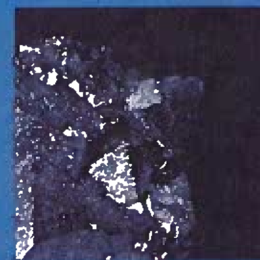
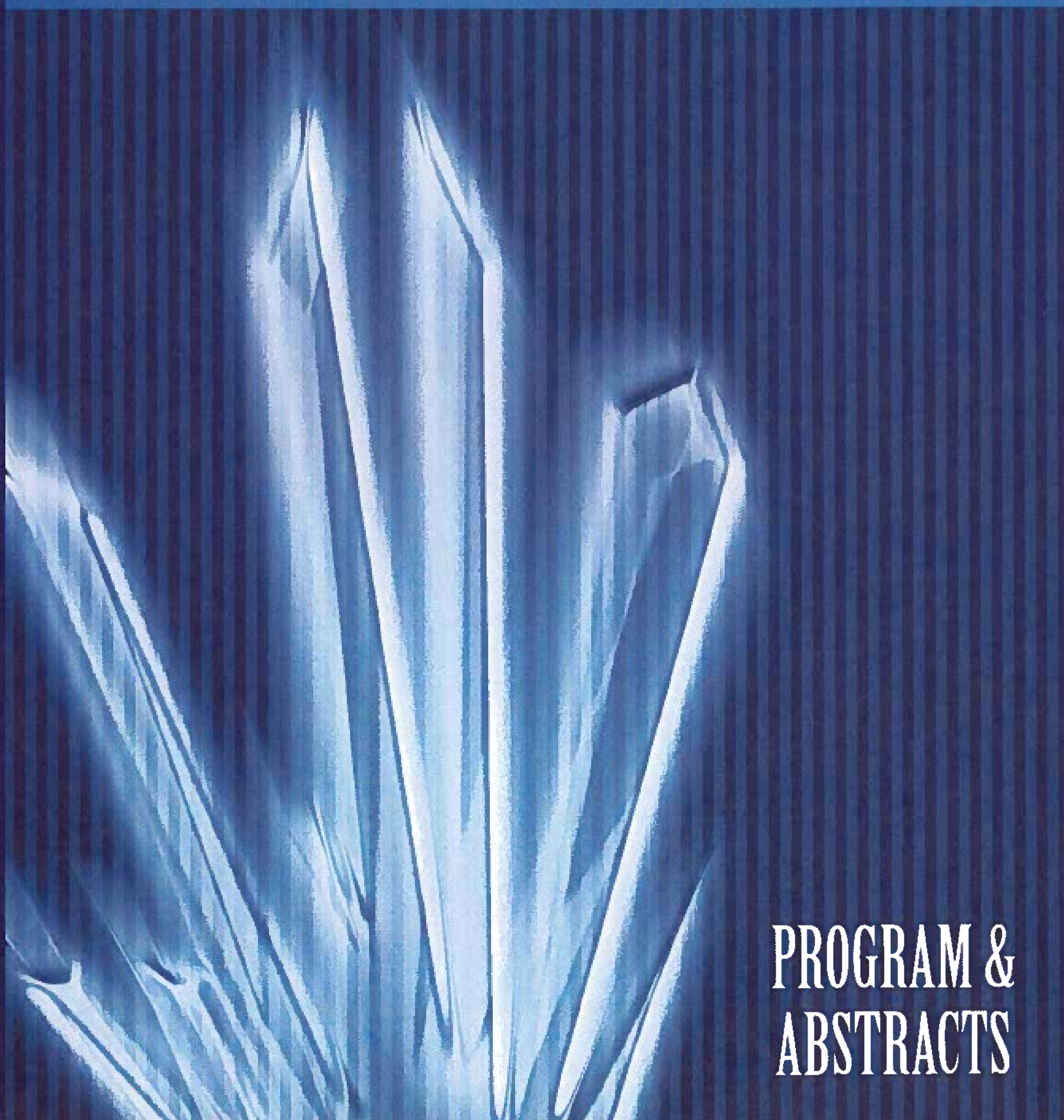
ANNUAL NEW MEXICO MINERAL SYMPOSIUM

36th Annual New Mexico Mineral Symposium

November 13, 14, & 15, 2015





PROGRAM & ABSTRACTS

36th Annual New Mexico Mineral Symposium

November 13, 14, & 15, 2015

New Mexico Bureau of Geology and Mineral Resources
A Division of New Mexico Institute of Mining and Technology

Socorro 2015

Welcome to

The Thirty-Sixth Annual
New Mexico Mineral Symposium

November 13, 14, and 15, 2015

Macey Center Auditorium
New Mexico Institute of Mining and Technology
Socorro, New Mexico

The Mineral Symposium is sponsored each year by the Mineral Museum at the New Mexico Bureau of Geology and Mineral Resources.

Additional sponsors this year include:

Albuquerque Gem and Mineral Club
Chaparral Rockhounds
Los Alamos Geological Society
New Mexico Geological Society Foundation
Grant County Rolling Stones
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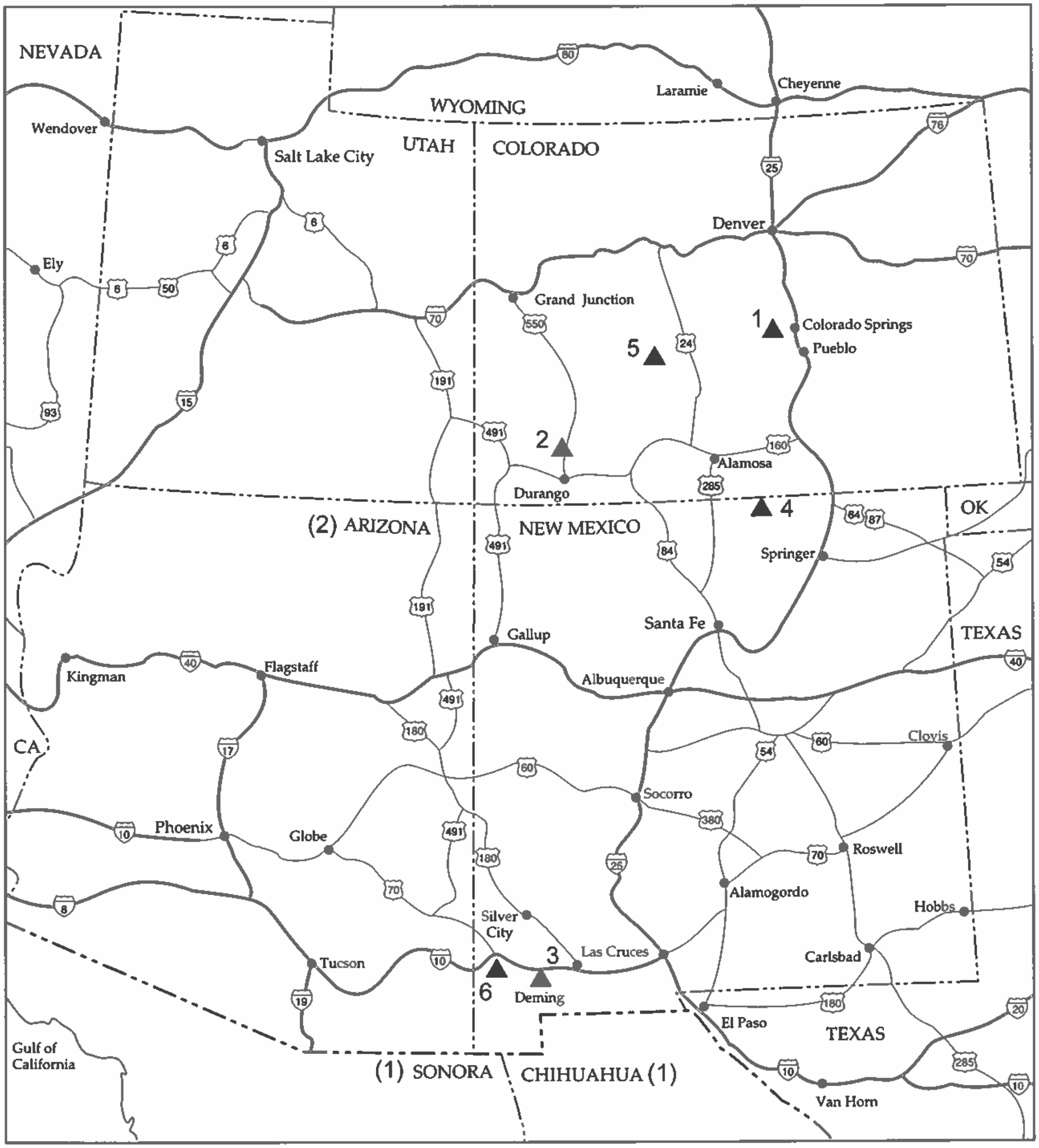
City of Socorro

CITY OF SOCORRO

The New Mexico Mineral Symposium provides a forum for both professionals and amateurs interested in mineralogy. The meeting allows all to share their cumulative knowledge of mineral occurrences and provides stimulus for mineralogical studies and new mineral discoveries. In addition, the informal atmosphere allows for intimate discussions among all interested in mineralogy and associated fields.

New Mexico minerals on the cover: *top left—pyrolusite; top right—halite; bottom left—malachite pseudomorph of linarite; and bottom right— magnetite.*



Geographic Index Map

36th New Mexico Mineral Symposium

36th Annual New Mexico Mineral Symposium

14–15 November 2015

SCHEDULE

Friday, November 13, 2015

5:00 – 7:00 pm	Museum Grand Opening Reception – Headen Center (Bureau of Geology) atrium. Appetizers and Cash Bar
7:00 pm	Informal motel tailgating and social hour, individual rooms, Comfort Inn & Suites **(# 1 on map)** and other venues - FREE

Saturday, November 14, 2015

8:00 am	Registration, Macey Center; continental breakfast
8:50	*Opening remarks*, main auditorium
9:00	*Arizona Gemstones with a few from New Mexico* – Wolfgang Mueller
9:30	*Why would anyone collect calcite? It's so common* – Terry Huizing
10:00	Coffee and Burrito break
11:00	*Amazonite Pegmatites on the Smoky Hawk Claim, Lake George District* – Joe Dorris **(1)**
11:30	*Memories of the San Juans* – Tom Rosemeyer **(2)**
12:00 pm	Lunch & Museum Tour
1:30	*Skarn minerals of the Victorio Mountains, Luna County, New Mexico* – Robert E. Walstrom **(3)**
2:00	*Late 20th Century Wulfenite Collecting in the San Francisco Mine, Sonora, Mexico* – Tony Potucek
2:30	*Mineralogy and Cultural History of the Naegi Pegmatite District, Nakatsugawa, Gifu Prefecture, Japan* – John Rakovan
3:00	**Coffee break**
3:30	*Smithsonite and other secondary zinc oxides of the Santa Eulalia District* – Peter Megaw
4:00	*An Overview of five great American Gold Specimen Locations* – Robert Cook (Featured Speaker)
5:30	Sarsaparilla and suds: cocktail hour, cash bar – Fidel Center Ballrooms
6:30	Silent Auction and Dinner followed by a voice auction to benefit the New Mexico Mineral Symposium – Fidel Center Ballrooms

Sunday, November 15, 2015

8:00 am	**Morning social, coffee and donuts**
8:50	*Welcome to the second day of the symposium and follow-up remarks*
9:00	*Minerals of the Questa Moly mine, Taos Co., New Mexico* – Ray DeMark **(4)**
9:30	*Quartz Creek pegmatite field, Gunnison County, Colorado: geology and mineralogy* – Mark Jacobson **(5)**
10:00	**Coffee break**
10:30	*50 Shades of Blue–Arizona Style* – Les Presmyk
11:00	*The Famous Silver Mines of Kongsberg, Norway* – Nathalie Brandes
11:30	*Mines, Minerals & History of the Lordsburg Mining District, Hidalgo Co., N.M.* – Fred Hurd **(6)**
12:00 pm	**Lunch**
1:15-3:00	Silent auction, upper lobby, Macey Center, sponsored by the Albuquerque Gem and Mineral Club for the benefit of the Mineral Museum **(FREE)**

The Famous Silver Mines of Kongsberg, Norway

Nathalie Nicole Brandes, Montgomery College
Paul T. Brandes, Quincy Mine Hoist Association

The city of Kongsberg is located approximately 70 km west southwest of Oslo at 171 m above sea level. The area of ore bearing rock is about 15 km wide trending along a north-south line for about 30 km. Silver ore was discovered in the area in the summer of 1623 and mining began later that year.

