

## March 2007 Mineral of the Month: Amazonite

"The microcline [amazonite] crystals have an exceptionally fine color, about the deepest blue-green one could hope for from Colorado microcline."—*Mineralogical Record*, November-December 2006.

### PHYSICAL PROPERTIES

Chemistry:  $\text{KAlSi}_3\text{O}_8$  Potassium Aluminum Silicate (Potassium Aluminosilicate), usually containing some sodium. Amazonite contains trace amounts of lead and structural water, which cause its characteristic blue-green color, as explained in Composition.

Class: Silicates

Subclass: Feldspars

Group: Alkali Feldspars (K-feldspars, Potassium Feldspars, Potash Feldspars)

Crystal System: Triclinic

Crystal Habits: Usually as single, equant prisms with generally square or rectangular cross sections and as tabular crystals; often blocky; twinning common; also occurs in granular forms and as cleavage masses and disseminated, irregular grains. Often exhibits lattice (perthitic) intergrowth with other feldspar minerals.

Color: In the amazonite variety of microcline, pale to intense green to blue-green, occasionally yellow-green, often streaked with white.

Luster: Vitreous

Transparency: Translucent to opaque, rarely transparent.

Streak: White

Cleavage: Perfect in one direction, good in two others.

Fracture: Uneven

Hardness: 6.0-6.5

Specific Gravity: 2.56

Luminescence: None

Refractive Index: 1.518-1.525

Distinctive Features and Tests: The best field indicators of the amazonite variety of microcline are its distinctive green or green-blue colors, hardness just below that of quartz, vitreous luster, occurrence in granite pegmatites, mineralogical association with quartz [ $\text{SiO}_2$ ] and albite [ $\text{NaAlSi}_3\text{O}_8$ ], and tendency to cleave into rhombohedrons. Amazonite, which can be confused with jade and turquoise, is the only bright, green-blue feldspar mineral.

Dana Classification Number: 76.1.1.5

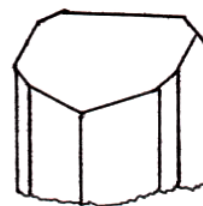


Figure 1. Microcline crystal.

### NAME

Microcline is pronounced MY-crow-kline; the variety name "amazonite" is pronounced AM-ah-zahn-ite. The name "microcline" combines the Greek words *mikro*, meaning "small," and *klinein*, "leaning" or "sloped," and refers to the mineral's cleavage angles that are slightly inclined from 90 degrees. The name "amazonite," a combination of the word "Amazon" and the suffix "-ite" for "stone," literally means "Amazon stone." Other names for microcline include "potash feldspar" and "ferruginous microcline" (an iron-bearing, orange-brown variety). European mineralogists refer to microcline as "microklin" and "microclina." Alternative names for amazonite include "Amazon stone," "green microcline," "green feldspar," "green spar," and "green stone."

### COMPOSITION

The introductory quote was written about amazonite crystals from one of the pockets comprising the

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Smoky Hawk mine, Teller County, Colorado, where our crystals were recently unearthed. Amazonite is the second mineral we have featured from Colorado, after rhodochrosite from the Sweet Home mine, Alma, Park County, Colorado, in October 1997. Since amazonite is recognized as a blue-green variety of the feldspar group mineral microcline, we will focus on the properties of microcline, and highlight amazonite as its most beautiful variety.

Microcline's chemical formula  $\text{KAlSi}_3\text{O}_8$  identifies its elemental components as potassium (K), aluminum (Al), silicon (Si), and oxygen (O). The molecular weight of microcline consists of 14.04 percent potassium, 9.69 percent aluminum, 30.28 percent silicon, and 45.99 percent oxygen. Stability within molecules requires an electrical balance between their cations (positively charged ions) and anions (negatively charged ions). In microcline, the double cation consists of a potassium ion ( $\text{K}^{1+}$ ) and an aluminum ion ( $\text{Al}^{3+}$ ) with a collective cationic charge of +4. The microcline anion is the silicate radical  $(\text{Si}_3\text{O}_8)^{4-}$ . Radicals are groups of two or more elements that act as a single chemical entity. The  $(\text{Si}_3\text{O}_8)^{4-}$  radical consists of three silicon ions ( $3\text{Si}^{4+}$ ) and eight oxygen ions ( $8\text{O}^{2-}$ ). Its anionic charge of -4 balances the microcline molecule's collective cationic charge of +4.

