

50TH ANNIVERSARY ISSUE!

Arizona



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THE MINERALOGICAL RECORD

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THE PIEDMONT MINE

YAVAPAI COUNTY, ARIZONA

Barbara L. Muntyan
3500 S. Beryl Avenue
Tucson, Arizona 85735
Azmarmot@gmail.com

The Piedmont mine is famous among Arizona mineral collectors because of a single pocket of beautiful, drusy quartz-coated pseudomorphs of malachite after azurite crystals discovered there by a collector in 1955. But the exact spot of the discovery remains unknown, and further searches of the area by many collectors since then have been unsuccessful at finding any more.

INTRODUCTION

The Piedmont mine in Yavapai County is the source for some of the most iconic copper minerals ever found in Arizona. From a single find made in 1955, scarcely 50 specimens exist. Yet these specimens—pseudomorphs of malachite after blocky azurite crystals coated by drusy quartz—are highly sought after, rarely available, and always expensive. They have been referred to as a Holy Grail for enthusiastic Arizona mineral collectors.

HISTORY

The Piedmont mine lies just west of Bloody Basin, along the Bloody Basin Road (Forest Service Road 269) in the Tonto National Forest near the east end of Yavapai County. It was a heavily promoted but poorly producing copper/gold/silver group of claims located to the north of Copper Creek, within sight of Brooklyn Peak.

The mine lies in high desert, with rolling hills to the east and south, some of them basalt-capped. Vegetation consists of sparse grasses, prickly pear cactus, scattered juniper and scrub. The altitude at the mine is about 4,000 feet. The local geology consists primarily of medium-grained granite cut by a series of subparallel quartz dikes striking northwest to southeast. The age of the granite has not been definitively determined, and is variously reported as either Paleozoic or Tertiary.

The original six claims of the Piedmont mine (called the Copper Queen No. 1 through 6), located in 1892 and never patented, are located in the NW¼, of Section 33, T10N, R4E. The mine was a



Figure 1. Location map showing the Piedmont mine in eastern Yavapai County. W. W. Besse map.



Figure 18. Malachite-after-azurite pseudomorphs with drusy quartz coating, 25 cm, from the Piedmont mine. Les and Paula Presmyk collection, ex Donald Wayne Thompson, Edward Swoboda, and Jim and Dawn Minette collections; Jeff Scovil photo.

that there were at least four different vugs. The specimens available for examination show major differences in their appearances. The matrix for the various specimens ranges from hematite-included breccia to larger, flattened, gray-white quartz crystals, to tan to red-brown to dark-gray rock, both breccia and andesite. The drusy quartz ranges from white, fine-grained crystals to larger, clear quartz crystal points. The underlying malachite pseudomorphs range from forest-green to emerald-green, grass-green, pale green and nearly white. The combination of rich green malachite pseudomorphs coated with gemmy quartz druses against dark matrix makes them a unique and beautiful occurrence in a state famous for beautiful malachite pseudomorphs. There are also a handful of quartz-coated malachite “worms” after an unknown mineral, probably monoclinic, from this locale.

Azurite $\text{Cu}_3(\text{CO}_3)_2(\text{OH})_2$

Sky-blue to medium-blue chalky blebs and coatings of weathered azurite occur in some quantity in the rubble surrounding the collapsed Sunshine shaft. No unaltered azurite was found near the Piedmont shaft; it has completely altered to fibrous malachite. Such altered azurite crystals occur as compressed pseudo-rhombic crystals up to 3.5 cm on edge. The appearance is similar to that found in azurite/malachite crystals from the New Cornelia pit in Ajo, Arizona.

Barite BaSO_4

A few tiny, tabular, pale tan crystals of barite to 3 or 4 mm were found at a prospect pit north of the Bloody Basin Road on the newer claims.



Figure 19. Malachite-after-azurite pseudomorphs with drusy quartz coating and a cluster of small quartz crystals with minor hematite, 4.5 cm, from the Piedmont mine. Evan Jones collection, ex Donald Wayne Thompson collection, ex Wayne A. Thompson, collection; Jeff Scovil photo.