The oldest bedrock in the Kongsberg area is ~1.6 Ga. Two events of deformation and metamorphism affected the area, the first at ~1.5-1.6 Ga and the second at 1.1-1.2 Ga. The history of these rocks can be summarized into four basic stages. The oldest rocks began as volcanics with geochemistry similar to island arcs as well as some sediments. These rocks were intruded by gabbros and diorites followed shortly thereafter by the first event of deformation and metamorphism. This amphibolite to granulite facies metamorphic event resulted in quartzo-feldspathic gneisses, dioritic gneisses, and amphibolites. Gabbro and dolerite later intruded the rocks. Lastly, the Meheia and Helgevannet granites were emplaced penecontemporaneous to the second event of deformation and metamorphism to amphibolite facies at 1.1–1.2 Ga. Ultimately, these events created bedrock consisting of quartz-plagioclase-biotite gneiss, mica and chlorite schist, amphibolite, and granite gneiss.

The ore deposits at Kongsberg are a five-element-type (Co-Ni-As-Ag-Bi) vein system. The age of the hydrothermal system that formed the veins has been dated at 265±3 Ma and is genetically related to the Oslo Rift. Studies have shown that the elevated heat flow associated with rifts can mobilize formational brines to form five-element-type deposits. The silver in the deposits is derived from the black shales of the Oslo region, which have been calculated to contain more than enough silver to account for the Kongsberg deposits. The ore formed about 3 to 4 km deep from fluids 200 to 300° C with salinities as high as 35% NaCl equivalent. The bedrock of the Kongsberg area includes sulphide-rich zones locally known as fahlbands. When the hydrothermal fluids encountered the fahlbands, they chemically reacted and formed the silver deposits. Minerals found in the hydrothermal veins include: quartz, pyrite, calcite, barite, fluorite, galena, sphalerite, chalcopyrite, silver sulphosalts, argentite, native silver, and pyrrhotite. "Coalblende," a bitumen compound likely derived from the Oslo Rift shales, is also found in the veins.

After the discovery of silver, King Christian IV of Denmark-Norway established the mines in 1623. The following year the town of Kongsberg was founded on a waterfall of the River Lågen to provide power for the stamp mill and smelter. At the time, the mining industry in Norway was not well-developed, so miners, engineers, and mining officers were imported from Germany to develop the silver mines. Firesetting was used during much of the history of the mining district as the main way to soften and break rock. The first use of black powder for blasting occurred in 1659, but it wasn't until the mid-1700s that blasting was commonly used. Firesetting, however, continued to be used to create horizontal works because of its low cost. The problem of ventilation was solved with the use of an "adit loft," which was created by dividing the adit by wood or brick into a lower level where the miners worked and an upper level for the smoke. After the use of dynamite was introduced in 1872, firesetting was abandoned, its last recorded use in 1890. The mines were initially dewatered using hand pumps, but waterwheels were soon installed to operate pumps. Many canals and aqueducts that were used to bring water to power the wheels can still be seen. Steam power and electricity were introduced to the mines in the 1880s.

For much of the Kongsberg Mining District's history, it was the largest mining operation in Norway. As early as the 1600s, the mines offered workers desirable benefits such as sick pay, free medical care, pensions, and primary and secondary schools for children. In 1757, the Norwegian Mining Academy was established in Kongsberg to train mining engineers. The high point of mining in the district occurred in 1770, when 78 mines employed about 4,000 workers. By 1805, however, much of the best ore had been extracted and most of the mines closed. In 1814, the Mining Academy was also closed. Fortunately, promising ore zones were discovered in 1816 and many mines reopened. Peak yearly production was achieved from 1915 to 1916 when 13 tons of silver were produced. Despite declining production, mining continued into the 1950s. The last silver from the Kongsberg Mines was smelted in 1958, ending 335 years of operation that extracted around 1,350 tons of silver.

The Norsk Bergverksmuseum (Norwegian Mining Museum) in Kongsberg has preserved many artifacts from the mining operations, including them in displays explaining the history of the mining district. In addition, the museum's vault contains hundreds of spectacular wire silver specimens on display. The museum also maintains surface facilities of the Kongens Gruve (King's Mine) and offers an underground tour of the mine via the Christian VII adit.

A Comparison Of Five Modern Gold Specimen Producers — The Ibex Mine, Lake County, Colorado; Lokel Mine, Pershing County, Nevada, Eagles Nest Mine, Placer County, California, and the Colorado Quartz and Mockingbird Mines, Mariposa County, California

Robert B. Cook, Professor Emeritus, Dept. of Geosciences, Auburn University, Alabama

Of the many gold occurrences known historically for fine specimens, only a few are productive today. Five of these are commonly represented by extraordinary gold specimens at most modern collector venues. Four are mines worked only intermittently and exclusively for specimen gold (the Lokel, Eagles Nest, Mockingbird, and Colorado Quartz mines) and one (the Ibex mine), although closed for decades, continues to yield fine gold specimens from its extensive dumps. Although within distinctly different physiographic and geologic settings, there are important features shared by several or all of the occurrences, as well as some striking differences.

The Ibex mine or group (including the famous Little Jonny) was the source of some of John Campion's finest gold specimens. It is situated in the Leadville district three miles east of town near the top of Breece Hill. Based on the published literature, mine maps, and information gleaned from the mineralogy and petrology of dump samples, it is clear that the fine wire and ribbon gold for which the area is famous may be of both primary and supergene origin. The gold-rich area is within a well-defined 12.000 foot long, northeast-trending zone that extends at least from California Gulch on the south to the area of the Resurrection mine on the north. Within this zone are fault blocks that contain complex replacement ores hosted within the Leadville or similar limestones, as well as narrow but persistent veins or mineralized faults. Primary gold occurs as wires and sheets with sulfides, particularly sphalerite, and rarely carbonates and in white vein-type quartz, while masses of wire and ribbon gold occur with iron oxides and clays and may be supergene. Some of these masses have weighed up to 75 ounces. In addition to the Ibex mine(s) other nearby gold specimen producers include the Winnie, Fanny Rawlins, Big Four, Hopemore, and Donovan mines.

Some 600 miles west of Leadville and about ten miles from Winnemucca in the great Basin and Range Province is a relatively new discovery, the Lokel mine. The mine is in Humboldt County about one mile south of a site known as Pronto along Jungo Road. Here wonderful groups of coarse gold crystals, crystalline gold, and hackly gold masses weighing up to 95 ounces were picked up from the surface and in shallow dozer cuts by the lucky discoverers, Rod Pearce and Gene Baum. Exploration by several companies and specimen dealers quickly determined that the gold was float originating from a single north-trending, sulfide-poor quartz vein. Although the total production of gold specimens is unknown, it appears that many hundreds of ounces were cleaned and placed on the collector market both in the United States and abroad. Nearby gold specimen occurrences, all generally to the north, include prospects on Blue Mountain and mines of the Ten Mile district including the Mad Mutha and Golden Amethyst mines.

The Eagles Nest mine, 2.5 miles west of Foresthill, Placer County, California, is famous for its brilliantly lustrous, sharply crystallized gold specimens. The mine, operated by the Sykora family, is not a Mother Lode occurrence, lying 10 miles north of the termination of this belt. It exploits narrow, shallowly-dipping quartz veins in structurally complex metamorphics. Gold occurs at the intersection of these quartz veins with erratically spaced, vertical "control" structures that appear to be weakly mineralized joints. The host rocks have undergone carbonate alteration near productive veins and carbonate minerals occasional occur with gold. The site is relatively near a serpentinite body and there is geochemically anomalous nickel associated with productive veins.

The Colorado Quartz and Mockingbird mines occupy segments of the same occurrence, lying in the eastern pocket belt near the southern end of the Mother Lode in Mariposa County, California. Both mines exploit pockety, shallowly-dipping quartz veins and lenses within intensely silicified zones at the contact between schists and a vertically-dipping mafic dike. Exceptional crystallized gold, including the famous Dragon and Cobra specimens, occurs at and within a few feet of the dike contact. The host quartz is generally deficient in associated minerals although some pockets contain powdery black manganese oxides. Near-surface gold has likely been exhausted; however, both mines offer potential for continued specimen production with depth.

Minerals of the Questa Moly Mine, Taos County, New Mexico

Ramon S. DeMark, Albuquerque, New Mexico, *Tom Katonak*, Corrales, N.M.

Molybdenum mining at Questa, New Mexico has drawn to a close after almost 100 years of on-and-off-again production.

Prior to 1916, the soft black mineral and earthy yellow material found along Sulphur Gulch were thought to be graphite and sulfur. However, in 1916, the true nature of the minerals (molybdenite and ferrimolybdite) was recognized. Thus began the history of moly mining along the Red River highway about six miles east of the village of Questa.

In 1918, the R&S (Rapp and Savery) Molybdenum Company was formed and production began in 1919 (Clark and Read 1972). Shortly thereafter, Molycorp of America (MCA) acquired the property and by 1941, an 850-foot pit had been excavated (Shilling 1990). Mining ceased in 1958, but open-pit mining began once again in 1965. Underground mining commenced in 1983, however operations shut down once again in 1986 due to a soft market for Molybdenum. The mine reopened in 1989 and MCA was taken over by Chevron Mining Inc. in 2005. In 2011, the mine was declared a "superfund site" by the EPA and on the 2nd of June, 2014, the mine was declared permanently closed by David Partridge, the President and CEO of Chevron Mining, Inc., at an employee meeting in Questa. Mine closure, including the demolition of mine structures is estimated at one to two years. "Full" reclamation could take decades.

