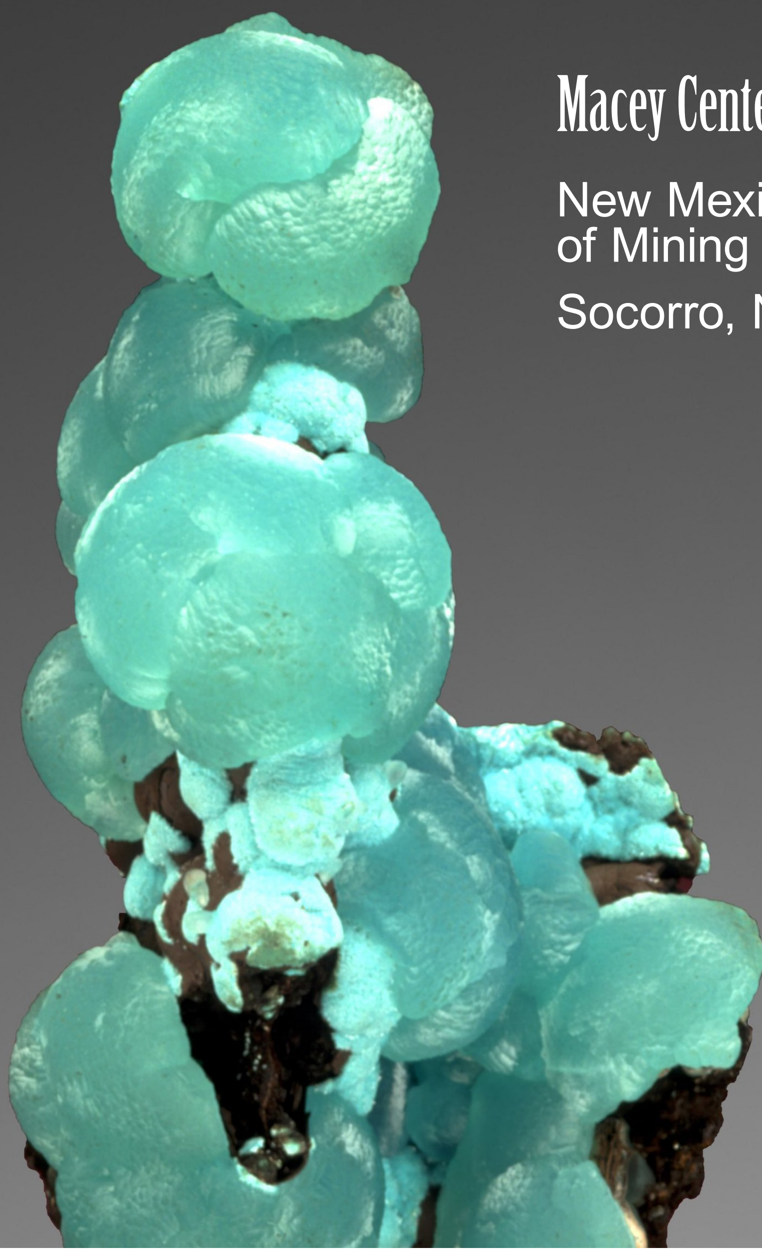
45th NEW MEXICO MINERAL SYMPOSIUM

Program and Abstracts

November 7 – 9, 2025

History and Highlights, Including New Mexico Specimens, of the Natural History Museum, London, England

Michael S. Rumsey, Featured Speaker



Macey Center

New Mexico Institute
of Mining and Technology
Socorro, New Mexico

WELCOME

to the

45th NEW MEXICO MINERAL SYMPOSIUM

November 7 – 9, 2025

Macey Center

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

Socorro, New Mexico 2025

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

Sponsors:
Albuquerque Gem and Mineral Club
Los Alamos Geological Society
John and Maryanne Fender
Sierra County Rock & Gem Society

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 encourages intimate discussions among all interested in mineralogy and associated fields.
Cover photo: Smithsonite from the Kelly Mine, Magdalena District, Socorro County, New Mexico.
Mineral Museum no. 16315. Gift of Roy and Pam Johnson. Photo by Jeff Scovil.

PROGRAM

Friday	**November 7, 2025**
9:00 am–4:00 pm	Micromineral Aficionados Gathering—Headen Center room 253 (Bureau of Geology)
9:00 am	Lake Valley Field Trip, organized by the Los Alamos Geological Society, limited attendance (reservation required)
4:00–6:00 pm	Friends of the Museum Reception—Headen Center atrium (Bureau of Geology), appetizers and cash bar
7:00 pm	Informal motel tailgating and social hour, individual rooms, Comfort Inn & Suites and other venues—FREE
Saturday	**November 8, 2025**
8:00 am	Check-in and continental breakfast—Macey Center
8:00 am–1:00 pm	Silent auction to benefit the New Mexico Mineral Symposium—Macey Center
8:45 am	Opening remarks—Main auditorium
9:00 am	*The Minerals of the San Pedro Mine, New Placers District, Santa Fe County, New Mexico*— Tony L. Potucek
9:30 am	*The Globe-Miami District, Gila County, Arizona*—Les Presmyk
10:00 am	**Coffee break**
11:00 am	*From Mineralogy to Quantum Materials*—Markus Raschke
11:30 am	*Rare Minerals of the Mendip Hills, England*—Michael S. Rumsey
12:00 pm	**Lunch**
1:00–2:00 pm	Silent auction checkout (pay for winning bids)—Macey Center
2:00 pm	*What's New in Minerals and Personal Favorites*—Jeffrey A. Scovil
2:30 pm	*History and Minerals of the San Manuel Mine, Pinal County, Arizona*—Mark Hay

PROGRAM

3:00 pm	**Coffee break**
3:30 pm	*Pegmatite Minerals from New Hampshire's White Mountain Igneous Province*—Donald A. Dallaire
4:00-5:00 pm	*History and Highlights, Including New Mexico Specimens, of the Natural History Museum, London, England*—Michael S. Rumsey (Featured speaker)
5:30 pm	Sarsaparilla and suds: cocktail hour, cash bar—Fidel Center Ballrooms
6:30 pm	Banquet followed by a live auction to benefit the New Mexico Mineral Symposium—Fidel Center Ballrooms
Sunday	**November 9, 2025**
8:00 am	Morning social, coffee, and donuts—Macey Center
8:50 am	Welcome to the second day of the symposium and follow-up remarks
9:00 am–12:00 pm	Silent auction to benefit the New Mexico Mineral Symposium—Macey Center
9:00 am	*Microminerals at the Nacimiento Mine, New Mexico*—G. Scott Braley
9:30 am	*New Mexico Vanadinites: An Update*—Ramon S. DeMark and Thomas Katonak
10:00 am	**Coffee break**
10:30 am	*Minerals of the Chilean Mineralogical Expedition of 1938, Sam Gordon and the Academy of Natural Sciences of Philadelphia*—Patrick E. Haynes
11:00 am	*Off the Map: Recent New Mexico Mineral Discoveries*—Rob Sanders
11:30 am	*Moonstone Madness*—Grant R. Kuck
12:00 pm	Silent auction checkout (pay for winning bids)—Macey Center

Symposium Keynote Speakers 1979–2025

Year	#	Keynote Speaker and Abstract
1979–1982	1–3	
1983	4	Robert W. Eveleth, “Of Bridal Chambers, jewelry shops, and crystal caverns—a glimpse at New Mexico’s mining camps, characters, and their mineral treasures”
1984	5	Laurence H. Lattman, President, New Mexico Institute of Mining & Technology; “High-tech materials for modern society”
1985	6	Peter Bancroft, “Gem and crystal treasures”
1986	7	Vandall T. King. “Pegmatite petrology through phosphate mineralogy”
1987	8	Robert W. Jones, “Copper throughout history”
1988	9	Peter Bancroft, “Gem and mineral treasures II”
1989	10	Philip C. Goodell and Kathryn Evans Goodell, “Adventures in the Sierra Madre, Batopilas, Chihuahua”
1990	11	Peter K.M. Megaw, “Mineralogy of the rhodochrosite-bearing “silicate” ore-bodies of the Potosi mine, Santa Eulalia mining district, Chihuahua, Mexico”
1991	12	Gilbert Gauthier, “Mineral classics of Shaba, Zaire”
1992	13	Stanley J. Dyl, II, “Mining history and specimen mineralogy of the Lake Superior copper district”
1993	14	Bernard Kozykowski, “Franklin—its mines and minerals;” and, “The Sterling mine—a precious hillside preserve”
1994	15	Fred Ward, “The ‘precious’ gems: where they occur, how they are mined;” and, “Jade”
1995	16	Dr. Miguel Romero Sanchez, “The Romero Mineral Museum”
1996	17	Robert W. Jones, “Gemstones of Russia”
1997	18	Carl A. Francis, “A fourth world occurrence of foitite at Copper Mountain, Taos County, New Mexico”
1998	19	Terry Huizing, “Collectible minerals of the Midwestern United States”, and, “Colorful calcites”
1999	20	Rodney Ewing, “Mineralogy, applications to nuclear waste”
2000	21	Richard Houck, “Sterling Hill: Yesterday, Today and Tomorrow”
2001	22	Jeff Scovil, “Sampling the Finest”
2002	23	Robert Barron, “Recovery of A 17 Ton Copper Boulder from Lake Superior”
2003	24	John Rakovan, “The Cause of Color in Fluorite with special reference to the Hansonburg District, NM”
2004	25	Harrison H. Schmidt, “Lunar Geology and Mineralogy”
2005	26	Terry Wallace, “Silver of the American West”
2006	27	Ed Raines, “The Leadville Silver Deposits”
2007	28	John Rakovan, “Mineralogical Meanderings in Japan”
2008	29	John Medici, “Some highlights of 45 years of Medici Family field collecting”
2009	30	Ray DeMark, “Thirty Years of symposium presentations: a retrospective”
2010	31	R. Peter Richards “Geology and Mineralogy of Mont Saint-Hilaire, Quebec, Canada”
2011	32	Dr. Anthony Kampf, “Solving Mineral Mysteries”
2012	33	Jean DeMouthe, “Ancient and modern uses of gems & minerals: talismans, tools & medicine”
2013	34	Allan Young, “Collecting Thumbnail Minerals”
2014	35	Virgil W. Lueth, “The Past, Present, and Future of the New Mexico Bureau of Geology & Mineral Resources—Mineral Museum”
2015	36	Robert Cook, “An Overview of five great American Gold Specimen Locations”
2016	37	John Cornish, “Upside down and in the future, mining Tasmania’s Adelaide Mine”
2017	38	Bob Jones, “The History of the Bristol Connecticut Copper Mine”
2018	39	Peter K.M. Megaw, “The Santa Eulalia Mining District, Chihuahua, Mexico”

Year	#	Keynote Speaker and Abstract
2019	40	Brad Cross, “An overview of the agates of northern Mexico and southern New Mexico”
2020		Cancelled due to Covid-19
2021	41	Jeffrey Post, “The Smithsonian Gem Collection—Unearthed: Surprising Stories Behind the Jewels”
2022	42	John Jaszczak, “120 Years of the A.E. Seaman Mineral Museum of Michigan Tech”
2023	43	Eloïse Gaillou, “History of collecting at the Mineralogy Museum of l’École des Mines de Paris”
2024	44	Daniel Trinchillo, “The King of Kashmir: Unearthing the World’s Greatest Mineral Specimen”
2025	45	Michael S. Rumsey, “History and Highlights, including New Mexico specimens, of the Natural History Museum, London, England”

The Minerals of the San Pedro Mine, New Placers District, Santa Fe County, New Mexico USA

TONY L POTUCEK
Show Low, AZ USA, tlpotucekhome@gmail.com

The San Pedro mine in New Mexico is one of the older mines in the Southwestern USA, with the first mentioned mining by non-Indigenous people in 1839, although earlier mining had been noted since the 1500's. Of much lesser consequence is that the San Pedro was the first underground mine where the author collected minerals, beginning in 1971. Introduced to the mine by an alumni geologist of the University of New Mexico while the mine was under care and maintenance, it became the author's preferred underground collecting location, even surpassing the famous Kelly mine renown for smithsonite.

The San Pedro mine is a limestone-tactite skarn hosted Cu-Au-Ag orebody located in the San Pedro Mountains, midway between the New Mexico cites of Albuquerque and Santa Fe. The mine is best known for producing numerous Japan Law twin quartz crystals (Fig. 1) and North America's largest chalcopyrite crystals, up to 10 centimeters (cm) on an edge (Fig. 2). Limestone replaced by marble and attendant volume losses during contact metamorphism in the tactite skarn produced numerous cavities and openings. Crystals of quartz, chalcopyrite, calcite, pyrite, hematite and garnet variety andradite line the openings. Less commonly, fluorite, sceptered amethystine quartz and scheelite occur. Supergene alteration and oxidation of the chalcopyrite produced coatings of covellite, chalcocite, bornite (Fig. 3), and malachite. Of particular note are the highly aesthetic lustrous groups of fine thin wire gold specimens occurring with calcite (Fig. 4), which have been found by collectors in several areas of the San Pedro mine.

Figure 1. Quartz, Japan law twin crystal, San Pedro mine, NM. Small cabinet. Phil Simmons specimen and Erin Delventhal photo.

Figure 2. Chalcopyrite, 30 Stope, San Pedro mine, NM. 7.6 x 9.1 x 4.7 cm. Tony L Potucek specimen (TLP 194) and photo.

Figure 3. Bornite on chalcopyrite, 32 Stope, San Pedro Mine, NM. Cabinet specimen. Jeff Scovil photo. Ex Young collection. New Mexico Bureau of Geology and Mineral Resources specimen.

Figure 4. Gold with calcite, San Pedro Mine, NM. Small cabinet. Kelsey MacNamara photo. Ex Young collection. New Mexico Bureau of Geology and Mineral Resources specimen 18511.

While the San Pedro mine still is capable of producing fine specimens of all of the minerals listed above, the San Pedro Mining Company still owns the mine. The Company maintains vigilance on the mining property and collecting in the mine and on the property is forbidden.

References

Atkinson, Jr., W. W. and Marsh, S. P., (2012), The San Pedro mine—a record of the history, geology, and mineral collection, in the 33rd Annual New Mexico Mineral Symposium.

Anonymous, (1901) a, the Bureau of Immigration, Mines and Minerals of New Mexico; With some reference to the geological associations in the various camps of the Territory; 136 pages.

Eidenbach, P. L., (2012), An Atlas of Historic New Mexico Maps, 1550-1941, University of New Mexico Press, Albuquerque, New Mexico.

Howe, C. S., (1881), Mines and Mining, in Hazeldine, W C., Report on Bernalillo County, New Mexico Bureau of Immigration, pp. 7-10, Albuquerque.

Jones, F. A., (1904), New Mexico mine and Minerals. Mining World, (Jan 16, 1882), v. 2, No. 9, Las Vegas, NM, p.152.

-----, (Sept. 1880), v. 1, No. 1, Las Vegas, NM, p. 4.

-----, (Sept. 1880-Dec. 1885), Las Vegas, NM.

Northrup, S. A., (1959), Revised Ed., Minerals of New Mexico, University of New Mexico Press, Albuquerque, NM.

Sanders, M. R., (1992), The San Pedro mine, Santa Fe County, New Mexico, in Rocks and Minerals, v. 67, pp. 390-395.

THE GLOBE-MIAMI DISTRICT, GILA COUNTY, ARIZONA

LES PRESMYK
Arizona State Mine Inspector, P.O. Box 1273, Gilbert, AZ 85299, Presmyk@cox.net

The Globe-Miami District is predominantly a copper mining area and has been for over 130 years. More copper has come from this district copper than all of the mines of Bisbee and is second only to the great Morenci open pit. The district boundaries are the Pinto Valley and Carlota Mines on the west, Pinal Mountain on the south, McMillanville to the east and the Richmond Basin to the north. This area was first prospected in 1874 with the location of silver in the Globe area. The district is also home to one of Arizona's best vanadinite localities. In addition, this district has produced some of Arizona's best silver specimens, along with azurites, cuprites, malachite pseudomorphs after azurite and probably most notably, Arizona's best gem silica and chrysocolla specimens. There are 108 different minerals from this district (Grant, et al, 2022).

In 1874, several ranchers from the Florence area decided to explore for a silver deposit at the base of the Stoneman Grade, a road built by the U.S. Army a few years earlier. They located the Silver Queen claim (renamed the Magma Mine 35 years later) and then followed the road over the escarpment known as Apache Leap, about 20 miles further east and located claims on what came to be known as the Old Dominion Mine just north of Globe (Presmyk, 2015).

A year later, they found the silver outcrop that started their prospecting adventures and named it the Silver King. Other prospectors continued to explore the Globe area as well, and in 1876 found the rich silver deposits of the Stonewall Jackson Mine, establishing the town of McMillanville, to the east and the silver deposits of Richmond Basin to the north. The most unique occurrence was a surface deposit of silver nuggets reminiscent of Planchas de Plata in Sonora, Mexico, was discovered north of Globe. From 1876 to about 1890, silver was the most valuable metal mined in the area. Even though some of these mines reached depths of 800 and 900 feet, the silver mines were mostly depleted by 1890. A very few of nuggets have survived to now but none of the large masses of silver encountered in the Richmond Basin mines (Galbraith, 1970) There were reports of large (as much as 100 pounds) silver nuggets and even one large nugget that supposedly looked like a globe, thus giving the town its name. The nugget is in the Smithsonian and the only problem with the naming story with this nugget is that is was found 20 years after Globe was founded (Presmyk, 2015).

The Old Dominion Mine (OD) was originally developed for and mined silver and gold contained in the oxidized veins closest to the surface. As the mining proceeded downward, the silver diminished and high-grade copper mineralization was encountered (Fig. 1). However, because of the remoteness of the area and the high costs of transporting supplies into the area and the copper ingots out of the area, even 20% copper rock was marginally profitable. From 1885 to 1900 the Old Dominion was the largest and most continuous producer of copper in the district. In 1894, the railroad was completed to Globe from New Mexico and the economics changed dramatically. The two major companies with operations in the Copper Hills area of Globe were the United Globe and Phelps-Dodge. In 1903, Phelps-Dodge bought out the United Globe and consolidated all of the operations under the Old Dominion Mining Company (Ransome, 1903).

The Old Dominion Mine continued to mine deeper, encountering huge quantities of water, and

Figure 1. Calcite on quartz on chrysocolla. Old Dominion Mine, Globe, Arizona. 4.8" (12.1cm) wide. Les and Paula Presmyk collection. Jeff Scovil photo.

brought in Cornish pumps to handle the water. By 1933, with a combination of low copper prices, lowering ore grades, continued water problems and labor issues, Phelps-Dodge shut down this mine and shuttered it for good.

In the meantime, Miami Copper had developed and was producing copper at a steady rate from the largest block caving mine west of the Mississippi. Inspiration was using more conventional mining methods to produce mainly oxide copper minerals and employing leaching metallurgy to extract the copper (Ransome, 1919).