Microcline is a member of the largest mineral group—the silicates, all of which are built around the silica tetrahedron  $(\text{SiO}_4)^{4-}$ . In the silica tetrahedron, a silicon ion is surrounded by, and covalently bonded to, four equally spaced oxygen ions. Silicate minerals fall into seven groups, each based on the number and type of atomic bonds that link the tetrahedra together. Microcline is a framework silicate, or tectosilicate. In framework silicates, each tetrahedron shares all four of its oxygen ions with adjacent tetrahedra to form framework structures that extend indefinitely in three dimensions.

The most familiar framework silicate is quartz [silicon dioxide,  $\text{SiO}_2$ ]. If silicon were the only ion that was stable in the silica tetrahedron, quartz and its chemically identical, temperature-phase minerals tridymite and cristobalite would be the only framework silicates. This is because silica tetrahedra share all four oxygen ions and are therefore electrically neutral and unable to combine with other ions. But the aluminum ion  $\text{Al}^{3+}$  is also stable within the silica tetrahedron and can replace certain silicon ions. The introduction of aluminum ions creates many mineralogical possibilities. When an aluminum ion ( $\text{Al}^{3+}$ ) occupies a silicon-ion site within a tetrahedron, it creates a negative electrical charge. To reestablish electrical stability, the resulting aluminum-silicate radical  $(\text{AlSi}_3\text{O}_8)^{1-}$  must accept another positively charged ion. Positively charged ions with suitable radii to fit between the tetrahedra include potassium ( $\text{K}^{1+}$ ), sodium ( $\text{Na}^{1+}$ ), and calcium ( $\text{Ca}^{2+}$ ). In the framework silicates, partial replacement of silicon ions by aluminum ions and the subsequent ionic bonding to potassium, sodium, or calcium ions create the feldspar minerals (see the box on "The Feldspar Group" on page 3.)

In the feldspar mineral microcline, the electrical imbalance created when aluminum ions occupy certain silicon sites is satisfied when the molecule bonds ionically to the potassium ion  $\text{K}^{1+}$ . The microcline formula  $\text{KAlSi}_3\text{O}_8$  can be expressed as  $\text{K}(\text{AlSi}_3\text{O}_8)$  to reflect its three-dimensional lattice structure in which aluminum ions replace one-quarter of the silicon ions. Potassium ions occupy spaces between the tetrahedra. The resulting three-dimensional structure explains microcline's uneven fracture. The plane of weak ionic bonding shows perfect cleavage, while the other two planes dominated by stronger covalent bonding have only good cleavage. The strong, oxygen-oxygen covalent bonding that dominates the lattice accounts for microcline's considerable hardness of Mohs 6.0-6.5, just below that of quartz (7.0). Microcline's relatively low specific gravity of 2.56, less than that of quartz (2.65), is due to loose atomic packing and large spaces between the tetrahedra.

Microcline is an allochromatic mineral, meaning its colors are due not to inherent chemical or physical properties, but to traces of nonessential elements. Pure microcline is colorless or white, but traces of iron

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produce off-white, pale-yellow, and salmon hues. Higher iron levels create the more intense, orange-brown colors of ferruginous microcline. Amazonite's distinctive greens and green-blues are produced by a combination of lead and structural water together with the effects of geochemical radiation. The natural radioactive decay of the isotope potassium-40 oxidizes the divalent lead ion  $Pb^{2+}$  to trivalent lead  $Pb^{3+}$ ; it also produces hydroxyl radicals  $[(OH)^1]$  that oxidize and displace oxygen ions to create vacant lattice positions. These vacant positions, called "color centers", then trap the trivalent lead ions, causing the microcline lattice to absorb the red end of the spectrum, while reflecting the greens and blues that we perceive in amazonite. (Continues on page 4.)

