

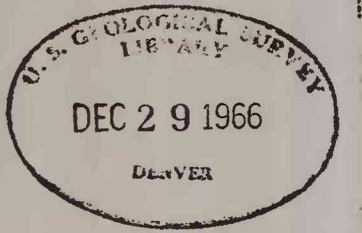
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CHART SHOWING NUMBER OF PARTICLES OF METAL EXPECTED PER 5-POUND¹ SAMPLE FOR VARIOUS LEVELS OF GRADE AND AVERAGE PARTICLE SIZE (REGARDLESS OF THE SPATIAL DISTRIBUTION OF PARTICLES²)

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A
B

Zones where sampling problems are unlikely. An average of at least 100 particles of metal can be expected per 5-pound sample. Assuming a uniform or random distribution of particles, it is not likely that material of interest will be missed. In the B zone visible metal should be present, as the particles will be of sufficient size to be seen with a binocular microscope and sufficiently numerous so as not to be missed with any reasonable degree of care

C

Zone where sampling problems may occur. An average of between 1 and 100 particles can be expected per 5-pound sample, but some samples with no particles will not be unlikely. Also, too few particles might cause grade to be below threshold of the analytical method

D

Zone where sampling problems will definitely occur. The problems, however, will not be insurmountable if one is willing to take very large amounts of sample (say, several hundred pounds). Most 5-pound samples will not contain even one particle of metal. Pounds of rock expected per single particle of metal is given in parentheses

E

Zone where the question of resource appraisal cannot be answered by any practical method of field sampling. Pounds of rock expected per single particle of metal is given in parentheses

¹ Assuming 0.5- (rather than 5-) pound samples, all values on the table are decreased by a factor of 10 and all zones are moved up one row on the table (that is, toward lower particle mass, column 1). Assuming 50-pound samples, the values are increased by a factor of 10 and all zones are moved down one row on the table (that is, toward larger particle mass, column 1).

² The distribution of metal particles in the rock may vary from uniform at one extreme, through random, to a clustered distribution at the other extreme. Where the distribution is uniform, the expected value in the table, for a given grade and particle size, will be attained in every 5-pound sample. Where the distribution is random some moderate amount of variation will occur from one sample to another, but the samples on the average will contain the number of particles indicated in the table. Where the distribution is highly clustered a greater variation will occur, but the expected value for 5-pound samples over the entire block being examined will be as indicated. There are any number of types of clustering, and each type presents its own particle sampling problems. Within some clusters the distribution of particles may be approximately random, or at least haphazard.

This report is preliminary and has not been edited or reviewed for conformity with U. S. Geological Survey standards and nomenclature.

