

# Conversion Table and Glossary

## *Conversion Table for Distances, Areas, Volumes, and Weights*

1 inch = 2.54 centimeters	1 are = 100 square meters = 119.6 square yards
1 square inch = 6.45 square centimeters	1 statute mile = 0.86 nautical miles
1 cubic inch = 16.39 cubic centimeters	1 square statute mile = 0.74 square nautical miles
1 centimeter = 0.39 inches	1 statute mile = 1.61 kilometers
1 square centimeter = 0.15 square inches	1 square statute mile = 2.59 square kilometers
1 cubic centimeter = 0.06 cubic inches	1 nautical mile = 1.16 statute miles
1 foot = 0.30 meters	1 square nautical mile = 1.35 square statute miles
1 square foot = 0.09 square meters	1 nautical mile = 1.85 kilometers
1 cubic foot = 0.03 cubic meters	1 square nautical mile = 3.43 square kilometers
1 meter = 3.28 feet	1 kilometer = 0.62 statute miles
1 square meter = 10.76 square feet	1 square kilometer = 0.39 square statute miles
1 cubic meter = 35.31 cubic feet	1 kilometer = 0.54 nautical miles
1 yard = .91 meters	1 square kilometer = 0.29 square nautical miles
1 square yard = 0.84 square meters	1 short ton = 2000 pounds = 0.91 metric tons
1 cubic yard = 0.76 cubic meters	1 long ton = 2240 pounds = 1.02 metric tons
1 meter = 1.09 yards	1 metric ton = 1.10 short tons = 0.98 long tons
1 square meter = 1.20 square yards	
1 cubic meter = 1.31 cubic yards	

## *Glossary*

*Abyssal Plain:* A flat region of the deep ocean floor.

*Acid-Grade Phosphate Rock:* Phosphate rock that can be used directly in fertilizer plants. A comparatively pure grade of phosphate rock that assays at 31 percent phosphorous pentoxide ( $P_2O_5$ ), and is also called "fertilizer-grade" rock.

*Acoustic:* Of or relating to sounds or to the science of sounds.

*Active Margin:* The leading edge of a continental plate characterized by coastal volcanic mountain ranges, frequent earthquake activity, and relatively narrow continental shelves.

*Alluvial Deposits:* Secondary deposits derived from the fragmentation and concentration of chromite minerals from primary stratiform or podiform deposits. Alluvial deposits are either placers, e.g., beach sands which occur in Oregon and stream sand deposits in the eastern States, or laterites, which occur in north-west California and southwestern Oregon.

*Anatase:* One of two major crystalline modifications of titanium dioxide ( $TiO_2$ ), the other being rutile.

*Argon-Oxygen-Decarburization (AOD); Vacuum-Oxygen-Decarburization (VOD):* Processes for removing carbon from molten steel without oxidizing large amounts of valuable alloying elements, especially chromium. AOD and VOD enable the use of lower grade, lower cost high-carbon ferrochromium.

*Attenuation:* A reduction in the amplitude or energy of a seismic or sonar signal, such as produced by divergence, reflection and scattering, and absorption.

*Barrier Island:* A long, narrow, wave-built sandy island parallel to the shore and separated from the mainland by a lagoon.

*Bathymetry:* The measurement of depths of water in the oceans. Also, the information derived from such measurements.

*Beneficiation-Grade Phosphate Rock:* Phosphate rock that assays at 10 to 18 percent phosphorous pentoxide ( $P_2O_5$ ) and requires the removal of hydrocarbons and other impurities before processing in a chemical plant. It may be upgraded to acid grade or furnace feed quality.

*Beneficiation:* Improvement of the grade of ore by milling, flotation, gravity concentration, or other processes.

*Benthos:* the animals living at the bottom of the sea.

*Bioassay:* a method for semi-quantitatively measuring the effect of a given concentration of a substance on the growth of a living organism.

*Biomass:* The amount of living matter in a community or population of a single species. (It may be measured either by wet, dry, or ash-free [burned] weight.)

*Calcium Phosphate:* Any of the calcium orthophosphates that may be used for fertilizers, plastics stabilizers, pharmaceuticals, animal feeds, and toothpastes. They include acid calcium phosphate, calcium dihydrogen

