



## **Minerals, Critical Minerals, and the U.S. Economy**

Committee on Critical Mineral Impacts of the U.S. Economy, Committee on Earth Resources, National Research Council

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## *Glossary*

**Alloy (metal, super)**—A mixture of two or more chemical elements, at least one of which is a metal (Oxford Dictionary and Thesaurus, 1996).

**Base metals**—Any of the more common and more chemically active metals (e.g., lead, copper; Bates and Jackson, 1987).

**By-product**—Material of some economic value produced in a process that is focused on extracting another material. For example, indium is a by-product of zinc processing (available online at <http://www.platinum.matthey.com/production/1048863442.html>, accessed September 27, 2007).

**Carbonatite deposit**—A carbonate rock of apparent magmatic origin, generally associated with kimberlites and alkaline rocks (Bates and Jackson, 1987).

**Catalytic converter**—A device incorporated in the exhaust system of a motor vehicle, with a catalyst for converting pollutant gases into harmless products (Oxford Dictionary and Thesaurus, 1996).

**Commodity**—A physical substance such as grain, fuel, or minerals that is interchangeable with a product of the same type and that investors buy and sell, often through futures contracts (Bates and Jackson, 1987).

**Conductivity**—A measure of the ease with which a conduction current can be made to flow through a material under the influence of an applied electric field (Bates and Jackson, 1987).

**Coproducts**—Different minerals that occur in a single ore body that are extracted and/or processed together or sequentially with one another be-

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cause of mineral or process similarities. Contrast to a mineral ‘by-product’ which is the residual of, or secondary to, extraction and production of a primary mineral of interest.

**Critical minerals**—Those that are both essential in use and subject to considerable supply risk.

**Dielectric**—A material in which displacement currents predominate over conduction currents (i.e., an insulator; Bates and Jackson, 1987).

**Divalent ion**—An atom that has acquired an electrical charge by gaining or losing two electrons.

**Electric arc furnace**—Steelmaking furnace in which scrap is generally 100 percent of the charge. Heat is supplied from electricity that arcs from the graphite electrodes to the metal bath. Furnaces may be either alternating current (AC) or direct current (DC). DC units consume less energy and fewer electrodes, but they are more expensive (<http://metals.about.com/library/bldef-Electric-Arc-Furnace.htm>).

**Froth flotation**—A method of mineral concentration used in platinum group metal production that separates the various minerals in the feed according to their differing surface properties. Separation is achieved by passing air bubbles through the mineral pulp. By adjusting the chemistry of the pulp with various reagents, valuable minerals can be made aerophilic (air avid) and gangue minerals aerophobic (water avid). Separation occurs when valuable minerals adhere to the air bubbles that form the froth floating on the surface of the pulp (available online at <http://www.platinum.matthey.com/production/1048863442.html>; accessed September 27, 2007).

**Galvanized steel**—Steel coated with a thin layer of zinc to provide corrosion resistance in underbody auto parts, garbage cans, storage tanks, or fencing wire. Sheet steel normally must be cold-rolled prior to the galvanizing stage (About Metals Glossary).

**Grade**—The relative quantity or percentage of the commodity or element of interest in a unit volume of mineralized rock.

**Layered igneous complex (or layered intrusion)**—A compositionally stratified intrusive magmatic rock body. Layering may be conspicuous because of variations in relative proportions of minerals.

**Light-emitting diode (LED)**—A semiconductor diode that converts applied voltage to light and is used in digital displays (e.g., a calculator). A diode is an electronic device that restricts current flow primarily to one direction (American Heritage Dictionary, 2000).

**Liquid crystal display (“flat screen”)**—A low-power flat-panel display used in many laptop computers, calculators, and digital watches, made up of a liquid crystal that is sandwiched between layers of glass or plastic and becomes opaque when electric current passes through it. The contrast between the opaque and the transparent areas forms visible characters (American Heritage Dictionary, 2000).

**Magnetic moment**—A vector quantity characteristic of a magnetized body or an electric current system; it is proportional to the intensity of the magnetic field produced by this body and also to the force experienced in the magnetic field of another magnetized body or electric current (Bates and Jackson, 1987).

**Metal**—Any of a class of chemical elements that have a characteristic luster, are good conductors of heat and electricity, and are opaque, fusible, and generally malleable or ductile (Bates and Jackson, 1987).

**Metallurgy**—The science and art of separating metals and metallic minerals from their ores by mechanical and chemical processes; the preparation of more metalliferous materials from raw ore (Bates and Jackson, 1987).

**Mineral deposit**—A mineral occurrence of sufficient size and grade that it might, under favorable circumstances, be considered to have economic potential (available online at <http://www.coalcreek.org/glossary.html>; accessed November 19, 2007).