Minerals from the mine of interest to collectors, in descending importance include: Molybdenite, fluorite, fluorophlogopite, fluorapatite, celestine, beryl, orthoclase, pyrite, calcite, hübnerite and rutile. Mindat lists 31 entries from the mine of which 25 are valid species. Molybdenite crystals are most noteworthy: They occur as platy, single and aggregate crystals up to 2.0 cm and hexagonal rosettes to 1 cm. These are often found in association with brown mica crystals that have been variously reported to be biotite or phlogopite, but have been more recently identified as fluorophlogopite (Lueth, pers. Comm. June 2015). Thin, bladed, white to colorless crystals to 1 cm have been identified as celestine by microprobe analysis (Hlava, pers. Comm. 2003). Tabular, water-clear crystals, collected by Klaus Althammer on an Albuquerque Gem and Mineral Club (AGMC) field trip in June 2002 have been visually identified as barite, but are most likely celestine. Rex Nelson found beryl crystals on the June 2002 field trip. These crystals are light blue, acicular prisms up to 1.5 cm and transparent to translucent. The beryl was found in the seams of a fine-grained, silicic rock. Staff geologists found beryl reputed to be emerald in December 2004, but microprobe analysis determined that there was insufficient Cr or V to classify it as emerald (Hlava, pers. Comm. June, 2015). Fluorite is found in anhedral masses and as cubo-octahedral crystals to 2.0 cm. Pale green is the most common color, but purple also occurs. Fluorapatite crystals are uncommon and are usually intergrown with crystals of fluorophlogopite. These are cream colored to colorless prisms with a pyramidal termination and fluoresce orange under short-wave UV illumination. Crystals are generally less than 5 mm. Blocky orthoclase crystals to 1 cm often have a slightly pink color and occur in vugs with molybdenite, quartz and fluorophlogopite crystals. Hübnerite crystals to 3 mm are tabular, brown and associated with a glassy colorless, anhedral scheelite. Pyrite crystals as simple cubes, to 3 mm are common. Phil Bové found irregular rutile crystals in sericite to 1 mm in March, 1989. Light purple cleavages of anhydrite have been collected and yellow coatings of ferrimolybdite are common. Rhodochrosite has been reported from the Questa mine but specimens are at best rare and not noteworthy. Colorless calcite crystals less than 1mm sometimes occur as a "fringe" on fluorophlogopite crystals. Scalenohedral crystals also occur.

This description of minerals from the Questa mine is not complete, but is intended topartially familiarize the mineral collector community with the mineral assemblage that did exist and will probably not be seen again from a mine that now appears to be "extinct".

References

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Shilling, J. H. (1956) *Geology of the Questa molybdenum (moly) mine area, Taos County, New Mexico*, NMBGMR Bull. 51, 87pp.

Shilling, J. H. (1965) *Molybdenum resources of New Mexico*, NMBGMR Bull. 76, 76pp.

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Amazonite and Smoky Quartz Mining on the Smoky Hawk Claim, Teller County, Colorado

Joseph Dorris, Colorado Springs, CO

Summer of 2012, the Dorris family uncovered a pegmatite on their Smoky Hawk claim in the Crystal Peak mining district, Teller County, Colorado which produced several large miarolitic cavities, the largest of which produced Colorado's largest high-quality amazonite and smoky quartz combination specimen now known as the Smoky Hawk King. The discovery was made at the end of June and excavation and collecting continued on and off through the end of July due to the unique opportunity of capturing the discovery and extraction on video by High Noon Productions of Denver Colorado for the TV series Prospectors.

The Smoky Hawk claim is one of approximately 200 unpatented mining claims within the 1,100 square mile Pikes Peak Batholith historically famous for producing the world's finest amazonite and smoky quartz combination specimens since its discovery in the late 1870s. The Smoky Hawk claim was filed in December of 1998, culminating years of prospecting by Joe Dorris and his family. Eventually a trend of pegmatites, now referred to as the Smoky Hawk trend was mapped. Production from numerous pockets commenced in 2003 after the completion of permitting. Exploration has continued within an area of 185 acres now covered by 20 unpatented mining claims. The majority of finds have been located along a narrow trend approximately .9 miles in length.

Historically, other claims including the Dry Hole, Jack Rabbit (Bartsch and Currier) and Two Point (Buckner) claims have produced significant pockets (Tree Root Pocket 1997, Bryan Lees) along the Smoky Hawk trend. Glacier Peak Mining LLC (Dorris) has produced from this trend through both leased and owned claims since the early 1990s. The most extensive and noteworthy production has centered on the Smoky Hawk claim since 2003 in a seven acre area with notable discoveries each year. The miarolitic pockets are abnormally abundant within this small area. To date, over 1,000 pockets have been excavated of which 14 have proved to be major pockets with exceptional specimens. These pockets include the Legacy, Majestic, Smithsonian, Lucky Monday, Chuck's, and Icon pockets.

The Smoky Hawk pegmatites are classified as rare-earth-element (REE) pegmatites of the niobium-yttrium- fluorine (NYF) family. They are noted for their abundance of miarolitic cavities which produce predominately amazonite, smoky quartz, and cleavelandite. This sharply contrasts with other Pikes Peak Batholith pegmatites which contain predominately common microcline in combination with smoky quartz. Other significant macro minerals include biotite (formerly zinnwaldite), fluorite, goethite, and hematite. The most common lesser minerals and micro crystals include bastnaesite, bertrandite, cassiterite, milarite, monazite, phenakite, rutile, xenotime, and zircon.

The most aesthetic and collectable specimens continue to be the amazonite with smoky quartz. Whereas the majority of the batholith generally produces light to medium bluish green amazonite, the Smoky Hawk trend generally produces deeply colored blue-green amazonite, some with white microcline caps. Although mining records for the district are sketchy, it is likely that the Smoky Hawk trend has now produced more vivid blue green amazonite than the rest of the batholith in total.

One reason for the marked production is the mining methodologies used at the Smoky Hawk. During the previous approximately one hundred years, pick and shovel were predominately used. Within the last forty years, collectors have turned to mechanized equipment, enabling them to go below the former, shallow digs. Glacier Peak Mining generally operates two excavators each season and conducts limited blasting in order to open deeper lying pegmatites.

Mining operations have now extended to depths of 60 feet but average 30 or less. Pockets are always collected by hand using water and screwdrivers.

Significant production has also increased due to improved laboratory techniques and the abilities of some individuals to piece together ruptured pockets. Although the cleaning and preparation for any given pocket may take a year or longer, better quality specimens are now becoming available.

In 2012 an unusually large, kite-shaped cavity six feet wide by eight and a half feet in length was discovered. This cavity produced approximately one ton of amazonite and smoky quartz crystals from which the largest plate, nearly three feet by two feet was assembled. Now dubbed the Smoky Hawk King, this plate is now at the Denver Museum of Nature and Science and is being prepared for exhibit.

Although mining regulations and restrictions continue to increase, the present future for mining more amazonite and smoky quartz combination specimens appears likely.

Why Would Anyone Collect Calcite? It's So Common

Terry E. Huizing, Cincinnati Museum Center, Cincinnati, Ohio

Calcium, carbon, and oxygen are abundant elements in the earth's crust that frequently combine to form calcium carbonate. Calcite is the stable form of $CaCO_3$ at the surface of the earth. Thus calcite is a widely occurring mineral that is common and abundant in all classes of rocks - igneous, metamorphic, and sedimentary. Sedimentary deposits of limestone and chalk are almost entirely composed of calcite; marble is metamorphosed calcite. Calcite occurs in silicate rocks, pegmatites, and hydrothermal veins; it precipitates in hot springs and caves and is even found in biologic settings. Rocks, such as granites, that are poor in calcium have little calcite.

Common — Because calcite occurs abundantly, many mineral collectors have access (either through the mineral marketplace or by collecting) to locations that produce large, beautiful crystals. Availability and abundance are often related to "low" price, a factor in assembling a specialized calcite collection. Thus, common is a key factor that explains collector interest in calcite.

Colorful — Calcite is colorless and transparent or white when pure; other colors are uncommon and highly desirable. When colored crystals are found, they are generally yellow to honey-colored. The cause for the yellow color is unknown but is thought to be associated with impurities of iron or perhaps to defect color centers.

Some of the most colorful calcite crystals result from the replacement of calcium by manganese, iron, zinc, cobalt, lead, strontium, magnesium, or barium. Although this substitution is typically on the order of only a few percent, it produces such notable calcite varieties as pink manganoan calcite, beige plumbian calcite, rose-red cobaltian calcite, and tan ferroan calcite. Colorful calcite is also produced by admixtures of other minerals.

Clarity — Clear and transparent crystals of calcite when included by such strongly colored minerals as boulangerite, celadonite, copper, hematite, and others can often produce striking specimens. The inclusions may occur either on an early calcite growth surface that has been overgrown by a later generation of clear calcite (a phantom), or it may be uniformly disseminated throughout the calcite crystal. Calcite may even incorporate up to 70% sand within its structure.

Whatever the cause for colorful calcite, all well-crystallized specimens are highly prized and generally priced accordingly. A calcite collection with a wide variety of colored calcites is a major step above a collection of "common" calcites.

Crystal structure — Calcite's structure consists of alternating layers of calcium atoms and carbonate groups stacked along the c-axis. Calcium has octahedral coordination with six oxygens from six different CO_3 groups. The crystal structure and composition determine the properties and appearance that makes calcite so interesting to collectors.

Durability

If calcite has any negatives, they would be associated with durability. Calcite hardness (Mohs scale = 3) and cleavage (readily induced) require careful handling of crystals throughout the acquisition, curation, and display processes. In addition to the obvious need to avoid contact with harder objects, calcite should never be subjected to freezing conditions, as many crystals are included with small amounts of water. Internal fractures and external damage decrease the desirability of specimens.

Forms of Calcite

Calcite has been described as the mineral with the most forms; in fact more than 600 have been documented. A single crystal of calcite may be bounded by more than one form. It is not uncommon for three, four, or even five or more forms to be combined on a single crystal; thus, the combinations number into the thousands. Although this variety is greater than that of any other mineral, all of the forms of calcite fall into the following five groups. They are:

Pinacoid – An open form made up of two parallel faces that are each perpendicular to the c-axis.

Prism – An open form composed of six or twelve faces, all of which are parallel to the c-axis.

Rhombohedron – A closed form composed of six faces; three at the top of the crystal alternate with three at the bottom. The two sets of faces are offset by 60°.

Scalenohedron – A closed form with twelve faces grouped in symmetrical pairs, three pairs above and three below in alternating positions. In perfectly developed crystals, each face is a scalene triangle; the faces meet in a zigzag line around the crystal's girdle.

Dipyramid – A closed form having twelve faces, six on the top of the crystal and six immediately below them on the bottom; each face is an isosceles triangle.

Habits of common calcite crystal aggregates can be described as fibrous, nodular, stalactitic, or botryoidal.

Twinning

When two crystals grow in a fixed relationship related to the structure of a mineral, they are described as twins. Typically, twins are uncommon and are highly prized by collectors. Calcite has four recognized twin laws, the most common of which occurs when the c-axes of the crystals lies in the same plane and is at 180° to one another. These are easily recognized by re-entrant notches along the contact at the basal plane.

Under the other three twin laws, the two crystals are inclined at an angle to one another, and frequently rapid growth occurs on faces where the two parts of the twin meet, making identification somewhat difficult. The second-most common twin law for calcite occurs when the c-axes of the twin are inclined at an angle of 127°29.5′ with respect to one another. Here the twin plane is parallel to a face of a shallow negative rhombohedron. These are often described as "butterfly" twins.

When the c-axes of the twin are inclined at an angle of 90°46′ with respect to one another, the twin plane is parallel to a face of the positive rhombohedron, which is defined by the cleavage of calcite. Occurrences of this calcite twin law are quite rare and are commonly referred to as "heart" and "axe-head" twins when rapid growth occurs.

Another rare twin law for calcite occurs when the twin plane is parallel to a face of a steep rhombohedron and the c-axes of the twin are inclined at an angle of 53°46′ with respect to one another and. These twins have been described as "fish-tail" and "bishop-hat" twins.

To put crystal structure into perspective, a calcite collection that contains specimens that are damage-free, has a wide representation of crystal forms, and includes the four twin laws is another major step above a collection of common calcites.

