CINNABAR AND MERCURY

Specimens of bright-red cinnabar [mercury sulfide, HgS] have always attracted attention because of their color. While cinnabar (the name is of uncertain origin) usually occurs in granular or earthy forms, it sometimes forms distinctive, needle-like or tabular crystals with a quartz-like symmetry that are popular among mineral collectors. Cinnabar also has an unusual chemistry as one of the few mercury-containing minerals. Other collectible mercury minerals, all much less common than cinnabar, are livingstonite [mercury antimony sulfide, $HgSb_4S_8$], corderoite [mercury chlorosulfide, $Hg_3S_2Cl_2$], coloradoite [mercury telluride, HgTe], and terlinguaite [mercury chlorate, Hg_2ClO].

Cinnabar crystallizes in the trigonal (hexagonal) system, has a Mohs hardness of 2.0-2.5, and perfect cleavage in three directions. Among its unusual physical properties is a very high specific gravity of 8.0-8.2 that makes it the densest of all sulfide minerals. Because of its high density, cinnabar also has the highest index of refraction of any mineral—50 percent higher than that of diamond.

From the standpoint of collecting, the most desirable and interesting cinnabar specimens are those with tiny, silvery droplets of elemental mercury. Mercury is named after the Roman god Mercurius; its chemical symbol, Hg, is from the Latin *hydrargyrum*, meaning "liquid silver." Mercury forms on cinnabar specimens through an oxidation process in which oxygen combines with sulfur to produce sulfur dioxide and thus reduce the mercury to its elemental state. This reaction is easily demonstrated by placing a small piece of cinnabar in the oxidizing portion of a flame.

Ranking 67th among the elements in crustal abundance, mercury is somewhat rare and only about as common as platinum. It is also the only relatively common metal that is liquid at room temperature.

Medieval alchemists, intrigued by mercury's bright, silvery luster and great density, tried for centuries to transmute the metal into gold and silver. Centuries later, mercury and cinnabar played important roles in the development of modern chemistry. French chemist Antoine Laurent Lavoisier (1742-1786) used cinnabar to demonstrate the nature of combustion (oxidation) and the composition of air—research that defined elements as simple substances that could not be broken down by known chemical methods.

Mercury combines with many common metals to form alloys. It can then be easily separated and recovered by simple distillation and condensation. Most of the mercury mined throughout history was reused many times in this manner to repeatedly recover gold from placer concentrates and crushed ores.

Mercury's uniform rate of thermal expansion suits it perfectly for use in thermometers. Mercury is also used in such diverse products as electrical switches, thermostats, oxide batteries, and fluorescent-light tubes.

Scientists had long suspected that mercury and its compounds were toxic. The metal's debilitating effects on 19th-century British hat-factory workers gave rise to the term "mad hatter." Gold miners who carelessly operated mercury retorts suffered similar disorders.

Extensive study into mercury's toxicity began in the 1960s, after researchers had positively determined that mercury, mercury vapor, and mercury compounds were indeed harmful to many bodily functions. Chronic mercury poisoning occurs when small amounts of

mercury or its salts are ingested or inhaled over long periods of time. Although symptoms can take years to develop, mercury poisoning can cause irreversible brain, liver, and kidney damage.

As a result of these studies, industrial uses of mercury were significantly reduced by replacing mercury switches with electronic switches, substituting other materials in mercury-oxide batteries, and developing fluorescent-light tubes that employ much smaller amounts of mercury. In the last 20 years, the industrial use of mercury has declined by 95 percent.

But certain other uses have increased. Small-scale gold mining, which is booming in this era of record gold prices, continues to employ mercury in gold recovery. And while compact fluorescent lamps (CFLs) use only tiny amounts of mercury, they are manufactured in great numbers.

Cinnabar mining now produces about 2,000 metric tons of mercury worldwide each year. The last cinnabar mine in the United States closed in 1992, but small amounts of mercury are still recovered from gold-milling and gold-refining operations. The current price of mercury is about $14 per pound. China is the world's leading producer of mercury and, consequently, also the leading source of cinnabar specimens.

Are cinnabar specimens, especially those with elemental mercury potentially dangerous? The answer is yes, but only with frequent, careless handling which could lead to the ingestion of cinnabar particles or mercury droplets. As is the case with many minerals, be sure to store specimens in a safe place and wash hands thoroughly after handling.

Steve Voynick

Steve has worked with the Mineral of the Month Club since 2002. As a former hardrock miner, he has mined Colorado molybdenum, Alaska gold, Arizona copper, and Wyoming uranium. Eight of his ten books deal with topics of minerals, mineral collecting, mining, and gemstones. He has written more than 1,000 articles and is a contributing editor and science columnist with *Rock & Gem* magazine. His work has also appeared in *The Mineralogical Record* and *Lapidary Journal*. He is a former member of the board of directors of the National Mining Hall of Fame & Museum