In the early 1940s a prolonged drought was plaguing this area, to the point where the Miami mill would have to shut down around 7pm every day because they ran out of water (personal communication, Jack Graybeal). Mine management entered into negotiations with Phelps-Dodge, purchasing the Old Dominion and all of the other properties Phelps-Dodge had accumulated in the area, including what would become the Castle Dome and the Copper Cities Mines. What had once been the curse of the underground mine now became the savior of another underground mine and mill. The Old Dominion has a major fault that separates industrial water suitable for using in a copper mill from drinking water on the other side of the fault. The OD continues to supply water to Pinto Valley for the mill and drinking water for the City of Globe.

Miami Copper continued this underground operation until 1958. In the meantime, the company had developed the Castle Dome Mine in 1942 to provide copper for the WWII and Korean war efforts and this mine operated until about 1952. Then all of the equipment was moved to the Copper Cities Mine (the source of Sleeping Beauty turquoise) and operations continued there into the 1970s.

In the late 1960s, Cities Service Company bought Miami Copper Company and began a drilling program at the closed Castle Dome Mine, ultimately deciding to open a new mine named Pinto Valley, an operation still producing copper today. South of the Pinto Valley operation, a small but productive oxide copper mine known as Carlota operated from 2007 to 2014, and reopened in 2018. In 2009, a series of pockets produced azurite, malachite after azurite along with prosopite, powellite and szenicsite (Wilson, 2020) (Fig.6).

Also in the 1960s, the Stovall family developed a small copper oxide mine on the western edge of Miami and south of Inspiration. The Bluebird Mine was purchased by Ranchers Exploration and the company installed the very first SX-EW (Solvent Extraction-Electrowinning) plant in the world. A very gusty move for a small mining company but one that paid off handsomely over the next 30 years.

Some of the smaller but notable mines in the district include the aforementioned Apache Mine, famous for its vanadinite specimens. It was a small underground mine operated in the 1950s for lead and vanadium. Once it closed it was a locality many Arizona collectors spent time in. South of Miami is the Blue Ball Mine, a small surface operation for azurite nodules, some of which are geodes and display drusy azurite crystals and even the occasional malachite spray.

The district has a rich history of producing notable mineral specimens and gemstones. Ransome, in his USGS Professional Paper 115 notes the gem chrysocolla (gem silica) and drusy quartz on chrysocolla. Both the Live Oak Mine and the Old Dominion Mine produced these specimens starting in the 1890s. The Like Oak was an underground mine until the late 1940s when mining expanded into an open pit. The 1950s and 1960s were the glory days for specimen production and some of the best and most unique pieces were encountered and saved (Fig. 2).

The Castle Dome Mine during its operating life became very well known for turquoise and

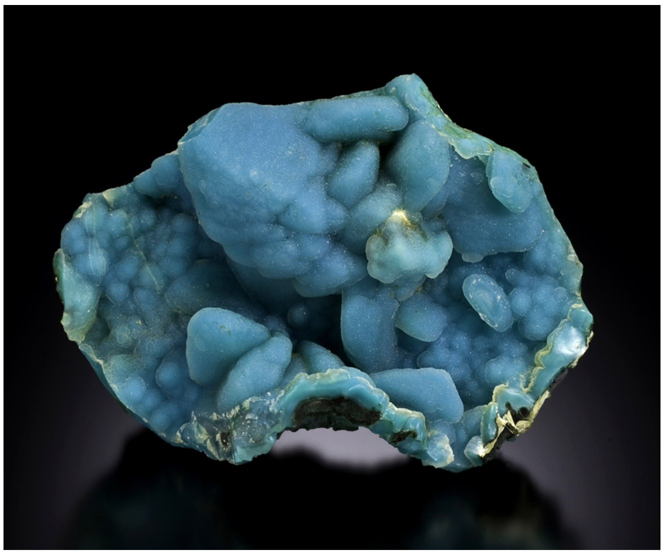


Figure 2. Chrysocolla and Quartz after malachite after azurite. Live Oak Mine, Miami, Arizona. 4" (10cm) wide. Les and Paula Presmyk collection. Jeff Scovil photo

significant turquoise production took place in the early days of the Pinto Valley Mine. Copper Cities (Sleeping Beauty) turquoise was mined by contractors for the next several decades after that mine closed. Sleeping Beauty is the name of the mountain on the north side of the mine and this was the name adopted for the turquoise. I guess Sleeping Beauty is marketable than Copper Cities.

Azurite and malachite specimens for collectors are known from the Old Dominion, the Live Oak , the Blue Ball (Fig. 3), and the Bluebird Mines (Fig. 4), along with the Castle Dome (Red Hill pit)(Fig. 5) and Carlota Mines. The Carlota Mine is probably the best azurite and malachite after azurite locality in the district (Fig. 6).

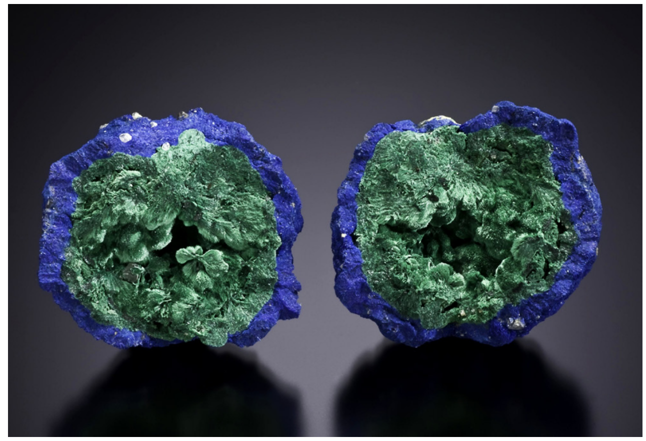


Figure 3. Malachite and azurite. Blue Ball Mine, Miami, Arizona. 1.3" (3.3cm) wide. Les and Paula Presmyk collection, Jeff Scovil photo.

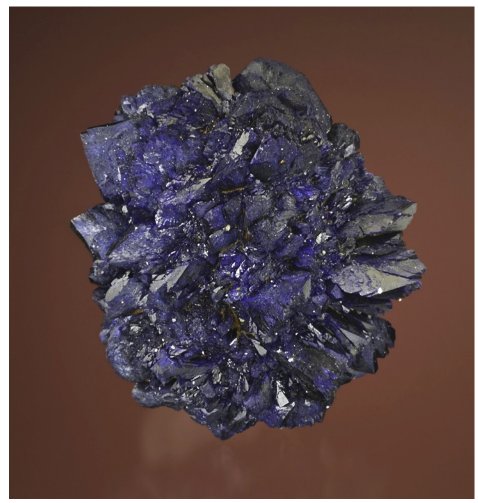


Figure 4. Azurite. Bluebird Mine, Miami, Arizona. 2.75" (6.8cm) wide. Les and Paula Presmyk collection. Jeff Scovil photo.

Figure 5. Gypsum on Azurite. Red Hill Pit, Castle Dome Mine, Miami, Arizona. 2.2" (5.5cm) tall. Les and Paula Presmyk collection. Jeff Scovil photo.

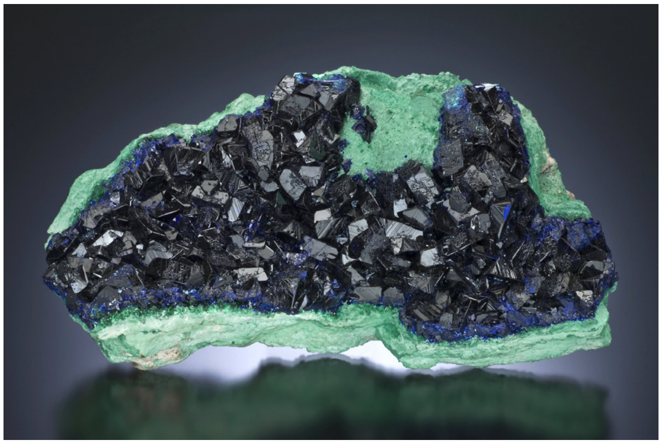


Figure 6. Azurite. Carlota Mine, Miami, Arizona. 5" (12.6cm) wide. Les and Paula Presmyk collection. Jeff Scovil photo.

And the silver nugget legacy continues. In 2018, after spending three years metal detecting in the Richmond Basin area, these dedicated explorers were rewarded with a phenomenal discovery. Covered with about four feet of soil they found what turned out to be a 406 pound silver nugget, along with two smaller ones, both weighing in excess of 100 pounds each. These three specimens are on display at the University of Arizona Alfie Norville Gem and Mineral Museum in Tucson. Several hundred pounds of additional nuggets have been found since 2018. The current owners hope to start drilling very soon.

References

Galbraith, F.W. and Brennan, D.J. (1970) Minerals of Arizona. The Arizona Bureau of Mines Bulletin 181. The University of Arizona, Tucson, Arizona, 116p.

Grant, R.W., Gibbs, R.B., Jong, H.W., Rasmussen, J.C., and Keith, S.B. (2022) Mineralogy of Arizona, 4th Edition. The University of Arizona Press, Tucson, Arizona, 730p.

Peterson, N. P. (1962) Geology and Ore Deposits of the Globe-Miami District, Arizona. Geological Survey Professional Paper 342. United States Government Printing Office, Washington, D.C., 151p.

Presmyk, L. (2015) The Arizona Silver Belt; Silver King to McMillanville. Mineralogical Record, 46, 507-527.

Ransome, F.L. (1903) Geology of the Globe Copper District, Arizona. Geological Survey Professional Paper 12. United States Government Printing Office, Washington, D.C., 168p.

Ransome, F.L. (1919) The Copper Deposits of Ray and Miami, Arizona. Geological Survey Professional Paper 115. United States Government Printing Office, Washington, D.C., 192p.

Wilson, W. and Jones, E. (2015) The Carlota Mine, Gila County, Arizona. Mineralogical Record, 46, 555-563.

Quantum Mineralogy: Why does nature rarely produce minerals with unusual quantum properties, and what are these anyway?

MARKUS B. RASCHKE
Department of Physics and JILA, Materials Science and Engineering Program, and Center for Experiments of Quantum Materials,University of Colorado, Boulder, CO 80303
markus.raschke@colorado.edu

"Mineralogy is dead" is often heard as a complaint in the mineral enthusiast community, with few geology departments at universities, federal agencies, or national labs still hiring faculty and staff in this traditional and once so vibrant field. However, the field has not only historically been foundational for different areas of science, but it lives on, and is even of growing importance in materials science and solid-state physics – fields which emerged almost directly from mineralogy. Mineralogy as a discipline has established the principles of crystal chemistry, crystal structure, and crystallographic symmetry based on minerals in the absence of synthetic analogues. Diamond (C), halite (NaCl), and sphalerite (ZnS) to this day serve as canonical examples of crystalline solids to teach crystal structure and chemical bonding in every condensed matter physics textbook.

Materials science and condensed matter physics evolved, inspired by mineralogy based on the observations of a wide range of interesting properties of minerals, such as magnetism of magnetite, optical birefringence of calcite, piezoelectricity of quartz, or pyroelectricity of tourmaline. With these properties of minerals quickly finding practical and industrial applications, the extension to solid state chemistry and materials synthesis then opened the door to make minerals artificially, with higher purity and better crystal quality. This also opened the door to synthesize new materials that are not found naturally in search for new properties.

This approach has been a hugely successful endeavor, with the first industrial revolution based on iron, steel, and alloys, and the second based on silicon as semiconductor for electronics and photovoltaics. In parallel, solid-state physics grew into the largest sub-field of physics with the discovery of a plethora of so-called quantum phenomena in crystalline materials. Effects like colossal magnetoresistance, high-temperature superconductivity, heavy fermion behavior (which are properties where the electrons appear to have a mass much higher than their original single particle mass), metal-insulator transitions, strange metals, complex magnetic order, topological phases, and in fact controllable phase transitions between these quantum phases have led to numerous Nobel Prizes.

However, while, e.g., natural **perovskite** ($CaTiO_3$) does not exhibit any interesting quantum phenomena, it is the parent compound for a range of synthetic derivatives, which by contrast host a wide range of such quantum phenomena. So why do most natural minerals, even when structurally and chemically similar to synthetic quantum materials, not exhibit these unusual quantum phases?

Rock forming minerals; the bulk of minerals that make up the earth crust are silicates and oxides of light elements, which makes them simple insulators. Their electronic and atomic structures are well understood, and described by simple quantum mechanics or even classical models. But one common mineral stands out in a distinct way, with the heavy transition metal element iron, and where its electron spin comes into play: **Magnetite** (Fe_3O_4). Magnetite and its magnetism (ferrimagnetism in this case) is a quantum phenomenon, which relies on the quantized nature of the electron spins and their interaction, which cannot be explained classically.

However, purity and crystal quality of natural minerals are an issue. Minerals grow from fluids of selectively enriched but always mixed composition, and under poorly controlled and often variable pressure and temperature conditions during crystal growth. This inevitably leads to chemical heterogeneity, incorporation of impurity atoms, and accumulation of structural defects – processes which make minerals often aesthetically appealing but typically interfere with electron correlation or magnetic order and the formation of exotic quantum states. This situation is particularly dramatic with rare earth element (REE) minerals. Indeed, a large number of quantum materials gain their unique characteristics from the unique electronic and spin properties of REE. However, in nature, because of their chemical similarity, geochemical processes cannot sufficiently separate the different REE into different minerals. At best a preference towards lighter (LREE) or heavier elements (HREE) will result in enrichments of one or the other. Therefore, without the complex artificial processes of REE separation, the formation of selective REE materials, like the strong permanent magnets $Nd_2Fe_{14}B$ or $SmCo_5$, in nature is very unlikely.

In this talk I will illustrate the physical basis of quantum materials and how this field emerged from mineralogy. Why nature generally fails, yet with notable exceptions succeeds to provide minerals with exotic quantum properties, discussing in particular the following examples:

Van der Waals materials: Micas, **graphite**, and **molybdenite** (MoS_2) are perhaps the most prominent examples of minerals with sheet structures, characterized by strong intra-layer connectivity and weak inter-layer Van der Waals bonding. Especially graphite and the different transition metal dichalcogenides (e.g., MX_2, with M=Mo,W, X=S, Se) can easily be exfoliated even using regular stationery grade adhesive tape to single monolayer thickness. These and related materials have become a laboratory for the discovery and control of many exotic quantum phenomena such Berry phases, Quantum Hall effect, Mott transitions etc. These discoveries triggered a wider recent search for material candidates, and it was found that even the natural and common clay mineral **vermiculite** $(Mg, Fe^{2+},Fe^{3+})_3[(Al,Si)_4O_{10}](OH)_2$□$4H_2O$ is both a semiconductor as well as an antiferromagnet (Pacakova, 2025).

Superconductivity: Besides the most prominent property of superconductivity, where below a critical temperature T_C, the electrical resistance abruptly drops to zero, another characteristic is that a magnetic field is expelled from within the material (Meissner effect). Superconductivity is fundamentally a quantum mechanical effect and occurs in certain metals (Hg, Pb, Nb, etc.), alloys, a wide range of transition metal oxides, notably cuprates, pnictides, MgB_2, and was recently discovered also in a bilayer of graphite and in solid H_2S at a very

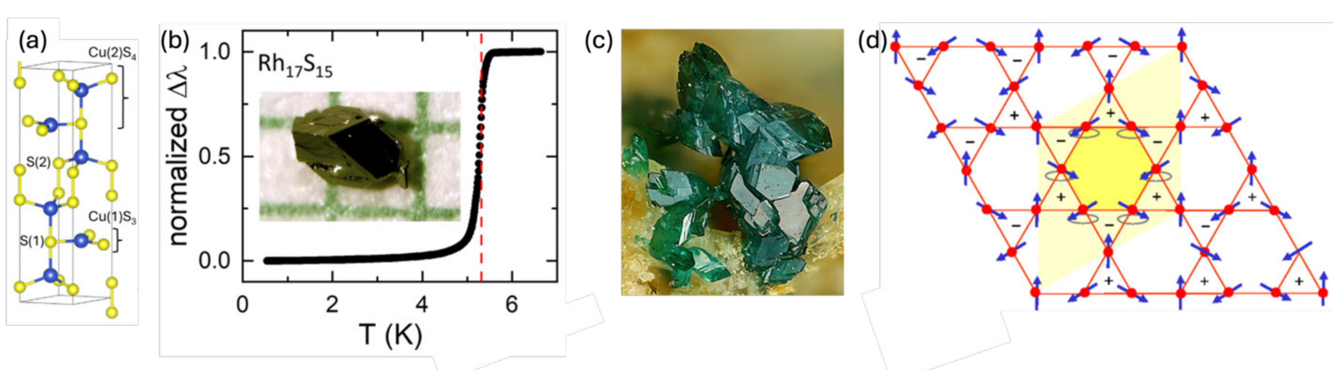


Figure 1. (a) Crystal structure of the natural superconductor covellite (CuS) (Antezak, 2025). (b) Single crystal and superconducting phase transition of miassite ($Rh_{17}S_{15}$) (Kim, 2024) at T_C showing the associated change in penetration depth of a magnetic field as a characteristic property of superconductivity. (c) Herbertsmithite ($Cu_3Zn(OH)_6Cl_2$) San Francisco Mine, Antofagasta, Chile (Elmar Lackner photo, FoV ca.1 mm, mindat:1128167).(d) illustration of so-called spin frustration on a kagome lattice with no long-range magnetic order as condition for a quantum spin liquid (Yildrim and Harris, 2006).

high pressure. While typically studied in synthetic compounds, the wide range of materials that exhibit superconductivity under certain conditions would suggest that some natural superconducting minerals may exist.

Indeed, with a critical temperature of 1.6 K, ***covellite*** (CuS) (Fig. 1a) was discovered as the first naturally occurring non-metallic superconductor (Di Benedetto, 2006). Despite its simple chemical formula, covellite is structurally complex featuring two inequivalent Cu and S sites, mixed valence of Cu, and a second-order structural phase transition at 55 K (Antezak, 2025). In fact, covellite's mixed valence resembles the physics of high-T_C cuprate superconductors.

A particularly exciting recent discovery is that of superconductivity in ***miassite*** ($Rh_{17}S_{15}$), a mineral discovered in isoferroplatinum (Pt_3Fe) deposits (Fig. 1b). Although its superconductive properties have been studied in lab-grown single crystals of that mineral, to eliminate Fe, Ni, Pt, and Cu impurities present in the natural samples (Kim, 2024). What makes this discovery significant is that miassite is a so-called 'unconventional' superconductor, exhibiting several anomalous properties, and for which no conclusive quantum theoretical description has yet been found (a Nobel Prize awaits). To date, only two other minerals where synthetic analogues exhibit superconductivity are known: ***parkerite*** ($Ni_3Bi_2S_2$) and ***palladseite*** ($Pd_{17}Se_{15}$), which is isostructural to miassite.

Quantum spin liquids: while ordinary magnetism is defined by long range order of electron spins quantum spin liquids exhibit the opposite. These are approximately described by rapidly fluctuating spin disorder. This is similar H_2O molecules in crystalline ice vs. liquid water, which are characterized by ordered vs. disordered states of water molecules. Quantum spin liquids are a very exotic quantum state of matter, originally hypothesized in theoretical condensed matter physics in the 1970s, and with many of the fundamental properties still occupying the minds of theoretical physicists. Incidentally, a mineral, namely ***herbertsmithite*** ($ZnCu_3(OH)_6Cl_2$) (Fig. 1c) is considered the first candidate material believed to host a quantum spin liquid (Norman 2016). In herbertsmithite, the copper ions form layers with a triangular Kagome lattice, separated by nonmagnetic intermediate layers of Zn and Cl – these structural conditions that are favorable for the formation of a quantum spin liquid phase (Fig. 1d). Investigations of this material for over a decade have discovered several intriguing physical phenomena, with work branching into the wider range of related minerals of the atacamite group.