Collectible

Because calcite seemingly occurs everywhere, it has been possible to acquire and preserve excellent calcite crystals from mining ventures operated primarily for metals. As older mines became uneconomic and are closed, new mines in new places become the source for metals (and for calcite). Thus, availability of calcite cycles from boom-to-bust at every location.

Consequently, it is challenging to include older classics in a calcite collection without compromising one's budget or quality standards. Specimens from the late 1800s and early 1900s mining operations in Germany, England, and Michigan are highly desirable and command high prices for even mediocre specimens.

In the late 1900s, mines in Mexico and Peru, at Tsumeb, and at many of the MVT deposits in the midwestern United States were producing seemingly inexhaustible quantities of minerals, including choice calcite. But where are these specimens now?

Today, mines in the former Soviet Union, India, China, and Africa are the source for much of the fine calcite now available in the marketplace. I suggest you not let this opportunity pass by. Of course, there will eventually be other new localities, but will they meet the standard of older and modern classic localities?

Summary

A well-documented calcite collection is, obviously, only as good as the specimens it contains. When careful attention is given to acquiring specimens without damage and those with a wide variety of crystal habits, including the four twin laws of calcite, the collection has a strong foundation. The addition of calcites colored either by substitution or from inclusions, and specimens from classic localities, both historical and modern, further enhance the collection. Ultimately, it is the collector's taste in aesthetics that completes the collection to his/her satisfaction.

Mines, Minerals, and History of the Lordsburg Mining District, Hidalgo County, New Mexico

Fred Hurd

The Lordsburg Mining District is situated in the northern part of the Pyramid Mountains, immediately southwest of Lordsburg, New Mexico. The district is composed of two sub districts, the Virginia district in the northern portion and the Pyramid district in the southern portion located on the northwestern slopes of the Leitendorf Hills and North Pyramid Peak.

The Lordsburg Ming District is composed of volcanic rocks of Tertiary–Cretaceous age comprising approximately 22 square miles of high desert, typical of the arid southwest, located within the closed Animas drainage basin. North Pyramid Peak is the highest peak in the district reaching an altitude of 6,002 feet. The only spring in the area was originally named Mexican Springs, the site of a stage stop and later after several more name changes became the town of Shakespeare.

The first claim in the district was located on April 7, 1870, followed by more prospecting for gold and silver. W. C. Ralston, a leading financier from San Francisco became involved early on in the development of the mines and then became the principal victim of the Great Diamond Hoax of 1872. Thus began the up and down cycle of boom and bust the district experienced throughout its history. The district was basically abandoned until 1880 when the railroad reached Lordsburg, by passing Shakespeare. Renewed interest in the district resulted in a number of mines being claimed and opened, including the mines which became the major producers in the district, the 85, the Bonney and the Atwood mines. The Panic of 1893 caused in part by a change in the silver standard to the gold standard resulted in the drop in silver prices and the closing of most silver mines in the west, including the Lordsburg district.

Interest in the district renewed again in 1899 with the rise in copper prices resulting in the Lordsburg district becoming a copper district. The 85 group of mines became the principal producers in the district. The town of Valedon was built to service the miners of the 85 mine during this time and a railroad spur was extended to the mines. After being bought and resold several times the 85 group was acquired by the Calumet and Arizona Mining Company in 1920 due to its need of siliceous fluxing ore at its smelter in Douglas. It continued to prosper until 1931 when the Calumet and Arizona Mining Company was acquired by the Phelps Dodge Corporation. Phelps Dodge had its own sources of fluxing ore and no longer needed the ore from the 85 group. The mines were shut down, the pumps pulled and the town of Valedon was dismantled.

By 1933 the district was almost deserted. Renewed interest in the Bonney mine by a group of investors from Oklahoma resulted in the incorporation of the Banner Mining Company in the fall of 1935. The mine was brought into production the following year and expanded until WW II, when price freezes and shortages of labor made mining difficult. After WW II, the Miser's Chest mine was acquired and production was increased again. In 196? The Banner mine was closed after 30 years of production, placing 2nd in production of copper in New Mexico for a number of those years. Currently there is no active mining going on in the district.

The Lordsburg district had its share of desperados, Apaches and con men who added to the colorful history of the district, among them, Curly Bill Brocius, John Ringo, and Billy the Kid.

The estimated value of production of metals during the period of 1904–1961 was $47,000,000 derived from approximately 156,000,000 pounds of copper, 4,400,000 pounds of lead, 500,000 pounds of zinc, 157,000 ounces of gold and 6,700,000 ounces of silver. Almost all of this production came from three mines, the Eighty-five, the Bonney-Miser's Chest and the Henry Clay-Atwood.

The district did produce some significant collectable mineral specimens, but never any in large quantities. As a result, the Lordsburg District is not well represented in collections. The best are preserved in the collection of the mineral museum at New Mexico Tech. Those specimens include chalcopyrite, azurite and native copper.

Future prospects for the district are being investigated at this time by the Santa Fe Gold Corporation and Rio Tinto. According to Curtis Floyd, vice president, Lordsburg Mining Company and Banner Mill Manager, a deep low grade porphyry copper deposit is believed to be located in the area of the Banner mine. Santa Fe Gold has claims controlling around 13 square miles and Rio Tinto has claims controlling around 9 square miles.

Perhaps the claims made in an 1880 "dodger" distributed by the railroads claiming the mines around Shakespeare to the "the Eighth Wonder of the World" may have some validity yet.

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Quartz Creek pegmatite field, Gunnison County, Colorado: geology and mineralogy

Mark Ivan Jacobson

The Quartz Creek pegmatite field is located 17 miles almost due east of Gunnison, in Gunnison County, north and south of the road connecting Parlin and Ohio City. The 1,803 mapped pegmatites are centrally located around the Black Wonder pegmatitic granite and cover an area of 26 square miles (Hanley, Heinrich, and Page 1950; Staatz and Trites 1955). The exposed pegmatites form an example of a zoned field where the pegmatites closest to its source pluton are geochemically less evolved with the most distal pegmatites being the most geochemically evolved. The minerals found in these pegmatites are among the most rare in Colorado.

The Proterozoic country rock of the Quartz Creek pegmatite field formed during the Routt orogenic event that spanned the age range of 1,770 to 1,670 million years including post-orogenic granitic plutons. Extensive age dating, however, shows that the Quartz Creek pegmatite field was intruded during the Berthoud anorogenic event at 1.39 + 40 million years. Most of the pegmatites crystallized within fractures that crosscut the foliation of a hornblende gneiss and less frequently within the older granitic and volcanic rocks.

Černý (1982, 422) was the first to suggest that the Black Wonder pegmatitic granite was the parental source to the pegmatite field, based solely on a rough mineralogical zoning of the surrounding pegmatites. Most of the pegmatites are simple, and frequently unzoned (comprising 78% of the total). They are located northeast of the Black Wonder and contain biotite and magnetite. The beryl-bearing pegmatites are found close to the Black Wonder as well as more distally to the south and west. The lithium-rich pegmatites, the Brown Derby, Bazooka, White Spar and Opportunity pegmatite groups, are the most distal, being found only to the south and southwest. The zoned pegmatites tend to be zoned in layers (as opposed to concentrically zoned), which is interpreted to reflect the influence of gravity during crystallization on moderately dipping pegmatite dikes.

At least twenty-seven minerals have been identified from this field (Elder 1998). Specimen quality lepidolite, non-gemstone elbaite, beryl, monazite, and columbite-tantalite have been found. Rarer minerals of microlite, rynersonite, gahnite, zircon, allanite, spodumene, amblygonite and stibiotantalite can also be found but are often unattractive. The Brown Derby pegmatite remains the best source of elbaite specimens in this district. Lepidolite is known from several other pegmatites in flat and curved crystals as well as the more common fine-grained masses that are ideal for polishing. Although beryl occurs at the Brown Derby, other pegmatites contain better crystallized specimens.

The Brown Derby pegmatite is the most highly geochemically evolved pegmatite in Colorado is. The premier indication of chemical evolution is the presence of pollucite, a cesium-bearing zeolite which has been found only in the Brown Derby pegmatite. This lithium-cesium-tantalum (LCT) geochemical class of complex pegmatite is formed at approximately 2.5 kilobars pressure (approximately 10 km below the surface) and 550° C. The Brown Derby was mined since its discovery in 1932 for beryl, microlite, lepidolite, and mineral specimens.

Most of the pegmatites are on National Forest land and can be accessed for viewing; although collecting may be restricted because of active claims. Private land is continuous adjacent to the Parlin to Ohio City road which follows Quartz Creek, thus access to the pegmatite area south of the Parlin to Ohio City road must be done via forest service dirt roads that enter the area from the south. Access to the areas north of the Parlin to Ohio City road must be done via the Willow Creek and the Big Gulch roads.

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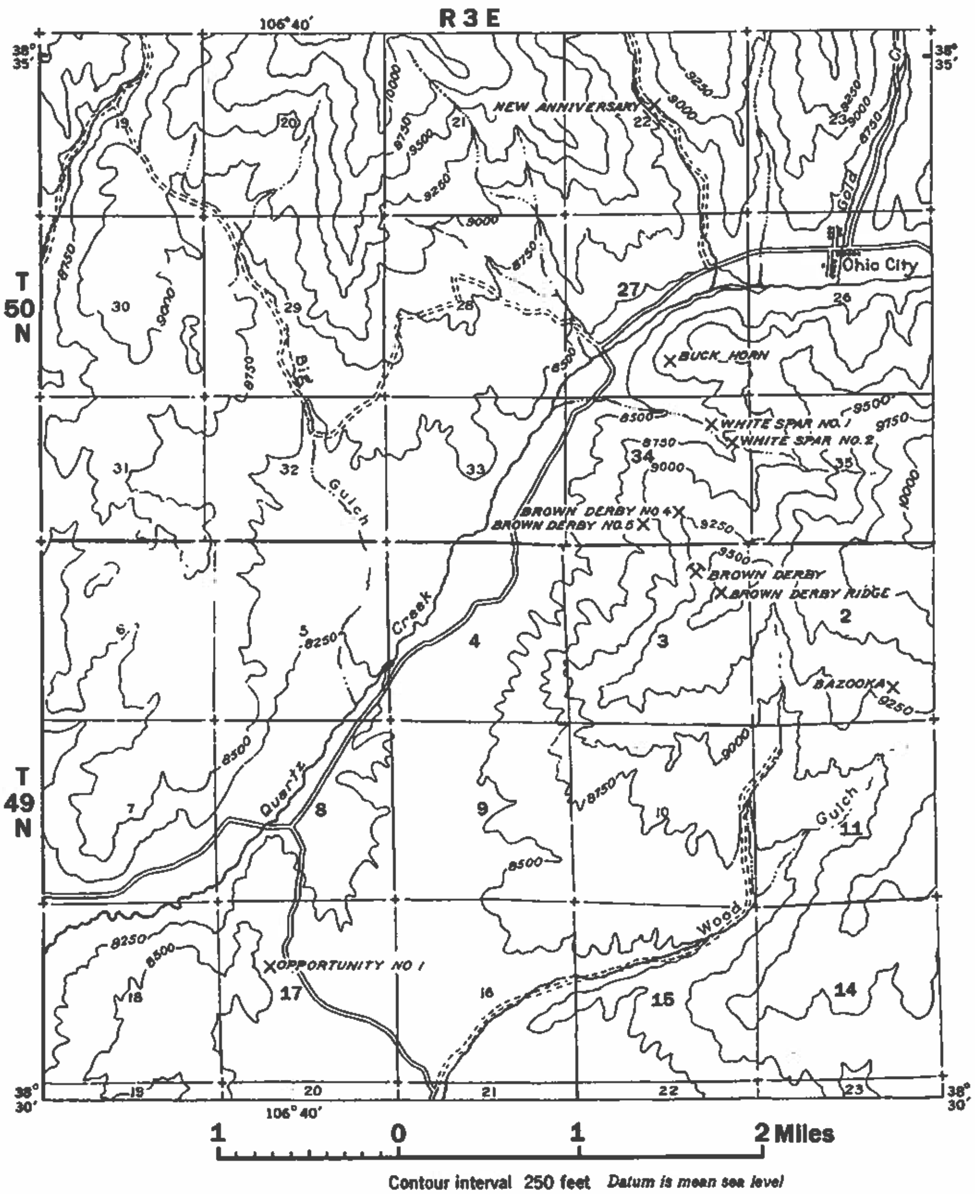

Caption 1. Index map of the major lithium-rich pegmatites in the Quartz Creek pegmatite district. From Hanley, Heinrich, and Page (1950).

