
DISCUSSION OF DETERMINATION OF GOLD VALUES, WEIGHTS,
METHODS OF CALCULATING GOLD PLACER DEPOSITS AND
MISCELLANEOUS WEIGHTS, ETC.

Colorado Bureau of Mines

(John H. Marks)

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GOLDEN, COLORADO

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THE DETERMINATION OF GOLD VALUES IN PLACER LAND.

In estimating value of placer land, a fractional part of a cubic yard is taken as a basis from which to calculate yardage values; usually one cubic foot or $\frac{1}{27}$ cubic feet.

CUBIC MEASURE

1728 cubic inches = 1 cubic foot.

27 cubic feet = 1 cubic yard.

1 cubic foot equals $\frac{1}{27}$ part of a cubic yard; $\frac{1}{54}$ cubic foot equals $\frac{1}{54}$ part of a cubic yard.

METHOD OF FINDING GOLD VALUES IN PLACER GRAVEL.

Make a box that will hold $\frac{1}{2}$ or 1 cubic foot and take measured (weights)?

A box 6 inches deep, 12 inches wide and 12 inches long inside measurement will contain $\frac{1}{54}$ cubic foot, or $\frac{1}{54}$ part of a cubic yard.

A box 12 inches deep, 12 inches wide and 12 inches long inside measurement will contain 1 cubic foot, or $\frac{1}{27}$ part of a cubic yard.

A $\frac{1}{2}$ cubic foot box is the most convenient size, this quantity weighing from 50 to 60 pounds. Material should be weighed before panning.

$\frac{1}{2}$ cubic foot of gravel will make about 3 pans, or 6 pans per cu. ft.

If prospecting is done by drilling, drill samples should be measured and weighed before panning.

Prospecting drills are usually made in sizes of 4 and 6 inch inside diameter of pipe; casing in 5 ft. lengths.

4 inch casing has inside area = 12.5664 square inches. 1 inch in depth would equal 12.5664 cubic inches.

1 cubic foot = 1728 cubic inches.

1728 divided by 12.5664 = 137.5096 inches required to contain 1 cubic foot.

137.5096 divided by 12 = $11\frac{1}{2}$ feet casing required to contain 1 cubic foot, and

$11\frac{1}{2}$ (11.4591 ft. exact) multiplied by 27 = 310.5 (309.3957 ft. exact) lineal feet of 4 inch casing required to contain 1 cubic yard.

1 lineal foot of casing would contain $\frac{1}{310}$ (.003226 cu. yd. exact) part of a cubic yard.

6 inch casing has inside area = 28.274 sq. ins.

1 inch depth in casing = 28.274 cu. ins.

1728 divided by 28.274 = 61.1162 inches of 6 inch pipe required to contain 1 cubic foot.

61.1162 divided by 12 = 5.093 feet of casing required to contain 1 cubic foot, and

5.093 x 27 = 137.51 lineal feet of 6 inch casing required to contain 1 cubic yard.

Fractional part of 1 cubic foot of gravel contained in 1 foot of 6 inch casing would = $\frac{1}{5.093} = .196347$ of a cubic foot. It is assumed in table for 6 inch drill calculations that 1 lineal foot contains .2 or 1/5 cubic foot.

Weight of gold found by panning a measured quantity is determined in milligrams, preferably using an assay balance having a sensitiveness of 1/100 milligrams.

Having determined weight of gold in sample in milligrams, its value is found as follows:"

Gold values are figured in Troy Weight and weight of gold in sample is found in Metric Weight.

In tables used herein it is assumed that 1/100 part of a milligram is the smallest weight used.

Gold values being calculated in Troy Weight, we determine value in cents of the smallest Troy denomination, viz. grains.

1 cent pure gold weighs .2322 grains
1 milligram weighs .015432 grains

$$\frac{.2322}{.015432} = 15.0466, \text{ or 1 cent equals 15.0466 milligrams.}$$

If 1 cent equals 15.0466 milligrams; 1 milligram equals 1 divided by 15.0466 or, .0664601 part of 1 cent and 1/100 of a milligram equals .000664601 part of 1 cent. It is assumed in tables herein that 15 milligrams equals 1 cent, or weight of gold in milligrams divided by 15 equals value of gold in cents, or 1/100 milligrams = .000666 cents.