THE SAN MANUEL MINE

PINAL COUNTY, ARIZONA

Mark Hay
4044 East Rancho Drive
Phoenix, Arizona 85018
sm-hay@hotmail.com

Garry Alexander
240 East Four Horses Place
Tucson, Arizona 85704
redrat66@comcast.net

In terms of total ore production, the San Manuel mine was the largest underground mining operation in North America, but most mineral collectors have never heard of it. Nevertheless, San Manuel has produced some superlative specimens over its 44-year history; you just have to look a little harder to find them. Though few in number, extraordinary examples of azurite, malachite, cuprite, native copper and pyrite rank among the treasures of Arizona mineralogy.

INTRODUCTION

During its operating lifetime, the San Manuel mine was a major copper producer in Arizona. By the time mining ceased in 1999, it had produced over 4.6 million tons of copper, over 73 tons of molybdenum and lesser amounts of gold and silver. In terms of total ore production, it was the largest underground mining operation in North America, but most mineral collectors have never heard of it. Even among collectors in Arizona it has remained largely below the radar. This is for two reasons. First, because of the method of mining, few mineral specimens were recovered. Second, collectors lucky enough to have good San Manuel pieces are reluctant to part with them, so they are rarely available on the specimen market. However, San Manuel has produced some superlative minerals over its 44-year history; you just have to look a little harder to find them.

The San Manuel mine is located in a mountainous region of south-central Arizona near the towns of San Manuel and Mammoth in Pinal County. It sits at an elevation of 3,450 feet, with the Galiuro Mountains to the east, the towering Santa Catalina Mountains to the southwest and the gently rolling Black Hills to the north and west. The San Pedro River, reported on Wikipedia as “the last major, free-flowing undammed river in the American Southwest,” is 3 miles east of the mine. The city of Tucson lies 45 miles to the southwest. The San Manuel mine is in the Old Hat Mining District, only a mile from the famous specimen mines at Tiger, but it could

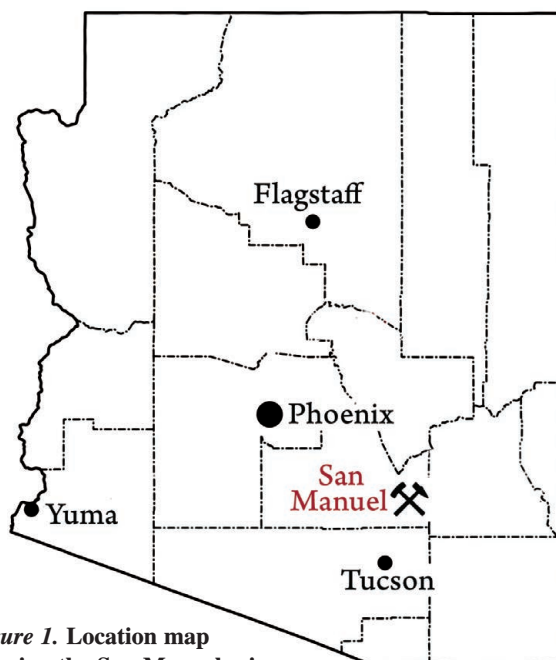


Figure 1. Location map showing the San Manuel mine in southeastern Pinal County.