- phosphate, monobasic calcium phosphate, monocalcium phosphate, and tricalcium phosphate.
- Cephalopods:** Marine mollusks including squids, octopuses, and Nautilus.
- Chromic Oxide:** A dark green amorphous powder that is insoluble in water or acids. Also known as chrome green. It is commonly used as a standard measure of chromium content in chromite.
- Chromite:** An iron-chromic oxide (chrome iron ore). A mineral of the spinel group, and the only mineral mined for chromium. "Chromite" is used synonymously for chromium ore and concentrates made from the ore used *in* commercial trade. When referring to the spinel mineral chromite, it is referred to as "chromite mineral."
- Conductivity:** The ratio of electric current density to the electric field in a material; the reciprocal of resistivity.
- Continental rise:** That part of the continental margin that is between the continental slope and the abyssal plain except in areas of an oceanic trench.
- Continental Shelf:** The part of the continental margin that is between the shore and the continental slope and is characterized by its very gentle slope.
- Continental Slope:** The relatively steeply sloping part of the continental margin that is between the continental shelf and the continental rise.
- Crustacean:** Jointed animals with hard shells. This group includes crabs, shrimp, lobsters, and barnacles.
- Deposit-Feeder:** An animal that feeds on particulate matter deposited on the seafloor.
- Detritus:** Particulate matter resulting from the degeneration and decay of organisms or inorganic substances in nature.
- Diversity:** a measure of the numbers and kinds of species found in a particular area.
- Dredging:** The various processes by which large floating machines, or dredges, excavate earth material at the bottom of a body of water, raise it to the surface, and discharge it into a hopper, pipeline, or barge, or return it to the water body after removal of ore minerals.
- Electrolytic Manganese Metal:** A relatively pure form of metal produced by the deposition of a metal on the cathode by passing an electric current through a chemical solution of manganous sulfate; at the same time electrolytic manganese dioxide ( $MnO_2$ ) is formed at the anode.
- Fauna:** the animal life characteristic of a particular environment or region.
- Ferrochromium:** A crude ferroalloy containing chromium that is an intermediate iron-chromic product used in the manufacture of chromium steel.
- Ferromanganese Crusts:** Crusts of iron and manganese oxides enriched in cobalt that are found on the flanks of seamounts, ridges, and other raised areas of ocean floor in the central Pacific.
- Ferromanganese Nodules:** Concretions of iron and manganese oxides containing copper, nickel, cobalt, and other metals that are found in deep ocean basins and in some shallower areas of the oceanfloor.
- Ferromanganese:** A ferroalloy containing about 80 percent manganese and used in steelmaking. There are three grades: (1) High-Carbon (Standard)—74 to 82 percent manganese; (2) Medium-carbon—80 to 85 percent manganese; and (3) Low-carbon—80 to 90 percent manganese.
- Filter-Feeder:** an animal that feeds on minute organisms suspended in the water column by using some screening and capturing (filtering) mechanism.
- Flotation Separation:** A method of concentrating ore that employs the principles of interracial chemistry that separates the useful minerals in the ore from the waste by adding reagents or oils to a water slurry mixture of fine particles of ore and collecting the useful portion that "floats" to the surface in association with the oil or reagent.
- Full Alloy Steel:** Those steels may contain between one-half percent to nine percent chromium, but more commonly contain between one and four percent. Chromium is used to impart hardness.
- Furnace-Grade Phosphate Rock:** Phosphate rock that assays at 18 to 28 percent phosphorous pentoxide ( $P_2O_5$ ). It may be charged directly to electric furnaces to produce slag and ferrophosphorus as byproducts and volatilized elemental phosphorus as the primary product.
- Gangue:** The nonmetalliferous or nonvaluable metalliferous minerals in an ore.
- Geomagnetic:** Pertaining to the magnetic field of the earth.
- Geophysics:** Study of the earth by quantitative physical methods (e. g., electric, gravity, magnetic, seismic, or thermal techniques).
- Grade:** The relative quantity or weight percentage of ore-mineral content in an orebody.
- Gradiometry:** Measurement of the difference in the magnetic or gravity field between two points, rather than the total field at any given point.
- Gravity Anomaly:** The difference between the observed value of gravity at a point and the theoretically calculated value. Excess observed gravity is positive and deficient observed gravity is negative.
- Hadfield Manganese Steel:** A steel containing 10 to 14 percent manganese; resistant to shock and wear.
- Ilmenite:** A black, opaque mineral consisting of impure  $FeTiO_3$  that is the principal ore of titanium.
- Interferometry:** The precise measurement of wavelength, very small distances and thicknesses, etc. through the separation of light (by means of a sys-

tern of mirrors and glass plates) into two parts that travel unequal optical paths and when reunited consequently interfere with each other.

*Invertebrate*: an animal lacking a backbone and an internal skeleton.

*Kroll Process*: A reduction process for the production principally of titanium metal sponge from titanium tetrachloride by molten magnesium metal.

*Larvae*: free-living immature forms that have developed from a fertilized egg but must undergo a series of shape and size changes before assuming the characteristic features of the adult organism.

*Laterite*: Weathered material composed principally of the oxides of iron, aluminum, titanium, manganese, nickel and chromium. Laterite may range from soil-like porous material to hard rock.