TO FIND VALUE IN CENTS PER CUBIC YARD IN SAMPLE

Given weight of gold in milligrams and quantity

Divide weight in milligrams by 15 and multiply result by fractional part of cubic yard.

Example:-

Weight of gold 8.50 milligrams
Sample 1 cubic foot, or 1/27 cubic yard.
 $\frac{8.50 \times 27}{15} = 15.28$ in cents per cu. yd.

Example:-

Weight of gold in sample 16.85 milligrams.
Sample $\frac{1}{54}$ cubic foot, or 1/54 part of a cu. yd.
 $\frac{16.85}{15} \times 54 = 60.64$ cents per cu. yd.

The above estimates and the tables which follow are based on pure gold values. The fineness of the gold should be determined by fire assay, as placer gold varies greatly in different localities.

When fineness of gold has been found the market value of the gold is obtained by multiplying the values in tables herein given by percentage of fineness.

Example:-

Fineness of gold .900
Value per cubic yard 20 cents (from tables)
 $20 \times .9 = 18$ cents per cubic yard.

Example:-

Fineness of gold .625
Value per cubic yard 20 cents (from tables)
 $20 \times .625 = 12\frac{1}{2}$ cents per cubic yard.

TABLES OF WEIGHTS AND MEASURES

Troy weight is used for gold and silver.

TROY WEIGHT

24 grains (grs) = 1 pennyweight
 20 pennyweights (dwt) = 1 ounce = 480 grains
 12 ounces (oz) = 1 pound = 240 dwts. = 5760 grains.

VALUES IN DOLLARS OF TROY WEIGHTS OF PURE GOLD

1 grain \$0.0430663 or, 4.30663 cents
 1 pennyweight, \$1.0535912
 1 ounce, \$20.6718240
 1 pound, \$248.0618880

TROY OUNCES TO GRAMS

TABLE IN CENTS OF PURE GOLD WEIGHT IN GRAINS

1 cent, .2322 grains
 10 cents, 2.3220 grains
 100 cents, 23.2200 grains

Oz.		Grams
1	=	31.10348
2	=	62.20696
3	=	93.31044
4	=	124.41392
5	=	155.51740
6	=	186.62088
7	=	217.72437
8	=	248.82785
9	=	279.93133
10	=	311.03480

TABLE OF TROY WEIGHT IN MILLIGRAMS AND GRAMS

1 grain, 64.79818 milligrams
 1 pennyweight, 1.55517 grams
 1 ounce, 31.10348 grams
 1 pound, 373.24176 grams

Grains to Milligrams

1	=	64.79818
2	=	129.59734
3	=	194.39675
4	=	259.19567
5	=	323.99459
6	=	388.79351
7	=	453.59243
8	=	518.39135
9	=	583.19026
10	=	647.98918

Pennyweights to Grams

1	=	1.55517
2	=	3.11035
3	=	4.66552
4	=	6.22070
5	=	7.77587
6	=	9.33104
7	=	10.88622
8	=	12.44139
9	=	13.99657
10	=	15.55174

METRIC WEIGHT IS USED IN DETERMINATION OF ASSAY VALUES.

METRIC WEIGHT

10 Milligrams (mg)	= 1 Centigram (cg)	= .15432 grains
10 Centigrams	= 1 Decigram (dg)	= 1.5432 grains
10 Decigrams	= 1 Gram (g)	= 15.43235 grains
10 Grams	= 1 Decagram (dg)	-
10 Decagrams	= 1 Hectogram (hg)	
10 Hectograms	= 1 Kilogram (kg)	
10 Kilograms	= 1 Myriogram (mg)	
10 Myriograms	= 1 Quintal (q)	
10 Quintals	= 1 Tonneau, Millier or Tonne.	

MILLIGRAMS AND GRAMS TO TROY WEIGHTS

1 Milligram	= 0.015432356 grains
1 Gram	= 15.43236 grains; legal value in U. S. = 15.432 grains
1 Gram	= 0.64301 pwt.
1 Gram	= 0.03215 oz.