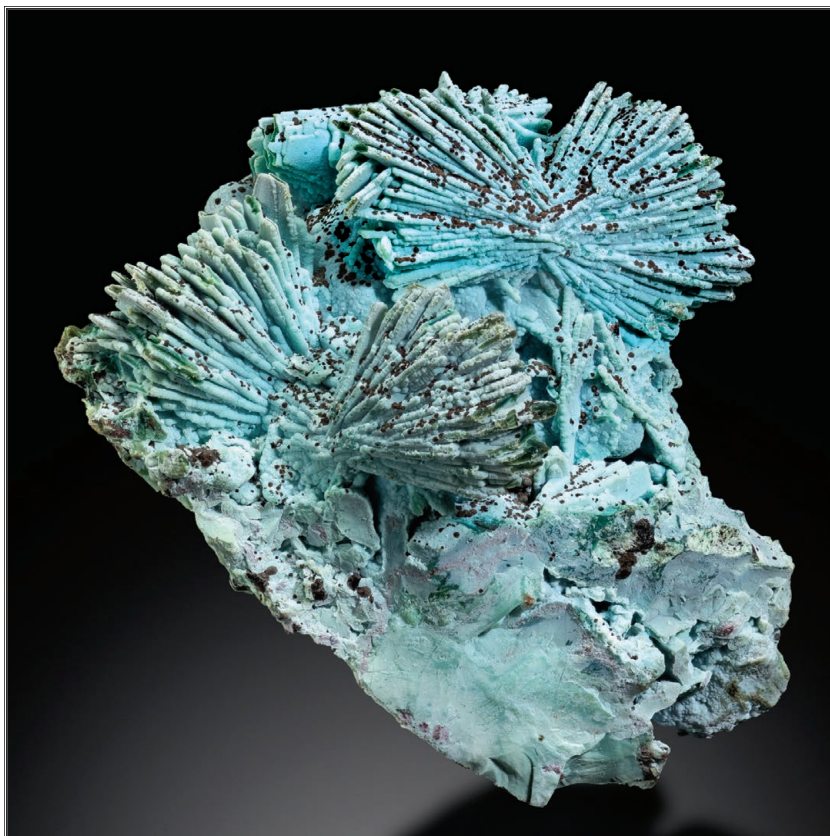


Figure 20. Chrysocolla coating malachite pseudomorphs after barite, 3.5 cm, from the Oxide pit of the San Manuel mine. Garry Alexander collection; Jeff Scovil photo.

Figure 21. Chrysocolla pseudomorphs after gypsum, 4.2 cm, from the Oxide pit of the San Manuel mine. Garry Alexander collection; Jeff Scovil photo.



Figure 22. Drusy quartz coating chrysocolla pseudomorphs after gypsum, 4.5 cm, from the Oxide pit of the San Manuel mine. Garry Alexander collection; Jeff Scovil photo.



THE MORENCI DISTRICT

GREENLEE COUNTY, ARIZONA

Mark Hay
4044 East Rancho Drive
Phoenix, Arizona 85018
sm-hay@hotmail.com

Wendell E. Wilson
4631 Paseo Tubutama
Tucson, Arizona 85750
minrecord@comcast.net

The Morenci District in eastern Arizona is home to many prolific copper mines. Since the first discoveries in 1863, the district has yielded a specimen bonanza of secondary copper minerals, especially azurite and malachite. Over 90 other mineral species have been found there as well, including brochantite, chrysocolla, copper, cuprite, cyanotrichite, and diopside.

INTRODUCTION

The Morenci District is one of Arizona's oldest mining districts and, in terms of total production, its largest. It is located in eastern Arizona only 16 miles from the border with New Mexico and approximately 115 miles northeast of Tucson. The district includes the towns of Morenci, Clifton and Metcalf, and is also referred to as the Copper Mountain District and the Clifton-Morenci District. It sits along the southern boundary of the Transition Zone physiographic province at an elevation of about 4,750 feet. The Transition Zone is a rugged mountainous region that extends northwest-southeast across the entire state of Arizona and separates the Colorado Plateau on the north from the Basin and Range province to the south.

HISTORY

Discoveries and Dangers

During the 1840s and 1850s, the Apache tribes in Eastern Arizona generally considered Anglo-Americans to be allies against their bitter enemies, the Mexicans—a situation reinforced by the Mexican-American War of 1846–1848. However, tensions eventually rose as more Americans settled in the area, and in 1861 a dispute caused by an inexperienced Army officer who made an accusation against Cochise, Chief of the Chiricahua Apache, resulted in bloodshed. Several of Cochise's relatives were killed, igniting a 25-year war, made worse when federal troops were pulled out to fight in the Civil War.

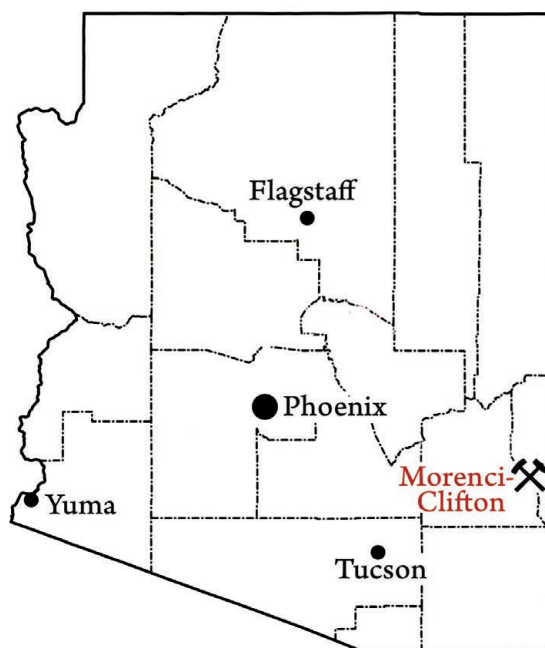


Figure 1. Location map showing the Morenci-Clifton-Metcalf area in central Greenlee County.