*Leucoxene*: A mineral assemblage of intermediate titanium dioxide ( $\text{TiO}_2$ ) content composed of rutile with some anatase or sphene. Usually an alteration product of ilmenite, with the iron oxide content having been reduced by weathering.

*Macrofauna*: animals barely large enough to be visible to the naked eye and not likely to be photographed from a meter or two. Average body length might be about 1 mm.

*Magnetic Anomaly*: The difference between the intensity of the magnetic field at a point and the theoretically calculated value. Anomalies are interpreted as to the depth, size, shape, and magnetization of geologic features causing them.

*Manganese Ore*: Those ores containing 35 percent or more manganese.

*Manganese Dioxide*:  $\text{MnO}_2$ , a black, crystalline, water-insoluble compound used in dry-cell batteries, as a catalyst, and in dyeing textiles. Also known as "battery manganese."

*Manganiferous Ore*: Any ore important for its manganese content containing less than 35 percent manganese but not less than 5 percent. There are two types of manganiferous ore: (1) "Ferruginous ore"—containing 10 to 35 percent manganese; and (2) "Manganiferous iron ore"—containing 5 to 10 percent manganese.

*Mining*: The process of extracting metallic or nonmetallic mineral deposits from the earth. The process may also include preliminary treatment, such as cleaning or sizing.

*Mollusk*: a division of the animal kingdom containing clams, mussels, oysters, snails, octopuses, and squids; they are characterized by an organ that secretes a shell.

*Nekton*: Free-swimming aquatic animals.

*Neutron Activation*: Bombardment of a material by high-energy neutrons which transmute natural ele-

ments to gamma-ray-emitting isotopes of characteristic identity.

*Ore*: The naturally occurring material from which a mineral or minerals of economic value can be extracted at a reasonable profit.

*Overburden*: Loose or consolidated rock material that overlies a mineral deposit and must be removed prior to mining.

$\text{P}_2\text{O}_5$ : Phosphorus pentoxide, the standard used to measure phosphorus content in ores and products.

*Passive Margin*: The trailing edge of a continent located within a crustal plate at the transition between continental and oceanic crust and characterized by its lack of significant volcanic and seismic activity.

*Pelagic*: pertaining to the open ocean.

*Perovskite*: A natural, complex, yellow, brownish-yellow, reddish, brown, or black calcium-titanium oxide mineral.

*Phosphate Rock*: Igneous rock that contains one or more phosphorus-bearing minerals, e.g. phosphorite, of sufficient purity and quantity to permit its commercial use as a source of phosphatic compounds or elemental phosphorus.

*Phosphorite*: A sedimentary rock with a high enough content of phosphate minerals to be of economic interest. Most commonly it is a bedded primary or reworked secondary marine rock composed of microcrystalline carbonate fluorapatite in the form of layers, pellets, nodules, and skeletal, shell, and bone fragments.

*Phylogeny*: the evolutionary or ancestral history of organisms.

*Phytoplankton*: the plant forms of plankton.

*Placer*: Concentrations of heavy detrital minerals that are resistant to chemical and physical processes of weathering.

*Placer*: A mineral deposit formed by mechanical concentration of mineral particles from weathered debris. The mineral concentrated is usually a heavy mineral such as gold, cassiterite, or rutile.

*Plankton*: passively floating or weakly motile aquatic plants and animals.

*Plate Tectonics*: A model to explain global tectonics wherein the Earth's outer shell is made up of gigantic plates composed of both continental and oceanic lithosphere (crust and upper mantle) that "float" on some viscous underlayer in the mantle and move more or less independently, slowly grinding against each other while propelled from the rear by seafloor spreading.

*Podiform-Type Deposits*: Primary chromite mineral deposits that are irregularly formed as lenticular, tabular, or pod shapes. Because of their irregular nature, podiform deposits are difficult to locate and evaluate. Most podiform deposits are high in chromium,