### THE FELDSPAR GROUP

*It is sometimes said that a thorough knowledge of feldspars is what separates mineralogists from the rest of us. While the in-depth, technical side of feldspars can be daunting, acquiring a basic understanding of this mineral group is not difficult. Feldspars are a group of closely related tectosilicate minerals that make up 60 percent of the Earth's crust. Because all have a hardness of Mohs 6.0-6.5 and a vitreous luster, any glassy mineral that is slightly softer than quartz is likely to be a feldspar. The name "feldspar" derives from the German Feld, or "field," and the Old German Spath (or spar), referring to any cleavable, lustrous mineral. The literal translation of "field spar" (or "field stone") alludes to the tendency of the feldspars to weather into soil-building clays. As explained previously, feldspars are aluminum silicates that contain potassium, sodium, calcium, or barium and that are structurally based on the silica tetrahedron. The feldspars fall into two primary groups: **alkali feldspars** and **plagioclase feldspars**.*

*Although the alkali feldspars have the same or similar chemical compositions, their crystal structures vary with the temperature at which they formed and the subsequent rate of cooling. The important alkali feldspars and their crystal structures are:*

*Anorthoclase (Na,K)AlSi<sub>3</sub>O<sub>8</sub>) sodium potassium aluminum silicate triclinic*

*Sanidine (K,Na)AlSi<sub>3</sub>O<sub>8</sub> potassium sodium aluminum silicate monoclinic*

*Orthoclase KAlSi<sub>3</sub>O<sub>8</sub> potassium aluminum silicate monoclinic*

*Microcline KAlSi<sub>3</sub>O<sub>8</sub> potassium aluminum silicate triclinic*

*The variations in crystal structure among these minerals reflect the degree of ordering of aluminum-ion and silicon-ion tetrahedral sites within the crystal lattice. Sanidine and anorthoclase, which crystallize at high temperatures and cool very rapidly, have disordered structures with near-random placement of the aluminum and silicon ions. Orthoclase, which crystallizes at intermediate temperatures and cools slowly, has a partially ordered structure. Microcline, which crystallizes at low temperatures and cools extremely slowly, has a perfectly ordered structure in which the aluminum and silicon ions occupy regular lattice positions.*

*Microcline is polymorphic with orthoclase. (Polymorphs are minerals that have the same chemical composition, but different crystal structures.) Both microcline and orthoclase have the same formula KAlSi<sub>3</sub>O<sub>8</sub>, but because of their formation at different temperatures, orthoclase crystallizes in the monoclinic system, while microcline crystallizes in the triclinic system. Despite their different crystal structures, microcline and orthoclase can be distinguished positively only by optical examination of thin sections under a polarizing microscope. The green-blue colors of amazonite occur only in microcline, apparently because the monoclinic structure of orthoclase does not readily accommodate lead ions.*

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*The plagioclase feldspars consist of two distinct minerals, albite and anorthite:*

*Albite  $\text{NaAlSi}_3\text{O}_8$  sodium aluminum silicate triclinic*

*Anorthite  $\text{CaAl}_2\text{Si}_2\text{O}_8$  calcium aluminum silicate triclinic*

*Albite and anorthite form a continuous, complete solid-solution series, with four intermediate members that are classified by specific proportions of contained sodium and calcium. Albite contains 0 to 10 percent calcium, while anorthite contains 90 to 100 percent calcium. The intermediate members (not formal mineral names) of this solid-solution series include oligoclase, 10-30 percent calcium; andesine 30-50 percent calcium; labradorite 50-70 percent calcium; and bytownite 70-90 percent calcium. Density measurements or thin-section examination under polarizing microscopes are necessary to distinguish these minerals and their solid-solution phases.*

