

Aluminum: The most abundant metal element in the Earth's crust. Bauxite is the main source of aluminum. Aluminum is used in the United States in packaging (31%), transportation (22%), and building (19%). Guinea and Australia have 46 percent of the world's reserves. Other countries with major reserves include Brazil, Jamaica, and India.

Antimony: A native element; antimony metal is extracted from stibnite and other minerals. Antimony is used as a hardening alloy for lead, especially storage batteries and cable sheaths; also used in bearing metal; type metal; solder; collapsible tubes and foil; sheet and pipes; and, semiconductor technology.

Asbestos: because this group of silicate minerals can be readily separated into thin, strong fibers that are flexible, heat resistant, and chemically inert, asbestos minerals are suitable for use in fireproof fabrics, yarn, cloth, paper, paint filler, gaskets, roofing composition, reinforcing agent in rubber and plastics, brake linings, tiles, electrical and heat insulation, cement, and chemical filters.

Barium: used as a heavy additive in oil-well-drilling mud; in the paper and rubber industries; as a filler or extender in cloth, ink, and plastics products; in radiography ("barium milkshake"); as getter (scavenger) alloys in vacuum tubes; deoxidizer for copper; lubricant for anode rotors in X-ray tubes; sparkplug alloys. Also used to make an expensive white pigment.

Bauxite: a general term for a rock composed of hydrated aluminum oxides; it is the main ore of alumina to make aluminum; also used in the production of synthetic corundum and aluminous refractories.

Beryllium: used in the nuclear industry and in light, very strong alloys used in the aircraft industry. Beryllium salts are used in fluorescent lamps, in X-ray tubes and as a deoxidizer in bronze metallurgy. Beryl is the gem stones emerald and aquamarine.

Chromite: 99 percent of the world's chromite is found in South Africa and Zimbabwe. Chemical and metallurgical industries use 85% of the chromite consumed in the U.S.

Cobalt: used in superalloys for jet engines; chemicals (paint driers, catalysts, magnetic coatings); permanent magnets; and cemented carbides for cutting tools. Principal cobalt producing countries include Zaire, Zambia, Canada, Cuba, and the former Soviet Union. The United States uses about one-third of total world consumption. Cobalt resources in the United States are low grade and production from these deposits is not economically feasible.

Columbite-tantalite group (columbium is another name for niobium): the principal ore of niobium and

tantalum, used mostly as an additive in steel making and in superalloys; used in metallurgy for heat-resistant alloys, rust-proofing (stainless steel), and electromagnetic superconductors. Brazil and Canada are the world's leading producers.

Copper: used in electric cables and wires, switches, plumbing, heating; roofing and building construction; chemical and pharmaceutical machinery; alloys (brass, bronze, and a new alloy with 3% beryllium that is particularly vibration resistant); alloy castings; electroplated protective coatings and undercoats for nickel, chromium, zinc, etc. The leading producer is Chile, followed by the U.S., the former Soviet Union, Canada, Zambia, and Zaire.

Feldspar: a rock-forming mineral; industrially important in glass and ceramic industries; pottery and enamelware; soaps; abrasives; bond for abrasive wheels; cements and concretes; insulating compositions; fertilizer; poultry grit; tarred roofing materials; and as a sizing (or filler) in textiles and paper.

Fluorite (fluorspar): used in production of hydrofluoric acid, which is used in the pottery, ceramics, optical, electroplating, and plastics industries; in the metallurgical treatment of bauxite, which is the ore of alumina; as a flux in open hearth steel furnaces and in metal smelting; in carbon electrodes; emery wheels; electric arc welders; toothpaste; and paint pigment.

Gold: used in dentistry and medicine; in jewelry and arts; in medallions and coins; in ingots as a store of value; for scientific and electronic instruments; as an electrolyte in the electroplating industry. South Africa has about half of the world's resources. Significant quantities are also present in the U.S., Australia, Brazil, Canada, China, and the former Soviet Union.

Gypsum: processed and used as prefabricated wallboard or as industrial or building plaster; Used in cement manufacture; agriculture and other uses.

Halite (Sodium chloride—Salt): used in human and animal diet, food seasoning and food preservation; used to prepare sodium hydroxide, soda ash, caustic soda, hydrochloric acid, chlorine, metallic sodium; used in ceramic glazes; metallurgy; curing of hides; mineral waters; soap manufacture; home water softeners; highway deicing; photography; herbicide; fire extinguishing; nuclear reactors; mouthwash; medicine (heat exhaustion); in scientific equipment for optical parts. Single crystals used for spectroscopy, ultraviolet and infrared transmission.