I will conclude with some general criteria of structure, composition, and valence state, for which certain classes of minerals in their natural form could be candidates exhibiting unusual quantum behavior, or inspire corresponding synthetic efforts.

References

Antezak, A. et al. (2025). Experimental electronic structure of the mineral superconductor covellite CuS.*Phys. Rev. B* 112:115103.

Di Benedetto, F. et al. (2006). First evidence of natural superconductivity:covellite. *Eur. J. Mineral.* 18: 283.

Kim, H. et al. (2024). Nodal superconductivity in miassite$Rh_{17}S_{15}$. *Communications Materials*, 5:17.

Norman, M.R. (2016). Herbertsmithite and the search for the quantum spin liquid. *Reviews of Modern Physics* 88:041002.

Pacakova, B. et al. (2025). Naturally occurring 2D semiconductor with antiferromagnetic ground state. *New Journal of Physics* 9:38.

Yildrim, T. and Harris, A.B. (2006). Magnetic structure and spin waves in the Kagomé jarosite compound $FKe_3(SO_4)_2(OH)_6$. *Phys. Rev. B* 73:214446.

Rare Minerals of the Mendip Hills

MICHAEL S. RUMSEY
Principal Curator in Charge, Mineral and Planetary Sciences, Science Department,
Natural History Museum, Cronwell Road, London, UK, SW7 5BD.

The mining area known as the Mendip Hills, like many places in the UK has an extremely long history of resource exploitation with lead being mined at least 2000 years ago by the Romans. However, the area is also one of only a handful of locations globally that has been important for specimen mineralogy since the 17th Century and is still productive for both collectors and scientists. A testament to this importance is in the eponymous mineral 'Mendipite'.

Although aesthetic samples are found at the location, many of the scientifically important samples are smaller and although brightly coloured do not tend to grace the cabinets of mineral collections unless there is a focus on 'classics' or systematic mineralogy. From a systematic perspective the Mendip Hills, and more specifically two locations within it, Merehead (or Torr Works) Quarry, and Higher Pitts Mine, can be considered the most important locality in the UK for systematic research being the discovery location for 11 type mineral specimens. Almost all of these minerals are complex lead-oxychlorides that are either unique to the location or found very sparingly elsewhere across the globe.

Figure 1. Image of fieldwork at Torr Works Quarry as it now stands

This talk will review the mineralogical discoveries from the Mendips starting in the 18th Century (Mendipite) and extending right up to today. Such a long time provides the perfect opportunity to review how the concept of a mineral species has changed and how the work required to define one evolves. Some of the new mineral species of the Mendips were just beyond our collective ability to resolve at the time of their discovery and took many years to come to fruition and be given a name.

This research gestation period, which in three instances for Mendip specimens was over 30 years (parkinsonite, mereheadite, yeomanite) is often mired with interesting tangents, dead-ends and unresolved questions. Yet this battle - between what nature provides and what our technology can understand very rarely appears in the final formal scientific paper.

Finally, we will look at the latest discoveries, the importance of 'geodiversity', what new minerals might just be around the corner and…. Am I inadvertently initiating more 30-40 year Mendip research sagas for the next generation of UK mineralogists?

Figure 2. Colourful systematic rarities of the Mendip Hills localities, including: mendipite, paralaurionite, symesite, nasonite, an unknown mineral, diaboleite, chloroxiphite and kentrolite

Figure 3. The occasional more aesthetic Mendip Hills specimen - Rhodochrosite

What's New in Minerals and Personal Photo Favorites

JEFFREY A. SCOVIL
PO Box 7773, Phoenix, Arizona 85011, jeffscovil@earthlink.net

"What's New in Minerals and Personal Photo Favorites" is a new, semi-regular presentation of mineral photos at the New Mexico Mineral Symposium, based on specimens that I professionally photographed during that year, with the addition of personal photo favorites of specimens that may not be new to the collecting scene.

Fig. 1. Silver. Vinoren Mine, Kongsberg, Norway. 2.7cm high. Anton Watzl Minerals.

Fig. 2. Elbaite. Pyingyi Taung, Myanmar. 4.5cm wide. Saphira Minerals.

Fig. 3. Fluorapophyllite, stilbite. Jalgaon, Maharashtra, India. 11.7cm wide. Creighton Beery.

History and Minerals of the San Manuel Mine, Pinal Co., Arizona

MARK HAY[1], GARRY ALEXANDER[2]

[1]Phoenix, AZ, sm-hay@hotmail.com, [2]Formerly Tucson, AZ

Introduction and History

The San Manuel mine is located in south-central Arizona in Pinal County about 45 miles northeast of Tucson. It is near the towns of San Manuel and Mammoth and only about a mile from the famous specimen mines at Tiger. However, even though it is so close to Tiger it could not be more different in almost every respect – history, geology, mineralogy and specimen production.

The first claims were staked at what was to become the San Manuel Mine in the late 1870s but due to its low-grade it would not become a viable mine for almost 70 years. In the late 1930s and early 1940s as hostilities were increasing overseas, the United States was looking for additional sources of strategic metals. In 1939 Congress passed the Strategic Materials Act and directed the US Geological Survey (USGS) and US Bureau of Mines (USBM) to locate additional domestic sources. The USGS identified the San Manuel property as having the potential to be a major, untapped copper deposit.

The USBM initiated a drilling program in late 1943 and by May 1944 results suggested a deposit of at least 30 million tons averaging 0.8% copper. Based on this, the Magma Copper Company optioned the property and began their own drilling program. The results were so encouraging they bought the property in May 1945. By 1951 Magma had proven 479 million tons of ore averaging 0.77% copper. They decided to move forward with mine development and the San Manuel Mine was brought on line in November 1955.

San Manuel became the largest underground mine in North America. Over its 44 year history it produced over 4.6 million tons of copper and 73 tons of molybdenum. At its peak, it provided high paying jobs for 3,400 people and made a significant economic contribution to Arizona. Mining ended in January of 2002 and by 2007 all surface facilities had been removed and the site reclaimed.

Historical "Firsts"

San Manuel played a significant role in several varied and unexpected firsts. One was the town itself which became a prototype of advanced urban design. There was no actual town of San Manuel before the mine. As the mine would be Magma's new flagship operation, they wanted an equally impressive and efficient community to go with it and they wanted it quickly. To accomplish this, they selected a contractor with extensive, recent experience building new bases for the military. The entire town including homes, stores, schools, parks, recreational and medical facilities plus streets and other infrastructure was completed in 1954. The contractor was Del E. Webb and San Manuel was his first master planned *residential* community. But it was certainly not his last. He went on to repeat and refine his master planned communities with spectacular success all across the American sunbelt from Florida to California.

San Manuel was also the inspiration for a new geologic understanding of porphyry copper deposits. A large, low-angle fault had cut the San Manuel orebody into two pieces and no one knew the location of the upper portion. However, an independent geologist in Tucson, J. David Lowell, believed that he could find it. He had been underground at San Manuel and observed alteration patterns and mineral assemblages in the rocks around the orebody.

He thought he recognized the same patterns in surface rocks he had mapped about a mile west of the mine. Using this information, he led a drilling program that accurately located the missing orebody at a depth of 2,500 feet. It identified an additional 560 million tons of ore averaging 0.72% copper. Lowell went on to work with University of Arizona professor J. M. Guilbert to develop a new geologic model for locating buried porphyry copper deposits (Lowell and Guilbert, 1970). Today, over 50 years later, their model is still used for exploration and research into porphyry deposits worldwide.

Mining Methods

Several methods were employed to mine the San Manuel orebodies: underground block caving for the deeper sulfide ores and open pit and heap leaching for the shallower oxide ores. In-situ leaching was also used for some of the deeper ox-

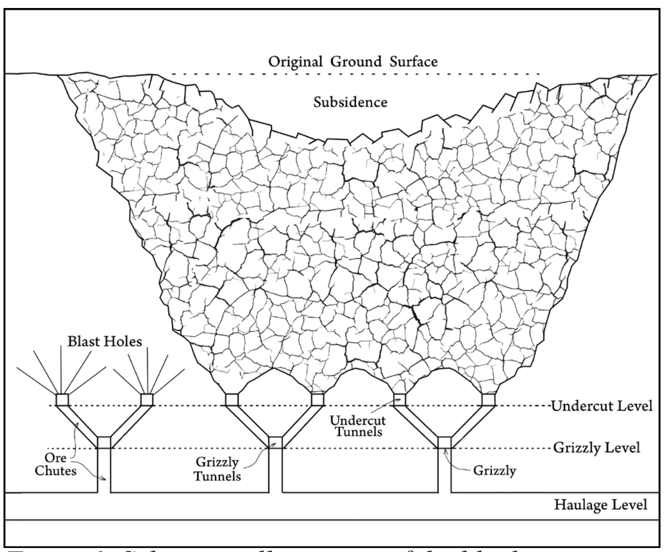


Figure 1. Schematic illustration of the block caving mining method used at the San Manuel Mine.

ides later in its history. One of these, block caving, is of particular interest for mineral collectors because it prevented access to much of the orebody and made specimen recovery almost impossible. For that reason, a brief explanation of the process is warranted.

The block caving mining method is highly complex to implement but its basic concept is simple: undercut the orebody by using explosives to shatter an entire layer of rock at its base. Remove the shattered rock and the rock immediately above it is destabilized and collapses. As long as the shattered rock is removed, the overlying rock will continue

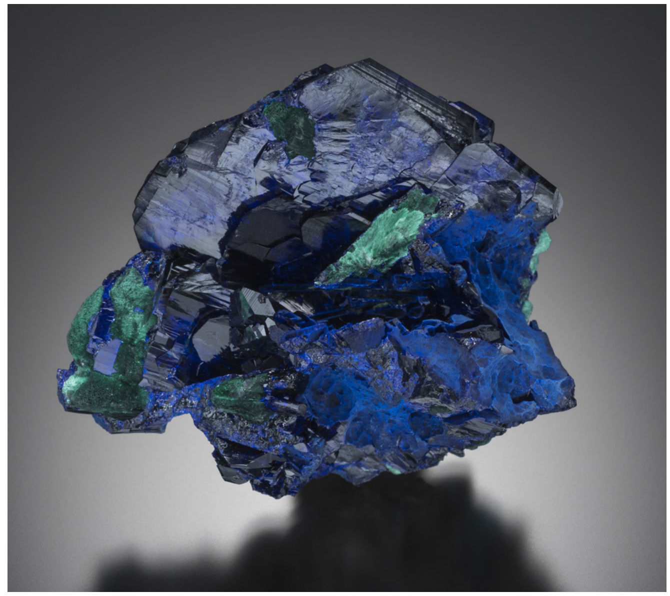


Figure 2. Azurite overgrowth on malachite pseudomorph after azurite, 5.2 cm. San Manuel Mine, Pinal Co., AZ. Private collection. Jeff Scovil photo.

Figure 3. Calcite crystals to 7 mm with cuprite inclusions. San Manuel Mine, Pinal Co., AZ. Garry Alexander collection. Jeff Scovil photo.

to destabilize and collapse progressing upward through the overlying orebody. The process may progress to the point that it results in land subsidence at the surface.

Minerals

Forty-nine species have been identified from the San Manuel mine (Table 1) and at least twenty of them occur in sufficient quality to be of interest to collectors. As might be expected, the open-pit excavation in the oxide zone produced many of the mine's best specimens but many were recovered from the underground as well. Most of these came from areas worked by conventional methods including the numerous tunnels, raises, work rooms and other areas where people were in close proximity to freshly exposed rock and could collect specimens. Surprisingly, though the block cave mining was definitely not favorable to specimen recovery, some did indeed survive.

Figure 4. Copper crystals,11.1 cm. San Manuel Mine, Pinal Co., AZ. Les and Paula Presmyk collection. Jeff Scovil photo.

Conclusion

San Manuel was the source of several innovative and historical firsts. The town was the first master planned residential community designed by Del E. Webb. Its success led him to build other residential communities throughout the American sunbelt. Additionally, characteristics and challenges specific to the San Manuel orebody inspired J. David Lowell to develop a new geologic model of porphyry copper deposits that significantly advanced the science of economic geology and is still the basis for the exploration for porphyry deposits.

Figure 5. Gypsum crystals with azurite and chrysocolla inclusions,7.6 cm. San Manuel Mine, Pinal Co., AZ. Evan Jones collection. Jeff Scovil photo.

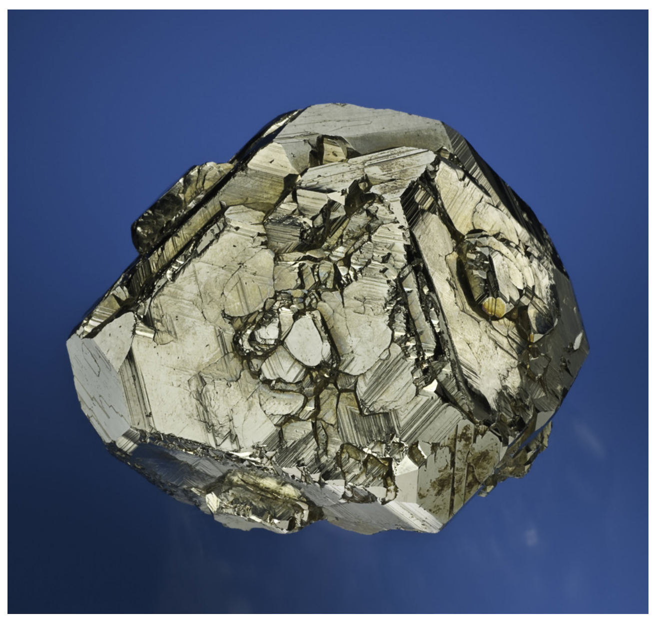


Figure 6. Cuboctahedral pyrite crystal,10.4 cm. San Manuel Mine, Pinal Co., AZ. Garry Alexander collection. Jeff Scovil photo.

Albite*	Allophane	Alunite	Anhydrite
Atacamite	Azurite*	Barite*	Beidellite
Bornite	Calcite*	Chalcocite	Chalcopyrite*
Chrysocolla*	Clinozoisite	Conichalcite	Copper*
Covellite	Cuprite*	Dickite	Dioptase*
Enargite	Endellite	Epidote	Epsomite
Fluorapatite	Galena (?)	Goethite	Gold
Gypsum*	Hematite	Hexahydrite	Jarosite*
Jurbanite (type locality)	Kaolinite	Libethenite*	Malachite*
Molybdenite*	Muscovite	Plancheite*	Pyrite*
Pyrophyllite	Quartz*	Rutile	Shattuckite
Siderite*	Sphalerite*	Starkeyite	Tenorite*
Zunyite			

Table 1 – Species identified from the San Manuel Mine (an asterisk indicates the mineral occurs in collector quality material).

For the mineral collector, the San Manuel mine was not extraordinarily productive of specimens, mainly because the primary mining method prevented access to so much of the orebody. But the parts of the mine outside the block cave areas produced a wide variety of beautiful and interesting collector-grade specimens.

References

Briggs, D. F. (2014). History of the San Manuel-Kalamazoo Mine, Pinal County, Arizona. *Arizona Geological Survey Contributed Report*, CR-14-A.

Creasy, S. C. (1965). Geology of the San Manuel Area, Pinal County, Arizona. *U.S. Geological Survey Professional Paper 471*.

Lowell, J. D., and Guilbert, J. M., (1970). Lateral and Vertical Alteration – Mineralization Zoning in Porphyry Ore Deposits. *Economic Geology*, 65, 373-408.

Schwartz, G. M. (1953). Geology of the San Manuel Copper Deposit, Arizona. *U.S. Geological Survey Professional Paper 256*.

Pegmatite Minerals from New Hampshire's White Mountain Igneous Province

DONALD A. DALLAIRE
829 Candia Rd., Chester, NH 03036. dadallaire@hotmail.com

New Hampshire is the 46th smallest state, but has 367 confirmed mineral species (Mindat accessed 2025), ranking it as the 33rd state with the most mineral species. The abundance of species can be attributed to the many pegmatites in New Hampshire that were formed as the supercontinent Pangea coalesced approximately 300Ma, and continuing during its breakup approximately 200Ma.

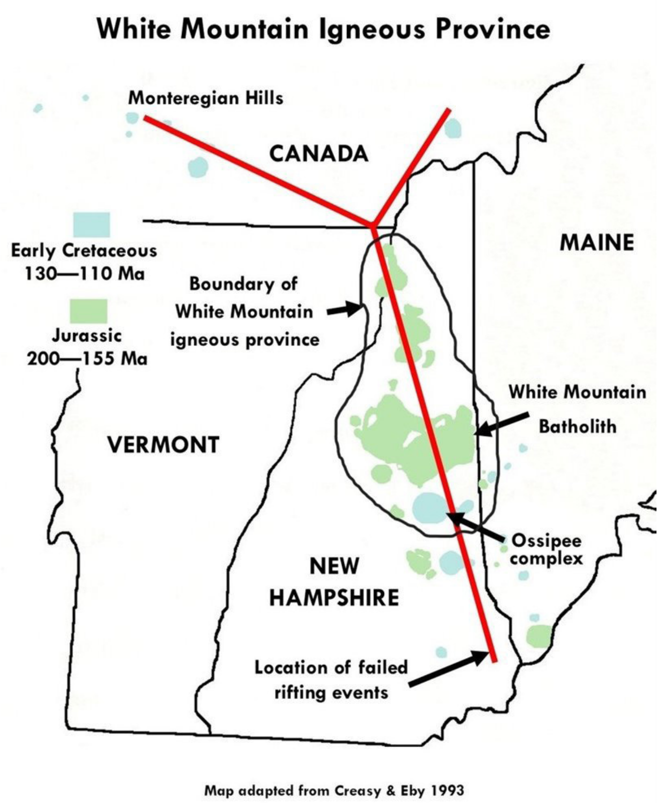


Fig.1 Map outlining the White Mountain Igneous Province in black. Red line depicts center of failed rifting events with green indicating first event and blue the second event.

The New Hampshire White Mountain Igneous Province (WMIP) was emplaced during two failed rifting events as Pangea landmasses continued on their path to the position of the continents we know today. The first event occurred during the Jurassic, 200-155 Ma, and the second during the Early Cretaceous, 130-110 Ma (Fig. 1). Although in both cases the rifting was halted by other geological forces, the crust was thinned and allowed magma to rise, emplacing granites and their associated pegmatites.

Fig. 2 Smoky quartz, microcline, and albite 8.7 cm tall from Moat Mountain, Hales Location, Carroll County, New Hampshire.

Pegmatites in the WMIP are anorogenic, with a NYF (Niobium, Yttrium, Fluorine) signature, as described by Černý & Ecrit's revision of pegmatite classification (Černý & Ercit, 2005). They also contain rare earth elements, CO_2, and are water-poor.