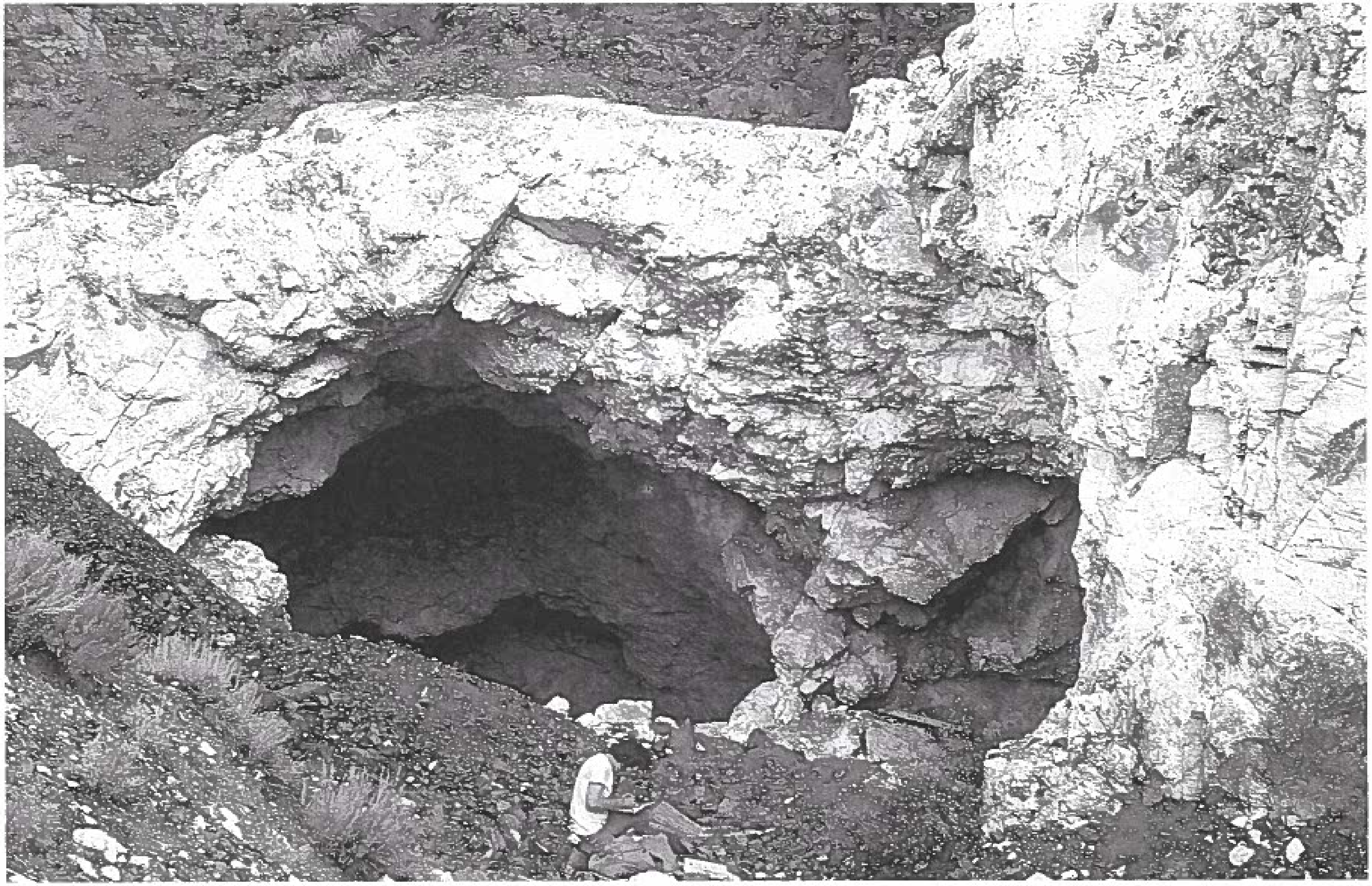

Figure 2. The Brown Derby pegmatite, main gallery in July 1980. This is the gallery where the coarse grained lepidolite, altered and unaltered elbaite and pollucite were mined between 1933 to 1950. View looking southeast. The fine grained lepidolite with microlite ore was mined from the incline located just to the northeast of this gallery.

Smithsonite and other secondary zinc minerals of the San Antonio Mine, Santa Eulalia District, Chihuahua, Mexico: Giving the Kelly Mine a run for its money

Dr. Peter K.M. Megaw

The San Antonio Mine in the East Camp of the famous Santa Eulalia District in Chihuahua has produced aurichalcite, green and bone-white smithsonite pseudomorphs after calcite and yellow and blue smithsonite that rival (surpass?) New Mexico's Kelly Mine. It has also yielded superb white and blue hemimorphite and other secondary zinc species. It is no accident these two distant mines have produced such similar specimens; both are Pb-Zn-Ag-Cu-Fe rich Carbonate Replacement Deposits (CRD) whose upper oxidized zones were diligently exploited for their silver-rich cerussite/anglesite bodies and both have associated irregular supergene zinc mineralization that was ignored until recently by almost everyone except specimen collectors. Modern solvent-extraction metallurgy has been developed that allows recovery of zinc from these long by-passed ores and with luck and changing economics both mines could see revived industrial interest with collateral specimen recovery.

Santa Eulalia is the world's largest known CRD district, with the bulk of production coming from the Buena Tierra and Potosi Mines in the "West Camp" and the San Antonio Mine in the "East Camp." Oxidation extends to several hundred meters depth in both camps so large volumes of primary sulfide ore were leached of their zinc, which was redeposited as supergene smithsonite, hemimorphite and Fe-Mn-Zn oxides (Megaw 2007). From a smithsonite perspective we care most about the San Antonio Mine, where the upper level sulfide ores were almost completely leached of zinc, which was redeposited as a very well defined, flat-bottomed smithsonite-dominated supergene ("genesis from above") zinc blanket at the modern water table at the 8th Level of the mine (1,100—1,250 m elevation). The planar nature of the base of this supergene blanket suggests that the water table has been at roughly the same elevation for a long time and that supergene zinc precipitation was triggered by mixing with ground water (Hewitt, 1943; Megaw, 1990). The water table is marked by laterally extensive caverns tens of meters high, wide and long dissolved by the descending acidic oxidizing fluids. The caves are decorated with stalactitic ropy gray, greenish-gray and green smithsonite and locally studded with smithsonite pseudomorphs after scalenohedral and flattened rhombohedral calcite crystals to 10 cm. Most of the pseudomorphs are stained brown by iron-oxide inclusions, but some are bright yellow-orange or yellow-green. These pseudomorphs are thick hollow shells with interior ribbed smithsonite boxworks that appear to follow rhombohedral cleavage patterns, indicating replacement in addition to epimorphic coating. In the upper part of the supergene zone the pseudomorphs occur on gossanous matrix, but they show a transition to depth where they occur on otherwise fresh arsenopyrite or sphalerite. Pristine sulfides with identical unreplaced scalenohedral calcite are known to continue to the bottom of the mine.

Little production work normally takes place in the smithsonite zone because the mixed oxide-sulfide ores found there are difficult to beneficiate. However, at depth in the preferred sulfide ore zone, the miners periodically encounter water-filled fractures that can gush up to 90,000 gallons/minute and rapidly flood the lower levels of the mine. When this happens, attention mining focus shifts to the mixed oxide/sulfide ores at the water table until the deeper levels are pumped out and production can resume. Almost every time this happens smithsonite specimens appear in profusion and this on and off pattern means many San Antonio Mine smithsonites can be dated fairly accurately. After a major flood in 1953 the mine stayed dry until 1982 and quantities of undistinguished white, gray to gray-green and rusty stalactitic smithsonite masses were intermittently produced without great commercial success. After a major flood happened in 1982 a substantial number of bright yellow, orange and lime-green smithsonite specimens (colored by greenockite inclusions) with botryoids to 8 cm and crude crystals to 2 cm were found. After sulfide production was restored smithsonite production dwindled to a trickle until early 1998, when an access drift for an expanded underground repair shop was carved out of the smithsonite zone. First, small numbers of rice-grain size and shaped bright-blue smithsonite perched on transparent colorless hemimorphite appeared. Although very pretty, they were too small to be of more than locality interest; but they did fire the imagination for more. Clandestine specimen collectors tried to work the zone, but the ground is hard and proximity to the shop meant company vigilance was high. Things changed quickly in the spring of 1999, when the mine again flooded and production shifted upwards. A small number of superb miniature to cabinet sized, brilliant green translucent smithsonite knobs and stalactites to 15 cm long studded with hemimorphite appeared. Although this flood was quickly controlled and mining returned to the deeper levels, the prices realized for the stalactites caught collectors' attention, so with the collusion of mine staff members, specimen collecting in the zone continued. Only gray-green to yellow-green balls and heart-shaped distorted twinned (?) rhombs were found until late November 1999 when phenomenal electric blue botryoidal and stalactitic masses from thumbnail to boulder-size were hit (Megaw 2007). Many had associated hemimorphite, some had sharp doubly-terminated anglesites to 1 cm, and a few had 7 mm cerussite crystals perched on them! Others showed patches of white hydrozincite, and a few 1 cm aurichalcite balls with hemimorphite were also found. This pocket only produced 25 very good pieces, with 6 truly excellent ones. However, hundreds of good pieces of botryoidal bluish, green and yellow smithsonite and numerous pieces with isolated 3-8mm blue rice-grain-shaped crystals perched on colorless 5–10mm hemimorphite blades were mined. Some of these have associated tiny sharp orange barite crystals. A few blue heart-shaped distorted rhombs (twins?) also appeared, including excellent thumbnails and small miniatures. During renewed flooding in 2012-13 a few superb lustrous lime green pseudomorphs after calcite scalenohedra up to 7 cm long were produced with large numbers of inferior examples. This find also included some very good replacements of platy and rhombohedral calcite.

The mine is currently (late 2015) struggling with flooding again, so we should expect to see new variations on the San Antonio smithsonite theme again soon.

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Arizona Gemstones — with a few from New Mexico

Wolfgang HT Mueller, Oracle, AZ

After several prior presentations of this subject, it was formalized during the Arizona Centenial as an article "ARIZONA GEMSTONES" in the Jan-Feb 2012 issue of Rocks & Minerals Magazine.

Gemstones have been collected for millennia in the area that is now Arizona. Native peoples have been using gemstones as personal adornment for at least 10,000 years. Materials used were shell, bone, and stone–argillite, claystone, copper, flint, sandstone, and turquoise. The use of turquoise only goes back about 1,500 years.