MILLIGRAMS TO GRAINS

1	=	0.015432356
2	=	0.03086
3	=	0.04630
4	=	0.06173
5	=	0.07716
6	=	0.09259
7	=	0.10803
8	=	0.12346
9	=	0.13889
10	=	0.15432

WEIGHT OF GOLD IN MILLIGRAMS AND VALUE IN CENTS

<u>MILLIGRAMS</u>	<u>CENTS</u>	<u>MILLIGRAMS</u>	<u>CENTS</u>
.01	= .000666	1.00	= .666666
.02	= .001333	2.00	= 1.333333
.03	= .002000	3.00	= 2.000000
.04	= .002666	4.00	= 2.666666
.05	= .003333	5.00	= 3.333333
.06	= .004000	6.00	= 4.000000
.07	= .004666	7.00	= 4.666666
.08	= .005333	8.00	= 5.333333
.09	= .006000	9.00	= 6.000000
.10	= .006666	10.00	= 6.666666
.20	= .013333	20.00	= 13.333333
.30	= .020000	30.00	= 20.000000
.40	= .026666	40.00	= 26.666666
.50	= .033333	50.00	= 33.333333
.60	= .040000	60.00	= 40.000000
.70	= .046666	70.00	= 46.666666
.80	= .053333	80.00	= 53.333333
.90	= .060000	90.00	= 60.000000
		100.00	= 66.666666

TABLE FOR ESTIMATING PLACER GOLD VALUE IN CENTS

PER CUBIC YARD FROM SAMPLES OF $\frac{1}{8}$ AND 1 CU. FT.

WEIGHT OF GOLD IN MILLIGRAMS	VALUE IN CENTS PER CU. YD. SAMPLE = $\frac{1}{8}$ CU. FT.	VALUE IN CENTS PER CU. YD. SAMPLE = 1 CU. FT.	WEIGHT OF GOLD IN MILLIGRAMS	VALUE IN CENTS PER CU. YD. SAMPLE = $\frac{1}{8}$ CU. FT.	VALUE IN CENTS PER CU. YD. SAMPLE = 1 CU. FT.
.01	.036	.018	1.00	3.600	18.000
.02	.072	.036	2.00	7.200	36.000
.03	.108	.054	3.00	10.800	54.000
.04	.144	.072	4.00	14.400	72.000
.05	.180	.090	5.00	18.000	90.000
.06	.216	.108	6.00	21.600	108.000
.07	.252	.126	7.00	25.200	126.000
.08	.288	.144	8.00	28.800	144.000
.09	.324	.162	9.00	32.400	162.000

.10	.360	.180	10.00	36.000	180.000
.20	.720	.360	20.00	72.000	360.000
.30	1.080	.540	30.00	108.000	540.000
.40	1.440	.720	40.00	144.000	720.000
.50	1.800	.900	50.00	180.000	900.000
.60	2.160	1.080	60.00	216.000	1080.000
.70	2.520	1.260	70.00	252.000	1260.000
.80	2.880	1.440	80.00	288.000	1440.000
.90	3.240	1.620	90.00	324.000	1620.000
			100.00	360.000	1800.000

This table gives weights from 1/100 to 100 milligrams and value in cents per cubic yard for samples containing $\frac{1}{8}$ or 1 cubic foot.

Example:-

If sample = $\frac{1}{8}$ cu. ft. and weight of gold = 2.95 milligrams

2.	Milligrams	=	7.200
.9	"	=	3.240
.05	"	=	.180
Value in cents per cubic yard			10.620

If sample = 1 cu. ft. and weight of gold = 12.98 milligrams

10.	Milligrams	=	18.000
2.	"	=	3.600
.9	"	=	1.620
.08	"	=	.144
Value in cents per cubic yard			23.364

TABLE FOR ESTIMATING PLACER GOLD VALUES

FOR USE WITH 4 INCH EMPIRE DRILL.

