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O T T A W A February 26, 1946.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2008.

Amalgamation, Flotation, Concentration and Cyanidation Tests on a Gold Ore from Duvay Gold Mines Limited, Duverny Township, Quebec.

Note:
This report relates essentially to the samples as received. It shall not, nor any correspondence connected therewith, be used in part or in full as publicity or advertising matter for the sale of shares in any promotion.

(Copy No. 14.)

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Shipment:

A shipment of ore, of a net weight of 1,054 pounds, was received from Duvay Gold Mines Limited, Amos, Quebec, on January 18, 1946.

A covering letter from Mr. L. B. Almond, resident engineer for the company, was received, asking for a mill test on the sample to determine the best method of treatment for the recovery of gold from the ore.

Location of Property:

The property of Duvay Gold Mines Limited from which the shipment was made is in Duverny township, Quebec, with Amos, Quebec, as the shipping point.

Sampling and Analysis:

Samples of the shipment as received, representative of the mineralization but not representative of its distribution, were taken and polished sections were prepared for microscopic examination. The ore was then crushed to minus 8 mesh and a quarter of the sample riffled out and reduced to 20 mesh, from which a head sample was cut.

Subsequently the whole shipment was reduced to 20 mesh and a second head sample cut out and sent for assay and analysis.

The remainder of the ore was bagged for test purposes.

The analysis made on the head sample gave the following results:

Gold	-	1.01 oz./ton
Silver	-	0.31 "
Copper	-	0.05 per cent
Lead	-	0.025 "
Zinc	-	0.30 "
Iron	-	6.31 "
Sulphur	-	0.33 "
Arsenic	-	None.
Insoluble	-	62.66 "

Test Observations:

The scarcity of metallic mineralization in the sample and the amount of gold unevenly distributed, gave considerable trouble in obtaining representative samples of the various products for assaying, throughout the test work.

It was considered advisable to reduce the whole of the 1,054 pounds of ore to a finer mesh to obtain a head sample which gave satisfactory checks in the assay office. This is not usual.

Considerable difficulty was had in getting the calculated head from the test products to check with the assay head, due to metallics in the concentrate products.

However, this feature provided the key to the procedure for an effective method of treatment for recovery of

(Test Observations, cont'd) -

the gold in the ore.

A screen analysis of the head sample showed the values, association and distribution of the gold in the various mesh sizes to be as follows:

Mesh	Weight, per cent	Assays Oz./ton Au	Assays Per cent Zn	Assays Per cent Fe	Assays Per cent S	Distribution, per cent Au	Distribution, per cent Zn	Distribution, per cent Fe	Distribution, per cent S
+65	49.3	1.20	0.12	5.88	0.35	58.7	29.6	47.2	47.8
+100	7.5	1.45	0.23	5.93	0.54	10.8	8.6	7.3	11.1
+150	7.1	1.68	0.33	5.57	0.63	11.8	11.6	6.3	12.1
+200	5.4	1.15	0.33	5.88	0.52	6.2	8.9	5.2	8.0
-200	30.7	0.41	0.27	6.77	0.25	12.5	41.3	34.0	21.0
Total	100.0	1.0076	0.20	6.13	0.36	100.0	100.0	100.0	100.0

Conclusions:

Of the four basic procedures for the treatment of this ore, i.e., amalgamation, concentration, flotation and cyanidation, by no one process alone was a tailing made which was sufficiently low to discard as waste, although in some cases the percentage of extraction, due to the grade of the ore, was quite high.

Due to the nature of the gold distribution and association, this was not unexpected.

As will be seen from Tests Nos. 1, 2, 8 and 9, where straight cyanidation was employed, the residues were high and erratic, due apparently to some undissolved coarse gold, even though the grinding was carried to approximately 90 per cent minus 325 mesh and agitation carried for 32 hours in a dilute pulp in Tests Nos. 2 and 9.

A sample of 100 grams of tailings from Test No. 9 was concentrated in a Haultain superpanner to a small amount. Examination of this concentrate under a microscope showed several particles of gold which would substantiate the assumption of undissolved unattached gold in the cyanide tailing.

