

## VERACRUZ AMETHYST

### Beautiful Crystals from Mexico

Of all the color varieties of quartz, amethyst is the most valuable and, in the eyes of many collectors, the most beautiful. Amethyst colors range from the palest shades of lilac to deep, rich purples that are highlighted by flashes of red. With such delightful colors, it is not surprising that more faceted gems are cut from amethyst than from all the other color varieties of quartz combined.

Amethyst has many collecting localities, most of which yield crystals that, while beautiful in color, are usually stubby or equant in shape. While such crystal shapes suffice for gem-cutting purposes or look attractive on the walls of geodes, they do not make the most sought-after specimens.

Collectors have always sought amethyst in elongated prisms or clusters of prisms. And for the last 45 years, superb specimens of elongated amethyst crystals have come from the tiny village of Piedra Parada near Las Vigas de Ramírez in Mexico's Veracruz-Llave state. Known variously as "Veracruz amethyst," "Las Vigas amethyst," or "Piedra Parada amethyst," it occurs as elongated prisms, often in eye-catching, complex clusters, and always in clean, bright lilac, violet, and purple colors. Collectors consider these specimens among the finest in the world. But, unfortunately, the supply of Veracruz amethyst is now beginning to run out.

Amethyst is not mineral species, but the purple color variety of the mineral quartz [silicon dioxide,  $\text{SiO}_2$ ]. Quartz consists of 46.74 percent silicon (Si) and 53.26 percent oxygen (O). A member of the silicate class of minerals, quartz is the most abundant of all minerals, making up 12 percent of the Earth's crust. Amethyst is one of the rarest forms of quartz.

Quartz crystallizes in the hexagonal system with four axes, three of equal length and lying in a common plane. The fourth axis is of variable length and is perpendicular to the plane of the other three. The dominant habit of quartz and its amethyst variety is the hexagonal or six-sided prism, in which six prismatic faces are parallel to the unique axis. Terminations are usually hexagonal pyramids or dihexagonal (12-sided) pyramids. Quartz has a conchoidal fracture, Mohs hardness of 7.0, a vitreous luster, and a specific gravity of 2.65.

Quartz is an allochromatic (other-colored) mineral, meaning that its colors are caused by traces of nonessential, color-producing elements called chromophores; the effects of geophysical radiation; lattice defects called "color centers"; or, as in the case of amethyst, by a combination of all three. Although pure quartz is colorless, its many color varieties, in addition to purple amethyst, include water-clear rock crystal, gray-brown smoky quartz, white milky quartz, yellow citrine, rose quartz, and pink quartz.

The primary chromophore that creates the purple of amethyst is ferric iron ( $\text{Fe}^{+3}$ ). Very small quantities of ferric iron—only about 40 parts per million—are present in the amethyst lattice. These ferric ions substitute for silicon ions and under certain conditions can give up electrons to produce  $\text{Fe}^{4+}$  ions. The free electrons migrate to vacant lattice sites called "electron traps" or color centers, which impart a local, negative charge that alters the absorption of visible light. In amethyst, these electron traps absorb the yellow and green portions of the visible spectrum, thus transmitting and reflecting the combined red and blue wavelengths to create colors that range from pale lilac, lavender, and violet to intense purples. Manganese ions  $\text{Mn}^{2+}$  can also contribute to amethyst color by introducing subtle reddish hues and highlights.

Amethyst color is always zoned, with the most intense hues concentrated in the terminations. Color zoning is caused by changes in the iron content of the silica solutions during crystallization. Intensely colored sections of amethyst crystals result from growth solutions that were relatively rich in ferric iron, while pale or nearly colorless sections formed from solutions that were deficient in ferric iron. The repetitive color banding seen in many amethyst crystals reflects a sequential enrichment and depletion of the ferric iron content in the silica solutions during the growth process.