WEIGHT OF GOLD IN MILLIGRAMS	VALUE IN CENTS PER CUBIC YARD 1 FOOT SAMPLE = 0.87097 CU.FT.	WEIGHT OF GOLD IN MILLIGRAMS	VALUE IN CENTS PER CUBIC YARD 1 FOOT SAMPLE = 0.87097 CU.FT.
.01	.2063	1.00	20.6262
.02	.4125	2.00	41.2524
.03	.6188	3.00	61.8786
.04	.8250	4.00	82.5048
.05	1.0311	5.00	103.1110
.06	1.2376	6.00	123.7572
.07	1.4439	7.00	144.3834
.08	1.6501	8.00	165.0096
.09	1.8564	9.00	185.6358

.10	2.0626	10.00	206.2620
.20	4.1252	20.00	412.5240
.30	6.1879	30.00	618.7860
.40	8.2505	40.00	825.0480
.50	10.3111	50.00	1031.1100
.60	12.3757	60.00	1237.5720
.70	14.4383	70.00	1443.8340
.80	16.5010	80.00	1650.0960
.90	18.5636	90.00	1856.3580
		100.00	2062.6200

This table gives weights from 1/100 to 100 milligrams; also value in cents per cubic yard for contents of sample of 1 lineal foot of 4 inch drill casing.

Example:-

To find value per cubic yard for any sample, divide value for 1 lineal foot by number of lineal feet in drill sample.

Example:-

Weight of sample 5.35 milligrams for 5.72 lineal ft. = $\frac{1}{2}$ cu.ft.

$$\begin{array}{r}
 \text{Milligrams} = 5. \quad = 103.1110 \\
 .3 \quad = 6.1879 \\
 .05 \quad = 1.0311 \\
 \hline
 110.3300 \quad = 19.29 \text{ cents per cu.yd.} \\
 5.72
 \end{array}$$

Example:-

Weight of sample 47.38 milligrams for 7 ft.

$$\begin{array}{r}
 40. \quad - \quad 825.0480 \\
 7. \quad - \quad 144.3834 \\
 .3 \quad - \quad 6.1879 \\
 .08 \quad - \quad 1.6501 \\
 \hline
 7) 977.2694 \\
 139.6099 \text{ cents per cu. yd.}
 \end{array}$$

The table herein for use with 6 inch Empire Drill assumes contents of 5 lineal ft. casing = 1 cu. ft., and 135 lineal feet casing = 1 cubic yard.

NOTE: Contents of 1 lineal foot of 6 inch casing = .196347 of a cubic foot; assumed in this table = .2 cu. ft.

This table gives weights from 1/100 to 100 milligrams; also value in cents per cubic yard for samples contained in 1, 2, 3, 4 and 5 lineal feet 6 inch drill casing.

Example:-

If 1 cu. ft. sample contains .01 milligram in gold, value per cubic yard is found by multiplying .000666 (the value of .01 milligram in cents) by 27 the number of cubic feet in 1 cu. yd.

$$\begin{aligned} 000666 \times 27 &= .017982 \\ \text{In this table .01 milligram} &= .018 \text{ cents} \end{aligned}$$

Example:-

If sample = 1/5 cu. ft. and weight of gold = 12.98 milligrams

10 Mg	=	90.000
2 Mg	=	18.000
.9 "	=	8.100
.08 "	=	<u>.720</u>
Value in cents per cubic yd.		116.820

TABLE FOR ESTIMATING PLACER GOLD VALUES:

FOR USE WITH 6 INCH EMPIRE DRILL

WEIGHT OF GOLD IN MILLIGRAMS	VALUE IN CENTS PER CU. YD. SAMPLE 1/5 CU.FT. = 1 LIN.FT.CASING	VALUE IN CENTS PER CU. YD. SAMPLE 2/5 CU.FT. = 2 LIN.FT.CASING	VALUE IN CENTS PER CU. YD. SAMPLE 3/5 CU. FT. = 3 LIN.FT.CASING	VALUE IN CENTS PER CU. YD. SAMPLE 4/5 CU. FT. = 4 LIN.FT.CASING	VALUE IN CENTS PER CU. YD. SAMPLE 1 CU. FT. = 5 LIN.FT.CASING
.01	.090	.045	.030	.022	.018
.02	.180	.090	.060	.045	.036
.03	.270	.135	.090	.067	.054
.04	.360	.180	.120	.090	.072
.05	.450	.225	.150	.112	.090
.06	.540	.270	.180	.135	.108
.07	.630	.315	.210	.157	.126
.08	.720	.360	.240	.180	.144
.09	.810	.405	.270	.202	.162