Pegmatite miaroles are either isolated in the host granite or form where thin pegmatite dikes swell or intersect. The size of most miaroles ranges from a few centimeters to 20 cm but occasionally reach sizes of 5 meters or more. Over 70 mineral species occur with microcline, albite, and quartz (primary constituents of granite), the most common minerals in the miaroles (Fig 2). Many uncommon or rare species also occur such as danalite (Fig. 3), bazzite, and milarite. The size of different species also has a wide range from crystals of a meter to 0.1 mm or less. Quartz crystals by far are the largest found with a few reaching 1meter. Bazzite crystals on the other hand rarely achieve 0.5 mm.

Fig. 3 Etched danalite crystal 5.25 cm tall from Government Pit, Albany, Carroll County, New Hampshire.

There are 12 beryllium species found in the WMIP, but beryl itself is quite rare. In the LCT (Lithium, Cesium, Tantalum) pegmatites in NH, beryl crystals are quite common but do not occur in pockets, while they are uncommon and generally form in pockets in the NYF pegmatites.

Topaz crystals were first found in 1888 on South Baldface Mountain (Fig. 4) and are abundant there as well as at Government Pit and the Moat Mountain locations. Crystals generally range from a few millimeters to 4 centimeters, but most are 2 cm or less. Occasionally, larger crystals have been found. A single topaz crystal from South Percy Peak in Stratford (the Northernmost portion of WMIP) reached 13.5 cm. Color varies from colorless to blue to brown. Many crystals were faceted through the years, with those from South Baldface Mountain referred to as "Baldface diamonds" (Fig. 5). The only other common gemstone from the WMIP is smoky quartz (the New Hampshire state gem), with faceted gems up to several hundred carats.

Fig. 4 Topaz 3.65 cm wide from South Baldface Mountain, Chatham, New Hampshire. Kevin Downey photo.

A brief overview of the geology will be followed by a review of the minerals from the WMIP from larger common specimens to the rare and small. A few important collectors will be included along with some historical content.

References

Černý, P. and Ercit, T.S. (2005) The classification of granitic pegmatites revisited. Canadian Mineralogist, V.43, p.2005-2026.

Dallaire, D. A., and Nizamoff, J. (2017) Topaz in New Hampshire's White Mountains. Rocks & Minerals, V. 92(6), p.508–36.

Dallaire, D. A. (2022) Beryllium minerals in New Hampshire. Rocks & Minerals, V.97(3). p.208–35.

Fig. 5 1.77 ct. Topaz faceted gem from South Baldface Mountain, Chatham, New Hampshire. Jeff Scovil photo.

History and Highlights, including New Mexico Minerals, of the Natural History Museum (NHM), London, England

MICHAEL S. RUMSEY
Principal Curator in Charge, Mineral and Planetary Sciences, Science Department,
Natural History Museum, Cronwell Road, London, UK, SW7 5BD.

Figure 1. The NHM, London, England.

The collections at the NHM were started with the purchase of the eclectic collections of Sir Hans Sloane in 1753, funded via a national lottery. This collection founded the British Museum which over time got so voluminous that it was separated into three different institutions, the British Museum, the British Library and the Natural History Museum (Figure 1). Sloane was not an avid collector of minerals, so despite a few notable exceptions the mineral collection did not get going until about 1799. Coinciding with a period of economic growth, scientific enquiry and the Victorian interest in collecting within the UK, the collection expanded at a rapid rate, slowing down only into the 1980s

In this talk, we will cover the history of the collection by looking at specific highlights, focusing on who these items came from (including royalty), the global coverage of the objects (with a little tangent on New Mexican minerals), what historical relevance they hold and who studied the specimens for the purpose of forwarding our scientific knowledge (including the discovery of elements, the first fluid

Figure 2. Smithsonite, Kelly Mine, Magdalena Mts., NM on display in the main mineral hall.

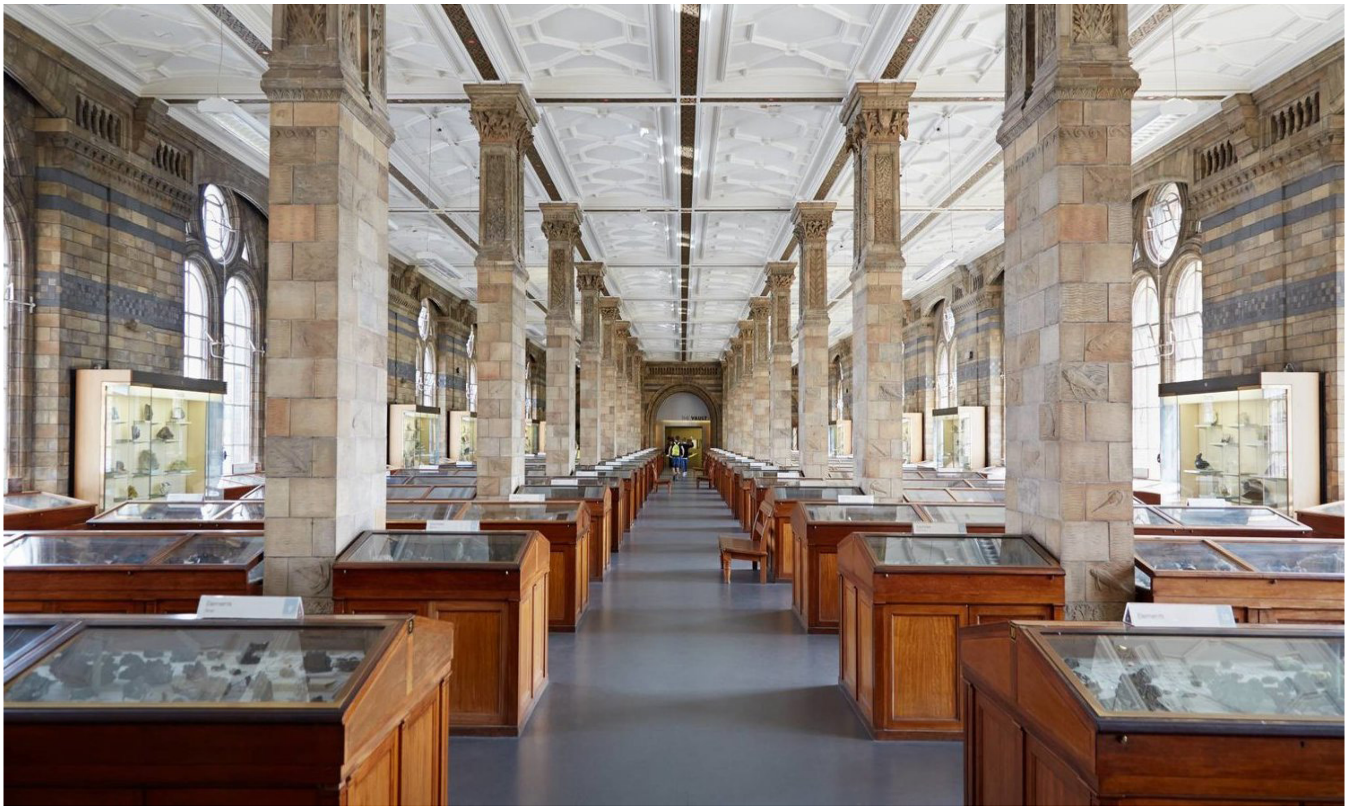


Figure 3. The main mineral hall, NHM.

inclusions and fundamental mineralogical concepts).

Well considered as a collection of collections, on four occasions, the finest private collection of minerals in the UK ended up at the museum; Charles Greville (1810), Allan/Greg (1860), Sir Arthur Russell (1964) and Heuland/Ludlam (1985). Two of these now stand alone as specific collections alongside the unique and incredibly well-documented Ashcroft Collection of Swiss Alpine minerals.

Containing nearly 200’000 minerals, around 5’000 gems, 5’000 meteorites, over 150’000 rocks and ores, there have been many beautiful and aesthetic samples acquired that have graced the cabinets of the iconic systematic mineral gallery, which remains largely unchanged since its opening at the current location in Soth Kensington after an early relocation in 1881 (Figure 2). With around 12’000 samples still on public display at the museum across three permanent galleries, the museum is an incredible place to view multiple different aspects of the mineral kingdom.

Finally, we will look at how the collection is used behind the scenes today, often not appreciated by the 5-6 million visiting tourists each year, the Natural History Museum is not just a bucket-list dinosaur attraction, but a museum with over 300 scientific staff and cutting-edge research labs in

Figure 4. Smithsonite, Kelly Mine, Magdalena Mts., NM on display in Hintze Hall, NHM.

the basement. We will look at how the collections are currently being developed and the new discoveries that are still made on this old collection – exemplifying the importance of having readily available scientifically aligned mineral specimens alongside knowledgeable curators who can help navigate over 250 years of history. A list of the 414 specimens from New Mexico in the Natural History Museum collection (as of September 2025) is given in the appendix of this volume.

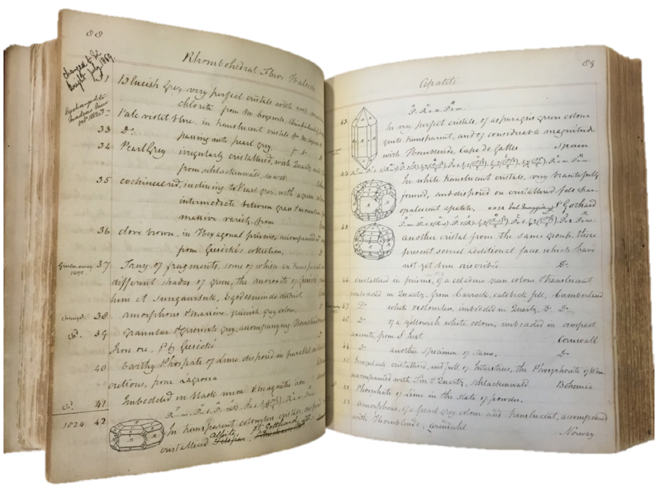


Figure 5. Pages from a museum registers

Figure 7. The Latrobe nugget is one of the largest clusters of cubic gold crystals known in the world and is kept at the Natural History Museum in London. The nugget weighs 717 grams. It was found at Mount McIvor, Victoria, Australia. It was raised on 1 May 1853 in the presence of Charles La Trobe, Governor of Victoria, and was named in his honour.

Figure 6. Painite, Hinthar-taung, Mogok Township, Mandalay Region, Myanmar

Figure 8. Bournonite , Herodsfoot Mine, Cornwall, England, UK

Microminerals at the Nacimiento Mine

G. SCOTT BRALEY
Santa Fe, NM gbraley@gmail.com

The Nacimiento Mine east of Cuba, in Sandoval Co., NM, is well-known among New Mexico collectors for its copper sulfide-replaced fossil wood and for azurite/malachite nodules. However, Nacimiento hosts a broad suite of microminerals that have not been extensively documented, though familiar to interested collectors.

During the Triassic Period (~230 MYA), a large logjam of conifers, which had burnt during a forest fire, formed along one of the channels of the Chinle River system and was quickly covered with mud. This wood was eventually substantially replaced by copper sulfides, primarily chalcocite. The overall mineralized formation is the Agua Zarca Member of the Chinle Formation, consisting of sandstone and conglomerate (Antony 1972). Later oxidation, perhaps during the uplift of the local Nacimiento mountains, led to the formation of secondary copper minerals, such as malachite and azurite (Fig. 1).

Figure 1. Fossil wood in a large sandstone boulder – note rims of malachite surrounding the fossil wood. Scott Braley photo, 2021.

.

The replacement itself is significantly more involved than a simple replacement by chalcocite, with plant cell structures preferentially mineralized by marcasite, hematite, and aragonite (Mustoe 2018) in addition to chalcocite, bornite, and djurleite.

The deposits were first documented in the 1860's, but were probably rediscovered repeatedly by native peoples, Spanish explorers, and Mexican prospectors prior to the area becoming part of the United States. The mine was initially operated sporadically on a small scale as an underground mine but was converted to an open-pit mine until it became unprofitable (with an interesting side-venture into in-situ leaching via sulfuric-acid injection, which is still being cleaned up today) (Mustoe 2018). Currently, the mine pit is partially water-filled, and the old dumps have been substantially remediated, limiting collecting opportunities.

While most attention is given to the fossil wood and azurite/malachite nodules, local collectors have been well-aware of the other minerals found at the mine. Pyrite and gypsum crystals have been commonly found. Septarian nodules and concretions originating in a different, overlying member of the Chinle Formation and unrelated to the copper mineralization have been widely collected at the mine site. Micro collectors have noted several less-common copper secondaries, such as spangolite and libethenite. Small clusters of hollow concretions ("knobby concretions," Fig. 2) with calcite crystals lining the cavities are also sought out.

Figure 2. "Knobby concretions" – small, often-hollow nodules. Scott Braley photo, 2022.

This work surveys the microminerals found at the Nacimiento mine, divided between 1) the copper secondaries and other minerals associated with the fossil wood, and 2) the minerals found in the "knobby concretions."

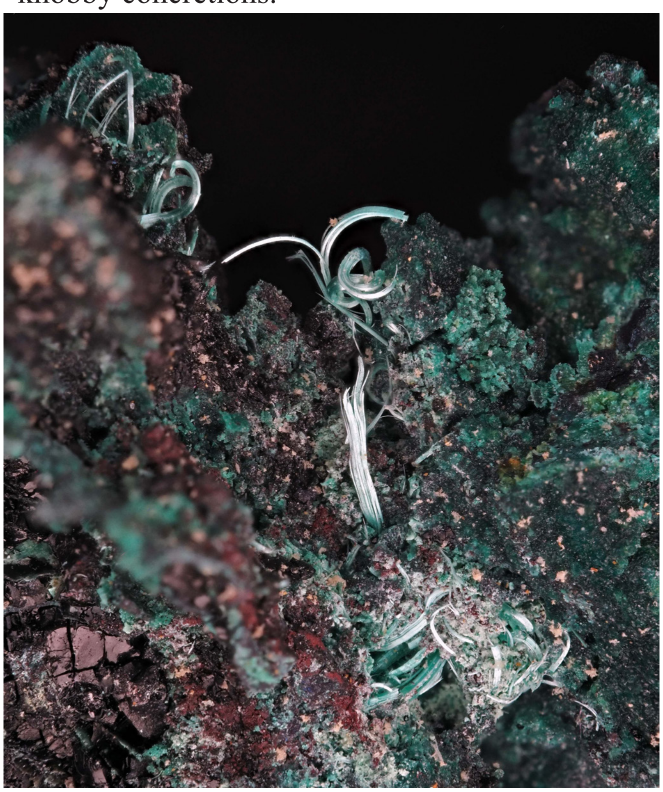


Figure 3. Malachite curls on chalcocite-replaced fossil wood. Jay Penn specimen. Scott Braley photo. FOV is 5 mm.

Secondary copper minerals positively identified include malachite, azurite, spangolite, libethenite, and cyanotrichite. Of special note are the malachite curls (Fig. 3). The "knobby concretions" produce an interesting suite of photogenic minerals including calcite, celestine (Fig. 4), quartz, and barite.

Figure 4. Pale blue celestine on calcite in a "knobby concretion". Scott Braley specimen and photo. FOV is 8 mm.

Bibliography

Antony, J.J. (1972) Geology and Copper Deposits of the Nacimiento Mine – Eureka Mesa Area, Sandoval and Rio Arriba Counties, New Mexico, [Master's Thesis, Colorado School of Mines], Mines Repository. https://repository.mines.edu/entities/publication/659eaad9-bf9f-490d-a92f-a5f4d43bb870

DeMark, R.S. (1992) New Mexico: Mineral Locality Index. Rocks & Minerals, 67(5):314-331

Mustoe, G.E. (2018) Mineralogy of Non-Silicified Fossil Wood. Geosciences, 8(3):85

Ottea, J.M., Uhl, B.H. (2020) Copper-Mineralized Fossil Wood from the Nacimiento Mining District, Sandoval County, New Mexico. Rocks & Minerals, 95(6):548-554

Talbott, L.W. (1974) Nacimiento pit, a Triassic strata-bound copper deposit 1974. In New Mexico Geological Society guidebook, 25th Field Conference, Ghost Ranch, New Mexico, 301–03.

Woodward, L.A., Kaufman, W.H., and Schumacher, O.L. (1974). Sandstone copper deposits of the Nacimiento region, New Mexico. In New Mexico Geological Society Guidebook, 25th Field Conference, Ghost Ranch, New Mexico, 295–99.

Woodward, L.A. (1987) Geology and mineral resources of Sierra Nacimiento and vicinity, New Mexico. Memoir 42, New Mexico Bureau of Mines & Mineral Resources

New Mexico Vanadinites – an Update

RAMON S. DEMARK[1], THOMAS KATONAK[2]
[1]Albuquerque, NM, demarkray@gmail.com [2]Corrales, NM, tkatonak@swcp.com.

The occurrence of vanadinite in New Mexico was initially covered in the 29th New Mexico Mineral Symposium abstract in 2008 (DeMark, 2008). Since then, additional occurrences and information have surfaced. This presentation will highlight some of these findings.

Mindat has documented 111 different locations for vanadinite in New Mexico and features 250 images of specimens from the state. Most of these images were posted by Jerry Cone and Bob Wahlstrom (now deceased) and primarily depict specimens from southwestern New Mexico. Many of these locations are small or obscure. Bob was meticulous in his collecting and mounted vanadinite specimens from twenty-six different locations in New Mexico

As noted by DeMark (2008), vanadinite in New Mexico was first mentioned by Dr. Benjamin Silliman (1882) at the Sierra Grande and Sierra Bella mines in Lake Valley, Sierra County. Genth and Roth (1885) determined the material to be a new mineral between vanadinite and mimetite, which they named endlichite after Dr. F. M. Endlich, the mine superintendent at the Lake Valley mines. This endlichite has since been identified as an arsenate rich variety of vanadinite and discredited as a distinct species. Specimens from this occurrence are quite rare today. Eight specimens are housed in the New Mexico Bureau of Geology and Mineral Resources (NMBGMR) museum collection. Additional specimens can be found in the Seaman Museum in Houghton, Michigan, as well as in several major mineral museums in the Eastern U.S. and Europe (Figs. 1-3).

Fig. 1 Bridal Chamber Stope, Sierra Grande Mine, Lake Valley District, Sierra Co, NM.

Fig. 2 George Washington Fiss Vanadinite (1.2mm crystal), Lake Valley District. From Mineralogical Record Vol-39, No.2. Sugar White photo.

The Georgetown district in Grant County is historically renowned for brilliant red/orange specimens of descloizite (Gibbs, 2008). Vanadinite often occurs with the descloizite in very distinctive combinations. Collectors accessed the Commercial mine via a decline during the 1980’s and recovered

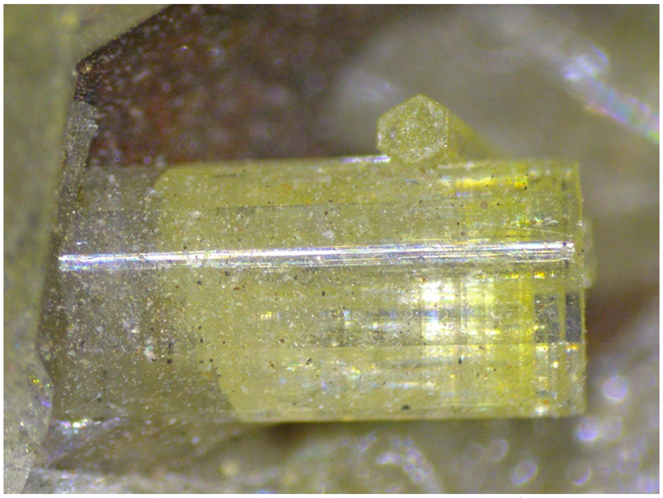


Fig. 3 Vanadinite, Lake Valley NM. 1.5mm fov. New Mexico Mineral Museum specimen. John Rakovan photo.

exceptional specimens. The decline has since been closed, but collectors have found micro specimens on the mine dumps at the Commercial mine and several others nearby including the Naiad Queen (Fig. 4).

