RHODONITE CRYSTALS FROM PERU

The Now-Closed San Martín Mine is a Classic Locality

Rhodonite, the mineral form of calcium manganese silicate, is best known in its massive form, which is fashioned into distinctive cabochons and decorative objects. But among collectors, rhodonite is most desirable in a much rarer, crystalline form that is found in only a very few localities. Among these is the San Martín Mine at Chiurucu, Huallanca District, Bolognesi Province, Ancash Department, Peru. Although the San Martín Mine is now closed, fine rhodonite specimens are still available to collectors.

The name "rhodonite," pronounced ROW-duh-nite, stems from the Greek *rhodon,* or "rose," referring to the mineral's red color. Rhodonite, chemical formula $CaMn_4Si_5O_{15,}$ consists of 6.26 percent calcium, 34.33 percent manganese, 21.93 percent silicon, and 37.48 percent oxygen. It is a member of the silicates, the largest mineral class, in which silicon and oxygen combine with one or more metals.

Rhodonite crystallizes in the triclinic system with three axes of different lengths, none of which are perpendicular to the others. Rhodonite usually occurs in a massive form that consists of tightly interlocked, microscopic, individual crystals. Rhodonite macrocrystals, which are much rarer, occur as blades and flat prisms, and less commonly as blocky or square prisms.

Rhodonite has a Mohs hardness of 5.5-6.5, a specific gravity of 3.5-3.7, good cleavage in two directions, longitudinal striations, a vitreous luster, a subconchoidal-to-uneven fracture, and a relatively high refractive index of 1.71-1.74. It is most often translucent or opaque, and only occasionally transparent.

Rhodonite is usually red, brownish-red, pinkish-red, or pink; occasionally it is black, yellowish, or greenish. All colors are often streaked with black.

As an idiochromatic, or self-colored, mineral, rhodonite's characteristic reddish colors are due to the essential element manganese. The divalent manganese ion Mn^{2+} is a powerful red chromophore (color-causing agent). Rhodonite colors vary considerably with the amounts of iron and magnesium that have replaced calcium and manganese. Excess iron shifts the color toward intense brownish-red, while an absence of iron produces lighter, more delicate pink hues. Massive rhodonite is often intermixed with white calcite and black pyrolusite (manganese dioxide) in contrasting and attractive patterns that increase its value as a gemstone and decorative stone.

Rhodonite forms in both contact metamorphic rocks and in hydrothermal replacement deposits that have elevated concentrations of manganese. In contact metamorphic rocks, rhodonite occurs with willemite (zinc silicate) and calcite (calcium carbonate). In hydrothermal replacement deposits, it is associated with the garnet mineral spessartine (manganese aluminum silicate).

Johann B. Ruprecht, a Hungarian mine inspector and later a chemist at the Schemnitz Academy of Mining (now the University of Miscolk in Banská Ŝtiavnica, Slovakia), first described rhodonite in 1783. German chemist Christoph Friedrich Jascha (1781-1871) confirmed Ruprecht's findings in 1819 and named this new mineral "rhodonite."

Mineralogists originally used the term "rhodonite" for all forms of manganese silicates, including those containing calcium and iron. But in 1823, researchers recognized a nearly pure form of manganese silicate with an orthorhombic structure as a new mineral, which they named

tephroite. Then in 1913, they recognized pyroxmangite (manganese iron silicate) as a separate species. Today, rhodonite refers only to calcium manganese silicate. Mineralogists used X-ray diffraction methods to define rhodonite's atomic structure in 1923.

Rhodonite was once informally considered the national gemstone of the Soviet Union and later of Russia. Despite an ongoing movement to formalize this recognition, many Russians still favor alexandrite, a variety of chrysoberyl (beryllium aluminum oxide), which is also mined in Russia. In the United States, rhodonite is the official gemstone of Massachusetts.

According to metaphysical practitioners, rhodonite strengthens resolve, builds self-confidence, enables one to better handle chaotic and confusing situations, and aids in physical and emotional healing following traumatic accidents or events. Rhodonite is also thought to alleviate joint pain and the symptoms of emphysema.