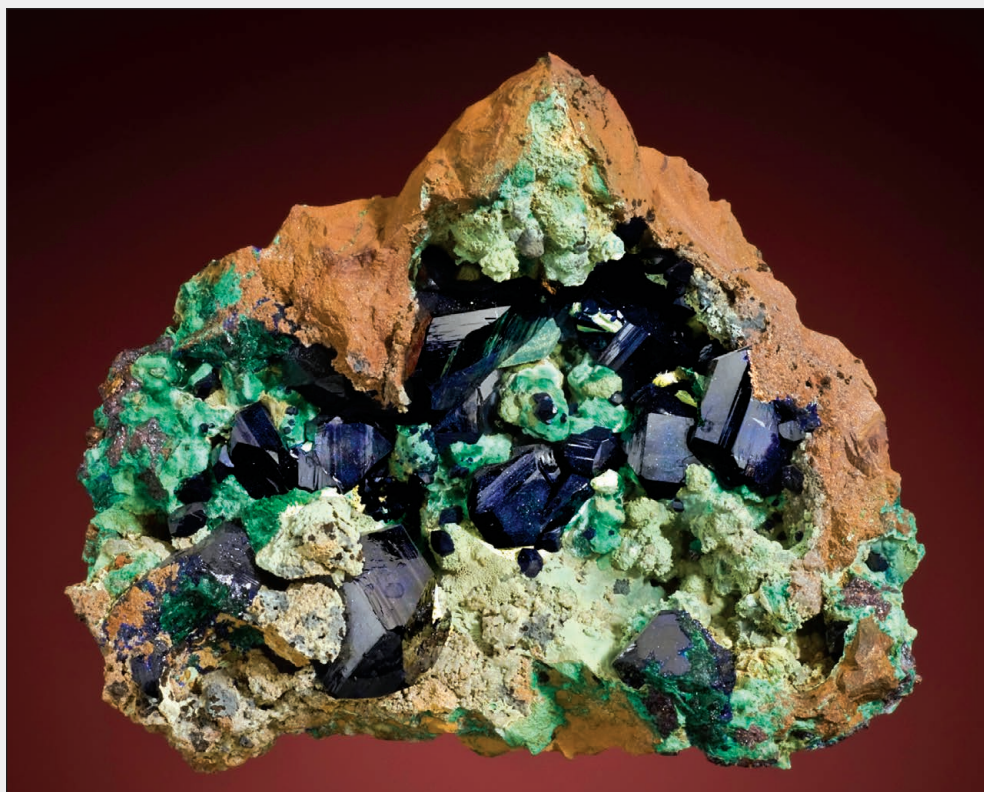
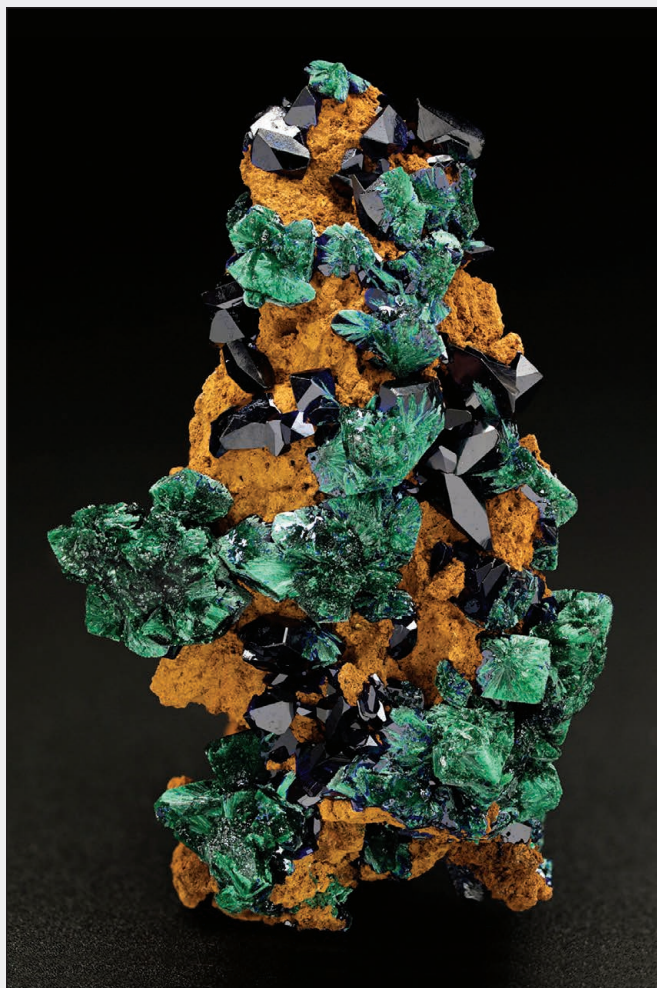