*Amazonite is not the only gem variety among the feldspar minerals. The moonstone gems, with their lamellar structures producing soft, blue-white sheens, are semi-transparent varieties of albite, microcline, or labradorite. Transparent orthoclase and bytownite crystals are faceted into beautiful champagne-colored gems. Twinned lamellae in some labradorite produce lustrous, blue-green metallic tints in a play of light called labradorescence. And aventurine feldspar, or sunstone, a translucent oligoclase in which tiny inclusions create a range of lustrous colors, is fashioned into cabochons.*

(Continued from page 3.) Feldspars are essential components of virtually all silica-rich igneous and metamorphic rocks. Microcline is especially common in granite pegmatites and hornfels (fine-grained silicate rocks) of contact and regional metamorphic rocks. Amazonite occurs almost exclusively in granite pegmatites. Pegmatites, bodies of very coarse-grained granite, form when residual magma—the last magma to solidify—retains its heat to cool very slowly. Rather than quickly “freezing” into fine-grained granite, residual magma crystallizes on a fractional, or mineral-by-mineral, basis to form pods, lenses, pockets, and irregular dikes. As this magma, often enriched with rare elements, slowly solidifies, gases sometimes create vugs, or miarolitic cavities, that provide space for the growth of unusually large, well-developed crystals. Amazonite derives its traces of chromophoric lead from enriched, residual magma.

Crystals of microcline (and amazonite) are often intergrown with other feldspar minerals such as albite [sodium aluminum silicate,  $\text{NaAlSi}_3\text{O}_8$ ]. At their crystallization temperatures, most feldspars are completely soluble. But because cooling decreases their solubility, following crystallization these minerals will sometimes exsolve or separate by solid diffusion. The sodium ions aggregate in bands along certain crystallographic axes where they replace potassium ions to form single crystals with alternating bands of microcline and albite. If microcline predominates in volume, the crystal is called perthite; if albite occupies the greater volume, it is called antiperthite (“perthite” and “antiperthite” are not formal mineral names). In amazonite, this perthitic effect creates an attractive green-white streaking. Some of our specimens show this phenomenon, called “white stripe” or “white cap.” Microcline forms unusually large crystals, and sizes less than one-half inch are rare. Microcline is thought to hold the record for the largest crystal size. In a feldspar quarry on Russia’s Kola Peninsula, one mass of microcline with single-crystal characteristics was estimated to weigh 2,000 tons!

The Dana mineral-classification number 76.1.1.5 first identifies microcline as a tectosilicate with an aluminum-silicon framework structure (76). The subclassification (1) defines it as an alkali feldspar. Microcline then falls into the orthoclase group (1), which includes alkali feldspars containing potassium, sodium, or barium, as the fifth (5) of eight members. Other group members include orthoclase [ $\text{KAlSi}_3\text{O}_8$ ], sanidine [(K,Na) $\text{AlSi}_3\text{O}_8$ ], hyalophane [(K,Ba) $\text{AlSi}_3\text{O}_8$ ], and anorthoclase [(Na,K) $\text{AlSi}_3\text{O}_8$ ].

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### *COLLECTING LOCALITIES*

Although microcline is an abundant mineral, its amazonite variety is rare, with only a half-dozen localities worldwide that produce fine specimens. In Europe, amazonite is collected in Austria at Gradischkogel Mountain at St. Vinzenz in Carinthia, and at the Pack pegmatite in the Packalpe Mountains of Styria; in France at Vizzalona Mountain, Vivario, Corsica; in Germany at the Ossling and Dubring quarries at Kamenitz in Saxony; and in Norway at the Landsverk feldspar quarry at Landsverk, Akershus. Russia produces fine specimens in commercial quantities from the Danburitovaya and Etyka pegmatites in the Chitinsilaya Oblast and from the Tazheranskii Massive in the Irkutskaya Oblast, both in the Eastern Siberian Region. Russian amazonite also comes from Kanozero on the Kola Peninsula in the Murmansk Oblast of the Northern Region.