Rhodonite has long served as a minor gemstone and decorative stone. It was first used extensively in Russia in the mid-1800s after large quantities of high-grade material became available from a. huge rhodonite deposit at Ekaterinburg in the Ural Mountains. Everyone from Russian royalty to peasants were attracted to the distinctive, pink-and-black appearance of rhodonite gems and decorative items.

In 1881, the sarcophagus of Russia's Emperor Alexander II (1818-1881) was carved from a 47-ton block of rhodonite mined at Ekaterinburg. Peter Carl Fabergé (1846-1920), jeweler to the Russian imperial court, used rhodonite extensively in his exquisite gold, enameled, and jeweled Easter eggs. For the Paris Universal Exposition of 1900, Fabergé created a jeweled replica of the Imperial Regalia that was exhibited atop a polished rhodonite column. The original Imperial Regalia, the royal collection of ceremonial crowns and scepters, included many objects heavily inlaid with polished rhodonite and accompanied by diamonds and precious metals.

Russia led the world in production of rhodonite until the 1880s, when miners opened a new deposit in Cummington, Massachusetts. In 1891, American gemologist George Frederick Kunz (1856-1932) wrote of the Cummington rhodonite: "Blocks were taken out weighing some hundreds of pounds each, having a rich pink-and-red color . . . and equal in quality and beauty to the Russian rhodonite, which is made into vases and also tabletops and mantels."

In 1919, miners opened a rhodonite deposit on Canada's Vancouver Island and removed several thousand tons of massive material. In the 1950s, when pink and black colors were in vogue for clothing, cars, and interior décor, rhodonite jewelry gained great popularity in North America, Europe, and Japan. Cabochons and polished "flats" of pink-and-black rhodonite were often set into necklaces, brooches, bracelets, cuff links, and tie clasps. To meet the booming rhodonite demand, Canada's Duncan mine, which had been closed since the late 1930s, reopened in 1980 to supply cutters around the world.

In 1991, Russia regained the lead in rhodonite production with the expansion of the Ekaterinburg stonecutting facility, which has since supplied most of the world's rhodonite for such decorative objects as candlesticks, jewelry boxes, vases, sculptures, desk accessories, mantels, and tabletops. Rhodonite from Ekaterinburg is one of the many decorative stones that adorn the stations of Moscow's Metro Subway. At the Mayakovskaya Station, polished rhodonite slabs cover the structural columns. At the Chekhovskaya Station, wall mosaics contain thousands of rhodonite inlay pieces.

High-quality, easy-to-cut-and-polish, massive rhodonite is available in an array of attractive reddish colors, the most desirable being bright pinks mottled with dense, dendritic patterns of black manganese dioxide and white calcite. Generally, translucent rhodonite is

fashioned into cabochons and beads, while opaque material is used for inlays and carvings. With its toughness and attractive color patterns, massive rhodonite makes a superb carving medium.

Transparent rhodonite crystals are occasionally faceted into collector's gems. When properly faceted, transparent rhodonite, with its distinctive reddish colors and relatively high refractive index makes very attractive gems. Faceted rhodonite gems are costly because of the rarity of large, transparent crystals that can be cut into gems larger than five carats, and also because rhodonite's two cleavage planes make cutting difficult. Top-quality rhodonite gems in the six-carat range cost about $4,500; those of ten carats can cost more than $6,000.

Mineral collectors value rhodonite crystals both as individual and composite specimens for their reddish colors, rarity, and unusual mineralogical associations.

Rhodonite is collected in Peru, Brazil, Bolivia, Canada, Russia, Mexico, Sweden, Italy, England, Japan, India, Namibia, South Africa, and Australia. In the United States, rhodonite is found in Massachusetts, New Jersey, Colorado, Montana, New Hampshire, North Carolina, Vermont, Virginia, and California.

Some of the finest rhodonite crystals come from the San Martín Mine at Chiurucu, Huallanca District, Bolognesi Province, Ancash Department, Peru, an area that is part of the Cordillera Blanca Andean sub-range. The Huallanca District, which covers 337 square miles with an average elevation of 6,000 feet, is 80 miles east of the Pacific Coast and 125 miles north-northeast of Peru's capital city of Lima.