PLEASE REPLACE IN POCKET
IN BACK OF BOUND VOLUME

M Mass of particles (grams)	Diameter (mm) of An spheres having mass M.	GRADE (parts per billion)															
		1	2	4	8	16	32	64	128	256	512	1024	2048	4096	8192	16,384	32,768
33 x 10 ⁻²³ (Mass of one atom)		4.9 x 10 ¹³	1.4 x 10 ¹⁶	2.8 x 10 ¹⁶	5.5 x 10 ¹⁶	1.1 x 10 ¹⁷	2.2 x 10 ¹⁷	4.4 x 10 ¹⁷	8.9 x 10 ¹⁷	1.8 x 10 ¹⁸	3.5 x 10 ¹⁸	7.1 x 10 ¹⁸	1.4 x 10 ¹⁹	2.8 x 10 ¹⁹	5.7 x 10 ¹⁹	1.1 x 10 ²⁰	2.3 x 10 ²⁰
33 x 10 ⁻²²		4.9 x 10 ¹⁴	1.4 x 10 ¹⁵	2.8 x 10 ¹⁵	5.5 x 10 ¹⁵	1.1 x 10 ¹⁶	2.2 x 10 ¹⁶	4.4 x 10 ¹⁶	8.9 x 10 ¹⁶	1.8 x 10 ¹⁷	3.5 x 10 ¹⁷	7.1 x 10 ¹⁷	1.4 x 10 ¹⁸	2.8 x 10 ¹⁸	5.7 x 10 ¹⁸	1.1 x 10 ¹⁹	2.3 x 10 ¹⁹
33 x 10 ⁻²¹		4.9 x 10 ¹³	1.4 x 10 ¹⁴	2.8 x 10 ¹⁴	5.5 x 10 ¹⁴	1.1 x 10 ¹⁵	2.2 x 10 ¹⁵	4.4 x 10 ¹⁵	8.9 x 10 ¹⁵	1.8 x 10 ¹⁶	3.5 x 10 ¹⁶	7.1 x 10 ¹⁶	1.4 x 10 ¹⁷	2.8 x 10 ¹⁷	5.7 x 10 ¹⁷	1.1 x 10 ¹⁸	2.3 x 10 ¹⁸
33 x 10 ⁻²⁰		6.9 x 10 ¹²	1.4 x 10 ¹³	2.8 x 10 ¹³	5.5 x 10 ¹³	1.1 x 10 ¹⁴	2.2 x 10 ¹⁴	4.4 x 10 ¹⁴	8.9 x 10 ¹⁴	1.8 x 10 ¹⁵	3.5 x 10 ¹⁵	7.1 x 10 ¹⁵	1.4 x 10 ¹⁶	2.8 x 10 ¹⁶	5.7 x 10 ¹⁶	1.1 x 10 ¹⁷	2.3 x 10 ¹⁷
33 x 10 ⁻¹⁹		6.9 x 10 ¹¹	1.4 x 10 ¹²	2.8 x 10 ¹²	5.5 x 10 ¹²	1.1 x 10 ¹³	2.2 x 10 ¹³	4.4 x 10 ¹³	8.9 x 10 ¹³	1.8 x 10 ¹⁴	3.5 x 10 ¹⁴	7.1 x 10 ¹⁴	1.4 x 10 ¹⁵	2.8 x 10 ¹⁵	5.7 x 10 ¹⁵	1.1 x 10 ¹⁶	2.3 x 10 ¹⁶
33 x 10 ⁻¹⁸		6.9 x 10 ¹⁰	1.4 x 10 ¹¹	2.8 x 10 ¹¹	5.5 x 10 ¹¹	1.1 x 10 ¹²	2.2 x 10 ¹²	4.4 x 10 ¹²	8.9 x 10 ¹²	1.8 x 10 ¹³	3.5 x 10 ¹³	7.1 x 10 ¹³	1.4 x 10 ¹⁴	2.8 x 10 ¹⁴	5.7 x 10 ¹⁴	1.1 x 10 ¹⁵	2.3 x 10 ¹⁵
33 x 10 ⁻¹⁷		6.9 x 10 ⁹	1.4 x 10 ¹⁰	2.8 x 10 ¹⁰	5.5 x 10 ¹⁰	1.1 x 10 ¹¹	2.2 x 10 ¹¹	4.4 x 10 ¹¹	8.9 x 10 ¹¹	1.8 x 10 ¹²	3.5 x 10 ¹²	7.1 x 10 ¹²	1.4 x 10 ¹³	2.8 x 10 ¹³	5.7 x 10 ¹³	1.1 x 10 ¹⁴	2.3 x 10 ¹⁴
33 x 10 ⁻¹⁶		6.9 x 10 ⁸	1.4 x 10 ⁹	2.8 x 10 ⁹	5.5 x 10 ⁹	1.1 x 10 ¹⁰	2.2 x 10 ¹⁰	4.4 x 10 ¹⁰	8.9 x 10 ¹⁰	1.8 x 10 ¹¹	3.5 x 10 ¹¹	7.1 x 10 ¹¹	1.4 x 10 ¹²	2.8 x 10 ¹²	5.7 x 10 ¹²	1.1 x 10 ¹³	2.3 x 10 ¹³
