DEPARTMENT OF MINES

South Australia

RESEARCH AND DEVELOPMENT BRANCH

URANIUM ORE,
PANDANUS CREEK, N.T.
BROKEN HILL PTY. CO. LTD.

FIRST REPORT

"PRELIMINARY TREATMENT INVESTIGATIONS"

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C O N T E N T S

1. SUMMARY.

A bulk sample of uranium ore from Pandanus Creek was amenable to leaching by the process in use at the Mary Kathleen Plant.

A simple leaching stage followed by direct precipitation of uranium or recovery by solvent extraction or ion exchange would also be effective.

2. INTRODUCTION.

Eight samples of uranium ore from Pandanus Creek N.T. were forwarded by the Broken Hill Proprietary Company Limited with a request that a bulk sample should be examined to determine the possibility of treatment by the process in use at the Mary Kathleen Plant in Queensland.

3. MATERIAL EXAMINED.

Eight samples of ore, PC.192-199 inclusive, were received. Each sample weighed about 30 pounds and contained material up to ½ inch in size.

The samples were mixed and the bulked material was crushed to minus 10 mesh. A representative 20 pound portion was wet milled to approximately 70 per cent. minus 200 mesh and the product was air-dried to a consistency suitable for handling. This sample was designated PC.1 and the relevant details are shown below :-

Composite Sample PC.1

Moisture	21 per cent.	
Uranium Oxide U_3O_8	1.75 per cent.	(moisture free basis)

Screen Analysis

Mesh B.S.S.	Weight %	Cumulative weight %
+ 52	0.1	0.1
- 52 + 72	2.9	3.0
- 72 + 100	8.5	11.5
- 100 + 150	10.1	21.6
- 150 + 200	14.9	36.5
- 200	63.5	
Feed	100.0	

4. EQUIPMENT.

A constant temperature bath was used to maintain the required temperature for the Mary Kathleen type leach.

Electrically operated stirrers were used to agitate the pulp during leaching. Samples taken during the leaching were separated and washed in a small centrifuge while the final residues were filtered and washed under suction on buchner funnels. pH and "redox" values of leach liquors were measured by conventional pH meters.

5. REAGENTS.

Acid -

98 per cent. sulphuric acid was diluted with water to make a solution containing 100 grams H_2SO_4 per 100 millilitres.

Magnesia -

Laboratory grade magnesium oxide (light) was used to precipitate the uranium from leach liquors.

6. EXPERIMENTAL PROCEDURE AND RESULTS.

6.1 Mary Kathleen Leach

A pulp containing ore at 60 per cent. solids was maintained at pH 1.7 by the addition of sulphuric acid. Samples were removed at intervals and uranium was determined in the washed residues. "Separan" flocculent equivalent to 0.2 pounds per ton of solids was added before the final filtration.

6.2 Direct Acid Addition

Sulphuric acid equivalent to 50 pounds per short ton of solids was added to a pulp containing ore at 55 per cent. solids. The pulp was leached at room temperature and samples were taken as described in 6.1. "Separan" equivalent to 0.4 pounds per ton was added before the final filtration.

6.3 Recovery of Uranium from Liquors

A water slurry of magnesium oxide was added to

measured volumes of the liquors, kept constantly agitated, until a pH value of 7.0 was reached. The precipitate was filtered, washed, dried at 110°C and weighed. This product was dissolved in hydrochloric acid, made up to a measured volume and the constituents determined.

6.4 Results

Results of leaching tests are shown in Table 1 and those for uranium recovery in Table 2.

TABLE 1.

PANDANUS CREEK COMPOSITE PC.1

LEACH NO.	PC.1/1			PC.1/2		
Type of Leach	Mary Kathleen			Direct Acid Addition		
Per cent Solids w/w	60			55		
Total H_2SO_4 (lb/2000 lb.)	42			50		
pH	1.7 maintained throughout.			1.0 - 1.3		
Temperature	40°C			20°C		
Head Assay (U_3O_8 per cent)	1.75			1.75		
Leaching Time Hours	Liquor emf Millivolts	Residue U_3O_8%	Leach Effi'cy %	Liquor emf Millivolts	Residue U_3O_8%	Leach Effi'cy %
1	400	0.086	95	430	0.128	93
2	410	0.075	96	430	0.115	93
4	410	0.095	94	430	0.111	94
Final[1] 6	410	0.148	92	430	0.162	91
Residue						
Composition of Final Liquors - 2000 ml from 1000 g Ore						
pH		1.9			1.7	
Uranium Oxide U_3O_8 g/l		7.7			7.6	
Ferric Iron, Fe^{+++} "		0.15			0.24	
Ferrous " Fe^{++} "		0.35			0.30	
Phosphate, PO_4''' "		0.10			0.10	
Silica SiO_2 "		1.2			1.4	

1) The higher uranium content of the final residues is due to difficulty in washing the comparatively large bulk of material on ordinary laboratory filtration equipment.

TABLE 2.

RECOVERY OF URANIUM FROM LIQUORS.

LEACH NO.	PC.1/1		PC.1/2	
Initial pH	1.9		1.7	
Final pH	7.0		7.0	
Volume liquor, ml	500		500	
MgO used g.	2		2	
Final product g.	6.1		6.1	
Composition of Final Product				
	g	%	g	%
U_3O_8	3.75	62	3.75	62
Fe_2O_3	0.4	6.6	0.4	6.6
P_2O_5	0.05	0.8	0.05	0.8
SiO_2	0.6	9.8	0.7	11.5

7. DISCUSSION.

Both types of leach were effective for this sample, but slightly more uranium was dissolved by the "Mary Kathleen" leach, probably due to the higher temperature. It was not necessary to add oxidant to either leach. The addition of "Separan" to the "Mary Kathleen" and "Direct Acid" leach pulps before filtration, in amounts equivalent to 0.2 and 0.4 pound per ton respectively, had no apparent beneficial effect on the filtration rate. It would probably be necessary to investigate this aspect further.

A product containing approximately 60 per cent. uranium oxide was obtained directly from the liquors by neutralising with magnesia but this product contained from 10 to 12 per cent. silica and would probably be unacceptable. The liquors would be amenable to anion exchange for uranium recovery, but it is considered that a solvent extraction system would be more satisfactory. It has been shown that solvent extraction with amine type extractants is not affected by the presence of silica in similar liquors and that very little silica appears in the product.