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Recovery of fine gold in a placer operation

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Fine gold may be found in any placer area (Cook and Rao 1973). As referred to here, fine gold is particulate gold that will pass a 65 mesh screen or is less than 210 microns (micrometres) in diameter. In a gravity concentrator, flakes of gold in the auriferous gravels react like fine gold and are often lost.

Origin of Placer Deposits

Fine gold is more likely to be found in areas with a low energy-gradient at the time of deposition. The origin of the deposit is important when considering fine-gold recovery.

Wolff (1969) classifies placer deposits as residual, stream, beach or marine, colluvial, and eolian. Most Alaskan gold placer deposits are from streams and beaches. In high-energy gradients segments near stream headwaters, auriferous gravels are poorly sorted, and fine gold may not be deposited. In marine or beach placers, the gravels or sand may be well sorted with fine gold concentrated by wave action and winnowing. The serious investigator may refer to Brady and Jobson (1973) for a report on the segregation of heavy minerals.

Mineral Recovery Techniques

There are proven gravity methods used in recovering gold. Classification or screening, which will discard a percentage of coarse material that has little or no value, may upgrade material enough to consider a more elaborate method such as froth flotation, chemical reaction, or a hydroclone (Wolff and Rao 1981).

Nearly all mineral recovery systems start with separation of material by size, because gravity recovery systems have optimum and limiting size ranges. Wills (1979) gives a rough classification of the more commonly used feed-particle sizes for gravity separators:

25mm-75micron jigs: lin to 200 mesh
3mm-30micron pinched sluices and cones: 6-400 mesh
3mm-75micron spirals: 6-200 mesh
3mm-15micron shaking tables: 6-600 mesh
100-5micron tilting frames: 150 mesh to 5micron
(micron = 0.000001 metre)

Recovery drops very rapidly on the

Fig 1. Particle size of gravels and gold from Goldstream (Cook and Rao 1973)

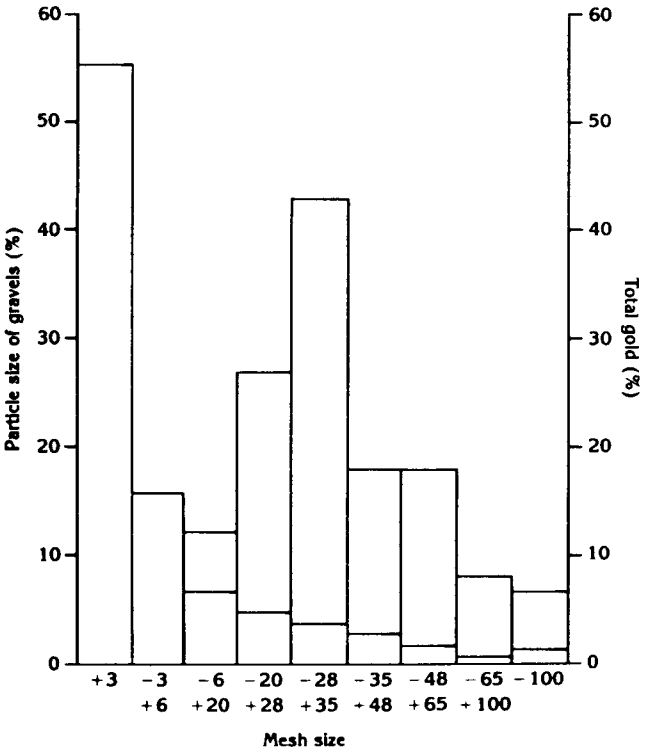

Table 1. Screen analyses of gold recovered from upper Goldstream creek

Tyler mesh Passed	Tyler mesh Retained	Wt %	Cumulative Retained	Wt-% Passed
3	8	0.00	0.00	100.00
8	20	6.59	6.59	93.41
20	28	26.03	32.62	67.38
28	35	41.12	73.74	26.26
35	65	17.11	90.85	9.15
65	100	7.63	98.48	1.52
100	—	1.52	100.00	—

Table 2. Screen analysis, Goldstream sample (from Cook and Rao, 1973)