33 x 10 ⁻¹⁵		6.9 x 10 ⁷	1.4 x 10 ⁸	2.8 x 10 ⁸	5.5 x 10 ⁸	1.1 x 10 ⁹	2.2 x 10 ⁹	4.4 x 10 ⁹	8.9 x 10 ⁹	1.8 x 10 ¹⁰	3.5 x 10 ¹⁰	7.1 x 10 ¹⁰	1.4 x 10 ¹¹	2.8 x 10 ¹¹	5.7 x 10 ¹¹	1.1 x 10 ¹²	2.3 x 10 ¹²
33 x 10 ⁻¹⁴		6.9 x 10 ⁶	1.4 x 10 ⁷	2.8 x 10 ⁷	5.5 x 10 ⁷	1.1 x 10 ⁸	2.2 x 10 ⁸	4.4 x 10 ⁸	8.9 x 10 ⁸	1.8 x 10 ⁹	3.5 x 10 ⁹	7.1 x 10 ⁹	1.4 x 10 ¹⁰	2.8 x 10 ¹⁰	5.7 x 10 ¹⁰	1.1 x 10 ¹¹	2.3 x 10 ¹¹
33 x 10 ⁻¹³		6.9 x 10 ⁵	1.4 x 10 ⁶	2.8 x 10 ⁶	5.5 x 10 ⁶	1.1 x 10 ⁷	2.2 x 10 ⁷	4.4 x 10 ⁷	8.9 x 10 ⁷	1.8 x 10 ⁸	3.5 x 10 ⁸	7.1 x 10 ⁸	1.4 x 10 ⁹	2.8 x 10 ⁹	5.7 x 10 ⁹	1.1 x 10 ¹⁰	2.3 x 10 ¹⁰
33 x 10 ⁻¹²		6.9 x 10 ⁴	1.4 x 10 ⁵	2.8 x 10 ⁵	5.5 x 10 ⁵	1.1 x 10 ⁶	2.2 x 10 ⁶	4.4 x 10 ⁶	8.9 x 10 ⁶	1.8 x 10 ⁷	3.5 x 10 ⁷	7.1 x 10 ⁷	1.4 x 10 ⁸	2.8 x 10 ⁸	5.7 x 10 ⁸	1.1 x 10 ⁹	2.3 x 10 ⁹
33 x 10 ⁻¹¹		6.9 x 10 ³	1.4 x 10 ⁴	2.8 x 10 ⁴	5.5 x 10 ⁴	1.1 x 10 ⁵	2.2 x 10 ⁵	4.4 x 10 ⁵	8.9 x 10 ⁵	1.8 x 10 ⁶	3.5 x 10 ⁶	7.1 x 10 ⁶	1.4 x 10 ⁷	2.8 x 10 ⁷	5.7 x 10 ⁷	1.1 x 10 ⁸	2.3 x 10 ⁸
33 x 10 ⁻¹⁰	0.0068	6.9 x 10 ²	1.4 x 10 ³	2.8 x 10 ³	5.5 x 10 ³	1.1 x 10 ⁴	2.2 x 10 ⁴	4.4 x 10 ⁴	8.9 x 10 ⁴	1.8 x 10 ⁵	3.5 x 10 ⁵	7.1 x 10 ⁵	1.4 x 10 ⁶	2.8 x 10 ⁶	5.7 x 10 ⁶	1.1 x 10 ⁷	2.3 x 10 ⁷
33 x 10 ⁻⁹	0.015	6.9 x 10 ¹	1.4 x 10 ²	2.8 x 10 ²	5.5 x 10 ²	1.1 x 10 ³	2.2 x 10 ³	4.4 x 10 ³	8.9 x 10 ³	1.8 x 10 ⁴	3.5 x 10 ⁴	7.1 x 10 ⁴	1.4 x 10 ⁵	2.8 x 10 ⁵	5.7 x 10 ⁵	1.1 x 10 ⁶	2.3 x 10 ⁶
33 x 10 ⁻⁸	0.032	6.9 x 10 ⁰	1.4 x 10 ¹	2.8 x 10 ¹	5.5 x 10 ¹	1.1 x 10 ²	2.2 x 10 ²	4.4 x 10 ²	8.9 x 10 ²	1.8 x 10 ³	3.5 x 10 ³	7.1 x 10 ³	1.4 x 10 ⁴	2.8 x 10 ⁴	5.7 x 10 ⁴	1.1 x 10 ⁵	2.3 x 10 ⁵
33 x 10 ⁻⁷	0.068	6.9 x 10 ⁻¹ (7.2)	1.4 x 10 ⁰	2.8 x 10 ⁰	5.5 x 10 ⁰	1.1 x 10 ¹	2.2 x 10 ¹	4.4 x 10 ¹	8.9 x 10 ¹	1.8 x 10 ²	3.5 x 10 ²	7.1 x 10 ²	1.4 x 10 ³	2.8 x 10 ³	5.7 x 10 ³	1.1 x 10 ⁴	2.3 x 10 ⁴
33 x 10 ⁻⁶	0.15	6.9 x 10 ⁻² (7.2)	1.4 x 10 ⁻¹ (36)	2.8 x 10 ⁻¹ (18)	5.5 x 10 ⁻¹ (9)	1.1 x 10 ⁰	2.2 x 10 ⁰	4.4 x 10 ⁰	8.9 x 10 ⁰	1.8 x 10 ¹	3.5 x 10 ¹	7.1 x 10 ¹	1.4 x 10 ²	2.8 x 10 ²	5.7 x 10 ²	1.1 x 10 ³	2.3 x 10 ³