(Continued on next page)

(Conclusions, cont'd) -

Flotation of the ore, as in Tests Nos. 6 and 7, gave a high percentage of extraction in the primary operation but still gave a tailing too high to discard. In addition, the overall recovery would be lowered by the cyanidation of the flotation concentrate were this process to be adopted.

The obvious method of treating this "free milling" portion of the gold is to remove it as early as possible in the circuit to avoid loss in the subsequent treatment. Jigs, traps, blankets, tables and amalgamation plates, used singly or in combination, are effective.

In Test No. 5 a recovery by amalgamation of 90.10 per cent of the gold, at a comparatively coarse grind, was made, followed by cyanidation without regrinding to give an overall recovery of 99.01 per cent.

In Test No. 11, where a blanket table was employed, an extraction of 91.1 per cent of the gold was made, which, when followed by cyanidation without regrinding, gave an overall recovery of 99.10 per cent.

In Test No. 15, using a Wilfley table to take off a rough concentrate and re-running the concentrate over the table, an extraction of 76.6 per cent of the gold was made, which upon treatment of the table tailing by cyanidation without regrinding gave an overall recovery of 99.41 per cent.

In Tests Nos. 5, 11 and 15 the cyanide residue was sufficiently low to discard. If amalgamation were used to remove the "free-milling" gold, the grinding and amalgamation would have to be done in water with a subsequent dewatering of the pulp. Blanket tables and Wilfley tables could be used where the grinding was done in solution.

Blanket concentrates could be treated in an amalgam barrel for the recovery of the gold. Wilfley table concentrates could also be barrel-amalgamated or could be concentrated for

(Conclusions, cont'd) -

the gold metallics which could be refined at the same time as the precipitate from the cyanidation of the table tailings.

In Test No. 16, where the procedure was amalgamation, followed by flotation, and cyanidation of the flotation concentrate without regrinding, the flotation tailings were not sufficiently low to discard. The overall recovery of the gold at 94.3 per cent must, however, be balanced against the higher capital and operating cost for plant practice in the case of Tests Nos. 5, 11 and 15, where cyanidation of the whole amalgamation, blanket or table tailing was the procedure.

In connection with the cyanidation of this ore, no particular difficulty is to be expected in the precipitation of the gold values from the solution, as can be seen from Tests Nos. 12 and 13. These results compare favourably with the results from tests on precipitation, in the laboratory, of solutions from other ores.

It should be noted that any suggestions or recommendations made herein refer to the ore as represented by the sample received. Any lowering of the gold content, or any change in ore characteristics, might alter partially or completely the method of treatment.

CHARACTERISTICS OF THE ORE:

Gangue -

Gangue material forms the greater portion of the six polished surfaces and is composed of milky white quartz with rather abundant finely disseminated carbonate. It bears local reddish-brown stains of iron oxides and is transected by minute sinuous fractures. A qualitative microchemical test for iron indicated that the carbonate was not ferruginous but it appears to be somewhat dolomitic in character.

(Characteristics of the Ore, cont'd) -

Metallic Minerals -

The metallic minerals, in their approximate order of abundance, are chalcopyrite, sphalerite, pyrite, "limonite", native gold, and galena. Of these the first two are by far the most abundant and are present in almost equal amounts in the six polished sections.

The copper and zinc sulphides occur as small masses and coarse to fine irregular grains disseminated unevenly through gangue. In many places they are very intimately associated; each contains inclusions of the other as well as of gangue. Tiny oriented dots and dashes of chalcopyrite are common in sphalerite.

Pyrite is present in very minor amount as occasional small crystals scattered through gangue, chalcopyrite and sphalerite. The largest grain visible in the polished sections is about 400 microns (-35 +48 Tyler mesh) in size.

As inferred under "Gangue" above, "limonite" is prevalent as deep reddish-brown stains in gangue and as narrow veinlets in and rims along borders of sulphides, particularly chalcopyrite.

A few small grains of galena associated with sphalerite were seen in one section but its total amount is very small.

