(b) Calc. Head & Residue	59.6
(c) Calc. Head & Solution	59.7

ABERFOYLE METALLURGY - LEACH TEST SUMMARY

COST CODE..... JOB NO #..... TEST NO #..... DATE...../...../.....
 TEST TYPE: Agitated ~~Batch~~ ~~Rolls~~ ~~Batch~~ VESSEL..... CONNICAL FLASK

SAMPLE AND LEACHING DATA:

SAMPLE ORIGIN..... MATHINNA-SAND TAIL..... PRE CONDITIONING HOURS..... 1
 SIZE RANGE..... 100% -600um..... LEACHING HOURS..... 48
 WT% SOLIDS..... 30..... NACN CONSUMPTION KG/T..... 2.7

SAMPLE ANALYSIS:

	<u>Ag</u>	<u>Au</u>	1	2	Ave
HEAD	1.9	1.9	1.9
FINAL RESIDUE	1.3	0.9	1.1
FINAL SOLUTION	0.6		
CALC. HEAD			2.5

EXTRACTION %:

CALC. ON :

	<u>Ag</u>	<u>Au</u>
(a) Head & Residue	42.0
(b) Calc. Head & Residue	56.0
(c) Calc. Head & Solution	55.0

ABENFOYLE METALLURGY - LEACH TEST SUMMARY

COST CODE 9.008 JOB NO # 84/1C TEST NO # 3 DATE 11 / 1 / 84
 TEST TYPE: Agitated/~~Batch~~/~~Rolls~~/~~Flotation~~ VESSEL CONNICAL FLAS

SAMPLE AND LEACHING DATA:

SAMPLE ORIGIN MATHINNA- RESIDUE PRE CONDITIONING HOURS 1
 SIZE RANGE 100% -600um LEACHING HOURS 48
 WT% SOLIDS 30 NACN CONSUMPTION KG/T 2.3

SAMPLE ANALYSIS:

	<u>Ag</u>	<u>Au</u>	1	2	Ave
HEAD	0.9	1.1	1.0
FINAL RESIDUE	0.6	0.4	0.5
FINAL SOLUTION	0.15		
CALC. HEAD			0.84

EXTRACTION %:

CALC. ON :

	<u>Ag</u>	<u>Au</u>
(a) Head & Residue	50.0
(b) Calc. Head & Residue	40.0
(c) Calc. Head & Solution	40.0

ABERFOYLE METALLURGY - LEACH TEST SUMMARY

COST CODE 9.008 JOB NO # 84/1A TEST NO # 4 DATE 11./...1./84
 TEST TYPE: Agitated/~~Stirred~~ ~~Batch~~ ~~Leach~~ ~~Tank~~ ~~Leach~~ ~~Tank~~ VESSEL CONNICAL FLASK

SAMPLE AND LEACHING DATA:

SAMPLE ORIGIN MATHINNA - RESIDUE PRE CONDITIONING HOURS 1
 SIZE RANGE 100% -600 μ m LEACHING HOURS 48
 WT% SOLIDS 30% NACN CONSUMPTION KG/T 3.0

SAMPLE ANALYSIS:

	<u>Ag</u>	<u>Au</u>	1	2	Ave
HEAD	0.9	1.1	1.0
FINAL RESIDUE		0.6	0.65
FINAL SOLUTION	0.20		
CALC. HEAD			1.11

EXTRACTION %:

CALC. ON :

	<u>Ag</u>	<u>Au</u>
(a) Head & Residue	35.0
(b) Calc. Head & Residue	41.4
(c) Calc. Head & Solution	41.3

TABLE 6: SIZE ANALYSIS OF MATHINNA SAMPLES

1. SAND TAIL

SIZE (μm)	wt (%)	Au (ppm)	Dist (%)
+3350	2.79)		
+2360	0.83)		
+1180	1.65)		
+ 600	4.34)	0.5	2.4
+ 300	19.91	1.6	15.9
+ 106	27.23	2.0	15.3
- 38	29.25	2.7	39.3
Head (Calc)	100.0	2.0	100.0

-600 μm head :- 1.9 ppm Ave

2. RESIDUE TAIL

+3350	3.62)		
+2360	1.50)		
+1180	2.85)		
+ 600	3.77)	0.5	7.4
+ 300	10.44	1.1	14.4
+ 106	16.16	0.8	16.3
+ 38	12.48	0.4	6.3
- 38	49.18	0.9	55.7
Head (Calc)	100.0	0.8	100.0

-600 μm head :- 1.0 ppm Ave

CYANIDE TESTING OF FOUR SAMPLES AS SUPPLIED BY TASMINEX N.L.