Amethyst crystals are usually transparent. Their refractive index of 1.544-1.553 is roughly equal to that of the beryl [beryllium aluminum oxide,  $\text{Be}_3\text{Al}_2\text{Si}_6\text{O}_{18}$ ] gemstones emerald and aquamarine.

Amethyst most often forms in granite pegmatites and hydrothermal-emplacment veins. Although it is widely distributed and has numerous occurrences, top-quality crystals are rare. Amethyst is collected in Mexico, Russia, Brazil, Uruguay, Bolivia, Canada, Zambia, and Namibia. In the United States, quality amethyst is found in Maine, Arizona, and North Carolina.

Because of its wine-like color, the ancient Greeks associated amethyst with the intoxicating effects of wine. The word “amethyst” stems from the Greek *amethystos*, literally meaning “remedy against drunkenness” and alluding to the idea that amethyst prevented inebriation. Both Greeks and Romans wore amethyst jewelry or amulets while drinking wine to ward off intoxication. Some revelers even drank wine from amethyst goblets, believing that, because the goblets retained their purple color after the wine had been consumed, they also retained the wine’s intoxicating effects.

An interesting myth about amethyst involves Dionysus, the Greek god of wine and joviality (the Roman equivalent is Bacchus), and Artemis, the Greek goddess of the moon and the hunt (the Roman equivalent is Diana). Insulted by a mortal, Dionysus swore revenge on the next mortal he met and created fierce tigers to carry out his wish. The unlucky mortal was a young maiden named Amethyst, who was on her way to pay homage to the goddess Artemis. Attacked by Dionysus’ tigers, Amethyst cried out to Artemis for help. To protect the maiden, Artemis turned her into a statue of pure, colorless quartz. Dionysus, awed by the statue’s beauty and shamed by his own ruthlessness, remorsefully wept tears of wine that colored the quartz purple.

Amethyst was one of the 12 gems in the jeweled breastplate of Aaron, the first high priest of the Hebrews. By the first century A.D., when Roman scholar Pliny the Elder recorded the preceding legend of how amethyst was created, it was also thought to aid in hunting, shield soldiers from harm in battle, and protect wearers from the intoxication of love.

Medieval physicians believed that amethyst removed toxins from the body, eased arthritic pain, and cured digestive and circulatory ailments. Because amethyst symbolized piety and was thought to encourage celibacy, it was worn by Catholic clergymen, a tradition that survives today in the amethyst rings of Catholic bishops. Modern, metaphysical practitioners believe that amethyst promotes serenity and calmness, enhances the assimilation of new ideas, provides mental strength and stability, and balances physical, intellectual, and emotional states.

Amethyst has been valued as a gemstone since antiquity. Stones with an intense, even color, called “royal purple,” have always had the greatest value, although the paler, lilac shades, called “rose de France,” were popular in Victorian-era jewelry. With their substantial hardness of Mohs 7.0, amethyst gems are suited for all types of jewelry, including rings.

Amethyst is usually faceted into square-, emerald-, or rectangular-cut gems. Most gems weigh between 2 and 6 carats, although gems of 10 or more carats are not unusual. Amethyst’s

pronounced color zoning somewhat limits gem size, since stones must be cut in a manner that conceals their uneven coloration. Sub-transparent and translucent amethyst, along with massive forms, are cut into cabochons. Amethyst gems are now routinely heat-treated to intensify color and reduce color zoning. Intensive heat-treating will, however, turn the purple color to a golden-yellow similar to that of the citrine variety of quartz. Most “citrine” gems sold today were originally amethyst.

Amethyst is often cut into collectors’ gems. Because large amethyst crystals are readily available, sizeable collectors’ gems are quite affordable. Amethyst gems in the 100-to-200-carat range sell for less than \$1,000.

