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Recovery of Gold from Black Sand by Classifier Concentration.

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Introduction.

This paper is one of a series giving the results of metallurgical tests conducted by the Alaska station of the Federal Bureau of Mines, on the recovery of gold from the black sands of placer clean-ups. The data given in this report were obtained from tests on a lot of black sand from a property located on St. Patrick Creek, Fairbanks mining district, Territory of Alaska. This property comprises the Sagan Fraction and adjoining bench claims, and is being operated by A. Lillie.

The sand had already been treated at the mine by amalgamation. A sample taken by Mr. Lillie and assayed at the station showed that the gold still remaining amounted to 11 cents per pound. As this gold content was sufficiently high to justify further treatment of the same, 770 pounds were shipped to the station for testing. The reader will note that the gold content is given in cents per pound, rather than per ton. This is in conformity with practice in the district in valuing black sands, as the quantity obtained at any one time is small, much less than one ton.

The sand consisted principally of schist and quartz, with very little mica and garnet; and no magnetite or sulphides. Most of the gold present was contaminated with quartz, as the free particles of gold had been removed by amalgamation at the mine.

Preliminary Examination.

The sand was screened on a 4-mesh screen. Careful examination and panning were used to detect any gold in a ground portion of the oversize. The undersize was assayed for assay. The weights of the different portions were as follows:

Oversize on 4-mesh screen - Discarded...	27	Lbs.
Assay sample, undersize 4-mesh screen...	7	"
For Testing... " " " "	736	"
Total original weight.....	770	"

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The distribution of the gold was found to be as follows:

	Per Cent Weight Sand	Per Cent Contents Gold
On 10-mesh screen.....	35.7	39.8
On 35, thru 10 mesh.....	43.5	53.7
Thru 35-mesh screen.....	20.8	6.5
	<u>100.0</u>	<u>100.0</u>

As the amount of fine gold was very small, it was decided that classification concentration would give satisfactory results, and this method of treatment was employed for the entire lot.

Treatment and Results

The 736 pounds of sand were treated in a one-spigot classifier having a rising velocity of 54 feet per minute. The concentrate was screened on a 6-mesh screen, the oversize going to waste and the undersize being amalgamated. The tailing was screened on a 30-mesh screen, the oversize going to waste, the undersize being concentrated on a canvas table, and the concentrate being amalgamated.

The weights of the products were as follows:

Concentrate, plus 6-mesh.....	66 Lbs	- Waste
Concentrate, minus 6-mesh.....	115 "	- Amalgamated
Tailing, plus 30-mesh (by difference).....	329 $\frac{1}{2}$ "	- Waste
Canvas concentrate.....	8 $\frac{3}{4}$ "	- Amalgamated
Canvas tailing (by difference).....	217 $\frac{1}{2}$ "	- Waste
	<u>736 "</u>	

The plus 6-mesh concentrate contained no free particles of gold, though some gold, adhering to quartz grains, was present. A jiggling test of this plus 6-mesh material indicated that approximately 75 per cent of this gold might be recovered by amalgamating the jig concentrate. This material could be jigged on a riddle in a tub of water, reserving only the heavier portion next the screen for amalgamation, but it is doubtful whether treatment would usually pay.

The minus 6-mesh concentrate contained approximately 90 per cent of the gold. This was amalgamated for 4 hours in an Abbe pebble mill; 1 $\frac{1}{2}$ pounds of caustic soda was used per ton of sand, and the pulp contained 50 per cent water.

The plus 30-mesh tailing was permitted to go to waste.

The canvas concentrate was amalgamated for 4 hours in an Abbe pebble mill using 1 $\frac{1}{2}$ pounds of caustic soda per ton of sand and equal portions of water and sand.

The canvas tailing was permitted to go to waste.

The results obtained were as follows:

	Weight	Assay	Contents	
	Pounds	Ozs Per Ton	Troy Ozs Gold	Per Cent
Fullion.....	0.3	----	3.1212	81.10
Concentrate, plus 6-mesh..	66.0	3.94	0.1300	3.38
Concentrate, minus 6-mesh.	114.8	5.37	0.3086	8.02
Tailing, plus 30-mesh.....	329.3	0.41	0.0675	1.75
Canvas concentrate.....	8.4	0.73	0.0031	0.08
Canvas tailing.....	217.2	2.01	0.2183	5.67
	<u>736.0</u>	<u>10.46</u>	<u>3.8487</u>	<u>100.00</u>

Conclusions and Recommendations.

In the treatment, the 736 pounds of sand were concentrated to 123½ pounds for amalgamation, which is 16.8 per cent of the original weight. A gold recovery of 81.1 per cent was obtained with a loss of 2 cents per pound.

The gold in this black sand was extremely difficult to amalgamate owing to its intimate mixture with quartz. Had the heavier portion of the plus 6-mesh concentrate been carefully amalgamated and had the minus 6-mesh concentrate been amalgamated for a period of eight hours instead of four, the recovery would probably have been increased to 90 per cent with a loss of but one cent per pound. This treatment, however, would not pay on such a low-grade material.

For a sand of this character, the simplest method of treatment is to screen out all coarse material that is practically free from gold, a point easily determined by panning.

The finer material can then be concentrated in a single spigot classifier, using an upward stream of 5½ feet velocity per minute. About one-eighth of the material would be a concentrate which would have to be amalgamated. The gold recovered from this amalgamation would amount to 80 per cent of the original gold in the sand.

In the treatment of a sand where a 20 per cent loss would be prohibitive, the classifier tailing should be passed over a fine screen (30 or 40 mesh), passing the fines over a canvas table and amalgamating the concentrates therefrom.

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