Figure 46. Azurite and malachite, 9.5 cm, from the Crystal Zone, 4600 Bench, Dispatch Hill, in the Copper Mountain area of the old Morenci pit, collected by Southwest Mineral Associates in 1995. Les Presmyk collection; Jeff Scovil photo.

Figure 47. Brilliantly lustrous azurite crystals with malachite pseudomorphs after azurite on limonite, 3.7 cm, from the Morenci mine. Tony Peterson collection and photo.



Figure 48. Azurite, 4.2 cm, from the Northwest Extension, Morenci mine. Collected circa 1990 by Southwest Mineral Associates. Mark Hay collection; Jeff Scovil photo.





LOST ARIZONA MINERAL COLLECTIONS

1863-1912

Wendell Wilson

Mineralogical Record
4631 Paseo Tubutama
Tucson, Arizona 85750
minrecord@comcast.net

Mineral collecting was rampant in the Arizona Territory, before statehood was achieved in 1912. The excitement was fed by specimens emerging from bonanza mines in every county. Early newspapers tell of those richly historic specimen cabinets exhibited not only in private homes but in saloons, hotels, assay offices newspaper offices, schools and even barber shops, drug stores and cigar stores, nearly all of which are now lost to history.

INTRODUCTION

Since the 1860s, people in Arizona have been collecting minerals. This early interest in collecting was fostered largely by the early heyday of prospecting and mining that flourished in every county, from the establishment of Arizona Territory in 1863 to statehood in 1912. Assayers received specimens to test and saved their favorites, while miners gave fine specimens to newspaper editors in hopes of getting some free publicity. Hotels, saloons, barber shops and drug stores put in collection cabinets to attract patrons and promote local discoveries. Soon mineralogists and mineral dealers from the East (locals referred to them as “mineral fiends”) were descending on Arizona in a quest for minerals, awakening people to specimen values and spreading knowledge of Arizona’s mineral wealth far and wide. People took great pride in the mineral resources of their local area, and enjoyed forming collections of local minerals they could show off to visitors. Many a house around the turn of the century counted a mineral cabinet among its furnishings.

Unfortunately, the majority of those early Arizona mineral collections are long gone and no one today knows what happened to

them. The usual fate of “lost collections” is that they were ultimately sent to the smelter to recover their silver and gold values, or thrown away in the trash after their builders passed away. Or they may have been given away to friends, donated to institutions somewhere, or sold to another collector or dealer.

And considering the high intrinsic value of silver and gold specimens, it should come as no surprise that many of them were stolen and smelted into bullion. A note in the *Arizona Republican* (29 January 1897) reported just such a robbery:

Sheriff Ruffner, of Yavapai County, came in from the south yesterday morning with a man named Canary [Charles Canaris], wanted in Prescott for burglary. He had raided a mineral cabinet [owned by Thomas Brown] and carried away a lot of valuable specimens, some of which he sold and had assayed.