Fig. 4 Vanadinite with Descloizite, Commercial mine. 2.2 x 1.6 x 1.4 cm. DeMark specimen. Erin Delventhal photo.

Vanadium ore was first mined in the Palomas Gap area of Sierra County, primarily from the White Swan and Dewey mines in 1910. A mill was constructed at Cutler, east of the mines, but proved economically unviable and was eventually shut down. The area has since been reclaimed, limiting mineral specimen recovery. Secondarily, mining occurred at the Lucky Bill Lead-Vanadium mine near the village of Vanadium in Grant County, where a 15-ton lot of vanadium ore was shipped to Germany in 1911 (Gibbs, 1952). Surprisingly, no specimens from this mine have been located - except for one from a deceased collector, which does not match descriptions of the vanadinite reported by the mine owner, P.B. Larsh, in a 1913 report. The mine area has been completely reclaimed, and no specimens are currently recoverable.

In June 2016, Phil Simmons discovered a pocket in the Percha (Macy) mine, yielding exceptional canary-yellow vanadinite crystals. These specimens are undoubtedly among the best recovered from this historic mine. The crystals, reaching up to 8mm in length, are associated with milky rhombohedral calcite crystals. Notably, vanadinite (endlichite) from this mine was advertised by A.E. Foote and George English in The Mineral Collector in December 1898. An advertisement by English that same year described these endlichites as "the finest known." Furthermore, in 1904, Fayette Jones wrote, "It is said that this is the largest body of vanadium ore known in the world. The property

Fig. 5 Vanadinite, Percha Mine. (1cm crystal) DeMark specimen. Erin Delventhal photo.

Fig. 6 Vanadinite, Percha Prince', Percha Mine. 4.2 cm tall. Phil Simmons specimen and photo.

is known as the 'S. J. Macy Lode" (Figs. 5-6) .

Around 2017, Pat Haynes recovered some very unusual vanadinite specimens from the Royal Flush mine in the Hansonburg mining district of Socorro County. These vanadinites are yellow to orangish in color and occur as one to two-millimeter globular masses that do not resemble typical vanadinite. Their identification has been confirmed by XRD (McNamara, personal communications, 2024). Additionally, Pat recovered excellent vanadinite specimens from the Jack Frost mine in the North Magdalena mining district, which has produced the most significant specimens in the area. These crystals generally appear as one to two-millimeter orange hexagonal prisms. Dave Wells, Fred Parker, and Joan Karrie have thoroughly examined most, if not all, of the mines in this district, documenting six principal occurrences and eight minor or trace occurrences—a remarkable achievement.

Fred Parker, Dave Wells, and Scott Braley have extensively collected high-quality vanadinite crystals from the Red Cloud copper mine in the Gallinas Mountains of Lincoln County. These bright red, lustrous prisms measure about 1mm in size. The Petroglyph mine near Hillsboro in Sierra County is well known for wulfenite, vanadinite, and willemite. In recent years, excellent orange vanadinite specimens have been collected from the mine dumps, with Scott Braley recovering particu-

Fig. 7 Vanadinite, Big Chief Mine. 0.9cm tall. DeMark specimen. Erin Delventhal.

Fig. 8 Vanadinite, Red Cloud Copper mine shaft. 0.4 mm fov. Scott Braley specimen and photo.

larly noteworthy thumbnail size specimens.

During a collecting trip in 1987, Brian Huntsman exposed a zone containing numerous orange/ red vanadinite crystals on a dark ocherous matrix (with some being cavernous) ranging in size from 2 to 8mm, in the Faywood mine on the west flank of Cookes peak in the Jose mining district. In 2025, a large specimen (over 30 cm) was found in the New Mexico Mineral Museum collection with no location or attribution information, and this was subsequently determined to be a Faywood mine specimen.

An unusual vanadinite occurrence was discovered in January 1992 at the Harding mine pegmatite in Taos County. One of the authors (RSD) recovered straw-yellow vanadinite crystals from the underground workings, associated with mottramite and pucherite.

The Macho mining district, located about 8 miles south of Lake Valley, was originally mined for silver. Stan Korzeb, a geologist evaluating the property for the U.S. Bureau of Mines, reported the presence of vanadate minerals. The primary mines in the district were the Old Dude shaft and the Anniversary shaft. Korzeb collected vanadinite specimens from the Old Dude shaft in 1994, but the mine dumps have since been used to fill the shaft. The 700-foot Anniversary shaft remains open but lies on private ranch land, with no access available.

Future vanadinite discoveries await diligent collectors.

Bibliography

DeMark, R.S. (2008). New Mexico Vanadinite, 29th New Mexico Mineral Symposium Abstract.

Emigh, O.G. (1942). A Report on Vanadium in the Macho District, Sierra County, New Mexico, Unpublished Report, NMBGMR File.

Genth, F.A. & Vom Rath, G. (1885). On the Vanadates and Iodyrite from Lake Valley, Sierra County, New Mexico, Amer. Phil. Soc. Proc., Vol. 22, pp. 365–375.

Gibbs, R. (1992). Minerals of the Ground Hog Mine, Grant County, Rocks and Minerals, Vol. 67, No. 5.

Gibbs, R. (2008). Mines and Minerals of the Georgetown district in Grant County, New Mexico, Rocks and Minerals, Vol. 83, No.1.

Harley, G.T. (1934). The Geology and Ore Deposits of Sierra County, New Mexico, NMBGMR Bulletin 10.

Hess, F.L. (1913). Vanadium in the Sierra de Las Caballos, New Mexico, USGS Bulletin 530.

Jones, F.A. (1904). New Mexico Mines and Minerals, World's Fair Edition, 349 pp.

Larsh, P.A. (1913). Lucky Bill Mine Report, Unpublished, NMBGMR File.

Leatherbee, B. (1911). Vanadium in New Mexico, Min. Mag. (London), Vol. 5, p. 282.

Northrup, S.A. & LaBruzza, F.A. (1996). Minerals of New Mexico (Revised), University of New Mexico, 246 pp.

The Mineral Collector (1894–1909), Volumes 1–15.

Minerals of the Chilean mineralogical expedition of 1938, Sam Gordon and the Academy of Natural Sciences of Philadelphia.

PATRICK E. HAYNES
patrickhaynes407@yahoo.com

The 1938 Expedition to Chile

The following notes are taken from an eight-part series, "Results of the Chilean mineralogical expedition of 1938", written by Sam Gordon and published between 1940 to 1942 in *Notulae Naturae* (Gordon 1940-1942). The first paper, titled "Results of the Chilean mineralogical expedition of 1938. Part I – the identity of lapparenite with tamarugite", includes a Foreword with a few easily-overlooked paragraphs regarding the expedition!

Gordon first thanks the financiers of the expedition (the American Philosophical Society and Mr. Cadwalader, then President of the Academy of Natural Sciences of Philadelphia, ANSP). He gives a general description of the Atacama Desert of Chile, and notes ”… more than ten thousand mines have been opened from prehistoric times to the present", and "It is a paradox that the minerals containing the most water (some up to 50%) are found in the driest deserts!" (Gordon 1940, p1).

Gordon left from New York on the S. S. Santa Maria, September 9, 1938 and returned to the same port on the S. S. Santa Clara, January 3, 1939. During the expedition he visited more than 100 mines and prospects, and stock piles of ores from hundreds of others were examined at shipping centers. Twenty-six boxes of mineral specimens were shipped to the Academy's mineralogical laboratory for study. While in Chile, some of his transportation was via a three-wheeled motorcycle that he had shipped from Pennsylvania. He spent just over $1,000 during those four months (Montgomery, 1975). One of the more notable discoveries was a new mineral, found on a mine dump at Cerro Pintados in Sierra Gorda, which he named cadwaladerite, after the President of the Academy (Gordon, 1941, p1-4).

The 2024 Donation

In November of 2024, Bryan Lees of Collector's Edge Minerals, Inc. donated 13 flats of Chilean minerals to the New Mexico Mineral Museum in Socorro, New Mexico (Haynes 2026). The flats were part of their purchase from the Academy of Natural Sciences of Philadelphia in 2006 and contained specimens collected by Samuel Gordon during his 1938 expedition to Chile; the donation includes many type locality specimens.

The Academy of Natural Sciences of Philadelphia was established in 1812. One of its earliest members was Thomas Jefferson, the lead author of the Declaration of Independence. By the time of the sale of its collection in 2006, the Academy had amassed over seventeen million items in its various collections (Montgomery 1975). In 2011, the Academy became affiliated with Drexel University and changed its name to the Academy of Natural Sciences of Drexel University.

When seeking information about the 1938 expedition, I contacted the Drexel University library where I spoke with Paul Roberts, the reference librarian. Roberts sent me 8 pages of Gordon's proposed "Project for a mineralogical survey of the Atacama Desert of Chile" (Gordon, 1938), which included details about the proposed expedition's logistics. Roberts also sent 14 pages of Gordon's "Meteorites Chile" (Gordon, undated), which gave descriptions of twenty Chilean meteorites, and a further 47 pages of some of the expedition's mineralogical descriptions that were published after the expedition in *Notulae Naturae* (Gordon

1940-1942). Roberts also put me in contact with a Drexel associate, Ned Gilmore, the collection manager for vertebrate paleontology.

Gilmore was familiar with the geologic collections and provided me with a list of 463 specimens from Chile that had been accessioned into the Academy's collection commencing with silvers cataloged as early as 1877! Of the specimens donated by the Collector's Edge Minerals, Inc., twenty-three were on this list!

The donation included two full flats, each with a letter-sized sheet of paper that labelled the contents as "reference material" and "junk". The bottom of each sheet had the initials "A. M." The identity of "A. M." was unknown until the author noted the following in Gordon's tamarugite paper, where he thanks numerous people, including "… Professor James L. Crenshaw for permitting Mr. Adolph Meier to use the facilities of his chemical laboratory at Bryn Mawr College" (Gordon, 1940, p2). Adolph Meier may have been an ANSP employee who aided Gordon in the identification of minerals. Both of these flats contained numerous pseudoboleite specimens, from two different mines, the La Compañía mine and the "Mina Santiagina". The name "Mina Santiagina" was a mystery; I could find no mention of it in my literature and online search. Initiating a discussion on Mindat led to the conclusion that the current name of this mine is Bella Santiaguina, with Gordon's "Santiagina" being both a shortening and a miss-spelling. It is also noted that Gordon's "La Compania mine" is now mindat's "La Compañia mine". Both of these mines are in Sierra Gorda, Antofagasta Province.

There are also specimens attributed to the "San Miguel mine" at Queténa. No reference to such a mine could be found and it is assumed that the locality intended is the Queténa mine, Toki Cu deposit, Chuquicamata District, Calama, El Loa Province, Antofagasta, especially given that the type locality for bandylite is the Queténa Mine, and four donated "bandylite" specimens (ANSP #22435) are labeled as being from the "San Miguel Mine, Queténa"; perhaps the mine changed its name. Unfortunately, however, these "bandylites" had been misidentified; one of them was X-rayed for this study and found to be atacamite.
Two specimens of "gold" were included in the donation, with matching catalog numbers on labels and specimens; however, no gold was present. Presumably they had been trimmed and the gold-bearing portions spirited away, leaving behind numbered specimens with no gold. Something similar may have happened to other specimens, where only post-trimming waste was left in the boxes.

A small bag contained fragments of cadwaladerite in halite from Cerro Pintado, Las Pintadas mining district, Tierra Amarilla, Copiapó Province, Atacama. Gordon had collected this material during the 1938 expedition, discovered a new mineral, and named it after Charles Cadwalader (1885-1959), President of the Academy between 1928 and 1951 (Gordon 1941).

It is clear that most of the donated specimens had been incompletely researched and curated. Some had no labels; others had labels with a locality but no mineral name. Some of the unlabeled species – such as clinoclase – were identifiable by their visual properties but, for the rarer minerals, identification was attempted in this study through a combination of powder X-ray diffraction (XRD), and searching Mindat for comparable material and further information. In some cases the Mindat comparisons were helpful, while in others they posed fresh questions. For example, many of Mindat's photos of gold from La Compañia mine show a matrix similar to that for "Mina Santiagina" specimens in the donation. Perhaps, these two mines have similar rock and mineral associations? Both are in Sierra Gorda, and are separated by only about ten miles.

The Minerals

Table 1 lists all of the minerals that were identified, visually or by X-ray diffraction, in the donation.

References

Gordon, S. G. 1938. Project for a mineralogical survey of the Atacama Desert of Chile. Unpublished Academy of Natural Sciences of Philadelphia paper [Expedition Proposal].

Gordon, S. G. 1940-1942. Results of the Chilean expedition of 1938. Parts I-VIII. Notulae Naturae (1940, Part I, Number 57; Part II, Number 64), (1941, Part III, Number 69; Part IV, Number 72; Part V, Number 80), (1942, Part VI, Number 97; Part VII, Number 101; Part VIII, Number 103).
Gordon, S. G. 1940. Results of the Chilean expedition of 1938. Part I.- the identity of lapparentite with tamarugite. Notulae Naturae 57:1-9.

Gordon, S. 1941. Results of the Chilean expedition of 1938. Part V.- cadwaladerite, a new aluminum mineral from Cerro Pintados Chile. Notulae Naturae 80:1-4.

Haynes, P.E. 2026. A donation of Chilean minerals collected by Samuel Gordon in 1938. Rocks & Minerals 101(1).

Alunogen	$Al_2(SO_4)_3\cdot 11H_2O$	Gypsum	$CaSO_4\cdot 2H_2O$
Antlerite	$Cu^{2+}{}_3(SO_4)(OH)_4$	Halite	$NaCl$
Aragonite	$CaCO_3$	Jarosite	$KFe^{3+}{}_3(SO_4)_2(OH)_6$
Atacamite	$Cu^{2+}{}_2Cl(OH)_3$	Kröhnkite	$Na_2Cu^{2+}(SO_4)_2(H_2O)_2$
Blödite	$Na_2Mg(SO_4)_2\cdot 4H_2O$	Leightonite	$K_2Ca_2Cu^{2+}(SO_4)_4\cdot 2H_2O$
Boleite	$KPb_{26}Ag_9Cu_{24}Cl_{62}(OH)_{48}$	Libethenite	$Cu^{2+}{}_2(PO_4)(OH)$
Botryogen	$MgFe^{3+}(SO_4)_2(OH)\cdot 7H_2O$	Lindgrenite	$Cu_3(MoO_4)_2(OH)_2$
Butlerite	$Fe^{3+}(SO_4)(OH)\cdot 2H_2O$	Meta-alunogen	$Al_4(SO_4)_6\cdot 27H_2O$
Cadwaladerite	$Al_5(H_2O)_3(OH)\cdot(Cl,H_2O)$	Metasideronatrite	$Na_2Fe^{3+}(SO_4)_2(OH)\cdot H_2O$
Caracolite	$Na_2(Pb_2Na)(SO_4)$	Metavoltine	$K_2Na_6Fe^{2+}Fe^{3+}{}_6O_2(SO_4)_{12}\cdot 18H_2O$
Chalcanthite	$Cu^{2+}SO_4\cdot$	Molybdenite-2H	MoS_2
Clinoatacamite	$Cu^{2+}{}_2(OH)_3Cl$	Natrochalcite	$NaCu_2(SO_4)_2[(H_2O)(OH)]$
Clinoclase	$Cu^{2+}{}_3(AsO_4)(OH)$	Natrojarosite	$NaFe^{3+}{}_3(SO_4)_2(OH)_6$
Cuprite	CuO	Paratacamite	$Cu^{2+}Cl(OH)$
Darapskite	$Na_3(SO_4)(NO_3)\cdot H_2O$	Pseudoboleite	$Pb_{31}Cu^{2+}{}_{24}Cl_{62}(OH)_{48}$
Dickite	$Al_2Si_2O_5(OH)$	Pyrite	FeS_2
Dioptase	$Cu_6Si_6O_{18}\cdot 6H_2O$	Quartz	SiO_2
Ferrinatrite	$Na_3Fe^{3+}(SO_4)_3\cdot 3H_2O$	Siderotil	$Fe^{2+}(SO_4)\cdot 5H_2O$
Fluorwavellite	$Al_3(PO_4)_2(OH)_2F\cdot 5H_2O$	Thénardite	Na_2SO_4
Greenockite	CdS	Unknown	XRD similar to montetrisaite.

Table 1. All of the minerals that were identified, visually or by X-ray diffraction, in the donation .

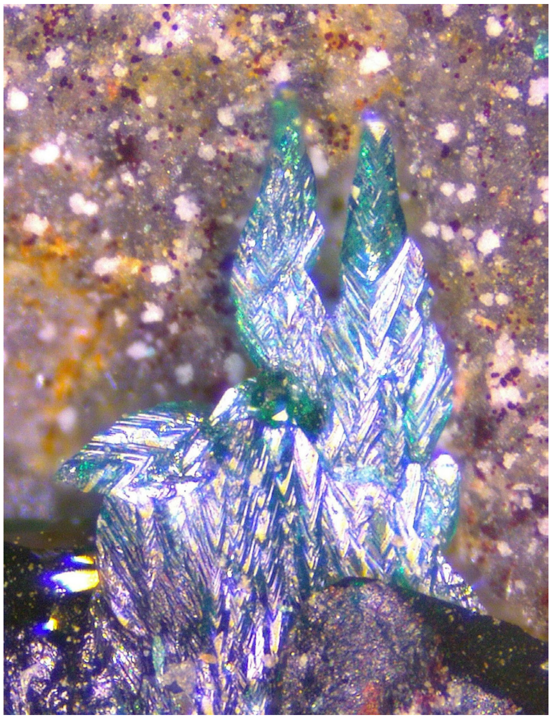


Figure 1- Atacamite from the Bella Santiaguina Mine, showing interesting growth striations. 1.5 mm field of view (FOV). Patrick Haynes photo.