Well over 200 grains of native gold were observed and measured. The results of this quantitative microscopic analysis are tabulated below.

(Continued on next page)

(Characteristics of the Ore, cont'd) -

Grain Sizes and Modes of Occurrence of Native Gold.

Tyler Screen Size	Free in Gangue, per cent	Associated with Sulphides: Chalcopyrite, per cent	Associated with Sulphides: Sphalerite, per cent	Totals, per cent
+48	12.5	--	--	12.5
-48 +65	3.9	4.1	--	8.0
-65 +100	10.1	1.1	1.1	12.3
-100 +150	6.2	2.0	0.8	9.0
-150 +200	12.7	2.6	1.3	16.6
-200 +280	11.1	1.5	2.8	15.4
-280 +400	6.9	1.4	1.7	10.0
-400 +560	9.3	0.6	1.1	11.0
-560 +800	1.7	0.1	--	1.8
-800 +1100	2.9	0.2	0.1	3.2
-1100	0.2	--	--	0.2
	77.5	13.6	8.9	100.0

As shown by the above table, the bulk of the gold occurs free in gangue as coarse to fine irregular particles, many of which are elongated in shape, some to such an extent as to be narrow discontinuous veinlets (Figure 1). Close inspection of these results usually reveals them to be along a fracture in the quartz.

The gold tabulated above as associated with sulphides occurs against, interlocked with, or entirely within the chalcopyrite or sphalerite (see photomicrograph). One tiny grain of gold, about twelve microns in size, was seen along a fracture in a small grain of pyrite, but since the iron sulphide was enclosed within chalcopyrite, in the table above this particle of gold is included in that associated with the copper mineral.

Conclusions from Microscopic Examination:

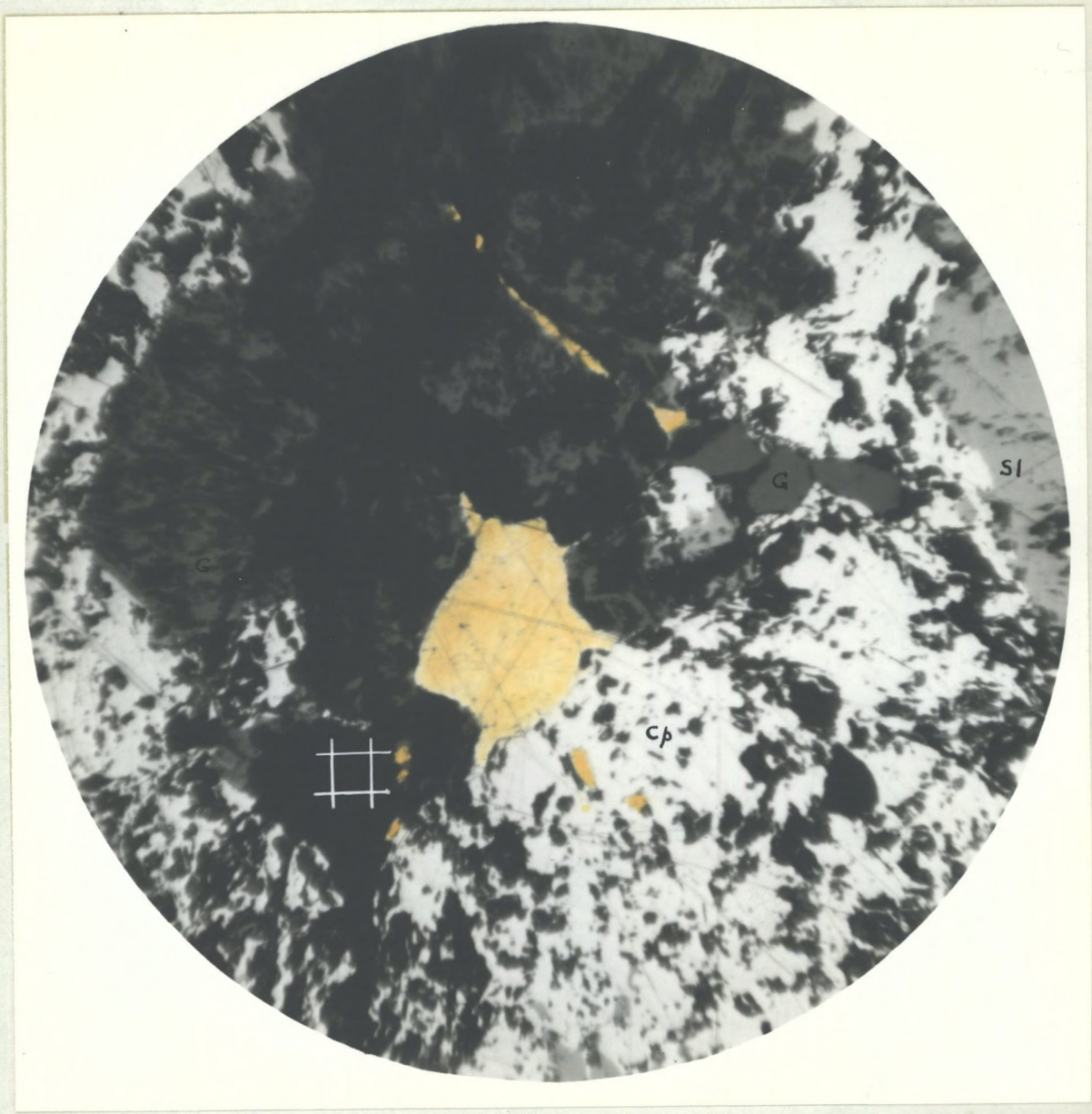
1. The gold ranges in size from coarse to fine and occurs largely as free grains in gangue.