Although the value of specimens did catch on fairly early in Arizona’s mining history, it was by no means universally known; the notion of collecting natural specimens for their own sake was hardly recognized at all in some mining camps, and consequently

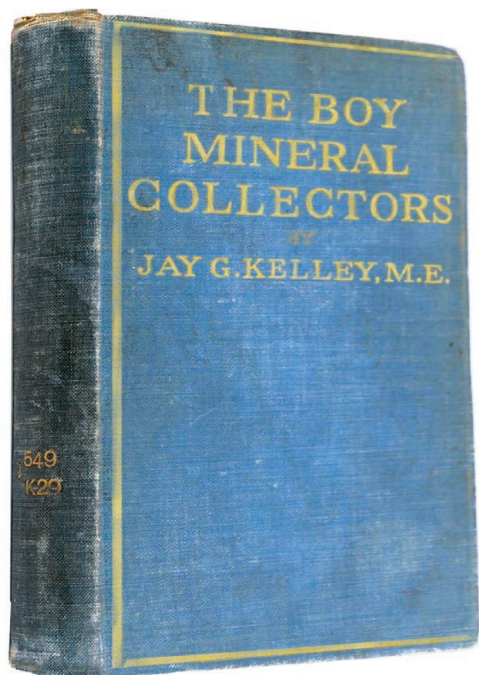


Figure 12. Prescott assayer Jay G. Kelley was such an enthusiastic and well-read mineral collector that he wrote a fictionalized but educational book for the youth market, *The Boy Mineral Collectors* (1898), designed to inspire an interest in mineral collecting among young boys.

Philadelphia mineral dealer A. E. Foote. The only other possible source where Kelley might have purchased it would have been in Europe. In any case, it was quite an assemblage to have on the frontier, but Kelley lived an adventurous life:

Jay George Kelley was born in Boston in 1838. As a boy he ran away from home and rode a clipper ship around Cape Horn to California. In 1859 he joined a company of volunteer Indian fighters and proceeded into Nevada to engage the Piutes, who were on the warpath at that time. Following a decisive battle at Pyramid Lakes he left the group and traveled to Carson City, Nevada, where he joined the Pony Express in 1860, riding through dangerous Indian territory. When the Pony Express shut down a year later he worked as a miner in the Carson City area, until he once again volunteered to fight Indians and was made Captain of a company by Governor Nye; he was put in command of Fort Churchill, while other men went off to fight in the Civil War (*Atlanta Constitution*, 5 December 1896).

Ultimately Kelley did serve in the Civil War in 1864, and was discharged in 1865. He then returned to San Francisco, California, where he appears to have studied assaying and smelting. It may be there that he began collecting minerals. He moved on to Virginia City, Nevada, where he worked as an editor for the *Chronicle* and also as an assayer before heading for Prescott, Arizona and opening his own assay office there in 1876.

In 1877 Kelley announced his intention to publish a book on "Mining Resources of Arizona," and solicited information from all of the mining men in all parts of the Territory, but apparently nothing came of it. In July 1877 he was hired as superintendent of the Zalida mine, but left Arizona to prospect in Colorado, opening an assay office in Leadville in 1879. By June 1882 he was working as an assayer in Bellevue, Idaho Territory. He then spent a few years in El Paso where he worked as a railroad detective and assisted with the Texas mining and mineral exhibit at the 1885 New Orleans World's Fair.

Kelley always carried gold nuggets in his pockets, and could launch off on many entertaining stories about his life in gold mining. The editor of the *Salt Lake Herald* (1 February 1894) described him thusly:

Capt. Jay G. Kelley, mining engineer and expert, is the man, and [I spent] one day looking at some of his peculiar and valuable specimens and listening to his fascinating explanation. [He is] a fine looking gentleman, with ruddy face as though well used to open weather, making a lively contrast with his gray hair and mustache. He will interest a listener more in two minutes than ordinary men can in a whole hour. Just let him pull one of those gold nuggets from his capacious pockets, or those chunks of gold embedded in quartz, and then listen to him tell of the various ways of finding gold . . . and you will look and look, and listen and listen in utter captivation.

Clearly Kelley had kept his collection with him all those years, was capable of spinning a good tale, and was eager to inspire interest in minerals. In 1898, the J. B. Lippincott Company published a book by Jay G. Kelley entitled *The Boy Mineral Collectors*, in which he recommends the "endless fund of entertainment and information open to the boy who chooses to pursue the study of mineralogy," by field-collecting specimens locally, supplemented by "purchases from time to time without creating too much of a drain on his pocket money" (*The Times*, Philadelphia, 13 November 1898). He at last settled in Denver sometime in the 1890s and died there in 1899.