33 x 10 ⁻⁵	0.32	6.9 x 10 ⁻³ (7.2)	1.4 x 10 ⁻² (36)	2.8 x 10 ⁻² (18)	5.5 x 10 ⁻² (9)	1.1 x 10 ⁻¹ (45)	2.2 x 10 ⁻¹ (23)	4.4 x 10 ⁻¹ (11)	8.9 x 10 ⁻¹ (6)	1.8 x 10 ⁰	3.5 x 10 ⁰	7.1 x 10 ⁰	1.4 x 10 ¹	2.8 x 10 ¹	5.7 x 10 ¹	1.1 x 10 ²	2.3 x 10 ²
33 x 10 ⁻⁴	0.68	6.9 x 10 ⁻⁴ (7.2)	1.4 x 10 ⁻³ (36)	2.8 x 10 ⁻³ (18)	5.5 x 10 ⁻³ (9)	1.1 x 10 ⁻² (45)	2.2 x 10 ⁻² (23)	4.4 x 10 ⁻² (11)	8.9 x 10 ⁻² (6)	1.8 x 10 ⁻¹ (28)	3.5 x 10 ⁻¹ (14)	7.1 x 10 ⁻¹ (7)	1.4 x 10 ⁰	2.8 x 10 ⁰	5.7 x 10 ⁰	1.1 x 10 ¹	2.3 x 10 ¹
33 x 10 ⁻³	1.5	6.9 x 10 ⁻⁵ (7.2)	1.4 x 10 ⁻⁴ (36)	2.8 x 10 ⁻⁴ (18)	5.5 x 10 ⁻⁴ (9)	1.1 x 10 ⁻³ (45)	2.2 x 10 ⁻³ (23)	4.4 x 10 ⁻³ (11)	8.9 x 10 ⁻³ (6)	1.8 x 10 ⁻² (28)	3.5 x 10 ⁻² (14)	7.1 x 10 ⁻² (7)	1.4 x 10 ⁻¹ (36)	2.8 x 10 ⁻¹ (18)	5.7 x 10 ⁻¹ (9)	1.1 x 10 ⁰	2.3 x 10 ⁰
33 x 10 ⁻²	3.2	6.9 x 10 ⁻⁶ (7.2)	1.4 x 10 ⁻⁵ (36)	2.8 x 10 ⁻⁵ (18)	5.5 x 10 ⁻⁵ (9)	1.1 x 10 ⁻⁴ (45)	2.2 x 10 ⁻⁴ (23)	4.4 x 10 ⁻⁴ (11)	8.9 x 10 ⁻⁴ (6)	1.8 x 10 ⁻³ (28)	3.5 x 10 ⁻³ (14)	7.1 x 10 ⁻³ (7)	1.4 x 10 ⁻² (36)	2.8 x 10 ⁻² (18)	5.7 x 10 ⁻² (9)	1.1 x 10 ⁻¹ (45)	2.3 x 10 ⁻¹ (22)
33 x 10 ⁻¹	6.8	6.9 x 10 ⁻⁷ (7.2)	1.4 x 10 ⁻⁶ (36)	2.8 x 10 ⁻⁶ (18)	5.5 x 10 ⁻⁶ (9)	1.1 x 10 ⁻⁵ (45)	2.2 x 10 ⁻⁵ (23)	4.4 x 10 ⁻⁵ (11)	8.9 x 10 ⁻⁵ (6)	1.8 x 10 ⁻⁴ (28)	3.5 x 10 ⁻⁴ (14)	7.1 x 10 ⁻⁴ (7)	1.4 x 10 ⁻³ (36)	2.8 x 10 ⁻³ (18)	5.7 x 10 ⁻³ (9)	1.1 x 10 ⁻² (45)	2.3 x 10 ⁻² (22)
33	15.	6.9 x 10 ⁻⁸ (7.2)	1.4 x 10 ⁻⁷ (36)	2.8 x 10 ⁻⁷ (18)	5.5 x 10 ⁻⁷ (9)	1.1 x 10 ⁻⁶ (45)	2.2 x 10 ⁻⁶ (23)	4.4 x 10 ⁻⁶ (11)	8.9 x 10 ⁻⁶ (6)	1.8 x 10 ⁻⁵ (28)	3.5 x 10 ⁻⁵ (14)	7.1 x 10 ⁻⁵ (7)	1.4 x 10 ⁻⁴ (36)	2.8 x 10 ⁻⁴ (18)	5.7 x 10 ⁻⁴ (9)	1.1 x 10 ⁻³ (45)	2.3 x 10 ⁻³ (22)
330 (approx. 0.7 lbs.)	32.	6.9 x 10 ⁻⁹ (7.2)	1.4 x 10 ⁻⁸ (36)	2.8 x 10 ⁻⁸ (18)	5.5 x 10 ⁻⁸ (9)	1.1 x 10 ⁻⁷ (45)	2.2 x 10 ⁻⁷ (23)	4.4 x 10 ⁻⁷ (11)	8.9 x 10 ⁻⁷ (6)	1.8 x 10 ⁻⁶ (28)	3.5 x 10 ⁻⁶ (14)	7.1 x 10 ⁻⁶ (7)	1.4 x 10 ⁻⁵ (36)	2.8 x 10 ⁻⁵ (18)	5.7 x 10 ⁻⁵ (9)	1.1 x 10 ⁻⁴ (45)	2.3 x 10 ⁻⁴ (22)

A

B

C

D

E