Mineralization in the Huallanca District was emplaced following the crustal fracturing that accompanied the Andean Orogeny (mountain-building episode) some 60 million years ago. During this time, mineral-rich, hydrothermal solutions surged upward in multiple phases into fractures within quartz-monzonite and granitic country rock to emplace complex and highly mineralized vein systems. These multimetal veins contain minerals of zinc, silver, lead, molybdenum, copper, and manganese. Although most veins are small and erratic, they are often exceedingly rich. Gases accompanying the late deposition phases created vugs or cavities within these veins that provided space for the growth of large and unusually well-developed mineral crystals. Much later, erosion exposed parts of these veins as mineralized outcrops.

Archaeologists believe that the Incas were mining silver in what is now the Huallanca District when the Spanish arrived in 1532. After the Incan conquest, Spanish prospectors also discovered silver at Huallanca and in adjacent areas. Although Huallanca was a relatively small mining district, it nevertheless contributed to overall Spanish silver production.

After Peru became independent in 1821, silver mining declined at Huallanca as government instability and raids by outlaws compounded the difficulties of mining in the rugged Andes. Huallanca's production of silver and lead increased again only after Peru legalized foreign mine ownership in the 1890s. Several underground zinc mines were developed at Huallanca in the 1960s. Today, one of Huallanca's two mining areas is Chiurucu, a small town that serves the miners of the nearby San Martín, La Gringa, and Chiurucu mines. These mines produce zinc and lesser amounts of silver, lead, and copper. The ores are hand-cobbed (manually concentrated) and trucked to concentrating mills in other districts. In recent decades, the operation of these mines has been sporadic and dependent upon fluctuating zinc prices.

The primary ores at the San Martín Mine are sphalerite (zinc sulfide) and galena (lead sulfide), which both contain significant amounts of silver. Other economic minerals are molybdenite (molybdenum disulfide), tetrahedrite (copper iron zinc antimony arsenic sulfide), chalcopyrite (copper iron sulfide), hübnerite (manganese tungstate), and tennantite (copper iron zinc arsenic antimony sulfide). Gangue minerals include pyrite (iron disulfide), quartz (silicon

dioxide), calcite (calcium carbonate), and rhodonite, the latter as well-developed crystals with a rich, pinkish-red color.

San Martín miners originally discarded rhodonite as a worthless gangue material. But in the 1980s, when Peruvian mineral specimens began to attract attention on international markets, specimens in high demand included rhodonite from the San Martín Mine. Prices rose sharply, prompting miners at San Martín to begin collecting rhodonite specimens to sell to buyers from Lima as a source of secondary income.

Rhodonite is somewhat uncommon in the San Martín ore veins. It occurs only in occasional pockets, but these, however, can be completely filled with rhodonite crystals. Pockets range from one to eight feet in length. Although recovering undamaged crystals is difficult, San Martín miners have become remarkably proficient at specimen extraction. The first major rhodonite pocket was opened in 1991. Four years later, a second pocket yielded a wealth of fine specimens that were widely acclaimed at major gem-and-mineral shows in the United States and Europe. San Martín rhodonite crystals were described in *The Mineralogical Record* in 1997, the same year that miners found yet another major pocket. By then, the San Martín Mine had been recognized as a classic locality for rhodonite crystals.

The next major pocket, discovered in 2007, became the source of most of the San Martín rhodonite crystals available today. Unfortunately, the San Martín Mine has since closed and is unlikely to reopen. Prices for specimens of San Martín rhodonite crystals have since increased sharply, with one-inch clusters now selling for hundreds of dollars each. A single cabinet-sized specimen can cost thousands of dollars.

Rhodonite specimens from the San Martín Mine typically have a distinctive, pinkish-red color that is caused by the essential element manganese. These sharp, bladed crystals often occur in radial or "spray" forms called "roseates," a habit that is rare at all other rhodonite localities. Among the most desirable specimens are composites of transparent-to-translucent rhodonite in association with small, white, trapezoidal crystals of calcite, hexagonal prisms of white quartz, cubic crystals of brassy pyrite, and dark specks of sphalerite.

Peru's San Martín Mine fully warrants its status as a classic locality for rhodonite crystals. And with the mine now closed, the supply of fine rhodonite specimens is dwindling, and prices continue to rise.