Four samples received in August and a repeat test of Drum 1 previously supplied were sampled and assayed.

HEAD ASSAYS

<u>SAMPLE</u>	<u>ASSAY</u>	<u>PREVIOUS ASSAY</u>
TSA	1.7 g/t	-
TSB	1.5 g/t	-
TSC	1.8 g/t	-
TSD	2.0 g/t	-
DRUM 1	1.7 g/t	1.50 g/t

As assays were in range expected cyanide tests were commenced.

PROCEDURE :

After slow drying 500g samples were taken. Five barrel agitation tests were run.

Additions to 500g Samples :

Limil	-	1g
Water	-	1000cc
NaCN	-	1g
Carbon	-	2.5g

Samples were agitated for 30 minutes and pH measured. 1g of limil was added and agitated for 30 minutes before measuring pH again. 1g of NaCN was added and agitation continued for a further 5 hours when NaCN concentration and pH were measured. Agitation was continued for a further 19 hours giving a total of 25 hours. NaCN concentration and pH were again measured and a 80cc pregnant solution sample was taken for assay. Carbon was added and agitation continued for a further 7 hours. Carbon was recovered by screening and dried for assay.

CYANIDE TEST RESULTS :

<u>SAMPLES</u>	<u>pH MEASUREMENT</u>				<u>NaCN %</u>		
	*						
	30min.	6hrs.	25hrs.	33hrs.	6hrs.	26hrs.	33hrs.
TSA	10.7	10.3	10.0	10.0	0.10	0.075	0.07
TSB	9.3	9.4	9.3	9.2	0.05	0.035	0.03
TSC	9.9	9.8	9.6	9.5	0.07	0.04	0.04
TSD	10.4	10.1	9.8	9.8	0.08	0.06	0.05
DRUM 1	11.3	11.3	10.8	10.6	0.10	0.095	0.095

* Limil had been added

ASSAY RESULTS :

<u>SAMPLES</u>	<u>PREGNANT SOLUTION</u>			<u>CARBON ASSAYS</u>	
	<u>SOLUTION ASSAY g/m³</u>	<u>EQUIVALENT g/t ORE</u>	<u>% RECOVERY</u>	<u>*ACTUAL g/t GOLD RECOVERED</u>	<u>RECOVERY %</u>
TSA	0.375	0.75	44.1	0.52 g/t	30.6
TSB	0.375	0.75	50.0	0.70	46.7
TSC	0.375	0.75	41.7	0.68	37.8
TSD	0.25	0.50	25.0	0.55	28.0
DRUM 1	0.50	1.00	58.8	0.78	45.9

* Adjusted for solution removed to assay and ...

DISCUSSION :

Lime consumptions were relatively low being similar to the previous samples. Cyanide consumptions were higher than previous samples. Maximum consumption is approximately 1.5 kilogram/tonne. Lime and cyanide consumptions for Drum 1 were very similar to the previous test.

Recovery of gold to solution ranged from 25% to 58.8% and averaged 0.75 g/t extraction. Drum 1 gave similar recoveries to previous test but the slightly higher head grade (1.7 g/t compared to 1.5 g/t) gave lower percentage recoveries. However, recovery to solution was still 1.0 g/t.

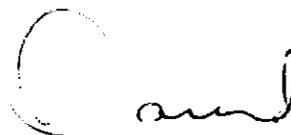
Recoveries to carbon were somewhat lower but they represent an accurate minimum recovery as the actual gold extracted is measured instead of relying on an assay of a solution sample.

From the tests so far conducted on Drum 1, TSA, TSB, TSC, and TSD, it would be reasonable to expect an average extraction of between 0.69 and 0.75 g/t for the area of dump represented by these samples.

The difference in treatment results of these five samples illustrates the necessity to conduct as many tests as possible on various samples within the one dump. Earlier tests done by the Tasmanian Department of Mines should still be considered.

Suggested further tests on these samples are as follows :

1. Evaluation of suitability to heap leaching.
2. Evaluation of increasing recovery by grinding.



David Wright



14th October, 1980.

CYANIDE TESTING OF 3 SAMPLES AS REQUIRED BY TASMINEX N.L.

PRELIMINARY REPORT

Three 200 litre drums of sample (labelled Drum 1, 2 and 3) were augered for assay and preliminary cyanide testing.