Arizona has one of the largest selections of gemstones in the U.S. as well as being a major U.S. producer. This is in great part due to the proliferation of Arizona's mines. The greatest influence being its world-class copper mines, producing gemstones from primary emplacement as well as secondary weathering/alteration of the ore bodies.

The most famous and/or abundant gemstones include: quartz, agate, jasper, azurite, "campbellite", chrysocolla, copper, fire agate, garnet, gem chrysocolla, magnesite, malachite, obsidian (apache tears), peridot, petrified wood, shattuckite, and turquoise. Manmade gemstones are also significant both unintentional as well as intentional. For discussion purposes the gemstones are divided into six groups: the quartzes, the metals, the classics, the leftovers, unnaturals (manmade) and beware and be aware. The featured gemstones are on display in the lobby.

This introduction to the great variety of Arizona gemstones will touch on the highlights, the major or famous locations as well as a cross section of the less known gemstones.

There are literally hundreds of gemstone locations throughout Arizona, from large to almost unrecognizable. Gemstones can be found almost anywhere in the state. Ten locations throughout the state are highlighted. The largest quartz group region is in the petrified forest area around Winslow, Holbrook, and the Petrified Forest National Park. Of course the park is off limits for collecting. The second largest is the Burro Creek area west of Bagdad. The remaining eight are copper mining camps: Ajo, Bagdad, Bisbee, Clifton/Morenci, Globe/Miami, Jerome, Kingman-Mineral Park, and Ray.

Arizona's major economic gemstones are fire agate, gem chrysocolla, peridot, petrified wood, and turquoise, "the big five." Of these turquoise undoubtedly is the best known, made famous by its extensive use in Native American jewelry.

It seemed only logical that some of New Mexico's gemstones also be featured since they were mainly formed by the same process as in Arizona and more importantly, to celebrate the opening of the new Mineral Museum here in Socorro. Featured New Mexico gemstones will include smithsonite, Chrysocolla, agate and ???

Photos and Lapidary Work by Wolfgang & Diana Mueller.

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Late 20th Century Wulfenite Collecting in the San Francisco Mine, Mexico

Tony L. Potucek

The San Francisco Mine, also known as Cerro Prieto, is located about 65 km (40 miles) east of Magdalena, Sonora Mexico in classic Sonoran Desert terrain. The closest municipality is Cucurpe, and the mine is located on Ranch Cerro Prieto property, owned by the Pedro Trelles family (Fig.1). While the mine is only a little over 100 km south of the USA-Mexico border town of Nogales, the trip can take a half day or more to get to the mine from Nogales due to customs, immigration, and poor roads. The San Francisco Mine is a world famous classic locality for being one of the most prolific producers of wulfenite-yellow to orange, clear window panes of wulfenite to 18 cm, some with attached balls of red-orange to yellow mimetite. Many collectors consider their collections incomplete unless at least one San Francisco wulfenite graces their shelves.

On or around the end of the 1800s, the unexplored veins on Cerro Prieto were found to be enriched in gold. The Chenowith family began working the mining property, and about 1900, a 20-stamp mill equipped for amalgamation of the ore was erected to treat the ores coming from workings near the top of Cerro Prieto. Today, large red open stopes testify to the size and amount of material worked during these early days. The rumor persists of a crew of miners buried forever within Cerro Prieto when a massive cave-in took place. Mining continued intermittently until the late 1960s although no specimens are known to have been produced. Specimen mining for wulfenite started in the early 1970s and continued through a series of intriguing episodes up to 1994.

Rocks consist of Lower Cretaceous-age Bisbee Group shales, limestone and arkosic sandstones and Lower Tertiary-age andesite-dacite flows, and silicic ash flow tuffs. The walls of a prominent north-northwest striking shear zone up to 30 m wide form what is called the East & West Veins. The dip is vertical to 80–90° easterly. The shear zone is traceable for a couple thousand meters on the surface. The shear zone shows movement, thus creating a complex series of parallel and horse-tailing faults within the brecciated interior underground.

Mineralization is very simple, consisting of wulfenite, mimetite, cerussite, anglesite, quartz, barite, hematite & calcite, with remnant galena and sphalerite. Rarely, visible gold can be seen without a hand lens. Mineralization (wulfenite) is restricted to the altered and brecciated Mn-rich oxides within the shear zone. Flexures (steepening/flattening) in the veins created open space to form the most productive & mineralized areas for pockets of crystallized wulfenite-mimetite.

Today, the San Francisco Mine is held by the Goldgroup, a Vancouver mining company, who has successfully conducted leach tests for Au and Ag in 2014. No specimens are known to have been produced since 1994.

50 Shades of Blue – Arizona Style

Les Presmyk

In 1880, Robert Ridgway was appointed the first full-time curator of birds at the Smithsonian. In addition to his significant contributions to ornithology, he also developed a systematic color nomenclature for naturalists. In 1912 he published Color Standards and Color Nomenclature, which continues to be used by ornithologists throughout the world. In an effort to determine just how many shades of blue there actually are, this book was used as a reference. It is not just about calling something reddish-blue or navy blue, but to provide consistency to the various shades of blue. As a result, one could spend a lot of time just discussing color nomenclature and never get to the confusion caused by paint manufacturers who feel the need to change their color names on a periodic basis. Starting with black and white, then red, then green or yellow and then green and yellow, blue does not show up in a language until there are at least seven colors named. Fairly low status for such a beautiful and otherwise important color.

Man's fascination with Arizona's blue minerals dates back millenia. Although azurite and lapis figure prominently in European and Middle Eastern histories and art, for Arizona the interest was mainly in one blue mineral, turquoise. As far back as 700CE, ornamental objects of turquoise have been discovered in archeological excavations. Turquoise was considered magical by the native populations in Arizona and New Mexico and used in commerce as far away as the Aztecs in central and southern Mexico. Turquoise Mountain, north of Kingman, was the site of extensive prehistoric mining. In 1898 Blake described benches and terraces that were evidence of significant efforts to extract turquoise from the quartz veins. This was tedious work requiring the building of fires against the rock faces and then quenching the fires with water to crack the rock.

Fast forwarding all the way to the 1870s interest by the newest inhabitants of the arid southwest in the blue stained outcrops were exploring for gold, silver and ultimately copper. The blue minerals of note, besides turquoise, were chrysocolla and azurite, which indicated the tops of what would become the great copper mines of Bisbee, Clifton-Morenci, Ajo, Globe-Miami, Ray, Mineral Park, and Bagdad.

The range of blues exhibited by Arizona's minerals do not quite cover 50 shades, as it turns out. Most of the minerals are inherently blue but a few are stained by other elements to produce their vivid blue colors. They range from rather common species to the very rare, from micro-size crystals to ones large enough to excite every collector.

The show theme for the 2016 Tucson Show is *"Shades of Blue Minerals of the World."* It seems appropriate to acknowledge and highlight some of the possible specimens Arizona may be able to contribute to the displays in support of this theme. While this examination could have been done on a locality by locality basis, it seemed to make more sense to proceed with an alphabetical examination and using a backward order Z to A, and saving azurite for last.

The first mineral is turquoise. It was found in the oxidized zones of most of Arizona's open-pit copper mines. It has been commercially extracted from the Pinto Valley and Copper Cities (Sleeping Beauty) Mines both during active mining and for years following the cessation of copper production in the Globe-Miami district. In the Morenci Mine, a contractor mined turquoise there for decades. In the 1960s the rules were such that if a PD employee bent over to tie a shoelace in the wrong area, he could have been subject to discharge. Bisbee Blue® was the name Warren Matthews gave to the turquoise from Bisbee's Lavendar Pit. He not only mined the material in the pit and the large waste dump but he sold it at his store overlooking the pit.

Mineral Park was also the location of commercial and midnight mining of turquoise. After a night of collecting turquoise from one of the dumps the collectors found themselves surrounded by Mohave County sheriff deputies. It seems there had been a bank robbery and when their vehicle had been spotted, the collectors were carrying out their turquoise in bags that appeared similar to money bags and the general appearance of the collectors was similar to the bank robbers' description. Ultimately, their innocence was proven when the bags were emptied to reveal turquoise, not $5, $10 and $20 bills. The deputies went on their chase of the bank robbers and did not have time to arrest the turquoise diggers for obviously trespassing.

One of Arizona's rarest blue minerals and one of its most famous species is spangolite from Bisbee. While the type specimen is labeled from Tombstone, and almost anything is possible, it is most likely from Bisbee. The world's finest specimens came from Bisbee and the best specimen is probably the one in MIM.

The type locality for shattuckite, a copper silicate, is the Shattuck mine in Bisbee. However the best crystallized material came from the New Cornelia Mine in Ajo. Masses weighing in the pounds were recovered and the material was thick and hard enough to be cut and polished.

Scheelite–Rogers (Cohen) Mine, Dos Cabezas Mts., Arizona. *Presmyk Collection/Jeff Scovil Photograph*

Scheelite is included in the list, not because of its orange color in daylight or under artificial light but because of its strong blue-white fluorescence. The Rogers/Cohen mine in the Dos Cabezas Mountains of southeastern Arizona produced some of the best scheelites in the U.S.

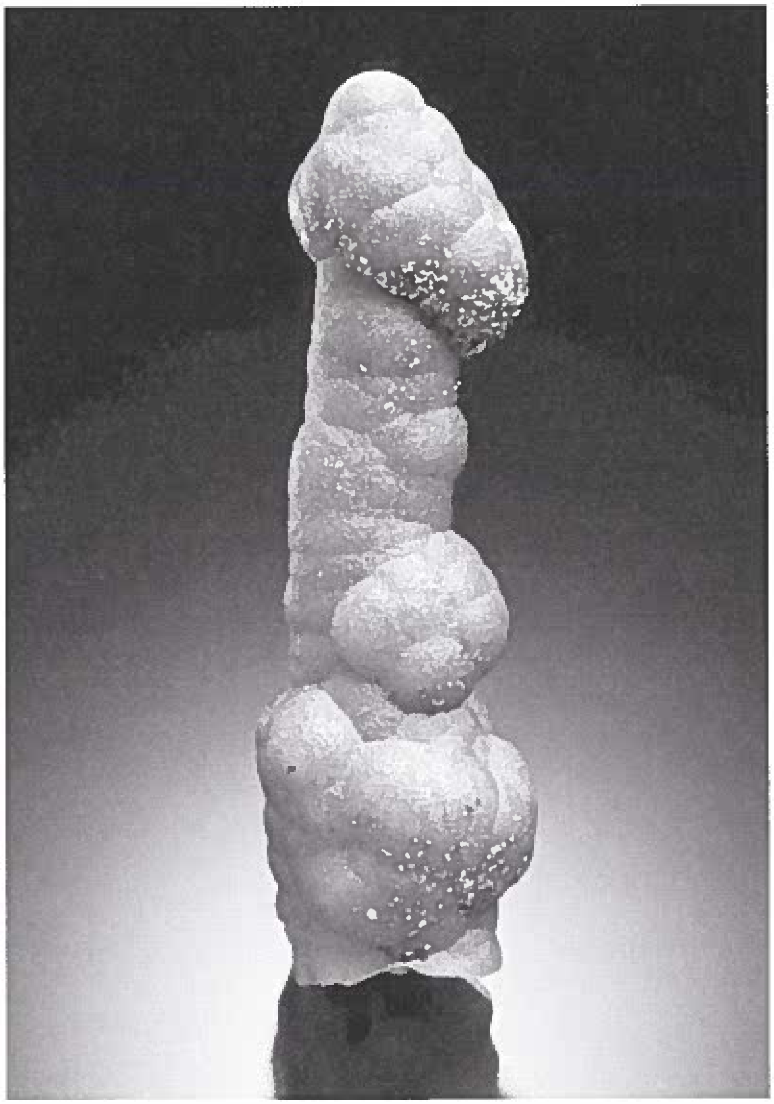
Rosasite is one of the copper carbonates found in fine specimens in several of Arizona's mines, most notably the Silver Hill Mine north of Tucson, the Silver Bill Mine at Gleeson and Bisbee.