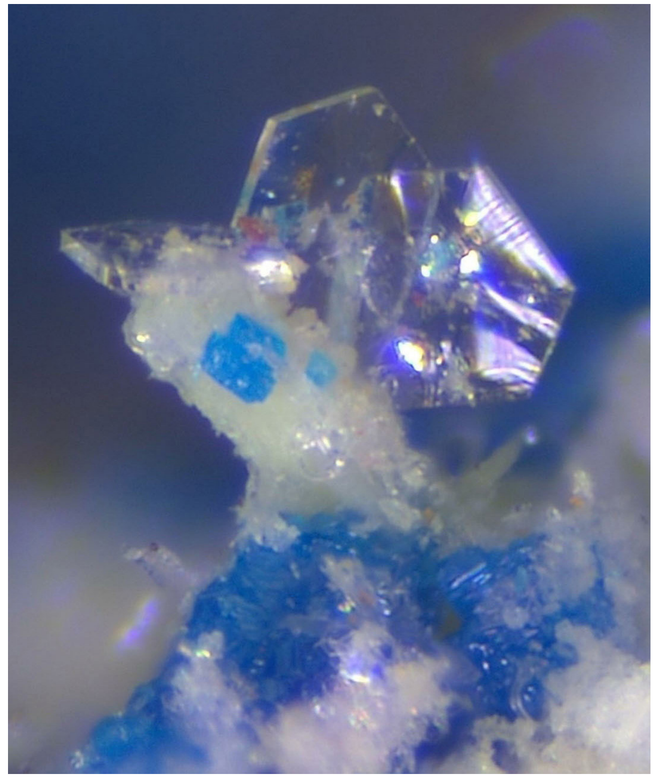


Figure 3- Caracolite with pseudoboleite from the Bella Santiaguina Mine. FOV = 0.3 mm. Patrick Haynes photo.

Figure 2- Botryogen with butlerite from Chuquicamata(?). 1.1 cm FOV. Patrick Haynes photo.

Figure 4- Kröhnkite with colorless blödite. From Chuquicamata. 10.9 cm wide. John Rakovan photo.

Figure 5- Leightonite with atacamite on ANSP specimen number 22392. The FOV = 3.5 mm. Patrick Haynes photo.

Figure 6- Lindgrenite from the type locale, Chuquicamata. A 1 mm long spray. Patrick Haynes photo.

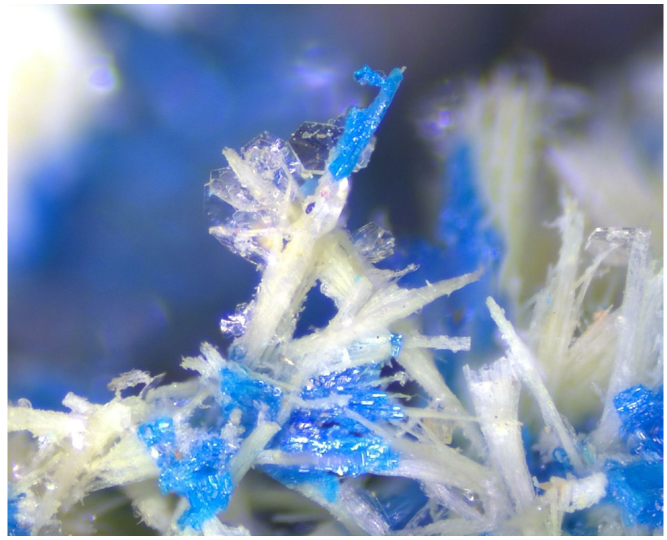


Figure 7- A white quartz spike with blue pseudoboleite and colorless caracolite. From the La Compañia Mine. 1.5 mm FOV. Patrick Haynes photo.

Figure 8- Pseudoboleite from the La Compañia Mine. 0.6 mm FOV. Patrick Haynes photo.Mine. 1.5 mm FOV. Patrick Haynes photo.

Off The Map: Recent New Mexico mineral discoveries

ROB SANDERS, PH.D.
Thief Mountain Mining, Datil, New Mexico

Since its discovery in 2005, Mina Herradura in Sierra County has continually produced amazing "Herkimer" style quartz crystals from quartz-calcite veins in the Cretaceous Mesa Verda sandstone. Mineralization appears to have exploited a regional structural architecture of extensional faults within the Jornada de Muerto basin. Abundance of organic material within the host sandstone allowed infiltrating fluids a high silicic acid chemistry that precipitated double terminated quartz crystals at

Fig.1 Quartz, Mina Herradura, Sierra County, NM. 9.5 cm tall. John Rakovan photo.

temperatures more amenable to chalcedony formation (100°C) based on fluid inclusion evaluation. Multiple species of hydrocarbons are also present

Fig.1 Quartz, Mina Herradura, Sierra County, NM. 9.5 cm tall. John Rakovan photo.

and inclusions and bubbles are responsible for the UV fluorescence of certain samples. The "Covid Leap Year Pocket" uncovered in February 2020 has to date produced the largest, finest, and most impressive specimens from the property.

The Magdalena district of Socorro county has an infamous mining history and is best known for the wonderful blue smithsonite from the Kelly mine. The nearby Graphic mine tailings (privately owned) have been very productive over the past several years as well. Very nice cabinet specimens of azurite and malachite can still be found with permission of the owner. If you venture beyond these popular areas and go "off the map" there are treasures to be found. A few years back, in the scrub brush of the steep mountain cliffs I located a deposit of large (up to 6 inches) double terminated prismatic milky quartz crystals. This was unusual as most quartz in the district are of a pyramidal morphology in Pennsylvanian limestone. These specimens, however, were extracted from a rare quartz arkosic unit interbedded within the limestone. I hypothesize that the mineralizing fluids deposited this anomalous prismatic morphology due to chemical and thermodynamic changes as they interacted with the arkose host rock as opposed to the limestone.

Fig.1 Quartz, Magdalena district, 16.5 cm. John Rakovan photo.

The Sierra Ladrones in Socorro County have long served as a legendary location of hidden gold, thieves hideout, and a buried silver altar stolen from a local church. With good reason; it is hot, cactus laden, bug infested, no shade, no water, always uphill, rattlesnakes, and a great spot to hide treasure near the Camino Real. Due to federal and private property ownership it is not very accessible. Mina Rosita is a new prospect on the steep slopes of the peak that produces milky, strawberry, and amethyst quartz crystals. It is an unusual deposit hosted in a rapakivi granite gneiss with a spectrum of quartz colors. In one area, complex double terminated milky quartz specimens up to two inches in length are suspended in a carbonate powder down to a minimum of four feet in depth. This is enigmatic as I had presumed it was a kaolinite alteration by-product of the fluid-granite interaction until I poured some acid on it out of curiosity and it fizzed.

Fig.2 Quartz, Mina Rosita, Sierra Ladrones, 10 cm. John Rakovan photo.

Catron County is host to the commonly known "Luna Agate" used for lapidary and the occasional crystalline quartz specimens. Nearby, "Luna Leopard" agate reveals a very complex paragenesis of phreato-magmatic clastic pumice injection into Tertiary volcanic host rocks and subsequently altered to a celadonite-gmelinite zeolite association followed by silicification. In some areas quartz overgrowths of dog tooth calcite and stalagtitic quartz specimens are present.

Fig.3 Quartz - agate, Reserve-Luna area, Catron County, NM. 5 cm. John Rakovan photo.

Fig.5 Silicified pumice fragments with celadonite and zeolite inclusions indicating a history of volcanic eruption followed by hydrothermal alteration. Reserve-Luna area, Catron County, 7 cm. John Rakovan photo.

Fig.4 Quartz cavity with calcite casts on its surface, Reserve-Luna area, Catron County, NM. 12 cm. John Rakovan photo.

Fig.6 Quartz coated calcite, Reserve-Luna area, Catron County, NM. 4.5 cm. John Rakovan photo.

Moonstone Madness
(Moonstones vs Moon Rocks)

GRANT, R.. KUCK
Albuquerque, NM 87112 gkuck@netzero.com

Moonstones and moon rocks have distinct origins and very little in common beyond their names. Moonstone is a terrestrial gemstone, a variety of the mineral feldspar. It is prized for its unique optical effect, known as adularescence, a shimmering, pearly sheen. Moon rocks, in contrast, come from the Moon itself but also are found on Earth.

Lunar rocks on our planet come from three primary sources:
• The Apollo Missions: U.S. astronauts collected 842 pounds (382 kilograms) of lunar material over six missions from 1969 to 1972.
• Soviet Luna Probes: Three robotic probes returned a total of 11.5 ounces (326 grams) of lunar soil and rock fragments in the 1970s.
• Lunar Meteorites: Material ejected from the Moon's surface by asteroid impacts traveled through space and then fell to our planet as meteorites. Over 2,400 pounds of lunar meteorites have been discovered in deserts and polar regions of Earth.

Figure 1. Lunar meteorite display, Maine Mineral & Gem Museum

Figure 2. Lunar meteorites, Maine Mineral & Gem Museum Maine Mineral Museum.

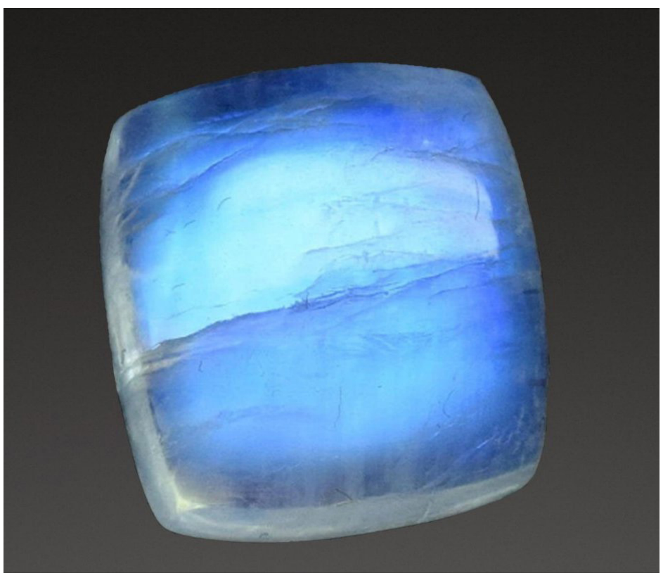
The majority of lunar samples from the Apollo missions are stored at the Lunar Sample Laboratory Facility at the Johnson Space Center in Houston, Texas. A smaller collection is housed at the White Sands Test Facility in New Mexico. While most samples are for scientific study, over 80 are on public display in museums worldwide, including the Smithsonian's National Air and Space Museum, which has a moon rock from the Apollo 17 mission, that you can touch. The Maine Mineral & Gem Museum (MMGM), in Bethel, is home to the largest known pieces of the Moon (and Mars), and has more lunar meteorites than all other museums combined.

The four most common minerals found in lunar rocks are:
• Plagioclase Feldspar: composed of calcium, sodium, aluminum, silicon, and oxygen.
• Pyroxene: A silicate mineral made of magnesium, iron, calcium.
• Olivine: A silicate mineral rich in magnesium and iron.

• Ilmenite: An iron and titanium oxide.

While they have different origins, moonstones and moon rocks do share a common mineral group: feldspar. One of the most abundant minerals on the Moon is plagioclase feldspar.

In contrast, Moonstone is a gemstone variety of the alkali feldspar family, that is found on Earth. Its distinct, shimmering light effect, known as adularescence, is caused by light scattering off the mineral's layered internal structure. This quality makes it the most prized of the feldspar gems. Deer, Howie & Zussman (1978) in An Introduction to the Rock Forming Minerals said that "Some alkali feldspars, called moonstones display on particular surfaces a sheen or iridescence, attributed to lameller micro- or cryptoperthitic intergrowth. One might say that the gemstone's distinctive iridescence is caused by light passing from one lamella of crystal to another." Miura (1978a) showed that iridescence in moonstones (Fig. 3) is produced by the lamellar intergrowths that can be



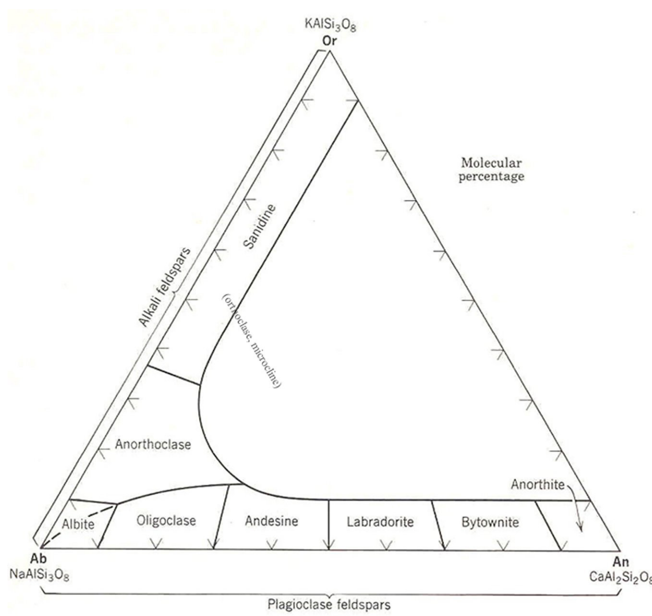
observed by transmission electron microscopy.
Figure 3. Moonstone cabochon: crytoperthitic orthoclase showing Adularescence.

Moonstone's defining characteristic is adularescence, a unique optical effect that is often confused with other phenomena. While iridescence is the production of rainbow colors caused by light interference, and opalescence is a milky sheen, adularescence is the flowing, billowy white or bluish light that appears to glide across the surface of a gemstone as it's turned.

This effect is caused by the way light diffracts off of microscopic, parallel layers of different feldspar conpositions within the stone. Moonstone's adularescence typically occurs in feldspars that have a mix of sodium and potassium.

As shown in a typical feldspar ternary diagram (Fig. 4), feldspars are classified based on their content of potassium, sodium, and calcium. Adularescence is best seen in alkali feldspars, such as albite, that have intergrowths of other feldspar types like either orthoclase, or sanidine, or anorthoclase, which all have slightly different refractive indexes.

To sum up, Moonstone is a gem-quality alkali feldspar with the chemical composition (K,Na) $AlSi_3O_8$. Its most notable feature is adularescence,



a milky or bluish sheen caused by light scattering
Figure 4. The feldspar ternary diagram.

off its layered structure. This effect is sometimes referred to as "schiller."

While it is often colorless, white, or blue, it can also be found in a range of colors, including yel

Figure 5. Sanidine Moonstones from Rabb Canyon, NM. New Mexico Mineral Museum. John Rakovan photo.

low, orange, brown, and green.Moonstone Deposits are found in 86 countries, but the highest-quality, gem-grade specimens come from a select few. The most significant sources for fine moonstone are:
• Sri Lanka: Renowned for producing the most valuable blue moonstones.
• Myanmar: A historical source for high-quality material.
• Tanzania: A notable producer of clear and colorless moonstone.
• India: Known for its deposits of multi-colored, or "rainbow" moonstone.

In America Moonstone has been found in 15 states, providing opportunities for both commercial mining and recreational collecting. Some of the most notable US locations include:
• Wisconsin: Famous for its rare, high-quality blue moonstones.
• Georgia and North Carolina: Known for smaller deposits of the mineral.
• New Mexico:

The Land of Enchantment has has at least three documented sites for moonstone collecting:
• Rabb Canyon, Grant County
• Jemez Mountains, Sandoval County
• San Mateo Mountains, Sierra County

Figure 6. Rabb Canyon in Grant County, NM 2020. Grant Kuck photo.

Figure 7. Sanidine Moonstone in matrix, Rabb Canyon in Grant County, NM. Mexico Mineral Museum. Gift of Dave Menzie and Richard Boltz. John Rakovan photo.

Bibliography

Burke, J. D. (2025). "Moon, Lunar rocks and soil." In Encyclopædia Britannica. [URL: https://www.britannica.com/place/Moon/Lunar-rocks-and-soil]

Deer, W. A., Howie, R. A., & Zussman, J. (1966). An Introduction to the Rock-Forming Minerals. Longman Group Limited.

Gary, M., McAfee Jr., R., & Wolf, C. L. (1974). Glossary of Mineralogy. American Geological Institute.

Mindat. (2025). URL: www.mindat.org - Moonstone: Mineral information, data and localities.

Newman, R. (1998). Gemstone Buying Guide. International Jewelry Publications.

Smith, J. V., & Brown, W. L. (1988). Feldspar Minerals (Second Revised and Extended Edition). Springer-Verlag.

Wikipedia. (2025). URL: www.wikipedia.org - Moon rock.

Figure 8. moonstone cabochon, Sri Lanka. John Rakovan photo. Mexico Mineral Museum. Gift of John Mastin. John Rakovan photo.

Figure 9. Sanidine Moonstonecrystals, Pili Mine, Chihuahua, Mexico. 4 cm crystal. Mexico Mineral Museum. John Rakovan photo.

Appendix

New Mexico Minerals in the Natural History Museum, London, England 10-2025

As Registered: (ID)	Number*	Verbatim Locality
Radioactive fused sand	BM.1985,MI28413	New Mexico
Plattnerite	BM.1957,32	Mex-Tex mine, near Bingham, New Mexico
Wolframite	BM.1985,MI36377	Luna Co., New Mexico, U.S.A.
Dolomite	BM.1985,MI33407	Debaca Co., New Mexico, U.S.A.
Descloizite	BM.64400	Mimbres mine, Georgetown, Grant Co., New Mexico, U.S.A.
Turquoise	BM.65296	Los Cerillos, New Mexico, U.S.A.
Descloizite	BM.65307	Commercial mine, Georgetown, Grant Co., New Mexico, U.S.A.
Turquoise	BM.65315	Los Cerillos, New Mexico, U.S.A.
Vanadinite	BM.65318	Commercial mine, Georgetown, New Mexico, U.S.A.
Descloizite	BM.65321	Commercial mine, Georgetown, Grant Co., New Mexico, U.S.A.
Wulfenite	BM.65322	Bennett mine, Las Cruces, Dona Ana Co., New Mexico, U.S.A.
Descloizite	BM.65323	Commercial mine, Georgetown, Grant Co., New Mexico, U.S.A.
Wulfenite	BM.65324	Bennett mine, Las Cruces, Dona Ana Co., New Mexico, U.S.A.
Wulfenite	BM.65326	Bennett mine, Las Cruces, Dona Ana Co., New Mexico, U.S.A.
Wulfenite	BM.65328	Bennett mine, Las Cruces, Dona Ana Co., New Mexico, U.S.A.
Turquoise	BM.65330	Los Cerillos, New Mexico, U.S.A.
Turquoise	BM.65345	Los Cerillos, New Mexico, U.S.A.
Wulfenite	BM.65356	Bennett mine, Las Cruces, Dona Ana Co., New Mexico, U.S.A.
Wulfenite	BM.65373	Bennett mine, Las Cruces, Dona Ana Co., New Mexico, U.S.A.
Descloizite	BM.65719	Mimbres mine, Georgetown, Grant Co., New Mexico, U.S.A.
Vanadinite	BM.65998	Commercial mine, Georgetown, New Mexico, U.S.A.
Copper ps. azurite	BM.66003	Grant Co., New Mexico, U.S.A.
Vanadinite	BM.66004	Commercial mine, Georgetown, New Mexico, U.S.A.
Smithsonite	BM.66975	Magdalena, Socorro County, New Mexico, U.S.A.
Vanadinite	BM.69109	Lake Valley, New Mexico, U.S.A.
Carnotite	BM.1985,MI34419	Grants dist., New Mexico, U.S.A.
Chalcocite	BM.1985,MI34505	Santa Rita Pit, Hurley, New Mexico, U.S.A.
Rajite	BM.1979,71	Lone Pine Mine, Catron Co., New Mexico, U.S.A.
Rajite	BM.1979,161	Lone Pine Mine, Catron Co., New Mexico, U.S.A.