In Brazil, fine specimens have come from the Velha Mine at Tenente Ananias in Rio Grande do Norte, and from the Santa Maria do Itabera Mine at Itabera and the Fazenda Mine at Ferros, both in the Minas Gerais state. Australian amazonite comes from the Cararra Mine in the Harts Range of the Northern Territory and the Pinnacles Mine at Broken Hill in New South Wales. In Japan, amazonite occurs at the Tadachi quarries in the Nagano Prefecture on Honshu Island. African amazonite sources include the Konso and Kenticha areas of Sidamo Province, Ethiopia; the Ankazobe pegmatite field in the Antananarivo Province of Madagascar; the Alto Ligonha pegmatite field at Alta Ligonha in the Zambesia Province of Mozambique; and at feldspar quarries at Kakamas and Bushmanland in the Northern Cape Province of South Africa.

In the United States, Colorado is the most important amazonite collecting area. The classic locality for large, intensely colored amazonite specimens is the Crystal Peak area of Teller and Park counties. Other central Colorado sources include the Devil's Head and Pine Creek pegmatite areas in Douglas County; the Cheyenne District and the Pikes Peak and Crystal Park areas in El Paso County; and Harris Park and Lake George in Park County. In other states, nice specimens occur at the Poor House Quarry at West Bradford Township in Chester County, Pennsylvania; the Zapot Pegmatite in the Fitting District, Mineral County, Nevada; and feldspar quarries at Rockport, Beverly, and Gloucester in Essex County, Massachusetts. The Morefield Mine at Winterham in Amelia County, Virginia, yields a fine, translucent amazonite. Other Virginia sources include the Amelia Mine at Amelia in Amelia County and the Burley Prospect at Roseland in Amherst County.

### *JEWELRY & DECORATIVE USES*

With its considerable hardness (Mohs 6.0-6.5) and pleasing range of green and green-blue colors, amazonite is a popular gemstone. Because it is usually opaque or semi-translucent, amazonite is cut into cabochons or flat inlay pieces, or fashioned into beads. Amazonite gems are most often mounted in silver for use as pendants, necklaces, and bracelets, and is now appearing in southwestern-style silver jewelry of the same type usually employed with turquoise, a gem which amazonite can closely resemble. Amazonite is also fashioned into spheres, small figurines, vases, bowls, candlesticks, and lamps. Most gem-quality amazonite used in beads, inlay, and decorative objects comes from Colorado's Crystal Peak and Russia's Irkutskaya area. We have seen an infusion of amazonite beads made from Russian rough at the major shows lately. Amazonite is not color-enhanced or otherwise treated.

Amazonite specimens, both as individual crystals and as composite specimens with albite and smoky quartz, are very popular among mineral collectors. The most desirable specimens have long, prismatic crystals with intense green-blue colors, sharp crystal edges, and a satiny luster. Amazonite specimens from different localities vary widely in both appearance and mineralogical associations.

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## *HISTORY & LORE*

Amazonite has been known since antiquity, and beads and carved objects have been found in ancient tombs from Egypt to central Russia. In historical writings, amazonite was long confused with turquoise and jade. The mineralogical understanding of amazonite began in the 1790s, when feldspars were recognized as a general mineral group. By 1830, thanks to an increasing knowledge of chemistry and crystallography, mineralogists had recognized orthoclase and microcline as separate feldspar-mineral species. A more complete understanding of the feldspars came after 1910 with the introduction of X-ray diffraction and spectrographic analysis methods.

In the early 1800s, amazonite was known as “Amazon stone.” Various sources attribute the context of the word “Amazon” to the Amazon River, the reflection of jungle canopies in the Amazon River, an Amazon Basin native culture that traded green-blue beads, and a race of female warriors of Greek mythology who offered gifts of green stones. The name “amazonite” originated in 1879, probably as a result of the Colorado amazonite discoveries of the 1860s and 1870s (see “About Our Specimens”) and the trend at the time to employ the new “-ite” mineralogical suffix.