**Mineral occurrence**—Any concentration of ore or economic mineral

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found in bedrock or as float but that are too low grade or for other reasons are not considered potentially economic (USBM/USGS, 1980).

**Mineral reserve**—That part of the reserve base which could be economically extracted or produced at the time of determination with existing technology (USBM/USGS, 1980; Bates and Jackson, 1987).

**Mineral reserve base**—That part of an identified resource that meets specified minimum physical and chemical criteria related to current mining and production practices, including those for grade, quality, thickness, and depth. It is the in-place demonstrated resource from which reserves are estimated (USBM/USGS, 1980).

**Mineral resource**—A concentration of naturally occurring solid, liquid, or gaseous material in or on the Earth's crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible. An "identified resource" is a resource whose location, grade, quality, and quantity are known or estimated from specific geologic evidence (USBM/USGS, 1980).

**Mineralization**—The process or processes by which a mineral or minerals are introduced into a rock, resulting in a valuable or potentially valuable deposit (Bates and Jackson, 1987).

**Open-pit mine**—Surface mining in which valuable rock is exposed by removal of overburden.

**Ore**—A naturally occurring material from which one or more minerals of economic value can be extracted at a reasonable profit (Bates and Jackson, 1987).

**Ore body**—A continuous, well-defined mass of material of sufficient ore content to make extraction economically feasible (Bates and Jackson, 1987).

**Ore deposit**—A mineral deposit of such grade, tonnage, or value that the minerals can be extracted, processed, and distributed at a profit.

**Oxide**—A mineral compound characterized by the linkage of oxygen with one or more metallic elements such as cuprite ( $\text{Cu}_2\text{O}$ ), rutile ( $\text{TiO}_2$ ), or spinel ( $\text{MgAl}_2\text{O}_4$ ) (Bates and Jackson, 1987).

**Platinum group metals**—Ruthenium, rhodium, palladium, osmium, iridium, and platinum (Bates and Jackson, 1987).

**Porphyry copper deposit**—A large body of rock that contains disseminated chalcopyrite and other sulfide minerals. Such deposits are mined in bulk on a large scale, generally in open pits, for copper and sometimes by-product molybdenum. A porphyry is an igneous (magmatic) rock that contains conspicuous phenocrysts (mineral crystals) in a fine-grained groundmass (Bates and Jackson, 1987).

**Pyrophoric alloy**—An alloy that emits sparks when scratched or struck with steel (Webster's Third New International Dictionary, 1986).

**Rare earth elements**—A series of 15 metallic elements, from lanthanum (atomic number 57) to lutetium (71) that occur as oxides in the Earth's crust. These elements are not especially rare, but their concentrations are low. Three other elements (yttrium, thorium, and scandium) are sometimes also considered rare earth elements (Bates and Jackson, 1987).

**Scanning electron microscope**—A microscope in which a finely focused beam of electrons is electrically or magnetically moved across the specimen to be examined, from point to point, again and again, and the reflected and emitted electron intensity is measured and displayed, sequentially building up an image. The ultimate magnification and resolution is less than for the conventional electron microscope, but opaque objects can be examined and great depth of field is obtained (Bates and Jackson, 1987).

**Semiconductor**—A material that does not conduct electricity at low temperatures but does so at higher temperatures (Chemistry-Dictionary).

**Strategic mineral**—A mineral associated almost exclusively with national security and military needs or requirements during national emergencies; synonyms for strategic include planned, tactical, and calculated.

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**Superalloy**—Any of several, complex, temperature-resistant alloys (American Heritage Dictionary, 2000).

**Superconductor**—A material that has no resistance to electricity. When current passes through a superconductor, there is no loss of electrical power due to these materials (Chemistry-Dictionary).

**Sustainable resource development**—The integration of economic activity with environmental integrity, social concerns, and effective governance systems (MMSD, 2002).

**Titanium sponge**—The metal product from reduction of titanium tetrachloride with magnesium (the Kroll process), called sponge because of its sponge-like appearance. Titanium sponge is highly susceptible to contamination and deterioration since its sponge-like characteristics permit pickup of free moisture if it is improperly packed and stored (available at [https://www.dnsc.dla.mil/iamthekey/UploadedFiles/GENERAL\\_CommodityData\\_titanium.pdf](https://www.dnsc.dla.mil/iamthekey/UploadedFiles/GENERAL_CommodityData_titanium.pdf); accessed September 27, 2007).

**Tonnage**—The amount of material containing the mineral commodity of interest.

**Trivalent ion**—An atom that has acquired an electric charge by gaining or losing three electrons.

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