

OFR 99-002

**ANALYSIS of TANGIER ORE SAMPLES
using GRAVITY and CYANIDATION METHODS**

for

Nova Scotia Department of Natural Resources

**Prepared by Minerals Engineering Centre
DalTech
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**C.D. Cole
Manager**

SUMMARY

The results of this test work showed that sample TAN-99-OR-B contained 2.375 ppm gold, TAN-99-UG-B contained 9.71 ppm, TAN-99-W3 contained 2.62 and TAN-99-W4 & W5 contained 70.85 ppm.

Coarse gold was observed in all samples except TAN-99-OR-B. The larger gold particles were thick and should be recovered with a jig by crushing the ore to minus 2.00 mm or 1.00 mm with an impact mill. A impact crusher would thicken the gold and this should improve recovery with gravity equipment.

The test work showed that the gold would smear to grinding equipment and would not be recovered with gravity equipment.

High recoveries could be obtained by cyanidation but the larger gold particles would have to be ground to flat particles to lower the leaching times. The test work showed that the coarse gold was not completely leached after 48 hours.

A jig should recovery over 80% of the gold. Recoveries of 80.0% was achieved with the jig. No effort was made to optimize the equipment. With optimization recovery would be higher. The minus 0.15 mm gold could be recovered with centrifuge equipment.

ORE SAMPLES

Five samples, labelled TAN-99-UG-B, TAN-99-OR-B, TAN-99-W3, TAN-99-W4 & TAN-99-W5 were delivered in April 1999, to assay for gold content. TAN99-UG-B weighed 41.8 kg, TAN99-W3 weighed 35.63 kg, TAN99-W4 weighed 34.96 kg and TAN99-W5 weighed 39.2 kg.

SAMPLE PREPARATION

Sample TAN-99-OR-B was assayed for gold by bottle roll cyanidation, as received.

Samples TAN-99-W3, W4 & W5 were wet screened and the coarse fractions were examined for gold. All samples had visable coarse gold. Because of the coarse gold, four samples were concentrated with a mineral jig to get a more reliable gold value.

The ore samples were crushed with jaw and cone crushers before a final stage of crushing to minus 2.0 mm with a hammermill.

METHOD FOR TESTING

Gravity Tests

The gravity tests were carried out on the ore using a Denver jig.

Method Used For Analysis

The jig products were assayed for gold by bottle roll cyanidation. The bottle test tails were dried, pulverized and releached by bottle roll cyanidation. The bottle test tails were analyzed by aqua regia method.

TEST WORK

Head Analysis

A head analysis was performed on samples TAN99-OR-B and TAN99-UG-B. Results are shown in Table 1. Samples TAN99-W3 and TAN99-W4 & W5 were calculated from jig test results. The results are shown in Table 2.

Table 1: Analysis of Head Sample by Bottle Roll Cyanidation

Sample	Au, ppm			Au, %
	Cyanide Extracted	Tails	Total	Cyanide Extracted
TAN-99-OR-B	2.34	0.035	2.375	98.53
TAN-99-UG-B	6.10	0.146	6.246	97.66
TAN-99-UG-B	6.49	0.144	6.534	99.33

Table 2: Calculated Head Analysis from Gravity Tests

Sample	Au, ppm
TAN-99-UG-B	9.71
TAN-99-W3	2.62
TAN-99-W4&5	70.85

Jig Test

A Denver Mineral Jig with a 100 mm x 150 mm screen area was used. The slot size of the grating was approximately 6 mm. For ragging, 1500 grams of 11 mm diameter steel balls were used. The feed rates varied from 1900 g/min to 4360 g/min. For all tests 20 L/min water was used.

The ore was separated into a concentrate, tails and the material remaining in the jig cell at end of the test. The tail samples were dried and samples were split out and sized at 80 mesh. All fractions were analyzed by bottle roll cyanidation.

The test results are shown in Table 3. A recovery of 81.4% was obtained by combining the concentrate with the ore remaining in the cell for TAN-99-UG-B. A recovery of 65.5% was achieved for TAN-99-W3 and 80.4% for TAN-99-W4 & W5.