- and are the only source of high-aluminum chromite. In the United States, they occur mostly on the Pacific Coast in California and Alaska.
- Polychaete:** a class of segmented marine worms.
- Polymetallic Sulfide:** A popular term used to describe the suites of intimately associated sulfide minerals that have been found in spreading centers on the ocean floor.
- Primary Productivity:** the amount of organic matter synthesized from inorganic substances in a given area or a measured amount of time (e. g., gm/m<sup>2</sup>/yr).
- Processing:** The series of steps by which raw material (ore) is transformed into intermediate or final mineral products. The number and type of steps involved in a particular process may vary considerably depending on the characteristics of the ore and the end product or products to be extracted from the ore.
- Pycnocline:** a vertical gradient in the ocean where density changes rapidly.
- Pyrolusite:** A soft iron-black or dark steel-gray tetragonal mineral composed of manganese dioxide (MnO<sub>2</sub>). It is the most important ore of manganese.
- Reconnaissance:** A general, exploratory examination or survey of the main features of a region, usually preliminary to a more detailed survey.
- Refractory:** A material of high melting point, possessing the property of heat resistance.
- Remote Sensing:** The collection of information about an object by a recording device that is not in physical contact with it. The term is usually restricted to mean methods that record reflected or radiated electromagnetic energy, rather than methods that involve significant penetration into the earth.
- Resistivity:** The electrical resistance offered by a material to the flow of current, times the cross-sectional area of current flow and per unit length of current path; the reciprocal of conductivity.
- Resolution:** A measure of the ability of geophysical instruments, or of remote-sensing systems, to define closely spaced targets.
- Rhodochrosite:** A rose-red or pink to gray rhombohedral mineral of the calcite group: MnCO<sub>3</sub>. It is a minor ore of manganese.
- Rhodonite:** A pink or brown mineral of silicate-manganese: MnSiO<sub>3</sub>.
- Rutile:** Occurs naturally as a reddish-brown, tetragonal mineral composed of impure titanium dioxide (TiO<sub>2</sub>); common in acid rocks, sometimes found in beach sands.
- Seafloor Spreading Center:** A rift zone on the ocean floor where two plates are moving apart and new oceanic crust is forming.
- Seamount:** A seafloor mountain generally formed as a submarine volcano.
- Seismic Reflection:** The mapping of seismic energy that has bounced off impedance layers within the earth.
- Seismic Refraction:** The transport of seismic energy through rock and along impedance layers.
- Silicomanganese:** A crude alloy made up of 65 to 70 percent manganese, 16 to 25 percent silicon, and 1 to 2.5 percent carbon; used in the manufacture of low-carbon steel.
- Sonar:** Sonic energy bounced off distant objects underwater to locate and range on them, just as radar does with microwaves in air.
- Stainless Steel:** Steel with exceptional corrosion and oxidation resistance, usually containing between 12 and 36 percent chromium. Chromium contents of 12 percent are required to be corrosion resistant. Some low-chromium stainless steels are produced (nine percent to 12 percent), but chromium content averages about 17 percent.
- Stratiform Deposits:** Primary chromite mineral deposits that occur as uniform layers up to several feet thick similar to coalbeds. Stratiform deposits generally contain chromite with low chromium-iron ratio, are comparatively uniform and extend over large areas. The chromite occurrences in the Stillwater Complex in Montana are characteristic of stratiform deposits.
- Stratigraphy:** Study of the order of rock strata, their age and form as well as their distribution and lithology.
- Substrate:** 1) The substance on or in which an organism lives and grows, 2) The underlying material (e. g., basalt) to which cobalt-rich ferromanganese crusts are cemented.
- Succession:** the gradual process of community change brought about by the establishment of new populations of species which eventually replace the original inhabitants.
- Superphosphate:** One of the most important phosphorus fertilizers, derived by action of sulfuric acid on phosphate rock. Ordinary superphosphate contains about 18 to 20 percent phosphorous pentoxide (P<sub>2</sub>O<sub>5</sub>). Triple superphosphate is enriched in phosphorus (44 percent to 46 percent P<sub>2</sub>O<sub>5</sub>) and is manufactured by treating superphosphate with phosphoric acid.
- Synthetic Rutile:** Rutile substitutes made from high-grade ilmenites by various combinations of oxidation-reduction and leaching treatments to remove the bulk of the iron.
- Taxonomy:** classification of organisms into groups reflecting their similarity and differences (Kingdom, Phylum, Class, Order, Family, Genus, Species).
- Thermocline:** a gradient in the ocean where temperature changes rapidly.
- Titanium Dioxide Pigment:** A white, water-insoluble powder composed of relatively pure titanium dioxide (TiO<sub>2</sub>) produced commercially from TiO<sub>2</sub> minerals

ilmenite and rutile (both rutile and anatase “grades” are manufactured).

**Titanium Slag:** High titanium dioxide (TiO<sub>2</sub>) slag made by electric furnace smelting of ilmenite with carbon, wherein a large fraction of the iron oxide is reduced to a saleable iron metal product.

**Titanium Sponge:** The primary metal form of titanium obtained by reduction of titanium tetrachloride vapor with magnesium or sodium metal. It is called sponge because of its appearance and high porosity.

**Transponder:** A radio or radar device that upon receiving a designated signal emits a signal of its own. Used for detection, identification, and location of objects, as on the seafloor.

**Turbidity:** cloudiness in water due to the presence of suspended matter.

**Zooplankton:** animal forms of plankton.