The British Museum in London displays a superb, 343-carat amethyst gem. Exhibits at the National Museum of Natural History (Smithsonian Institution) in Washington, D.C., include a 1,362-carat gem from Brazil and a 202.5-carat gem from North Carolina. Many major museums feature large amethyst collectors’ gems side-by-side with uncut crystals. Amethyst is also included in the British crown jewels, alongside other gemstones of far greater rarity and value.

Veracruz or Las Vigas amethyst has been considered among the world’s best for the past 45 years. It is obtained from a few sources near the tiny mountain village of Piedra Parada, population 400, in Mexico’s Veracruz-Llave state. This region is 150 miles east-northeast of Mexico City and 50 miles northwest of Xalapa, the capital of Veracruz-Llave. Piedra Parada is eight miles north of Las Vigas de Ramírez (formerly called Professor Rafael Ramírez), population 8,000. This region is located at the southern limit of the Sierra Madre Oriental mountain range at an elevation of 7,500 feet.

Spanish colonists established the first ranch at Las Vigas in 1524, only a few years after the conquistadores had destroyed the Aztec Empire at what is now Mexico City. Near that ranch, a crude bridge made of two heavy wooden beams crossed a stream; subsequently, the town later founded there was named Las Vigas (The Beams). Today, the economy of Las Vigas is based on ranching, logging, and the production of coffee, corn, rice, and fruit.

Loose specimens of amethyst had long been collected from the surface near Piedra Parada. In the 1960s, these specimens came to the attention of Alfonso Ontiveras, a miner and mineral collector from the state of Querétaro. Ontiveras purchased all the specimens the local residents had available, then began searching for their source in the nearby, heavily eroded canyons. The source turned out to be quartz veins within formations of dark volcanic rock. Ontiveras extracted intact specimens and sold them to American markets in the late 1960s, where they created a sensation among collectors and were featured in mineralogical journals and mineral-collecting magazines.

But with his manual mining methods, Ontiveras’ production was limited. In 1980, an American specimen miner and dealer leased the property and began mining specimens with pneumatic rock drills. Within a few years, collectors worldwide had acquired fine specimens of what was now being called Piedra Parada, Las Vigas, or Veracruz amethyst. By whatever name, the source near Piedra Parada had earned recognition as a classic collecting locality for rare, elongated amethyst crystals.

The host rock at Piedra Parada is andesite, a tough, dark-gray volcanic rock that, like basalt, contains very little silica. The amethyst crystals occur in gas cavities, clefts, vugs, and veins within the andesite. This amethyst does not occur as geode linings or stubby crystals, but as very well-developed, elongated prisms and clusters of prisms.

The crystals are transparent, with the most intense coloration near the terminations. The color, which is due to complex interactions between ferric iron chromophores, color centers, and

geophysical radiation, grades from pale lilac and lavender to violet and royal purple. Color intensity varies from vein to vein and color zoning is prominent. Violet “phantoms”—subtle internal structures that mimic the external crystal shape, are sometimes seen within the crystals.

These crystals are usually about an inch or two in length, only rarely reaching three inches. All contain small inclusions of orange-brown hematite [iron oxide,  $\text{Fe}_2\text{O}_3$ ] that do not diminish the transparency. Many of the amethyst prisms rise from a base of tiny, sparkling, colorless quartz crystals. The paler amethyst crystals formed first and are attached to cavity and vein walls. Those that formed later have the most color intensity and grow atop the paler crystals.

Some mineralogists suggest that amethyst coloration in quartz seems to inhibit the development of long, prismatic crystals, and that Veracruz amethyst crystals may actually have formed as colorless rock crystal and developed their coloration later.

But regardless of how their color originated, Veracruz amethyst is among the most beautiful and collectible of all amethyst crystals. Because of its rarity, it is never used for gem purposes, but only as specimens.

Unfortunately, the supply of amethyst specimens at Piedra Parada began to slow in the late 1990s. In recent years, the supply has stopped completely because of drug-related violence that has made the area very dangerous. Because future availability remains uncertain, the prices of Veracruz amethyst are at record highs.

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