Table 3: Jig Test Results

Sample: TAN99-UG-B

Sample	Wt,g	% wt	Au,ppm	% Distribution
Conc	682.4	1.63	381.73	64.06
Cell	468.8	1.12	150.22	17.32
Tails	40648.8	97.25	1.86	18.62
Total	41800.0	100.00		100.00
	Calc Head		9.71	

Sample: TAN99-W3

Sample	Wt,g	% wt	Au,ppm	% Distribution
Conc	324.1	0.91	185.23	64.29
Cell	669.2	1.88	1.66	1.19
Tails	34636.7	97.21	0.93	34.52
Total	35630.0	100.00		100.00
	Calc Head		2.62	

Sample: TAN99-W4 & W5

Sample	Wt,g	% wt	Au,ppm	% Distribution
W4 Conc	573.3	0.77	5200.5	56.52
W4 Cell	682.7	0.92	427.36	5.55
W5 Conc	502.6	0.68	1784.6	17.13
W5 Cell	691.8	0.93	88.55	1.16
Tails	71709.6	96.70	14.39	19.64
Total	74160.0	100.00		100.00
	Calc Head		70.85	

The jig concentrates and cell material were analyzed by bottle roll cyanidation. The solution was analyzed for gold and the samples were filtered, dried, pulverized and re-leached by bottle roll cyanidation. TAN99-UG-B jig samples were bottle roll for 24 hours. Because of the high gold value in the reground samples, the rest of the concentrates and cell material samples were leached for 48 hours. This was required because of coarse gold particles. The bottle test tails were analyzed by aqua regia method. Results are shown in Table 4.

Table 4: Bottle Roll Cyanidation Results of Jig Concentrates and Cell Material.

Sample	Au, ppm						Au, %
	Cyanide Leachable				Bottle Test		Cyanide Extracted
	24 hrs	48 hrs	Regrind	Total	Tails	Total	
TAN99-UG-B-Jig-Concentrate	249.12		101.36	350.48	31.25	381.73	91.81
Cell	27.73		121.52	149.25	0.97	150.22	99.35
TAN99-W3-Jig-Concentrate	88.86	158.23	26.81	185.04	0.19	185.23	99.90
Cell	0.70	0.90	0.75	1.65	0.01	1.66	99.40
TAN99-W4-Jig-Concentrate	2481.0	3250.0	1715.0	4965.0	235.5	5200.5	95.47
Cell	78.80	188.52	238.27	426.79	0.57	427.36	99.87
TAN99-W5-Jig-Concentrate	1509.0	1684.0	98.0	1782.0	2.62	1784.6	99.85
Cell	13.08	33.06	55.17	88.23	0.32	88.55	99.64

The jig tails were screened at 80 mesh and each fraction was analyzed by bottle roll cyanidation. The plus 80 mesh fraction was pulverized before assaying for samples TAN99-UG-B and TAN99-W3. The plus 80 mesh fraction for TAN99-W4 and TAN99-W5 was analyzed with out pulverizing and the sample was filtered, dried, pulverized and releached. The results are shown in Table 5. 76% of the gold was in the plus 80 mesh fraction and 63% of the gold was recovered without pulverizing the plus 80 mesh fraction.

Table 5: Bottle Roll Cyanidation Results of Jig tails

Sample	% Wt	Au, ppm					Au, % Distrubition
		Cyanide Leachable		Bottle Test Tails	Total	Total	
		24 hrs	Regrind				
TAN99-UG-B-Jig-							
Tails +80	71.59	1.68		1.68	0.03	1.71	65.90
Tails -80	28.41	2.20		2.20	0.03	2.23	34.10
Calc. Head	100.00	1.86					100.00
TAN99-W3-Jig-							
Tails +80	71.07	0.64		0.64	0.003	0.643	48.76
Tails -80	28.93	1.56		1.56	0.08	1.64	51.24
Calc. Head	100.00	0.93					100.00
TAN99-W4&5-Jig-							
Tails-1 +80	40.92	8.01	4.34	12.35	0.13	12.48	35.50
Tails-1 -80	9.02	17.72		17.72	1.47	19.19	12.03
Tails-2 +80	41.07	8.54	5.44	13.98	0.17	14.15	40.40
Tails-2 -80	8.99	18.44		18.44	0.87	19.31	12.07
Calc. Head	100.00	14.39					100.00

Close examination of the bottle test tails for TAN99-W4 concentrate showed that this sample still had gold that was not completely leached. This sample was pulverized to minus 0.25 mm, but no gold was found on the screen. The grinding equipment was cleaned with sand and the sand was analyzed by bottle roll cyanidation. This test showed that 75% of the gold was lost in the pulverizing equipment. Results are shown in Table 6. This shows that the gold is soft and would smear in grinding equipment. This gold would be smeared on quartz particles and be lost to tails with gravity equipment.

Table 6: The Effect of Grinding on Gold Particles.

Sample	Au, ppm	Au, %
		Distrubition
TAN99-W4-Jig-Conc	437.0	25.5
Sand	1278.0	74.5
Total	1715.0	100.0