Zippeite	BM.1980,390	Section 35 mine, Grants, Valencia Co., New Mexico, USA
Unknown (brassy pyrite)	BM.1980,391	New Mexico
Lannonite	BM.1984,471	Lone Pine Mine, Catron Co., New Mexico, U.S.A.
Wilcoxite	BM.1984,472	Lone Pine Mine, Catron Co., New Mexico, U.S.A.
Spurrite	BM.1984,549	Tres Hermanos Mtns., Luna Co., New Mexico, U.S.A.
Malachite	BM.1984,569	Otero County, New Mexico, U.S.A.
Dolomite	BM.1947,316	Pecos river valley, Roswell, Chavas County, New Mexico
Dolomite	BM.1947,317	Pecos river valley, Roswell, Chavas County, New Mexico
Chalcopyrite	BM.1957,346	Ground Hog mine, Vanadium, Grant Co., New Mexico
Chrysocolla	BM.1972,86	Silver City dist., Grant Co., New Mexico, U.S.A.
Pseudobrookite	BM.1972,199	Cuchillo, Sierra Co., New Mexico, U.S.A.
Murdochite	BM.1972,202	Granite Gap, Hidalgo Co., New Mexico, U.S.A.
Hidalgoite	BM.1972,203	Granite Gap, Hidalgo Co., New Mexico, U.S.A.
Beudantite	BM.1972,204	Granite Gap, Hidalgo Co., New Mexico, U.S.A.
Bromargyrite	BM.1972,205	Gage Siding, Victorio, Dona Ana Co., New Mexico, U.S.A.
Spurrite	BM.1931,273	New Mexico, U.S.A.
Spurrite	BM.1932,6	Luna Co., New Mexico, U.S.A.
Sylvine	BM.1929,125	American Potash Company, Carlsbad, Eddy Co., New Mexico, U.S.A.
Carnallite	BM.1929,127	American potash company, Carlsbad, Eddy Co., New Mexico, U.S.A.
Muscovite	BM.1972,449	Harding mine, Taos Co., New Mexico, U.S.A.
Pyrite	BM.1972,451	Pecos, San Miguel Co., New Mexico, U.S.A.
Metahewettite	BM.1972,461	Grants, Valencia Co., New Mexico, U.S.A.
Sodium-zippeite	BM.1982,156	Jackpile Mine, Laguna, near Grants, Valencia Co., New Mexico, U.S.A.
Heulandite	BM.1967,35	Grant Co., New Mexico, U.S.A.
Wulfenite	BM.1921,103	Las Cruces, Dona Ana Co., New Mexico, U.S.A.
Descloizite	BM.1921,104	Sierra Grande mine, Lake Valley, Sierra Co., New Mexico, U.S.A.
Gadolinite	BM.1928,31	near Tres Piedras, Taos Co., New Mexico, U.S.A.
Monazite	BM.1928,36	Tres Piedras, Taos Co., New Mexico, U.S.A.
Lepidolite	BM.1928,218	Ernludo, Taos Co., New Mexico, U.S.A.
Fluorite	BM.1983,98	Royal Flush mine, Bingham, Socorro Co., New Mexico, U.S.A.
Fluorite	BM.1983,102	Galena King mine, Bernalillo Co., New Mexico, U.S.A.
Cuprite	BM.1983,105	Rose mine, Grant Co., New Mexico, U.S.A.
[goldmanite]	BM.1983,119	Sandy mine, Laguna, Valencia, New Mexico, U.S.A.

Columbite	BM.1946,101	Las Tablas, Petaca, Rio Arriba Co., New Mexico
Hydrozincite	BM.1946,208	New Mexico
Hemimorphite	BM.1946,209	New Mexico, U.S.A.
Hemimorphite	BM.1946,210	Hanover, Grant Co., New Mexico, U.S.A.
Hydrozincite	BM.1946,211	Hanover, Grant County, New Mexico
Murdochite	BM.1969,256	Tex mine, Socorro Co., New Mexico
Bismuthinite	BM.1952,166	Organ, Donan Ana Co., New Mexico, U.S.A.
Descloizite	BM.1985,MI6143	Mimbres Mine, Georgetown, Grant Co., New Mexico, U.S.A.
Copper ps. azurite	BM.1985,MI6170	Georgetown, Grant Co., New Mexico, U.S.A.
Smithsonite	BM.1985,MI6212	Magdalena, Socorro Co., New Mexico, U.S.A.
Pyrolusite	BM.70365	Lake Valley, New Mexico, U.S.A.
Copper	BM.1968,334	Santa Rita, Grant Co., New Mexico, U.S.A.
Bismutite	BM.1910,322	Eagle Station, Sierra County, New Mexico, U.S.A.
Hemimorphite	BM.1910,566	Organ mtns., Don Ana Co., New Mexico, U.S.A.
Durangite	BM.1984,166	Black Range, Sierra Co., New Mexico, U.S.A.
Durangite	BM.1984,243	near Winston, Sierra Co., New Mexico, U.S.A.
Biotite	BM.1948,271	Waldo Mine, Magdalena, Socorro Co., New Mexico
Molybdenite	BM.1948,272	Questa, Taos Co., New Mexico
Bastnasite	BM.1948,277	Gallinas Mts., Lincoln County, New Mexico, U.S.A.
Manganite	BM.1948,278	Bridal Chamber mine, Lake Valley, Sierra Co., New Mexico
Quartz	BM.1911,28	San Pedro, Santa Fe Co., New Mexico
Baryte	BM.1911,31	S.F. Copper Co.'s mine, San Pedro, Santa Fe Co., New Mexico, U.S.A.
Ramsdellite	BM.1987,256	Sierra_Co., New_Mexico, USA
Copper (ps. after azurite)	BM.1987,405	Grant Co., New Mexico, U.S.A.
Wulfenite	BM.1985,MI27449	Las Cruces, New Mexico
Sylvine	BM.1985,MI25652	Carlsbad, New Mexico, U.S.A.
Halite	BM.1985,MI25653	Carlsbad, New Mexico, U.S.A.
Sylvanite	BM.1985,MI25654	Carlsbad, New Mexico, U.S.A.
Carnallite	BM.1985,MI25655	Carlsbad, New Mexico, U.S.A.
Halite	BM.1985,MI25656	Carlsbad, New Mexico, U.S.A.
Halite	BM.1985,MI25657	Carlsbad, New Mexico, U.S.A.
Anhydrite	BM.1985,MI25658	Carlsbad, New Mexico, U.S.A.
Halite	BM.1985,MI25659	Carlsbad, New Mexico, U.S.A.

Polyhalite	BM.1985,MI25660	Carlsbad, New Mexico, U.S.A.
Sylvine	BM.1985,MI25661	Carlsbad, New Mexico, U.S.A.
Sylvine	BM.1985,MI25662	Carlsbad, New Mexico, U.S.A.
Polyhalite	BM.1985,MI25663	Carlsbad, New Mexico, U.S.A.
Sandstone	BM.1985,MI25924	Carlsbad, New Mexico, U.S.A.
Clay	BM.1985,MI25925	Potash deposits, Carlsbad, New Mexico, U.S.A.
Limestone	BM.1985,MI25926	Potash deposits, Carlsbad, New Mexico, U.S.A.
Limestone (caliche)	BM.1985,MI25927	Potash deposits, Carlsbad, New Mexico, U.S.A.
Shale	BM.1985,MI25928	Potash deposits, Carlsbad, New Mexico, U.S.A.
Shale	BM.1985,MI25929	Potash deposits, Carlsbad, New Mexico, U.S.A.
Shale	BM.1985,MI25930	Potash deposits, Carlsbad, New Mexico, U.S.A.
Shale	BM.1985,MI25931	Potash deposits, Carlsbad, New Mexico, U.S.A.
Galena	BM.1985,MI3005	New Mexico, U.S.A.
Becquerelite	BM.1958,329	Paguate, Valencia_Co., New_Mexico
Uranophane	BM.1958,330	near Grants, Valencia Co., New Mexico
Olivine	BM.1958,331	Kilbourne Hole, Dona Ana Co., New Mexico
Phosphuranylite	BM.1958,344	Paguate, Valencia Co., New Mexico, U.S.A.
Meta-torbernite	BM.1958,345	Paguate, Valencia_Co., New Mexico, USA
Halotrichite	BM.1958,347	Raton, Colfax Co., New Mexico, U.S.A.
Cryptomelane	BM.1965,376	Socorro Co., New Mexico, U.S.A.
[santafeite]	BM.1965,458	Grants, Valencia Co., New Mexico, U.S.A.
Uraninite	BM.1957,539	Grants, valencia_Co., New_Mexico
Baryte	BM.1957,544	Magdalena, Socorro Co., New Mexico, U.S.A.
Zippeite	BM.1957,547	near Bibo, Valencia_Co., New_Mexico
Kettnerite	BM.1986,46	Victorio, Luna Co., New Mexico, USA
Fluorite	BM.1986,149	Burro_Mtns.,............., New_Mexico, USA
Plattnerite	BM.1982,400	Groundhope mine, Silver City, Grant County, New Mexico, U.S.A.
Allophane	BM.1985,Lin21086	Magdalena, New Mexico, U.S.A.
Turquois	BM.1985,Lin21291	Los Cerillos, New Mexico
Vanadinite	BM.1985,Lin17672	Hillsboro, Sierra Co., New Mexico
Vanadinite	BM.1985,Lin17673	Hillsboro, Sierra Co., New Mexico
Turquoise	BM.1985,Lin17686	Jumilla Mts., Dona Ana Co., New Mexico
Wulfenite	BM.1985,Lin17711	Organ Mts, New Mexico

Wulfenite	BM.1985,Lin17713	Organ Mts, New Mexico
Copper ps. azurite	BM.1985,Lin17856	New Mexico, U.S.A.
Turquoise	BM.1985,MI27919	New Mexico or Arizona ?, U.S.A.
Kaolinite	BM.1985,MI29674	Canada del Camino, Mesa Alta, New Mexico
Montmorillonite	BM.1985,MI29681	Bayard, New Mexico
Montmorillonite	BM.1985,MI29685	Santa Rita, New Mexico
Stromeyerite	BM.1985,MI4706	Bremen Mine, New Mexico, U.S.A.
Turquoise	BM.1985,MI4950	Las Vegas, New Mexico
Turquoise	BM.1985,MI4951	New Mexico
Turquoise	BM.53728	New Mexico
Muscovite	BM.53731	Rio Arriba Co., New Mexico
Cuprite	BM.53742	New Mexico
Gold	BM.53744	Cortez mines, New Mexico, U.S.A.
Chrysocolla	BM.53745	Cortez mines, New Mexico, U.S.A.
Wulfenite	BM.53746	Silver mines, Grant Co., New Mexico, U.S.A.
Wulfenite	BM.53747	Silver mines, Grant Co., New Mexico, U.S.A.
Vanadinite	BM.55178	Dona Anna Co., New Mexico, U.S.A.
Chalcopyrite	BM.1985,MI29007	Colorado Shale (Cretaceous), Hanover Mountain, New Mexico, U.S.A.
Sphalerite	BM.1985,MI29016	Buckhorn Gulch, New Mexico, U.S.A.
Chlorite var. thuringite	BM.1985,MI29023	Pewabic mine area, New Mexico
Altered rock	BM.1985,MI29027	New Mexico, U.S.A.
Sphalerite	BM.1985,MI29035	Groundhog Mine, New Mexico, U.S.A.
Sphalerite	BM.1985,MI24007	Hanover mine, New Mexico, U.S.A.
Smithsonite	BM.1985,MI24010	Hanover mine, New Mexico, U.S.A.
Smithsonite	BM.1985,MI24011	Hanover mine, New Mexico, U.S.A.
Hedenbergite	BM.1985,MI24019	Hanover mine, New Mexico, U.S.A.
Epidote	BM.1985,MI24022	Hanover mine, New Mexico, U.S.A.
Hedenbergite	BM.1985,MI24024	Hanover mine, New Mexico, U.S.A.
Altaite	BM.1977,101	Hilltop mine, Organ Mtns., Dona Ana Co., New Mexico, U.S.A.
Copper ps. azurite	BM.1985,MI6883	near Georgetown, New Mexico, U.S.A.
Ramsdellite	BM.1973,533	Sierra Co., New Mexico, U.S.A.
Melanotekite	BM.1924,713	Hillsboro, Sierra Co., New Mexico, U.S.A.
Doloresite	BM.1965,60	Section 33 Mine, near Grants, Valencia Co., New Mexico, U.S.A.

Unknown	BM.1986,159	near Organ, Dona_Ana_Co., New_Mexico, USA
Metahewettite	BM.1959,455	Jackpile mine, Laguna, Valencia Co., New Mexico, U.S.A.
Treasurite	BM.1984,20	Tyrone, Grant Co., New Mexico, U.S.A.
Tellurium	BM.1968,349	Grant Co., New Mexico
Turquoise	BM.63071	Los Cerillos, New Mexico, U.S.A.
Vanadinite	BM.63091	Sierra-Grande mine, Lake Valley, New Mexico, U.S.A.
Endlichite	BM.63092	Sierra-Grande mine, Lake Valley, New Mexico, U.S.A.
Vanadinite	BM.63093	Sierra-Grande mine, Lake Valley, New Mexico, U.S.A.
Graphite	BM.63536	Colfax Co., New Mexico, U.S.A.
Vanadinite	BM.84512	Hillsboro, New Mexico, U.S.a.
Vanadinite	BM.84513	Hillsboro, New Mexico, U.S.a.
Vanadinite	BM.84514	Hillsboro, New Mexico, U.S.a.
Calcite	BM.84900	Magdalena, Socorro County, New Mexico, U.S.A.
Copper ps. azurite	BM.85148	Potosi mines, Grant Co., New Mexico, U.S.A.
Wulfenite	BM.85727	Las Cruces, Dona Ana Co., New Mexico, U.S.A.
Selenium	BM.1976,209	Grants, Valencia Co, New Mexico, U.S.A.
Sillimanite	BM.1976,256	Kilbourne Hole, Dona Ana Co., New Mexico, U.S.A.
Wulfenite	BM.1985,Lin21583	Organ Mts, New Mexico
Muscovite	BM.1944,145	Embudo, Rio Arriba Co., New Mexico, U.S.A.
Staurolite	BM.1960,531	near Pilar, Taos Co., New Mexico, U.S.A.
Staurolite	BM.1960,532	Taos Co., New Mexico, U.S.A.
Unknown (melaconite)	BM.1961,98	Magdelena, New Mexico
Unknown (brassy pyrite)	BM.1980,155	New mexico, U.S.A
Spangolite	BM.1967,111	Mex-Tex mine, Bingham, Socorro Co., New Mexico, U.S.A.
Spangolite	BM.1967,155	Bingham, Hansonberg dist., Socorro Co., New Mexico, U.S.A.
Altaite	BM.1967,174	Las Cruces (W. of), Organ Mtns., Dona Ana Co., New Mexico, U.S.A.
Pintadoite	BM.1985,43	Poison Canyon Mine, Grant's Dist., McKinley Co., New Mexico, U.S.A.
Bixbyite	BM.1985,65	Beryllium Virgin claim, Sierra Co., New Mexico, U.S.A.
Brindleyite	BM.1983,623	Victoria, Luna Co., New Mexico, U.S.A.
Murdochite	BM.1956,397	Bingham, Hansonberg dist., Socorro Co., New Mexico, U.S.A.
Turquoise	BM.1985,MI5596	Los Cerillos, New Mexico, U.S.A.
Turquoise	BM.1985,MI5608	Los Cerillos, New Mexico, U.S.A.
Microlite	BM.1971,161	Harding mine, 5m. E. of Dixon, Taos Co., New Mexico, U.S.A.

Microlite	BM.1971,162	Harding mine, 5m. E. of Dixon, Taos Co., New Mexico, U.S.A.
[djalmaite]	BM.1971,163	Harding mine, 5m. E. of Dixon, Taos Co., New Mexico, U.S.A.
Langbeinite	BM.1985,MI34929	near Carlsbad, Eddy Co., New Mexico
Microcline	BM.1926,231	Taos, Taos Co, New Mexico, U.S.A.
Muscovite	BM.1926,235	Taos, Taos Co, New Mexico, U.S.A.
Calcite	BM.1921,743	Organ Mines, Dona Ana County, New Mexico
Uranophane	BM.1967,269	near Grants, Valencia Co., New Mexico, U.S.A.
Descloizite	BM.82677	Magdalenas mining dist., Socorro Co., New Mexico, U.S.A.
Vanadinite	BM.83020	Lake Valley, Grant Co., New Mexico, U.S.A.
Vanadinite	BM.83021	Lake Valley, Grant Co., New Mexico, U.S.A.
Limonite	BM.83024	Jarilla Mts. Jacarilla, Lincon County, New Mexico, U.S.A.
Vanadinite	BM.83397	Hillsboro, New Mexico, U.S.A.
Endlichite	BM.83398	Hillsboro, New Mexico, U.S.A.
Vanadinite	BM.83474	Lake Valley, Grant Co., New Mexico, U.S.A.
Vanadinite	BM.83475	Lake Valley, Grant Co., New Mexico, U.S.A.
Vanadinite	BM.83476	Lake Valley, Grant Co., New Mexico, U.S.A.
Vanadinite	BM.83607	Lake Valley, Grant Co., New Mexico, U.S.A.
Vanadinite	BM.83608	Lake Valley, Grant Co., New Mexico, U.S.A.
Vanadinite	BM.83609	Lake Valley, Grant Co., New Mexico, U.S.A.
Vanadinite	BM.83610	Lake Valley, Grant Co., New Mexico, U.S.A.
Quartz ps. wulfenite	BM.83611	Lake Valley, Sierra Co., New Mexico, U.S.A.
Vanadinite 'endlichite'	BM.83996	Hillsboro, near Lake Valley, Sierra Co., New Mexico, U.S.A.
Melanotekite	BM.83997	Hillsboro, near Lake Valley, Sierra Co., New Mexico, U.S.A.
Turquoise	BM.1937,1580	New Mexico, U.S.A.
Quartz	BM.1937,1688	Acme, Pecos valley, Chavas Co., New Mexico
Aragonite	BM.1985,Lin18713	Organ Mtns, New Mexico
Copper ps._azurite	BM.1985,Lin18842	near Georgetown, New Mexico, U.S.A.
Aurichalcite	BM.1985,Lin18854	Magdalena, New Mexico, U.S.A.
Aurichalcite	BM.1925,495	Graphic mine, Magdalena, Socorro County, New Mexico
Halite	BM.1978,520	Lea Co., New Mexico, U.S.A.
Sphalerite	BM.1985,MI33215	Lady Mary Lode, Virginia Mining District, Hidalgo County, New Mexico, U.S.A.
Fluorite	BM.1985,MI33216	Lady Mary lode, Virginia Mining dist., Hidalgo Co., New Mexico, U.S.A.
Chalcopyrite	BM.1985,MI33217	Lady Mary Lode, Virginia mining District, Hidalgo County, New Mexico, U.S.A.