HEAD ASSAYS

	By D. Wright	By Independent Assayer	Average Used In Calculations
Drum 1	1.50 g/t	1.50 g/t	1.50 g/t
Drum 2	3.0 g/t	3.17 g/t	3.08 g/t
Drum 3	1.66 g/t	1.66 g/t	1.66 g/t

As assays were in range expected, cyanide tests were commenced.

After slow drying, 500g samples were taken. Four barrel agitation tests were run. The tests were as follows:-

Drum 1	-	As received
Drum 1	-	Pulverised
Drum 2	-	As received
Drum 3	-	As received

Additions to 500g Samples

limil	-	1g
water	-	1000 c.c.
NaCN	-	1g
Carbon	-	205g

PROCEDURE:-

Samples were agitated with, water for one hour. Initial pH was then taken. 1g of limil was then added to all samples and agitation continued for one hour, pH was again measured and Drum 3 required a further 1g of limil. Cyanide was added and after a further two hours of agitating pH and NaCN concentration were measured.

Agitation was continued for a further 22 hours before measuring pH NaCN and taking 80ml of pregnant solution for assay. Carbon (2.5g) was added at this stage and agitation continued for eight hours. Carbon was recovered by screening and dried for assay.

CYANIDE TEST RESULTS:-

	pH Measurement			Final	NaCN %	
	As Received	After Limil	After NaCN		After 3hrs%	Final
m 1	7.9	11.4	11.4	10.8	0.096	0.086
m 1 verified	7.9	11.0	10.8	10.6	0.090	0.083
2	7.4	10.6	10.4	10.1	0.075	0.050
3	6.3	8.5* /10.3	10.1	9.6	0.066	0.063

* Required an extra lg of limil

ASSAY RESULTS:-

SAMPLE	PREGNANT SOLUTION			CARBON ASSAYS	
	Solution Assay g/m ³	Equivalent g/t of ore	Gold Recovery	Actual* gold recovered	Recovery %
1	0.50	1.0 g/t	67%	0.90 g/t	60
1 verified	0.75	1.5 g/t	100%	1.375 g/t	91.7
2	1.25	2.5 g/t	81.2%	2.49 g/t	80.8
3	0.625	1.25 g/t	75.0%	0.725g/t	43.7**

* Adjusted for solution removed to assay and tritrate.

** This sample contained a trace of oil or kerosene which is detrimental to carbon recovery of gold.

DISCUSSION:-

Cyanide and lime consumptions were relatively low. Drum 3 giving highest lime consumption of approximately 4 kilo per tonne to maintain a pH of 10.

Drum 2 had highest NaCN consumption of approximately 1 kilo/tonne.

Recovery of gold to solution was between 67 and 100%. It should be emphasised that recoveries in excess of 100% are indicated when there is more gold present in the cyanide test sample than is indicated by head assay. This occurs particularly with "spotty" and coarse ores.

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Carbon recoveries are a direct measurement of gold actually recovered and as such are a very reliable minimum. Hence, it can be assumed that for the samples tested, recoveries will not be below the values indicated.

Recoveries were from 43.7% to 91.7% the low recovery from Drum 3 was probably due to the oil present in the drum. Normally, carbon recoveries would be very near to that of solution recoveries. In fact, gold extraction to carbon can be greater than to solution as removal of gold by the carbon allows more to be dissolved. This occurs where dissolving and absorption take place simultaneously and is explained by gold equilibrium considerations.

Grinding of Drum 1 could improve recovery by as much as 33% but added cost would have to be carefully considered. Also, the equipment required to cyanide the ground material would probably be more complex.

More test work can be done on Drums 1, 2 and 3 but, considering earlier cyanide testing done by Tasmanian Department of Mines R778 a question of how representative the sample 1 is of the whole heap has arisen. Results in 1948 (R201) at 67% recovery are in line with this report. Sample variation may explain differences in recoveries but this is unlikely. In report R778, the highest recovery of 43.2% was on the lowest grade material and highest grade material only gave 31.2% recovery.

Cyanide testing on samples from various parts of the dump maybe appropriate at this stage. Such testing on perhaps 6 samples would help establish whether or not reasonable recoveries can be maintained across the dump.

The copies of papers attached to this report outline briefly a cheap and quick method of gold extraction from certain ores.

Drum 1 would most likely fall into this range of ore sand and perhaps Drum 3 could be pretreated to allow similar treatment. Special evaluation tests determine the suitability of various ores to such extraction.

Report signed by: DAVID WRIGHT
20th July, 1980.