Amazonite specimens have been featured on the one-franc French Southwest Antarctic Territories stamp of 1996, the 150-shilling stamp of Kenya of 1977, and the 150-shilling stamp of Uganda of 1988. Amazonite is an alternative birthstone for December.

Anthropologists believe that various ancient cultures attributed talismanic value to amazonite pendants and carvings. Ancient physicians used amazonite to alleviate skin and eye ailments and to generally enhance the condition of the skin. Modern metaphysical practitioners refer to amazonite as the “hope stone,” reflecting the belief that it inspires hope and increases personal confidence.

## *TECHNOLOGICAL USES*

Microcline and other feldspar minerals have been mined for centuries, initially for use in glassmaking. Today, finely ground feldspar is used in container glass (bottles, etc.), ceramics, tiles, and in filler materials to manufacture paper and glossy cardboards. In glassmaking, feldspar provides silica and acts as a flux to lower the melting point of the glass mix. Powdered feldspar is also the abrasive in most household scouring powders. Because its hardness of Mohs 6.0-6.5 is less than that of glass (Mohs 7.0), feldspar-based scouring powders clean, but do not abrade, glass. The United States now mines 800,000 tonnes (metric tons) of feldspar annually, mostly from primary feldspar quarries with lesser amounts coming as co-products of lithium and mica mining. Worldwide, 13 million tonnes of feldspar worth more than a half-billion dollars are mined annually.

## *ABOUT OUR SPECIMENS*

Our lovely amazonite specimens come from the Smoky Hawk mine in the Crystal Peak area of central Colorado. Crystal Peak and its adjacent hills are located several miles north of Florissant in northwest Teller County. Florissant is on U. S. Highway 24 about 12 miles northwest of 14,110-foot-high Pikes Peak, the main regional landmark, and 35 miles west of Colorado Springs. The Florissant area is roughly 9,000 feet in elevation and consists of rolling hills and pine forests interspersed with open meadows.

Crystal Peak, really a steep hill rather than a “peak,” is located at the western edge of the Pikes Peak Batholith, a 60-mile-long intrusion of coarse, pinkish Pikes Peak granite that covers 1,200 square miles of Douglas, Fremont, El Paso, Park, and Teller counties. The Pikes Peak Batholith is famed for its pegmatite

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pockets of amazonite, topaz, and smoky quartz crystals. The batholith was formed one billion years ago as a deep granitic intrusion. Its very slow cooling is evident in its coarsely textured granite and many pegmatite dikes and pockets. Some 65 million years ago, the Laramide Orogeny, the mountain-forming event that created the Rocky Mountains, uplifted the entire region. The subsequently accelerated surface erosion eventually wore away the upper part of the batholith to expose the pegmatites.

In the early 1800s, the Utes and Arapahos wore and traded small amazonite beads fashioned from material most likely obtained from Crystal Peak. Anglo prospectors found amazonite at Crystal Peak during or immediately following the Pikes Peak gold rush of 1858-59. Commercial collecting of amazonite and smoky quartz crystals began as early as 1865. By the time amazonite was formally recognized as a Colorado mineral variety in 1867, the crystal-collecting area was known variously as "Crystal Peak," "Crystal Butte," and "Florissant Crystal Beds."

In 1872, the American mineralogist Dr. A. E. Foote (1846-1895), head of the Philadelphia-based Foote Mineral Company, the nation's largest distributor of mineral specimens, hired 20 men to dig amazonite and smoky quartz crystals at Crystal Peak. Their production enabled the United States to displace Russia as the world's leading amazonite source. By 1880, "crystal tours" were an important part of the local economy. Large displays of "Pikes Peak Crystals" even greeted arriving passengers at the Colorado Springs railroad station! In Colorado's first fee mineral-collecting venture, \$20 bought a three-day collecting expedition to Crystal Peak that included horses, tents, meals, and "knowledgeable guidance in the gem fields." Mineralogist George Frederick Kunz (1856-1932), America's first true gemologist, wrote extensively about Crystal Peak amazonite in his gemstone reports for the United States Geological Survey's *Mineral Resources* books in the early 1880s.

