U. S. GEOLOGICAL SURVEY

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Number of particles of gold per 5lb sample

x10⁻² x10⁻¹ x10⁰ x10¹ x10² x10³ x10⁴ x10⁵ x10⁶ x10⁷

Diameter (mm) Gold spheres

64.5 129 258 516

8.0 — 32.8 — 10^6 — 16.4 — 8.19 — 4.0 — 4.10 — 10^5 — 2.05 — 2.0 — 1.02 — .512 — 10^4 — .256 — .128 — 1.0 — .064 — 10^3 — .032 — .016 — .5 — .008 — 10^2 — .004 — .002 — .5 — .25 — .001 — 10^1 — .0005 — .00025 — .25 — .125 — 10^0 — .125 — .062 — .062 — .031 — 10^{-1} — .031 — .016 — 10^{-2} — .008 — 10^{-3} — .004 — 10^{-4} — .002 — 10^{-5}

Diameters (mm) Gold flakes (diameter=10x thickness)

Particle mass (10^{-6} grams)

5,120lbs 2,560lbs 1,280lbs 640lbs 320lbs 160lbs 80lbs 40lbs 20lbs 10lbs 5lbs 1Kg 500g 250g 100g 50g

Size of sample that would contain twenty gold particles in the grade and particle size combinations intersected (assuming uniform distribution of particles)

Area of no preconcentration for 10 gram portions, atomic absorption analysis (Average of at least 20 particles in each 10 grams of sediment)

Area of no preconcentration for 2gram portions, atomic absorption analysis (Average of at least 20 particles in each 2 gram of sediment)

EXAMPLE (SEE TEXT)

516 258 129 64.5 32.8 16.4 8.19 4.10 2.05 1.02 .512 .256 .128 .064 .032 .016 .008 .004 .002 .001 .0005 .00025

.00025 .0005 .001 .002 .004 .008 .016 .032 .064 .128 .256 .512

x10⁻² x10⁻¹ x10⁰ x10¹ x10² x10³ x10⁴ x10⁵ x10⁶ x10⁷

Number of particles of gold per 5lb sample

SAMPLE SIZE AND PRECONCENTRATION REQUIREMENTS FOR MEANINGFUL ANALYSIS OF GOLD

H. Edward Clifton

Vertical axis of chart represents mass in micrograms of individual particles and also the equivalent diameters of gold in spheres or in circular flakes where thickness is one tenth of diameter (flakes may be the most common detrital gold shape in the medium sand to coarse silt size range). Horizontal axis represents the number of particles of gold (assuming uniform mass) per 5-pound sample. Diagonal lines are lines of equal grade (ppm) of gold in the field of particle mass versus particle number per 5-pound sample (plotted from data tabulated by Miesch, 1967).

Vertical lines on the left half of chart indicate the size of sample that will contain 20 particles at the particle mass and grades intersected by these lines, assuming uniform particle distribution. Samples that contain at least twenty particles are here assumed to be sufficiently representative of the deposit from which they came. The vertical lines therefore indicate the size of sample that would adequately represent combinations of particle size and grade to the right of the lines. To use the chart, one must first establish the range of gold particle size and grade for a particular type of deposit. The first vertical line to the left of this area indicates the minimum sample size that would be representative of the deposit. For example, 500 grams of sample would be adequate for a beach deposit of black sand containing gold in flakes ranging from .125-.062 mm in diameter in grades between 0.128 and .256 ppm.

The two fields on the right half of chart indicate grain size and grade combinations that provide at least twenty particles per ten and two grams of sample (the sizes currently used for atomic absorption analysis). Assuming these sizes to be analytical subsamples of a larger sample, these fields delineate areas where no preconcentration (Clifton and others, in press) is necessary. Outside of these fields, preconcentration is required, either (as in the case left of the vertical boundary of the field) to attain enough particles to be representative of the initial sample or (below the diagonal base of the field) to increase the gold content to the level of detectibility by atomic absorption techniques.

Chart also provides means of estimating gold grain size without sieving, by preconcentrating a 5-pound sample to 500 grams and splitting randomly into 50 ten gram subsamples for analysis. The number of subsamples containing gold and the uniformity of the detected values will suggest the approximate number of particles per 5-pound sample. The total grade (ppm) of the 5-pound sample can be calculated from the individual analyses. The intersection of this grade with the approximate number of particles suggests the general gold size range, which in turn determines the amount of sample required.

References

Clifton, H. E., Hubert, A., and Phillips, R. L., in press, Marine sediment sample preparation for analysis of low concentrations of fine detrital gold: U.S. Geol. Survey Circular.

Miesch, A. T., 1967, Chart showing number of particles of metal expected per 5-pound sample for various levels of grade and average particle size (regardless of the spatial distribution of particles): U.S. Geol. Survey open-file report.

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