Several of Arizona's mines have produced post-mining sulfate minerals, starting with the United Verde Extension Mine in Jerome and these resulted from the mine fire. In the past 40 years, Dick Graeme and his sons Douglas and Richard have documented and collected a number of these sulfate minerals in the underground mines of Bisbee. They include ransomite and boothite, along with the much more common chalcanthite.

The next two blue minerals were first discovered at the New Cornelia mine in the late 1950s. Papagoite and Ajoite are also copper silicates and provide two very different shades of blue from Arizona.

The two representatives for "L" are linarite and leadhillite. Some of the world's best linarites have been collected at the Mammoth-St. Anthony Mine at Tiger and at the Grand Reef Mine at Klondyke. In the case of linarite its color is blue. Blue leadhillite occurs as the finest specimens in the U.S. at Tiger, but in this case the blue is due to copper impurities because pure leadhillite is colorless.

The type locality for Kinoite is a drill hole in the Helvetia area of Arizona. The collector's specimens were discovered at the Christmas mine where crystals are rare but rock covered with thin layers of kinoite have been produced both during mine production and as the result of collectors working the dumps and pit benches.

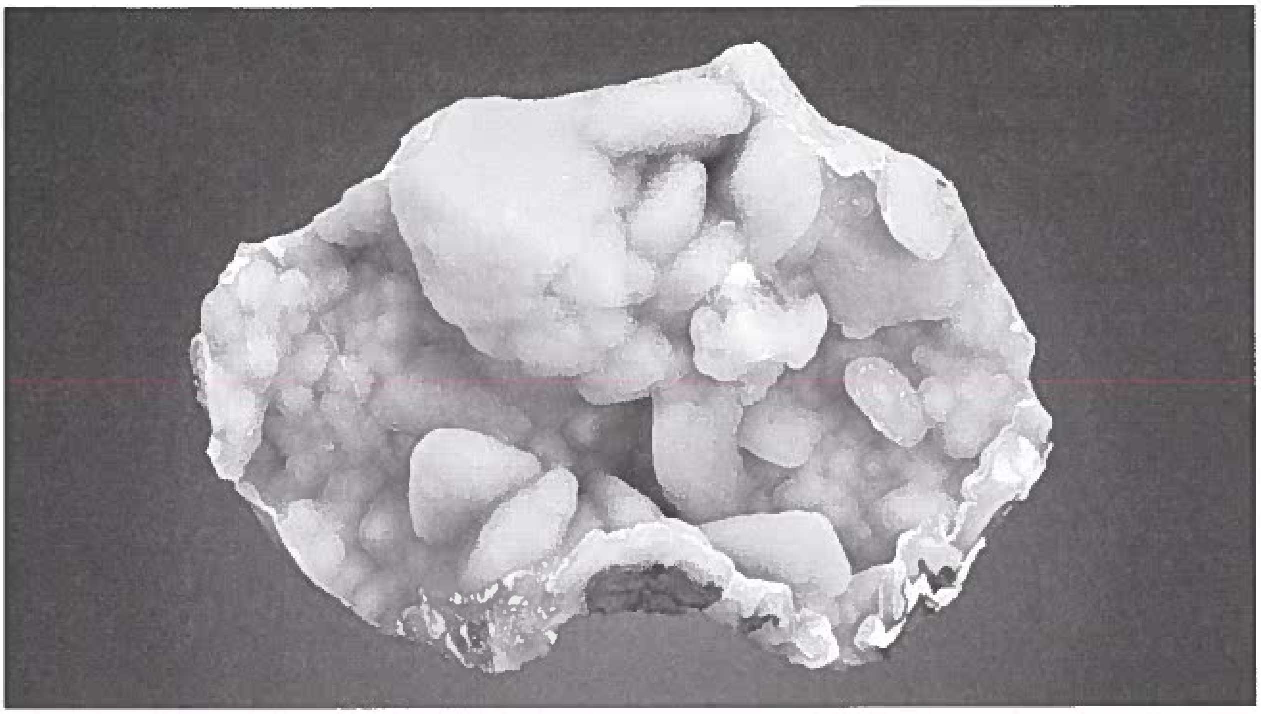


Hemimorphite – 79 mine, near Winkelman, Arizona. *Presmyk Collection/ Jeff Scovil Photograph*

Hemimorphite from the 79 mine has been produced for decades. Hemimorphite is white or colorless in its purest forms but fortunately, there are enough impurities to give the best of this mine's specimens several attractive shades of blue.

Diaboleite is another rare lead copper species from the Mammoth-St. Anthony Mine, where world-class specimens were recovered. Crystals over an inch long and associated with leadhillite and caledonite were found during the last period of mining in the 1940s.

The "Cs" are probably the best represented letter starting with Cyanotrichite from the Maid-of-Sunshine Mine at Courtland and the Grandview Mine in the Grand Canyon. Connelite from Bisbee is a deep blue mineral, most commonly massively crystallized in chunks of cuprite and rarely as free-standing crystals. Chalcoalumite is a robin's egg blue botryoidal mineral for which Bisbee is the type locality. It is found by itself and as coatings on botryoidal azurite. Caledonite is another rare lead copper species from the Mammoth-St. Anthony Mine, where world-class specimens were recovered. Finally, chrysocolla is found in a number of Arizona's copper deposits including Ajo, Bagdad, the Live Oak Mine in Miami, the Old Dominion in Globe, Ray and uncommonly in Bisbee and Morenci. The chryscolla is associated with drusy quartz crystals and chalcedony style quartz which makes for very attractive specimens. In addition, when the chrysocolla is the coloring agent in chalcedony, gem silica can result, producing some beautiful blue gemstones.

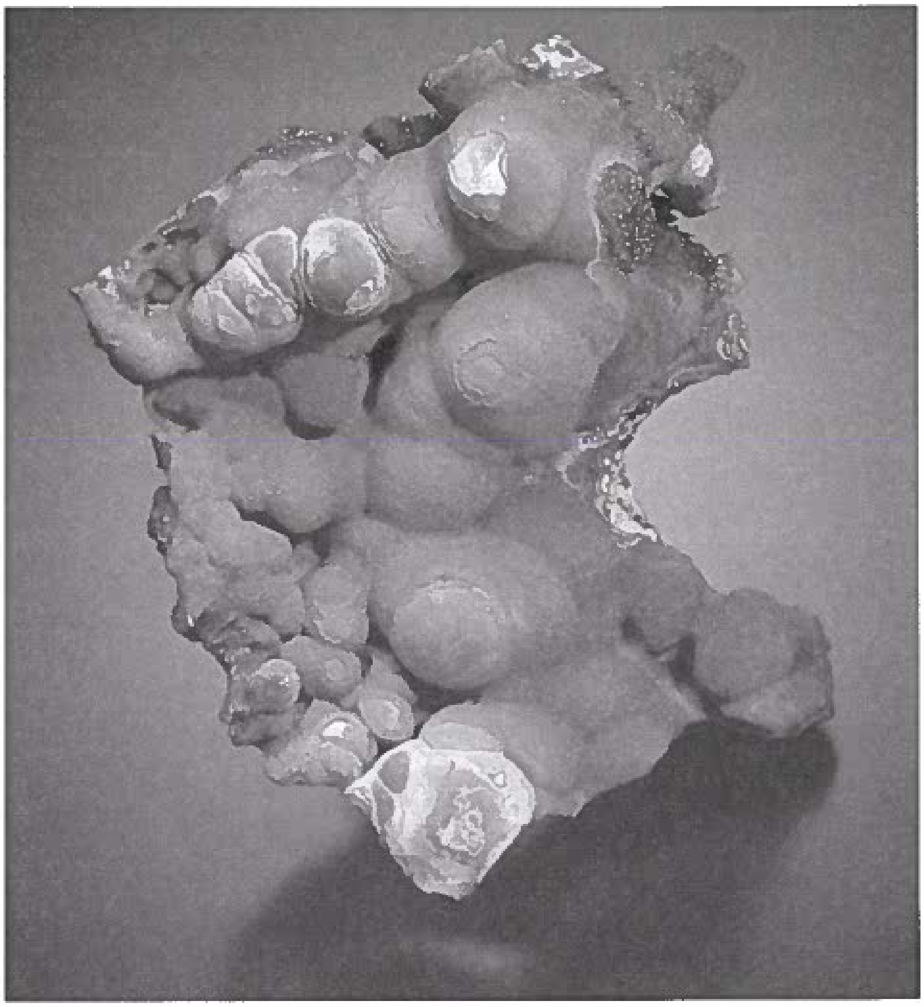


Quartz after Chrysocolla after malachite after azurite – Live Oak Mine, Miami, AZ. *Presmyk Collection/Jeff Scovil Photograph.*

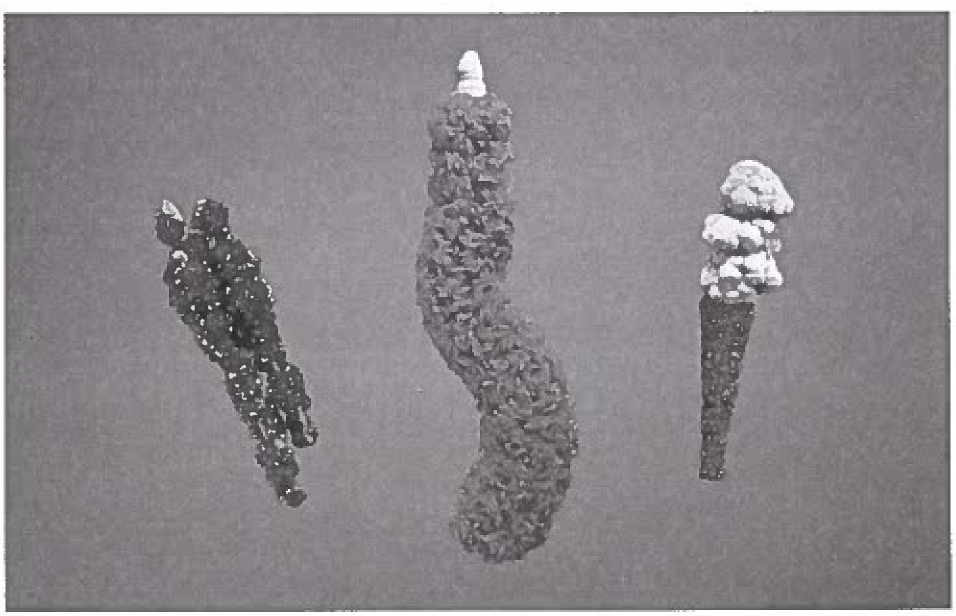
Beryl actually does occur in Arizona and even has produced a few okay specimens. The Sierrita Mountains south of Tucson have a number of small pegmatites that have produced beryl crystals up to over ten inches long. Cores of some of the crystals were truly aquamarine and 1 and 2 carat stones were cut. Recently the miarolitic cavities in the Santa Teresa Mountains have yielded a few notable aquamarine crystals and clusters.