.10	.900	.450	.300	.220	.180
.20	1.800	.900	.600	.450	.360
.30	2.700	1.350	.900	.670	.540
.40	3.600	1.800	1.200	.900	.720
.50	4.500	2.225	1.500	1.120	.900
.60	5.400	2.700	1.800	1.350	1.080
.70	6.300	3.150	2.100	1.570	1.260
.80	7.200	3.600	2.400	1.800	1.440
.90	8.100	4.050	2.700	2.020	1.620

1.00	9.000	4.500	3.000	2.200	1.800
2.00	18.000	9.000	6.000	4.500	3.600
3.00	27.000	13.500	9.000	6.700	5.400
4.00	36.000	18.000	12.000	9.000	7.200
5.00	45.000	22.250	15.000	11.200	9.000
6.00	54.000	27.000	18.000	13.500	10.800
7.00	63.000	31.500	21.300	15.700	12.600
8.00	72.000	36.000	24.000	18.000	14.400
9.00	81.000	40.500	27.000	20.200	16.200

10.00	90.000	45.000	30.000	22.000	18.000
20.00	180.000	90.000	60.000	45.000	36.000
30.00	270.000	135.000	90.000	67.000	54.000
40.00	360.000	180.000	120.000	90.000	72.000
50.00	450.000	222.500	150.000	112.000	90.000
60.00	540.000	270.000	180.000	135.000	108.000
70.00	630.000	315.000	213.000	157.000	126.000
80.00	720.000	360.000	240.000	180.000	144.000
90.00	810.000	405.000	270.000	202.000	162.000
100.00	900.000	450.000	300.000	220.000	180.000

THE FOLLOWING TABLE SHOWS CUBIC YARDS AND VALUE PER YARD ON ONE ACRE OF GROUND; DEPTHS FROM 1 TO 20 FEET. VALUES FROM 5 ¢ TO 25 ¢ PER CUBIC YARD; ALSO FOR 25, 30, 40 & 50 FEET DEPTH OF GRAVEL.

Depth in feet	Cu. Yds. in 1 acre	Values per acre @ 5, 10, 15, 20 & 25 cents per cubic yard.				
		¢	¢	¢	¢	¢
		5¢	10¢	15¢	20¢	25¢
1	1613	81	161	242	322	403
2	3226	161	322	484	644	806
3	4839	242	484	726	968	1210
4	6452	323	645	968	1290	1613
5	8065	403	807	1210	1614	2017
6	9678	484	967	1452	1934	2419
7	11291	565	1129	1694	2258	2823
8	12904	645	1290	1936	2580	3226
9	14517	725	1452	2178	2904	3630
10	16130	807	1610	2420	3220	4030
11	17743	887	1774	2662	3548	4436
12	19356	968	1936	2904	3872	4840
13	20969	1048	2097	3146	4194	5243
14	22582	1129	2258	3388	4516	5646
15	24195	1209	2420	3630	4840	6050
16	25808	1290	2581	3872	5162	6453
17	27421	1371	2742	4114	5484	6856
18	29034	1452	2903	4356	5806	7259
19	30647	1532	3065	4598	6130	7663
20	32260	1613	3226	4840	6452	8066
25	40325	2016	4033	6050	8066	10063
30	48390	2419	4839	7260	9678	12099
40	64520	3226	6452	9680	12904	16132
50	80650	4033	8065	12100	16130	20165

