

# Manganese

*Lisa Corathers, the Manganese Commodity Specialist for the U.S. Geological Survey, has compiled the following information about manganese, an extremely versatile mineral with many applications in the manufacturing of iron, steel, aluminum alloys, batteries and chemicals.*

Manganese is one of the most important ferrous metals and one of the few for which the United States is totally dependent on imports. It is a black, brittle element predominantly used in metallurgical applications as an alloying addition, particularly in steel and cast iron production, which together provide the largest market for manganese (about 83 percent). It is also used as an alloy with nonferrous metals such as aluminum and copper. Nonmetallurgical applications of manganese include battery cathodes, soft ferrite magnets used in electronics, micronutrients found in fertilizers and animal feed, water treatment chemicals, and a colorant for bricks and ceramics.

Manganese is the 12th most abundant element in Earth's crust, at about 0.1 percent; however, it is not found free in nature. Deposits occur on all land areas, deep ocean floors, other marine locations and on lake bottoms. Economically significant manganese deposits are of two general types — marine chemical sediments and secondary enrichment deposits.

Estimated world manganese ore reserves total 380 million metric tons, and leading producers are South Africa, Australia, Gabon, Brazil, Ukraine and China. For manganese ores to be commercially produced, the ore must contain 35 percent manganese or more, but the United States does not possess such reserves. As a result, manganese ore is not mined in the United States, except for recovery of ultra low-grade manganese schists that are used for coloring bricks and are mined at the Grover and Martin mines in South Carolina.

Manganese ferroalloy production waxed and waned in the United States during the 1900s. During the last quarter of the 20th century, manganese ferroalloy production and the number of producers decreased because of global competition. Production continued only at Eramet's plant in Marietta, Ohio, at the turn of the 21st century. Since 2002, two other companies have produced silicomanganese sporadically — Highlanders Alloys LLC in New Haven, W.Va., and Globe Metallurgical Inc., in Beverly, Ohio — although neither is currently producing. In a similar fashion, manganese metal production in the United States diminished in the mid-1980s, with production ceasing altogether by mid-2001.

Because it is essential to steel production, a continued supply of manganese materials is vital to any defense effort as well as to maintenance and growth of an industrial economy. Concerns about the manganese supply led the U.S. federal government to establish a considerable manganese stockpile following World War II. In 1965, the federal government began selling stockpiled manganese materials determined to be in excess. The manganese content of manganese inventories being held by the federal government at year-end 2003 was estimated to be more than 1.03 million metric tons. Even with shipments from the government stockpile and domestic production of some manganese materials, the United States has been reliant upon imports for 100 percent of its manganese needs since 1985.

In 2003, the apparent consumption of manganese in the United States was roughly 692,000 tons. The leading sources of manganese imports in 2000 through 2003 were South Africa (36 percent), Gabon (21 percent), Australia (12 percent) and France (7 percent). World consumption of manganese ore in 2003 approached 23 million tons (gross weight), approximately the same level as world production.

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Sample of manganese ore with penny for scale. Image from *Minerals in Your World*.