Figure 13. Charles Wores; oil painting (undated, ca. 1884) by Theodore Wores. Society of California Pioneers collection, gift of Carrie B. Wores.

Charles Wores

One early assayer who made the most of his collecting opportunities was Charles R. Wores. His story is known in some detail:

Charles Roth Wores was born in San Francisco in February 1859, the son of a hat maker from Hungary. As a young man Charles worked in his father's hat-making business, while attending school and studying chemistry and assaying. In 1880 he moved to Arizona to seek his fortune, and began prospecting, filing his first claim, the Olympic, in the Arivaca District, on November 21, 1880. At



THE UNIVERSITY OF ARIZONA

MINERAL MUSEUM

EMINENT PAST, BRIGHT FUTURE

Wendell E. Wilson
The Mineralogical Record
4631 Paseo Tubutama
Tucson, Arizona 85750
minrecord@comcast.net

The Mineral Museum at the University of Arizona in Tucson, founded in 1892, is among the most active University-associated mineral collections in the country. It has absorbed numerous fine private collections and donations, and has big plans for a major expansion in 2020.

HISTORY

The University of Arizona's Mineral Museum houses one of the finest mineral collections of its kind in an academic department. It began with an act of the Arizona State Legislature establishing a School of Mines in Tucson, Arizona Territory, in 1885; the main building opened for classes in 1891, and Arizona became a state 21 years later, in 1912. The original building, known today as "Old Main," still stands at the center of the sprawling University of Arizona campus.

Mineralogy was one of the original subjects taught at the University, and a proper collection of minerals was deemed essential for teaching purposes. Future mining engineers needed to know what good ore looked like and how to identify a whole host of mineral species without access to modern analytical equipment. The 1892 *University of Arizona Register* states: "In addition to collections made by Prof. Blandy, formerly Territorial Geologist, the private collections of the Director of the School of Mines (Dr. Theo Comstock) are on deposit in the Museum." This is the first reference to the Mineral Museum, and suggests that it had been established as soon as the school opened its doors.

In 1893 the Territorial Museum was established on campus, incorporating not just the growing mineral collection started by the School of Mines but also ethnographic artifacts and historical documents.

FOUNDERS OF THE COLLECTION

In 1883, Arizona Territorial Governor Frederick A. Tritle expressed his desire to establish a Geological Survey for Arizona

Territory. The U.S. Congress responded in 1888 by creating the post of Territorial Geologist of Arizona. The unpaid position went first to mining engineer John Frederic Blandy (1833–1903), an American graduate of the Freiberg Mining Academy, who served from 1889 to 1890. During that time he traveled throughout Arizona Territory, visiting various mining districts, collecting specimens, and preparing three reports for the Governor. His personal mineral collection became the start of the University of Arizona collection.

The office of Territorial Geologist lapsed in 1890, and a School of Mines was established at the University of Arizona in 1893. Although the title of Territorial Geologist was not used between 1890 and 1898, the duties were performed by Dr. Theodore Bryant Comstock (1849–1915) in 1891–1894, who was appointed its first Director and held the post until 1895, when it was taken over by William Phipps Blake (1826–1910) until 1897. Comstock's mineral collection was the second to be added to the University's collection. In 1898 the office of Territorial Geologist was reinstated and Blake assumed the position again until 1904, while continuing to serve as Director of the University's School of Mines until 1905. Specimens from Blake's collection can be found in the University's collection as well.

SHIFTING QUARTERS

The Territorial Museum, including the ever-growing mineral collection, was moved to new quarters in 1905, in 1915, and again in 1919 when the new Mines and Engineering Building was completed and the Mineral Museum once again became a formal entity

Figure 5. The historic “Old Courthouse” in downtown Tucson, new home of the University of Arizona Alfie Norville Gem & Mineral Museum.



the continued growth of the collection. Other donors included P. G. Beckett, Boodle Lane, Martin Schwerin, J. E. Burtin, Susie Davis, Ed Davis, William Pinch, Richard Bideaux, Hubert de Monmonnier, Gene Meieran, Pat Rose, Princeton University, Rock Currier and Wendell Wilson. A portion of the collection of Mexican specimens assembled by the late Miguel Romero, Mexico’s leading mineral collector, was donated to the Museum by his family. The collection has also been temporarily enlarged by the loan of specimens from the currently-closed Arizona Mining and Mineral Museum in Phoenix.