And we finally get to the "A" minerals. Starting with aurichalcite, the best specimens are from Bisbee and the 79 mine. If you have or have seen blu calcite from Bisbee, it is actually aragonite. In a conversation with Dick Graeme about these blue specimens, only the aragonite crystal structure can contain the copper salts which give these mineral its vibrant blue coloring.

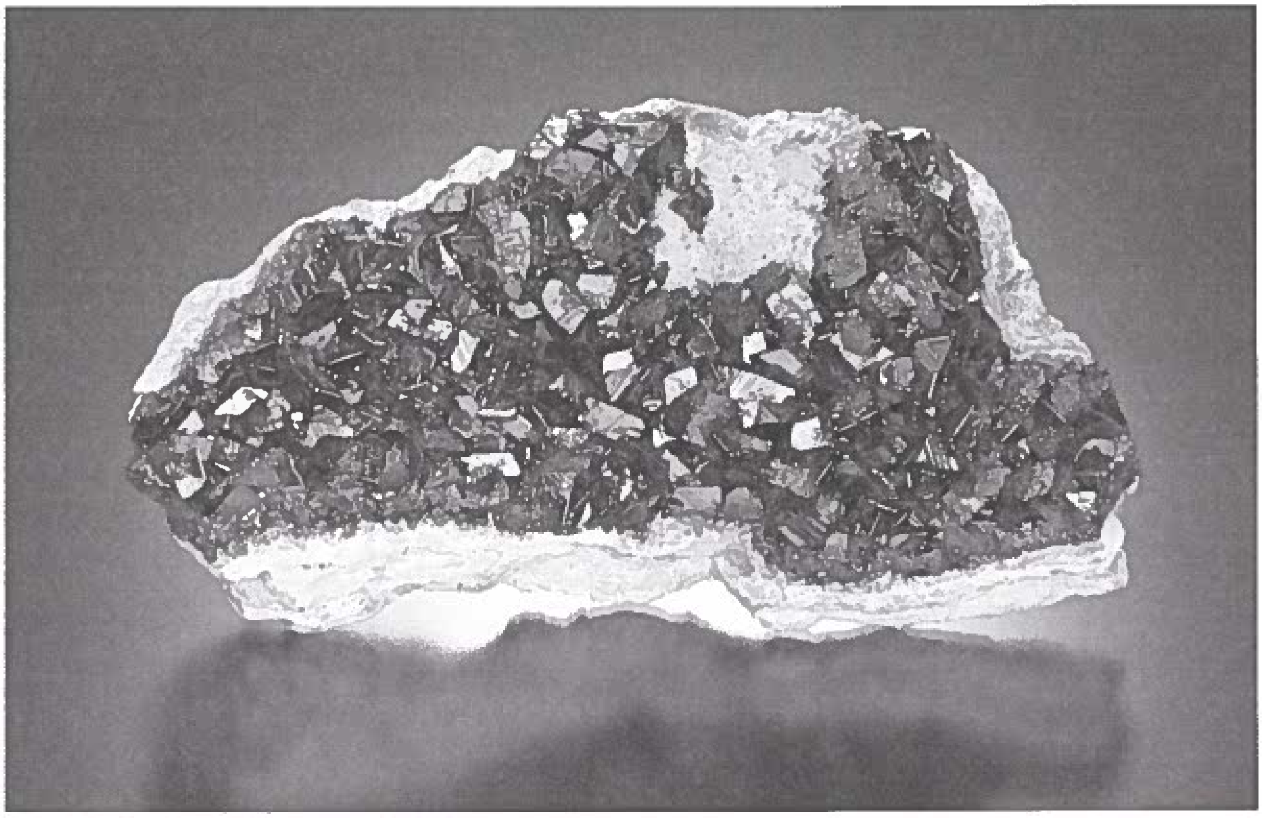
The king of Arizona's blue minerals is azurite. Fine specimens have been recovered from Bisbee, Ajo, Morenci, Old Dominion and the Carlota Mine near Miami. Specimen production from Bisbee, Morenci and the Old Dominion date from as early as the 1880s and 1890s. The best azurites from Ajo were recovered between 1958 and 1962. The Carlota Mine has produced its lustrous azurite crystals as recently as the last four years.



Azurite – Czar Mine, Bisbee, Arizona. *Presmyk Collection/Jeff Scovil Photograph.*



Azurite Stalactites–Morenci Mine, Morenci, Arizona. *Presmyk Collection/Jeff Scovil Photograph*



Azurite – Carlota Mine, Miami, Arizona. *Presmyk Collection/Jeff Scovil Photograph*

Mineralogy and Cultural History of the Naegi Pegmatite District, Nakatsugawa, Gifu Prefecture, Japan

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The Naegi Pegmatite District in the Hirukawa area of Gifu Prefecture is one of the classic mineral localities of Japan. Historically, this area produced some Japan's finest topaz crystals. Tsunashirō Wada wrote in his 1904 book Minerals of Japan (Nihon Kōbutsushi) that "Among the best known minerals from Japan are stibnite, in crystals most gigantic and splendid of all metallic minerals, topaz [from the Naegi District and Tanakamiyama]..., and rock crystal which presents an uncommon form of twinning [Japan law twins]." More recently the district includes type locations for the minerals hingganite-(Ce) and proto-ferro-anthophyllite.

Mining in the area started in the latter half of the 19th century with the development of alluvial (placer) deposits that concentrated resistant minerals that had weathered from the granites and related hydrothermal veins. Later, in the 20th century, with growing interest in western building styles, quarrying of the local granite for building stone began. This exposed many pegmatites which are the main source of mineral specimens from the area. Polymetallic vein deposits that are also associated with the granites and are hosted by it and surrounding lithologies. Many of these have been mined for ores of molybdenum, tungsten, tin, bismuth, copper, lead and zinc.

During the Edo period Nakatsugawa was a post town (station) along the Nakasendō, an important travel route that stretched through the central mountains of Honshu from Edo (modern-day Tokyo) to Kyoto. Although heavily traveled, and farmed for more than a millennia, there seems to have been no mineral development in this area prior to the Meiji Restoration.

The dominant specimen producing lithologies in the Naegi District are miarolitic pegmatites of the NYF family, found throughout the Naegi-Agematsu granite, and related pneumatolytic-hydrothermal veins that crosscut the granite and the Nohi rhyolite. The granite contains many miarolitic pegmatitecassiterite, molybdenite s, ranging from a few centimeters to a meter or so in diameter.

As with most NYF family pegmatites, the dominant mineralogy of the Naegi District pegmatites is quite simple comprising beautiful crystals of smoky quartz, microcline (of a great variety of forms and twins), albite, muscovite, biotite, zinnwaldite, schorl, fluorite, beryl and most notably topaz. There are also accessory minerals, usually found in microcrystals. These include zeolites such as chabazite-Ca and stilbite-Ca, cassiterite, molybdenite and a suite of REE and actinide bearing minerals such as zircon, hingganite-(Ce), fergusonite-(Y), samarskite-(Y), monazite-(Ce), allanite-(Ce), xenotime-(Y) and gadolinite-(Y).

Memories of the San Juans — the 1970s

Tom Rosemeyer, Magdalena, NM

In August 1968 I was drafted into the United States Army from a job at Summitville, CO where I was employed as a mine engineer with the Cleveland Cliffs Iron Company. This was my first job in the San Juan Mountains and looked forward to returning to the mountains once I had served my two years with the military. When I was discharged in July 1970 Cleveland Cliffs had already shut down the Summitville operation, but I had secured a job at the Camp Bird mine in Ouray, CO. I arrived on 10 August 1970 to start employment as a mining engineer and re-start my mining career that would last for the next 40 years.

The 1970s were a golden decade in the San Juan Mountains of Southwestern Colorado for mining and the mineral collector. The Sunnyside, Idarado, and Camp Bird mines were the three major operations in full production and producing a plethora of mineral specimens. At the peak of mining in the mid-1970s the payroll at the Sunnyside mine was 200 people, the Idarado mine 400 people, and the Camp Bird mine 100 people. Small mines were also in development and mining stage and accounted for another 100 people. This accounted for 800 people in the mining industry and had the largest payroll in the San Juans. Tourism was also a major source of local revenue but was confined to the summer months.

The Sunnyside mine was known for the beautiful combinations of crystallized rhodochrosite and fluorite specimens that were being found in the Washington vein and recovered by miners. At this time the Sunnyside mine was the premier locality for rhodochrosite in Colorado and specimens could be procured locally from the miners or dealers. About 1972 rich gold or shoots were discovered in adjacent veins and high grading and became big business at the Sunnyside mine and specimens could be discreetly purchased at the saloons from miners.

At the Idarado on Red Mountain Pass hundreds of fine quartz crystal groups were being recovered by miners in large vugs along the Argentine vein. The mine also produced some very rich gold specimens for a short period of time. PB-Cu-Zn replacement ore bodies were also being exploited and a number of fine specimens of galena, sphalerite, and chalcopyrite and associated minerals were being recovered by miners.

At this time the Camp Bird mine was developing and mining similar base metal replacement ore bodies adjacent to the Orphan and Walsh veins. These deposits were almost identical to the ones being mined at the Idarado mine. Hundreds of attractive specimens of galena, sphalerite, and chalcopyrite were recovered along with accessory minerals. Many of these fine specimens are still in Colorado collections.

By the end of the 1970s the three major mines had ceased operations and a great era in mineral collecting came to an end. I made the most of it in those ten years and built a very nice San Juan collection especially from the Camp Bird mine where I ended my early career as Mine Manager. I was fortunate to see the base-metal replacement ore bodies mined from start to finish. I'm now retired and can look back at my mining career in the San Juans and can say that I enjoyed every day of it and met many fine people and a few scoundrels. Amen!!

Skarn minerals of the Victorio Mountains, Luna County, New Mexico

Robert E. Walstrom, Silver City, NM

Skarn can be defined as a metamorphic zone developed when igneous rock intrudes carbonate sedimentary rocks. The Victorio Mountains skarn was formed when Montoya Limestone of Ordovician age and other related sedimentary units were intruded by a Tertiary granitic pluton containing large amounts of silicon, aluminum and other elements. The metamorphic rock formed contains calcium and aluminum-rich minerals along with potentially economic amounts of Be-Bi-Mo-W. The Victorio Mountains skarn is located on the south slope of the Middle Hills. This study, excluding the Irish Rose Vein, is concerned with an area of approximately 160 acres which includes the Tungsten Hill mine, Ogre-Bogle mine, Victorio 10 mine, Gulf Oil Victorio Project and other major workings in the area. Drilling conducted by mining companies show the south portion of this skarn slopes gently beneath Quaternary alluvium and continues to the south. Exploration for non-pegmatite sources of beryllium going back as far as the 1950s, reveal the presence of beryllium in the form of helvite occurring in several of the workings. The author, noting the unusual chemistry of the skarn, set out to determine if other beryllium occurrences could be developed within the study area. As a result of extensive sampling and scientific analyses, a list of 35 species has been developed. These include seven localities containing helvite, virtually all major workings, and two localities for beryl (the first of this species to be found entirely within the skarn). Additionally, several species has been added to the Victorio District mineral list, including cotunnite, hydrozincite, perite, rutile and xilingolite. In the opinion of the author the skarn area holds a high potential for the dozen or so beryllium minerals known to occur in skarn deposits world-wide.

Notes