2. A minor portion of the gold is associated with sulphides.

(Figure 1 follows, on Page 8.)

(Characteristics of the Ore, cont'd) -

Figure 1.



X80.

PHOTOMICROGRAPH OF POLISHED SECTION, SHOWING GOLD ASSOCIATED WITH CHALCOPYRITE AND FREE IN GANGUE.

Note the narrow discontinuous veinlet in gangue and two small grains within dense chalcopyrite. A 200-mesh Tyler screen opening is outlined in white.

Gold - deep yellow.
Chalcopyrite (Cp) - white, pitted surface.
Sphalerite (Sl) - light grey.
Gangue (G) - dark grey.
Pits - black.

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RESULTS AND DETAILS OF INVESTIGATIVE TESTS:

Test No. 1.

1,000 grams of ore of minus 20 mesh was taken and ground in a laboratory jar mill to 92.2 per cent minus 200 mesh.

This was transferred to a bottle agitator and agitated with cyanide and lime at 2 to 1 dilution for 30 hours.

Residue filtered and washed and sent for assay.

Results -

Assay heads, oz./ton gold	=	1.01
Assay residue, oz./ton gold	=	0.02
Extraction, per cent gold	=	98.02
NaCN consumed, lb./ton ore	=	0.56
CaO " " "	=	5.48

-

Test No. 2.

Procedure the same as in Test No. 1, except that the grinding was done to 97.2 per cent minus 200 mesh or 88.4 per cent minus 325 mesh.

Results -

Assay heads, oz./ton gold	=	1.01
Assay residue, oz./ton gold	=	0.05
Extraction, per cent gold	=	95.10
NaCN consumed, lb./ton ore	=	0.88
CaO " " "	=	5.72

-

Test No. 5.

1,000 grams of minus 20 mesh ore was ground to 78.8 per cent minus 200 mesh.

Agitated in a jar mill with 7 c.c. of mercury, 0.75 gram CaO and 6 small pebbles for 1 hour. Dilution, 1 to 1.

Mercury recovered, pebbles removed, and residue sent for assay.

Results -

Assay heads, oz./ton gold	=	1.01
Amalgamation tailings, oz./ton gold	=	0.10
Extraction, per cent gold	=	90.10

(Continued on next page)

(Results and Details of Investigative Tests, cont'd) -

500 grams of tailings from amalgamation agitated, without regrinding, for 32 hours at 2 to 1 dilution, with cyanide and lime.