Crystal Peak amazonite occurs in in situ pockets that are usually subterranean but sometimes partially exposed, collapsed in situ pockets, and alluvial concentrations. The rare intact pockets are similar to geodes, with large, well-developed crystals of amazonite and smoky quartz protruding downward from the roof. Wall crystals are smaller and less developed, while floor crystals are usually broken and naturally cemented together with a reddish clay of albite [ $\text{NaAlSi}_3\text{O}_8$ ] and hematite [ $\text{Fe}_2\text{O}_3$ ]. Much more common are the collapsed pockets in decomposed granite that are filled with a jumble of often-broken crystals cemented together with albite-hematite clay. Alluvial concentrations are the remains of pockets after the surrounding granite has completely decomposed and begun alluvial movement. Crystal Peak pegmatite pockets are rarely longer than four to six feet. The largest documented pocket, found in the early 1900s, was 15 feet long and contained \$3,500 (in 1910 dollars) worth of amazonite and smoky quartz crystals. Of course, a composite smoky quartz and amazonite cluster sells for that much now! The largest single amazonite crystal ever found at Crystal Peak measured 18 inches in length and was recovered during this period.

During the 1930s, commercial mining at Crystal Peak, utilizing mechanical equipment to trench into decomposed granite, was an important local industry and tourist attraction. Crystal Gem Mines, a popular fee-collecting attraction, opened in 1935 and operated continuously until 1968. The Crystal Peak area is now classified as rural-residential. Most pegmatites are on land that is privately owned or leased by collectors, mineral clubs, or commercial miners. More than 150 pegmatite claims are currently registered in the immediately adjacent Pike National Forest. Our specimens come from the Smoky Hawk Mine, one of several Crystal Peak pegmatite properties claimed by Glacier Peak Mining LLC of Colorado Springs. In 2006, Glacier Peak



**Figure 2.** Trenching at Smoky Hawk mine.



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joined forces with the Colorado Calumet Company, Inc., owned by noted Colorado mineral dealer Bryan Lees. This partnership is currently the most active and productive mining group at Crystal Peak and employs mechanical trenching equipment to dig for in situ pegmatite pockets, as seen in Figure 2.

Occasionally, crystal-lined pockets are encountered, such as the one shown in Figure 3. Unfortunately, though, most crystals have been broken off by natural forces through the millennia since they formed. The collectors carefully remove all the in situ and loose crystals they can, and “like putting together a giant jigsaw puzzle, we spend months trying to repair significant pieces. Often, success is limited, but we do not like to give up until we have checked fits on all crystals. Sometimes there are hundreds of crystals in a single pocket.” Can you imagine the joy and the frustration of such work!



Figure 3. Crystal pocket at Smoky Hawk.



Figure 4. Cluster removed at Smoky Hawk.

Of course, the most valuable specimens from Crystal Peak are composites of smoky quartz and amazonite, and even though most are repaired, they remain extremely valuable and much sought after by collectors. A choice specimen can easily sell for many thousands of dollars. Part of the reason is the high cost of mining commercially in the United States, but mainly it is the rich color and luster of both minerals found here, and the fact that Crystal Peak is considered a classic American locality. We owe a debt of gratitude to the mine owner Joe Dorris, who gave us a huge discount so that we could all have a Crystal Peak amazonite. It is easy to appreciate both the lovely blue-green

color, and the excellent, sharp crystal faces, formed because the residual magma cooled ever so slowly all those aeons ago, allowing the atoms to line up in the crystal lattice. A few of our specimens even showed the “White Stripe” and the “White Cap” described earlier in the write-up. Yes, we have many reasons to be grateful to be able to add such a wonderful specimen to our collection!

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