Mesh size	Wt %	Retained	Passing
+3	54.21	54.21	45.79
−3/+6	15.10	69.31	30.69
−6/+20	11.96	81.27	18.73
−20/+28	4.71	85.98	14.02
−28/+35	3.14	89.12	10.88
−35/+48	2.62	91.74	8.26
−48/+65	1.13	92.87	7.13
−65/+100	0.84	93.71	6.29
−100 +	6.29	100.00	—

Table 3. Screen analysis, beach gold placer

Mesh size	Wt (g)	Percent	Retained	Passing
+28	22	4.91	4.91	96.09
−28/+35	73	16.30	21.21	78.79
−35/+48	144	32.16	53.37	46.63
−48/+65	193	43.10	96.47	3.53
−65/+100	6.3	1.41	97.88	2.12
−100/+150	8.0	1.79	99.67	0.33
−150	1.5	0.33	100.00	—
	447.80	100.00		

Table 4. Gold distribution, beach sand

Tyler Mesh size	Wt (%)	Assay (oz/ton Au)	Total gold (%)
+28	4.91	—	—
−28/+35	16.30	0.0127	0.89
−35/+48	32.16	0.0718	9.91
−48/+65	43.10	0.0530	9.81
−65/+100	1.41	0.2062	1.25
−100/+150	1.79	4.2477	32.64
−150	0.33	32.1200	45.50
	100.00		100.00

Table 5. Assay value of −100 mesh fraction, beach sand

Tyler size	Percent total weight	Assay (oz/ton Au)	Product
−100/+150	1.79	4.2477	7.60
−150	0.33	32.120	10.60
	2.12	8.25	18.20

Table 6. Concentrate ratio and value by froth flotation

Tyler Mesh size	Wt (%)	Concentrate ratio	Assay (oz/ton Au) Conc.	Tails
+28	not floated	—	—	—
−28/+35	16.30	80.11	0.664	0.0035
−35/+48	32.16	130.11	5.298	0.0287
−48/+65	43.10	134.1	6.005	0.0309
−65/+100	1.41	188.1	32.666	0.0303
−100/+150	1.49	356.1	1266.75	0.0696
−150	not floated	—	—	—

percentage and find a way to recover it.

Table 7. Gold recovery by froth flotation.

Mesh size	Percent		Assay		Product		Recovery by flotation		Factor
+28	4.91		—		—		—		—
−28/+35	16.3	×	0.0127	=	0.2070	×	0.73	=	0.15111
−35/+48	32.16	×	0.0718	=	2.3091	×	0.60	=	1.38546
−48/+65	43.10	×	0.0530	=	2.2843	×	0.42	=	0.95941
−65/+105	1.41	×	0.0062	=	0.2907	×	0.86	=	0.25291
−100/+150	1.79	×	4.2477	=	7.6034	×	0.86	=	6.53892
−150	0.33	×	32.1200	=	10.5996	×	1.00	=	10.5996
					23.2491				19.88740

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Table 8. Screen analysis, alluvial gold placer

Mesh size	Wt (g)	Percent	Retained	Passing
+14	100	20.01	20.01	79.99
−14/+28	96.6	19.33	39.34	60.66
−28/+35	93.2	18.65	57.99	42.01
−35/+48	99.7	19.95	77.94	22.06
−48/+65	51.8	10.37	88.31	11.69
−65/+100	20.60	4.12	92.43	7.57
−100/+150	18.90	3.78	96.21	3.79
−150/+200	10.60	2.12	98.33	1.66
−200	8.30	1.66	—	—
	499.70	99.99	100.00	

Table 9. Distribution of gold by mesh size, alluvial placer

Mesh size	Sample (wt %)	Gold assay	Product	Distribution
+14	20.00	0.000	0.000	0.00
−14/+28	19.32	0.000	0.000	0.00
−28/+35	18.69	0.001	0.019	0.66
−35/+48	19.94	0.001	0.020	0.69
−48/+65	10.37	0.002	0.021	0.73
−65/+100	4.12	0.020	0.082	2.85
−100/+150	3.78	0.300	1.134	39.40
−150/+200	2.12	0.460	0.975	33.88
−200	1.66	0.378	0.627	21.79
	100.00	0.029	2.878	100.00