Iron Ore: used to manufacture steels of various types. Powdered iron: used in metallurgy products; magnets; high-frequency cores; auto parts; catalyst. Radioactive iron (iron 59): in medicine; tracer element in biochemical and metallurgical research. Iron blue:

in paints, printing inks; plastics; cosmetics (eye shadow); artist colors; laundry blue; paper dyeing; fertilizer ingredient; baked enamel finishes for autos and appliances; industrial finishes. Black iron oxide: as pigment; in polishing compounds; metallurgy; medicine; magnetic inks; in ferrites for electronics industry. Major producers of iron ore include Australia, Brazil, China, and the former Soviet Union.

Lead: used in lead batteries, gasoline additives and tanks, and solders, seals or bearings; used in electrical and electronic applications; TV tubes, TV glass, construction, communications, and protective coatings; in ballast or weights; ceramics or crystal glass; tubes or containers, type metal, foil or wire; X-ray and gamma radiation shielding; soundproofing material in construction industry; and ammunition. The U.S. is the world's largest producer and consumer of lead metal. Other major mine producers include Australia, Canada, and the former Soviet Union.

Limestone: the most versatile and widely used rock in the earth's crust. Nearly 500 million tons annually (70% of the total) is crushed and used as concrete aggregate. Certain types highly desired as dimension stone; source of lime, the chief raw ingredient in cement; a fertilizer and soil conditioner; as a flux in the melting of iron; used in paints and plastics; commonly used as a livestock feed as a source of calcium.

Lithium: lithium compounds are used in ceramics and glass; in primary aluminum production; in the manufacture of lubricants and greases; rocket propellants; vitamin A synthesis; silver solders; underwater buoyancy devices; batteries.

Manganese: essential to iron and steel production. The U.S., Japan, and Western Europe are all nearly deficient in economically minable manganese. South Africa and the former Soviet Union have over 70% of the world's reserves.

Mica: micas commonly occur as flakes, scales, or shreds. Sheet muscovite (white) mica is used in electronic insulators (mainly in vacuum tubes); ground mica in paint, as joint cement, as a dusting agent, in well-drilling muds; and in plastics, roofing, rubber, and welding rods.

Molybdenum: used in alloy steels (47% of all uses) to make automotive parts, construction equipment, gas transmission pipes; stainless steels (21%) used in water distribution systems, food handling equipment, chemical processing equipment, home, hospital, and laboratory requirements; tool steels (9%) bearings, dies, machining components; cast irons (7%) steel mill rolls, auto parts, crusher parts; super alloys (7%) in furnace parts, gas turbine parts,

chemical processing equipment; chemicals and lubricants (8%) as catalysts, paint pigments, corrosion inhibitors, smoke and flame retardants, and as a lubricant. As a pure metal, molybdenum is used because of its high melting temperatures (4,730 °F.) as filament supports in light bulbs, metalworking dies and furnace parts. Major producing countries are Canada, Chile, and the U.S.

Nickel: vital as an alloy to stainless steel; plays key role in the chemical and aerospace industries. Leading producers include Australia, Canada, Norway and the former Soviet Union. Largest reserves are found in Cuba, New Caledonia, Canada, Indonesia, and the Philippines.

Perlite: expanded perlite is used in roof insulation boards; as fillers, filter aids, and for horticultural.

Platinum Group Metals (includes platinum, palladium, rhodium, iridium, osmium, and ruthenium): they are among the scarcest of the metallic elements. Platinum is used principally in catalysts for the control of automobile and industrial plant emissions; in catalysts to produce acids, organic chemicals, and pharmaceuticals. PGMs used in bushings for making glass fibers used in fiber-reinforced plastic and other advanced materials, in electrical contacts, in capacitors, in conductive and resistive films used in electronic circuits; in dental alloys used for making crowns and bridges; in jewelry. The former Soviet Union and South Africa have nearly all the world's reserves.

Potash: a carbonate of potassium; used as a fertilizer; in medicine; in the chemical industry; used to produce decorative color effects on brass, bronze, and nickel.

Pyrite: used in the manufacture of sulfur, sulfuric acid, and sulfur dioxide; pellets of pressed pyrite dust are used to recover iron, gold, copper, cobalt, nickel, etc..

Quartz (Silica): as a crystal, quartz is used as a semi-precious gem stone. Cryptocrystalline forms may also be gem stones: agate, jasper, onyx, carnelian, chalcedony, etc. Crystalline gem varieties include amethyst, citrine, rose quartz, smoky quartz, etc. Because of its piezoelectric properties quartz is used for pressure gauges, oscillators, resonators, and wave stabilizers; because of its ability to rotate the plane of polarization of light and its transparency in ultraviolet rays it is used in heat-ray lamps, prism, and spectrographic lenses. Used in the manufacture of glass, paints, abrasives, refractories, and precision instruments.