Today the mineral museum, under curator Robert T. Downs, houses over 23,000 specimens in the main collection, over 6,000 in the micromount collection, and about 10,000 specimens in the

Figure 6. Spodumene “hiddenite,” 4.9 cm, from the Warren mine, Alexander County, North Carolina. Jeff Scovil photo.



Main Exhibit Areas

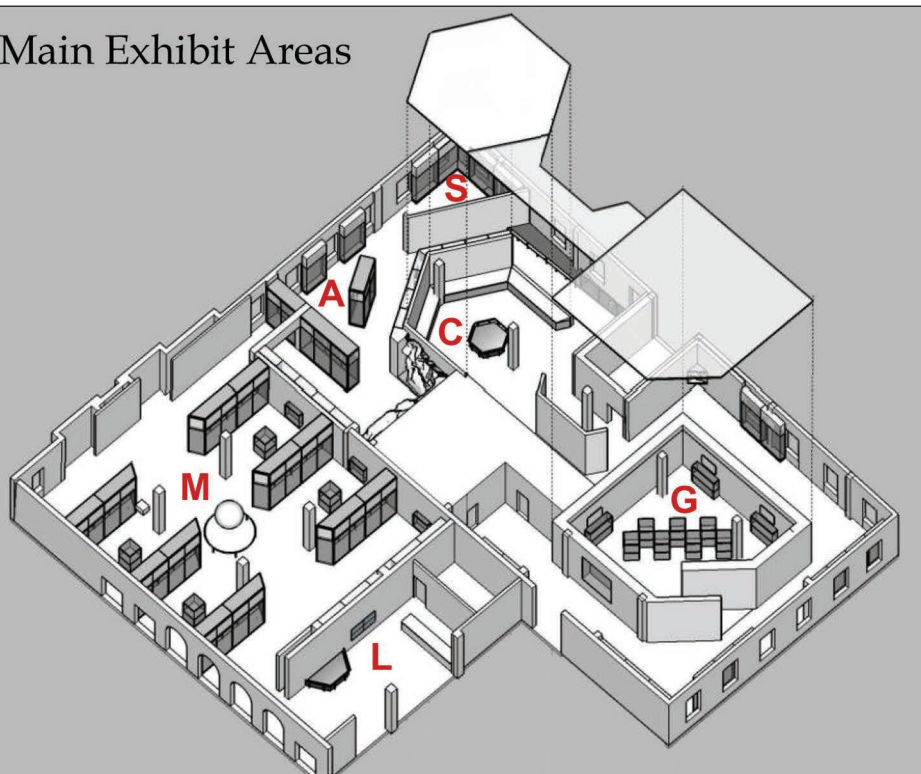


Figure 7. Floor plan of the new museum: (L) Lobby, (M) Mineral Evolution Gallery, (A) Arizona Gallery, (S) Special Exhibits, (C) Crystal Arcade, (G) Gem Gallery.

Publisher & Editor-in-Chief
Wendell E. Wilson

**Associate Publisher &
Circulation Director**
Thomas M. Gressman
tom.gressman@minrec.org

Editors
Thomas P. Moore
Christopher J. Stefano

Associate Editors
Malcolm Back
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akampf@nhm.org
Steve Neely
neelytn@aol.com
Gail Copus Spann
Gspann50@gmail.com
Stephanie Snyder
stephanie@stonetrust.com
Wendell E. Wilson
minrecord@comcast.net

Printing
Allen Press, Lawrence, Kansas

Editing Office
Wendell E. Wilson
Thomas P. Moore
4631 Paseo Tubutama
Tucson, AZ 85750
Tel: (520) 299-5274
Email: minrecord@comcast.net

**Subscriptions, Back Issues
& Book Orders**
Thomas M. Gressman
5347 N Ridge Spring Place
Tucson, AZ 85749
Tel: (520) 529-7281

Advertising Office
Thomas P. Moore
2709 E Exeter Street
Tucson, AZ 85716
(520) 325-3625
Email: tpmoores1@cox.net

Associate Photographers
Jeffrey A. Scovil
Gail Copus Spann
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