Opal	BM.1985,MI33218	Lady Mary lode, Virginia Mining dist., Hidalgo Co., New Mexico, U.S.A.
Altaite	BM.1960,264	Hilltop mine, Dona Ana Co., New Mexico
Columbite	BM.1960,270	Petaca, Rio Arriba Co., New Mexico
Selenium	BM.1960,293	Poison Creek, Ambrosia Lake, McKinley Co., New Mexico
Cuprite	BM.1960,297	Chino Pit, Santa Rita, Grant Co., New Mexico
Selenium	BM.1960,407	Homestake mine, Ambrosia Lake, McKinley Co., New Mexico
Wulfenite	BM.1985,MI31095	Organ Mts, New Mexico
Bayleyite	BM.1973,387	Ambrosia Lake mining dist., Mckinley Co., New Mexico
Scrutinyite	BM.1989,5	Sunshine no.1 tunnel, Socorro Co., New Mexico, USA
Quartz	BM.1989,59	Smoky Bear prospect, Lincoln Co., New Mexico, USA
Bayleyite	BM.1963,389	Homestake mine, Ambrosia Lake, Mckinley Co., New Mexico, U.S.A.
Calcite	BM.80311	Socorro, New Mexico
Turquoise	BM.80644	New Mexico, U.S.A.
Copper ps. azurite	BM.80699	Georgetown, Grant Co., New Mexico, U.S.A.
Copper ps. azurite	BM.80700	Georgetown, Grant Co., New Mexico, U.S.A.
Copper ps. azurite	BM.80701	Georgetown, Grant Co., New Mexico, U.S.A.
Vanadinite	BM.81443	near Lake Valley, New Mexico, U.S.A.
Quartz	BM.1934,17	Vaughn, Guadalupe Co., New Mexico, U.S.A.
Tellurium	BM.1934,607	Sylvanite, Grant Co., New Mexico, U.S.A.
Vanadinite	BM.1936,1343	Hillsboro, Sierra Co., New Mexico, U.S.A.
Vanadinite	BM.1968,1098	near Lake Valley, Sierra Co., New Mexico, U.S.A.
Vanadinite	BM.1968,1099	near Lake Valley, Sierra Co., New Mexico, U.S.A.
Fluorite	BM.1968,1116	Socorro, Socorro Co., New Mexico, U.S.A.
Kaolinite	BM.1985,MI35859	Mesa Alta, Canada del Camino, New Mexico, U.S.A.
Dolomite	BM.1975,282	near Fort Sumner, De Baca County, New Mexico, U.S.A.
Quartz	BM.1975,283	Yeso, De Baca Co., New Mexico, U.S.A.
Quartz	BM.1975,284	Yeso, De Baca Co., New Mexico, U.S.A.
Allanite	BM.1973,194	Las Cruces (near), Dona Ana Co., New Mexico, U.S.A.
Wilcoxite	BM.1980,545	Lone Pine Mine, Silver City, Grant Co., New Mexico, U.S.A.
Aurichalcite	BM.1908,392	Graphic mines, Magdalena, Socorro County, New Mexico, U.S.A.
Cerussite	BM.1908,402	Organ, Doan Ana Co., New Mexico, USA
Aragonite	BM.1939,224	near Lake Arthur, Chaves County, New Mexico, U.S.A.
Quartz	BM.1965,194	Yeso Creek, De Baca Co., New Mexico

Aragonite	BM.1965,195	Yeso Creek, De Baca County, New Mexico, U.S.A.
Aragonite	BM.1965,196	Fort Stanton cave, Lincoln County, New Mexico, U.S.A.
Gypsum	BM.1965,197	White Sands, Lincoln Co., New Mexico, U.S.A.
Staurolite	BM.1929,61	Taos Co., New Mexico, U.S.A.
Lepidolite	BM.1929,86	Taos County, New Mexico, U.S.A.
Microcline	BM.1929,88	Taos County, New Mexico, U.S.A.
Tantalite	BM.1968,999	Taos Co., New Mexico
Pickeringite	BM.1912,323	Tucumcari, New Mexico, U.S.A.
Halite	BM.1955,248	U. S. Potash mine, Carlsbad, Eddy Co., New Mexico
Allophane	BM.1968,726	Socorro Co., New Mexico, U.S.A.
Aurichalcite	BM.1907,637	Magdalena, Socorro County, New Mexico, U.S.A.
Copper	BM.1985,MI26879	Chino mine, Santa Rita, New Mexico, U.S.A.
Brecciated granodiorite	BM.1985,MI26882	N. side of Chino openpit copper mine, Santa Rita, New Mexico
Fluorite	BM.1937,368	Organ Mtns., Hansenburg dist., Socorro Co., New Mexico, U.S.A.
Fluorite	BM.1937,369	Organ Mtns., Hansenburg dist., Socorro Co., New Mexico, U.S.A.
Fluorite	BM.1937,370	Organ Mtns., Hansenburg dist., Socorro Co., New Mexico, U.S.A.
Piemontite	BM.1947,94	Pilar, Taos Co., New Mexico, U.S.A.
Sepiolite	BM.1947,151	Pinos Altos, Grant Co., New Mexico
Greenockite	BM.1947,250	Hanover dist., Grant Co., New Mexico, U.S.A.
Wulfenite	BM.1947,261	Red Hills mine, Hidalgo Co., New Mexico, U.S.A.
Fluorite	BM.1962,304	Mex Tex mine, Hansonburg dist., Socorra Co., New Mexico, U.S.A.
Brochantite	BM.1962,310	Mex tex mine Hansonbury dist Socorro co New Mexico
Linarite	BM.1962,311	Mex tex mine Hansonbury dist Socorro co New Mexico
Allanite	BM.1977,9	El Capitan, Lincoln Co., New Mexico, U.S.A.
Spurrite	BM.1985,MI32355	Luna Co., New Mexico, U.S.A.
Acanthite	BM.56451	Lake valley, New Mexico, U.S.A.
Wulfenite	BM.56858	Sierra Co., New Mexico
Wulfenite	BM.56866	Organ Mtns., Dona Ana Co., New Mexico, U.S.A.
Descloizite	BM.56878	Sierra Grande mine, Lake Valley, Sierra Co., New Mexico, U.S.A.
Lepidolite	BM.1985,73	Harding mine, Picuris Range, Taos Co, New Mexico.
Zircon	BM.1985,74	HardIng mine, Picuris Range, Taos Co., New Mexico, U.S.A.
Villiaumite	BM.1985,75	Point of Rocks, Colfax Co., New Mexico, U.S.A.
Fluorite	BM.1985,387	T and G prospect, Grant Co., New Mexico, U.S.A.

Tyuyamunite	BM.1985,573	F-33 mine, Grants, Valencia Co., New Mexico, U.S.A.
Nepheline	BM.1985,644	Point of Rocks Mesa, near Springer, Catron Co., New Mexico, U.S.A.
Selenium	BM.1964,699	Homestake mine, Ambrosia Lake, McKinley Co., New Mexico
Cuprite	BM.1996,37	Santa Rita, Grant Co., New Mexico, USA
Ramsdellite	BM.1996,164	Lake Valley, Sierra Co., New Mexico, USA
Lannonite	BM.1984,371	Lone Pine Mine, Catron Co., New Mexico, U.S.A.
Nepouite	BM.1984,395	Victorio, Luna Co., New Mexico, U.S.A.
Triangulite	BM.2010,316	Grants District, Cibola Co.,New Mexico, USA
Halite	BM.2013,49	10th Ore Zone, Intrepid East Mine, Carlsbad, Eddy Co., New Mexico, USA
Tyuyamunite	BM.1958,3	Valencia_Co., New_Mexico
Hydrogen-autunite	BM.1956,51	Valencia Co., New Mexico, USA
Altaite	BM.86888	Las Cruces, Dona Ana Co., New Mexico, U.S.A.
Spangolite	BM.1967,42	Blanchard claim, Bingham, Oscura Mtns, Socorro Co., New Mexico, U.S.A.
Brochantite	BM.1967,43	Blanchard claim, Bingham, Oscura Mtns, Socorro Co., New Mexico, U.S.A.
Murdochite	BM.1973,200	Blanchard claim, Bingham, Socorro Co., New Mexico, U.S.A.
Fluorite	BM.1978,477	Blanchard mine, Bingham, Socorro Co., New Mexico, U.S.A.
Brochantite	BM.1967,270	Blanchard Claims, Bingham, Socorro Co., New Mexico, U.S.A.
Sphene	BM.1972,200	Cuchillo, Sierra Co., New Mexico
Turquoise	BM.1907,887	Burrow Mts. near Silver City, New Mexico.
Turquoise	BM.1937,1578	New Mexico, U.S.A
Turquoise	BM.1937,1579	New Mexico
Azurite	BM.1909,324	Kelly, Socorro County, New Mexico, U.S.A.
Smithsonite	BM.81038	Kelly, Socorro County, New Mexico, U.S.A.
Smithsonite	BM.1912,272	Kelly mine, Socorro County, New Mexico, U.S.A.
Smithsonite	BM.1968,711	Kelly, Socorro County, New Mexico, U.S.A.
Aurichalcite	BM.1949,268	Kelly mine, Magdalena, Socorro County, New Mexico
Smithsonite	BM.1925,118	Kelly mine, Magdalena, Socorro County, New Mexico, U.S.A.
Smithsonite	BM.1948,411	Kelly mine, Magdalena, Socorro County, New Mexico, U.S.A.
Smithsonite	BM.1967,5	Kelly mine, Magdalena, Socorro County, New Mexico, U.S.A.
Smithsonite	BM.1985,MI30060	Kelly, New Mexico, U.S.A.
Quartz var. chalcedony	BM.1968,602	Deming, Luna Co., New Mexico
Quartz var. mocha stone	BM.53727	New Mexico
Andalusite var. manganandalusite	BM.1985,MI34959	Petaca, New Mexico, U.S.A.

Calcite var. paperspar	BM.1985,Lin19548	Magdalena, New Mexico, U.S.A.
Garnet var. almandine	BM.1985,71	East Grants Ridge, Cibola Co., New Mexico, U.S.A.
Garnet var. almandine	BM.1985,72	East Grants Ridge, Cibola Co., New Mexico, U.S.A.
Garnet var. pyrope	BM.53729	New Mexico, U.S.A.
Quartz var. smoky quartz	BM.1977,45	Tiro Estrella mine, El Capitan, Lincoln Co., New Mexico, U.S.A.
Vanadinite var. endlichite	BM.1985,MI5612	Sierra Grande Valley, Lake Valley, New Mexico
Vanadinite var. endlichite	BM.1985,MI7466	Sierra Co., New Mexico
Vanadinite var. endlichite	BM.1985,MI8987	Hillsboro, Sierra Co., New Mexico
Georgiadesite	BM.1985,302	Wind Mountain, Otero Co., New Mexico, USA
Scrutinyite	BM.1992,234	Blanchard mine, Bingham, New Mexico, USA
Squawcreekite	BM.1990,21	Squaw Creek mine, Catron Co., New_Mexico, USA
Maxwellite	BM.1990,22	Squaw Creek mine, Catron Co., New Mexico, USA
Lannonite	BM.1980,546	Lone Pine Mine, Silver City, Grant Co., New Mexico, U.S.A.
Rajite	BM.1980,547	Lone Pine Mine, Silver City, Grant Co., New Mexico, U.S.A,
Smithsonite	BM.1968,712	Kelly mine, Socorro County, New Mexico, U.S.A.
Clinoptilolite	BM.2005,27	Buckhorn, Grant County, New Mexico, USA
Wulfenite	BM.1905,31	Organ Mtns., Dona Ana Co., New Mexico, U.S.A.
Quartz	BM.1905,39	Organ, New Mexico
Fluorite	BM.2005,101	[Wilcox distrcit], Catron Co., New Mexico, USA
santa rita stock granodiorite	BM.1985,MI29030	East wall, South Pit, Chino Mine, [Santa Rita], New Mexico, [USA]
post ore	BM.1985,MI29028	Cuts Santa Rita stock, between N & S Pits, Chino Mine, [Santa Rita], [New Mexico], [USA]
Chalcocite ore	BM.1985,MI26880	Chino Mine, Santa Rita, New Mexico, [USA]
cap rock	BM.1985,MI26881	Chino Mine, Santa Rita, New Mexico, [USA]
chalcocite granodiorite	BM.1985,MI29031	South Pit, Chino Mine, [Santa Rita], New Mexico, [USA]
native copper	BM.1985,MI29029	Chino Mine, [Santa Rita], Central Mining District, New Mexico, [USA]
granodiorite sphene	BM.1985,MI29037	Bullfrog Mine, [New Mexico], [USA]
garnet replacing shale	BM.1985,MI24023	Hanover mine, New Mexico, U.S.A.
Ilvaite	BM.1985,MI24020	Hanover mine, New Mexico, U.S.A.
Granodiorite	BM.1985,MI24015	Hanover mine, New Mexico, U.S.A.
Epidote	BM.1985,MI24026	Hanover mine, New Mexico, U.S.A.
Quartz-diorite-porphyry-dyke	BM.1985,MI24016	Hanover mine, New Mexico, U.S.A.
Quartz-latite-dyke	BM.1985,MI24017a	Hanover mine, New Mexico, U.S.A.
Andradite ps. limestone	BM.1985,MI24018	Hanover mine, New Mexico, U.S.A.

Magnetite	BM.1985,MI24021	Hanover mine, New Mexico, U.S.A.
Quartz-latite-dyke	BM.1985,MI24017	Hanover mine, New Mexico, U.S.A.
Limestone	BM.1985,MI24013	Hanover mine, New Mexico, U.S.A.
Zinc Ore	BM.1985,MI29017	[Groundhog Mine], [In the area of Fierro-Hanover], New Mexico, [USA]
Lower blue limestone	BM.1985,MI29015	[Groundhog Mine], [In the area of Fierro-Hanover], New Mexico, [USA]
epiodte replacing diorite	BM.1985,MI24025	Hanover Mine, [Hanover], New Mexico, USA
parting shale	BM.1985,MI24014	Hanover Mine, [Hanover], New Mexico, USA
Hedenburgite-sphalerite ore	BM.1985,MI24005	Hanover mine, New Mexico, U.S.A.
Galena-sphalerite ore	BM.1985,MI24008	Hanover mine, New Mexico, U.S.A.
Magnetite-sphalerite ore	BM.1985,MI24009a	Hanover mine, New Mexico, U.S.A.
altered hanover limestones	BM.1985,MI29018	[Groundhog Mine], [In the area of Fierro-Hanover], New Mexico, [USA]
garnet-sulphide ore	BM.1985,MI24006	Hanover Mine, [Hanover], New Mexico, USA
magnetite-blende ore	BM.1985,MI24009	Hanover Mine, [Hanover], New Mexico, USA
smithsonite	BM.1985,MI24012	Hanover Mine, [Hanover], New Mexico, USA
Auiferous iron ore	BM.53743	Cortze mine, New Mexico, USA
ore	BM.1985,MI29033	[Groundhog Mine], [In the area of Fierro-Hanover], New Mexico, [USA]
sphalerite ore	BM.1985,MI29034	Groundhog Mine, [In the area of Fierro-Hanover], New Mexico, [USA]
upper limestone	BM.1985,MI29024	[Groundhog Mine], [In the area of Fierro-Hanover], New Mexico, [USA]
south lode of hanover pluton	BM.1985,MI29021	[Groundhog Mine], [In the area of Fierro-Hanover], New Mexico, [USA]
hanover limestone	BM.1985,MI29019	[Groundhog Mine], [In the area of Fierro-Hanover], New Mexico, [USA]
Copper ore	BM.1985,MI29006	Hanover Mountains Area,Central Mining District, New Mexico, [USA]
sphalerite	BM.1985,MI29025	Oswaldo No2 Mine, New Mexico, [USA]
granodiorite rock	BM.1985,MI29022	South End Pewabic Mine Area, New Mexico, [USA]
Silver Ore	BM.1985,MI2486	Ralston, Virginia Co., New Mexico, USA (Morgan 1870)
magnetite ore	BM.1985,MI29012	Union Hill, New Mexico, [USA]
magnetite dolomite ore	BM.1985,MI29014	Union Hill, New Mexico, [USA]
ore	BM.1985,MI29036	Groundhog Mine, [In the area of Fierro-Hanover], New Mexico, [USA]
epidotizied shale	BM.1985,MI29020	[Groundhog Mine], [In the area of Fierro-Hanover], New Mexico, [USA]
sphelerite	BM.1985,MI29026	Oswaldo No2 Mine, New Mexico, [USA]
quartz monzonite	BM.1985,MI29032	Central Mining District, New Mexico, USA
Silver ore	BM.53738	Cerillos Mtns., 17 miles from town of New Mexico, New Mexico, USA (from Arny, Gov. NM 1880
Silver ore	BM.53734	Cerillos Mtns., 17 miles from town of New Mexico, New Mexico, USA (from Arny, Gov. NM 1880
Silver ore	BM.53733	Cerillos Mtns., 17 miles from town of New Mexico, New Mexico, USA (from Arny, Gov. NM 1880

Silver ore	BM.53736	Cerillos Mtns., 17 miles from town of New Mexico, New Mexico, USA (from Arny, Gov. NM 1880)
Silver ore	BM.53735	Cerillos Mtns., 17 miles from town of New Mexico, New Mexico, USA (from Arny, Gov. NM 1880)
Silver ore	BM.53739	Cerillos Mtns., 17 miles from town of New Mexico, New Mexico, USA (from Arny, Gov. NM 1880)
Silver ore	BM.53737	Cerillos Mtns., 17 miles from town of New Mexico, New Mexico, USA (from Arny, Gov. NM 1880)
Silver ore	BM.1985,MI3001	Southern New Mexico, USA (from Ryan 1872)
Silver ore & chlioride of silver	BM.1985,MI2999	Southern New Mexico, USA (from Ryan 1872)
Silver ore	BM.1985,MI3004	Southern New Mexico, USA (from Ryan 1872)
Silver ore	BM.1985,MI3003	Southern New Mexico, USA (from Ryan 1872)
Silver ore	BM.1985,MI3000	Southern New Mexico, USA (from Ryan 1872)
Silver ore	BM.1985,MI3002	Southern New Mexico, USA (from Ryan 1872)
quartz monzonite	BM.1985,MI29009	Central Mining District, New Mexico, [USA]
granodiorite stockwork	BM.1985,MI29010	Central Mining District, New Mexico, [USA]
chalcocite ore	BM.1985,MI29008	Central Mining District, New Mexico, [USA]
Silver ore	BM.1985,MI2691	Burro Mines, New Mexico, [USA] (Ryan 1871)
[geerite]	BM.1984,262	Cuchillo, Sierra Co., New Mexico, U.S.A.
Melanotekite	BM.1926,1467	Hillsboro, Sierra Co., New Mexico, U.S.A.
Turquoise	BM.1927,1949	Los Cerillos, Sante Fe Co., New Mexico, U.S.A.
Hydrogen-autunite	BM.1958,343	Paguata, Valencia_Co., New_Mexico
Haiweeite	BM.1965,63	Jackpile mine, Laguna, Valencia Co., New Mexico
Cerargyrite	BM.1985,Lin18189	Silver City, New Mexico
Cerargyrite	BM.1985,Lin18187	Silver City, New Mexico
Blodite	BM.1985,Lin21535	New Mexico
Nickel-skutterudite	BM.83283	Grant Co., New Mexico, U.S.A.

* BM no.: (Registration)/BM Number: (BM Number)