Rare Earth Elements: consumption of rare earth ores is primarily in petroleum fluid cracking catalysts, metallurgical additives, ceramics and polishing compounds, permanent magnets, and phosphors. Rare

earth elements are lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, & lutetium.

Silica: used in manufacture of glass and refractory materials; ceramics; abrasives; water filtration; component of hydraulic cements; filler in cosmetics, pharmaceuticals, paper, insecticides; rubber reinforcing agent, especially for high adhesion to textiles; anti-caking agent in foods; flatting agent in paints; thermal insulator.

Silver: used in photography, chemistry, jewelry; in electronics because of its very high conductivity; as currency, generally in some form of an alloy; in lining vats and other equipment for chemical reaction vessels, water distillation, etc.; catalyst in manufacture of ethylene; mirrors; electric conductors; batteries; silver plating; table cutlery; dental, medical, and scientific equipment; electrical contacts; bearing metal; magnet windings; brazing alloys, solder. Silver is mined in 56 countries. Nevada produces over 30% of the U.S. silver. Largest silver reserves are found in the U.S., Canada, Mexico, Peru, and the former Soviet Union.

Sodium Carbonate (Soda Ash or Trona): used in glass container manufacture; in fiberglass and specialty glass; also used in production of flat glass; in liquid detergents; in medicine; as a food additive; photography; cleaning and boiler compounds; pH control of water.

Stibnite (the main ore of Antimony): used for metal antifriction alloys, metal type, shot, batteries; in the manufacture of fireworks. Antimony salts are used in the rubber and textile industries, in medicine; and glassmaking.

Sulfur: used in the manufacture of sulfuric acid, fertilizers, chemicals, explosives, dyestuffs, petroleum refining; rubber; fungicides.

Taconite: a flint-like rock high enough in iron content to be commercially valuable as a source of iron. See Iron Ore for uses. The United States is a major producer of taconite ores.

Tantalum: A refractory metal with unique electrical, chemical, and physical properties is used to produce electronic components; used for high-purity metals in products ranging from weapon systems to superconductors; capacitors; chemical equipment; dental and surgical instruments; rectifiers; vacuum tubes; furnace components; high-speed tools; catalyst; sutures and body implants; electronic circuitry; thin-film components. Used in optical glass and electroplating devices. Australia, Brazil, Canada and Thailand are the leading producers. There is no tantalum mining in the United States.

Titanium: a metal used mostly in jet engines, airframes, and space and missile applications; produced in the westerns and central U.S., the United Kingdom, China, Japan, and the former Soviet Union.

Tungsten: used in metalworking; construction and electrical machinery and equipment; in transportation equipment; as filament in light bulbs; as a carbide in drilling equipment; in heat and radiation shielding; textile dyes, enamels, paints, and for coloring glass. Major producers are China, Korea, and the former Soviet Union. Large reserves are also found in the U.S., Bolivia, Canada, and The Federal Republic of Germany.

Vanadium: used in metal alloys; important in the production of aerospace titanium alloys; as a catalyst for production of maleic anhydride and sulfuric acid; in dyes and mordants; as target material for X-rays. The former Soviet Union and South Africa are the world's largest producers of vanadium. Large reserves are also found in the U.S. and China.

Zeolites: used in aquaculture (fish hatcheries for removing ammonia from the water); water softener; in catalysts; cat litter; odor control; and for removing radioactive ions from nuclear plant effluent.

Zinc: used as protective coating on steel, as die casting, as an alloying metal with copper to make brass, and as chemical compounds in rubber and paints; used as sheet zinc and for galvanizing iron; electroplating; metal spraying; automotive parts; electrical fuses; anodes; dry cell batteries; fungicides; nutrition (essential growth element); chemicals; roof gutters; engravers' plates; cable wrappings; organ pipes; in pennies; as sacrificial anodes used to protect ship hulls from galvanic action; in catalysts; in fluxes; in phosphors; and in additives to lubricating oils and greases. Zinc oxide: in medicine, in paints, as an activator and accelerator in vulcanizing rubber; as an electrostatic and photoconductive agent in photocopying. Zinc dust: for primers, paints, sherardizing, precipitation of noble metals; removal of impurities from solution in zinc electrowinning. Zinc is mined in over 50 countries with Canada the leading producer, followed by the former Soviet Union, Australia, Peru, and China. In the U.S. mine production mostly comes from Tennessee, Missouri, New York and Alaska.