ASSAYING EQUIPMENT FOR PLACER EXAMINATION

- 1 Portable 1/100 milligram Assay Balance, gram and milligram weights
- 1 Assay button tongs
- 1 Spring balance for weighing gravel (1 to 150 lbs)
- 1 Horse shoe magnet (5 to 7 inches)
- 1 Gross small sample bottles, corks and gummed labels, in cigar boxes or case
- $\frac{1}{2}$ Gross 2 oz sample bottles, corks and gummed labels, in cigar boxes or case
- 1 Pocket case containing 12 small sample bottles
- 2 Small glass funnels to fit into sample bottles
- 2 Small camels hair brushes
- 6 Unglazed annealing cups
- 6 Glazed annealing cups
- 6 White porcelain crucibles and covers
- 6 Oval glass dishes
- 3 Porcelain evaporating or concentrate dishes
- 1 Alcohol lamp with complete retort stand
- $\frac{1}{2}$ Lb. Cyanide
- 1 Pine alcohol
- 1 Pint Nitric Acid
- 1 Lb. Quicksilver
- 3 Iron gold pans size
- 1 Gold pan screen
- 12 Ore sacks
- 24 Sample sacks
- 1 Pick
- 1 Long handle $\frac{1}{2}$ spring shovel
- 1 Rocker
- 1 Small round mirror, 2 inch diameter
- 1 Reading glass
- 1 Field Book
- 1 Time Book
- 2 Water pails, galvanized iron
- 2 Tubs galvanized iron
- $\frac{1}{2}$ Yard black velveteen
- 1 Package cloth shipping tags, plain white
- 1 Pair rubber gloves
- 1 Pair rubber boots

ENGINEERING EQUIPMENT FOR PLACER EXAMINATION

- 1 Combination transit, tripod, reading glass and plumb bob.
- 1 Field Book (Dietzgen #403)
- 1 Hand axe $2\frac{1}{2}$ lb.
- 1 Steel pocket tape 50 ft.
- 1 Steel chain tape 100 ft.
- 1 Steel chain tape 660 ft. and tape menders or splicers.
- 1 Folding rule 4 to 6 ft.
- 1 Chicago level rod (telescoping)
- 1 Pair Field glasses
- 1 Hand level
- 1 Carpenter's square level
- 1 Engineer's metallic scale 10-60
- 2 Slide rules common and stadia
- 1 Map Measurer
- 1 Aneroid Barometer
- 1 Set drafting instruments
- 1 Sand block
- 1 Parallel Rule
- 2 8 inch celluloid triangles 1-45°, 1-30°X 60°
- 1 Book Log. tables and Ephemeris
- 1 Valuing Mines, by R. H. Stretch
- 1 Morrisons Mining Rights
- 1 Troutwine
- Catalogues of Placer dredges, water wheels, pipes, drilling and pumping machinery
- 1 Evans Hydraulics
- 1 Skeleton Mining Report (McDonald)
- 1 Set Mining Report Books (Janin)
- 2 Bundles Lath
- 1 Whetstone
- 1 Cold Chisel
- Knives
- Tents, flies, stoves, pipe, dampers, tables, wash basins, etc.

STATIONERY

- Stamped envelopes and writing paper
- Fountain pen and ink
- Carbon letter book and carbons
- 1 Large Calculation book, yellow paper, quadrille ruling
- Code book (Bedford McNeill and Terminal index)
- 1 Check Book, Calendar, Telegraph blanks
- Blotters
- 1 Receipt Book
- 1 Set Prospecting Blanks for Drill records (Min. & Sci. Press)
- 1 Time Book
- Railroad Time Tables
- 1 Drafting Board
- 10 Yard Roll Manilla 36" Cream Detail paper
- 1 paper protractor sheet
- 10 Yards Profile paper (Plate A Green)
- 5 Yards Imperial Tracing Cloth 36"
- $\frac{1}{2}$ Doz. Township plats (Onion skin)
- 1 Pad Cross Section paper 1:10
- 2 Each 3H and 4H pencils
- 1 Set Colored pencils (Castelle)
- 1 Pair Shears
- Rubber bands and rubber eraser
- 1 Ball Twine
- 1 Doz. Thumb Tacks
- 1 Le Page Glue, small

MISCELLANEOUS

- 1 Doz. placer location certificates
- 1 Map of State
- 1 Set Geological Survey publications, folios and maps
- 1 Set maps and field notes of survey of ground from Survey.Gen.Office
- 1 Map of property
- 1 Set of reports on property
- 1 Postal card size camera
- 1 Al Vista Camera (4 x 12)

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