Residue filtered and washed.

Cyanide residue, oz./ton gold	=	0.01
Extraction by cyaniding, per cent -	=	90.00
Additional extraction on heads by cyaniding, per cent	=	8.91
Overall recovery, per cent gold - -	=	99.01
NaCN consumed, lb./ton ore	=	0.32
CaO " " "	=	2.32

-

Test No. 6.

2,000 grams of minus 20 mesh ore ground to 90.4 per cent minus 200 mesh.

Reagents Added:

	Lb./ton	
To Grinding -		
Soda ash -	1.5	
Reagent No. 301 -	0.2	
" No. 208 -	0.1	
" No. 425 -	0.1	
Aerofloat No. 25 -	0.07	
To Conditioning -		
Potassium amyl xanthate	0.10	(3 minutes) pH, 8.8.
To Flotation -		
Pine oil - -	0.05	(10 minutes)

Results

PRODUCTS	Weight, per cent	Assays Oz./ton: Au	Assays Per cent: Zn	Fe	S	Distribution, per cent: Au	Zn	Fe	S
Flot. conc.	14.5	4.85	0.90	8.50	2.30	96.5	50.4	19.4	93.5
Flot. tailings	85.5	0.03	0.15	6.13	0.027	3.5	49.6	80.6	6.5
Totals	100.0	0.729	0.26	6.47	0.35	100.0	100.0	100.0	100.0

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(Results and Details of Investigative Tests, cont'd) -

Test No. 7.

Procedure same as Test No. 6 except for grinding to 96.4 per cent minus 200 mesh.

Reagents Added:

To Grinding -	Lb./ton
Soda ash -	1.5
Reagent No. 301 -	0.2
" No. 208 -	0.1
" No. 425 -	0.1
Aerofloat No. 25 -	0.07

To Conditioning -		
Potassium amyl xanthate	0.10	(3 minutes) pH, 8.9.

To Flotation -		
Pine oil - -	0.05	(10 minutes)

Results

PRODUCTS	Weight, per cent	Assays Oz./ton Au	Assays Per cent Zn	Fe	S	Distribution, per cent Au	Zn	Fe	S
Flot. Conc.	15.6	5.26	0.65	8.19	2.07	97.0	37.5	19.8	95.7
Flot. tailings	84.4	0.03	0.20	6.13	0.017	3.0	62.5	80.2	4.3
Totals	100.0	0.846	0.27	6.45	0.33	100.0	100.0	100.0	100.0

Test No. 8.

Procedure the same as Tests Nos. 1 and 2, with grinding to 87.8 per cent minus 200 mesh.

Results -

Assay heads, oz./ton gold	=	1.01
Assay residue, oz./ton gold	=	0.0375
Extraction, per cent gold	=	96.3
NaCN consumed, lb./ton ore	=	0.6
CaO " " "	=	6.0

Test No. 9.

Procedure the same as Tests Nos. 1, 2 and 8, with grinding to 98.2 per cent minus 200 mesh or 90.4 per cent minus 325 mesh.

(Continued on next page)

(Results and Details of Investigative Tests, cont'd) -

Results -

Assay heads, oz./ton gold	=	1.01
Cyanide residue, oz./ton gold	=	0.105
Extraction, per cent gold	=	89.6
NaCN consumed, lb./ton ore	=	1.08
CaO " " "	=	6.80

In all the cyanide tests the lime consumption is somewhat above the normal amount usually encountered in plant practice.

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Test No. 11.

1,000 grams of ore ground to 78.0 per cent minus 200 mesh.

Diluted to 3 to 1 with water and run over a corduroy blanket table at a slope of 2 inches per foot.

Two products obtained, concentrate and tailings.

Results

PRODUCTS	Weight, per cent	oz./ton Au	Distribution Au
Blanket conc.	11.82	7.66	91.1
Blanket tailings	88.18	0.10	8.9
Totals	100.00	0.994	100.0

500 grams of blanket tailings cyanided for 32 hours without regrinding at 2 to 1 dilution.

Residue filtered and washed.

Cyanide residue, oz./ton gold	=	0.01
Extraction by cyaniding, per cent	=	90.00
Additional extraction on heads by cyaniding blanket tailings, per cent - -	=	8.00
Overall recovery, per cent gold	=	99.10
NaCN consumed, lb./ton ore	=	0.32
CaO " " "	=	2.24

-

Test No. 12.

500 c.c. solution from cyanide Test No. 9 were de-aerated, precipitated and filtered in a continuous-process laboratory apparatus with the addition of 0.1 gram NaCN

(Results and Details of Investigative Tests, cont'd) -

+0.2 gram $PbNO_3$ and 0.5 gram zinc dust as the precipitating agent.

De-aeration period, 30 minutes; precipitation period, 7½ minutes.

Results -

Pregnant solution Test No. 9, oz./ton gold = 0.378

Barren solution Test No. 9, oz./ton gold = 0.0055

-

Test No. 13.

Same general procedure as in Test No. 12 except that 0.35 gram NaOH and 0.2 gram aluminium dust were used to precipitate the gold.

Results -

Pregnant solution, oz./ton gold = 0.378

Barren solution, oz./ton gold = 0.0055

-

Test No. 15.

2,000 grams of ore ground to 87.8 per cent minus 200 mesh.

Pulp was concentrated on a Wilfley table, with concentrate and middlings re-run to take off a high-grade concentrate in a small percentage of the weight.

Products filtered.

Results

PRODUCTS	Weight, per cent	Assay, Oz./ton: Au	Distribution, per cent Au
Table conc.	4.5	13.92	76.6
Table tailings	95.5	0.20	23.4
Totals	100.0	0.817	100.0

500 grams of table tailings cyanided at 2 to 1 dilu-

(Results and Details of Investigative Tests, cont'd) -

tion for 32 hours without regrinding.

Residue filtered and washed.

Cyanide residue, oz./ton gold	=	0.005
Extraction by cyaniding, per cent	=	97.5
Additional extraction on heads by cyaniding table tailings, per cent	=	22.81
Overall recovery, per cent gold	=	99.41
NaCN consumed, lb./ton ore	=	0.32
CaO " " "	=	2.20

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Test No. 16.

2,000 grams ore ground to 87.6 per cent minus 200 mesh.

Filtered and cake halved, and each half amalgamated in a jar mill with 7 c.c. mercury, 0.5 gram CaO and 1,000 c.c. water. Four pebbles included in charge. Amalgamated for 1 hour.

Pulp combined and mercury recovered.

Amalgamation tailings were filtered and a sample sent for assay. The remainder of the wet cake was repulped and floated without regrinding.

Results -

Heads, oz./ton gold	=	1.01
Amalgamation tailings, oz./ton gold	=	0.16
Extraction, per cent gold	=	84.2

Reagents Added:

To Conditioner -	Lb./ton	
Soda ash	0.5	
Reagent No. 301 - -	0.2	
" No. 208 - -	0.1	pH, 9.5
" No. 425 - -	0.1	(5 minutes)
Potassium amyl xanthate -	0.1	

To Flotation -		
Pine oil - -	0.05	(8 minutes)

(Continued on next page)

(Results and Details of Investigative Tests, cont'd) -

Results

Products	Weight, per cent	Assay, oz./ton Au	Distribution, per cent Au
Flot. conc.	11.7	0.90	64.7
Flot. tailings	88.3	0.065	35.3
Totals	100.0	0.16	100.0

137 grams of flotation concentrate from amalgamation tailings were cyanided at 3.6 to 1 dilution for 48 hours without regrinding.

Cyanide residue, oz./ton gold	=	0.01
Extraction, per cent gold	=	98.9
Overall extraction on amalgamation tailings, per cent gold	=	64.0
Additional extraction on heads by treating amalgamation tailings, per cent gold	=	10.1
Overall recovery on ore, per cent gold	=	94.3
NaCN consumed, lb./ton ore	=	0.76
CaO " , " "	=	2.12

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