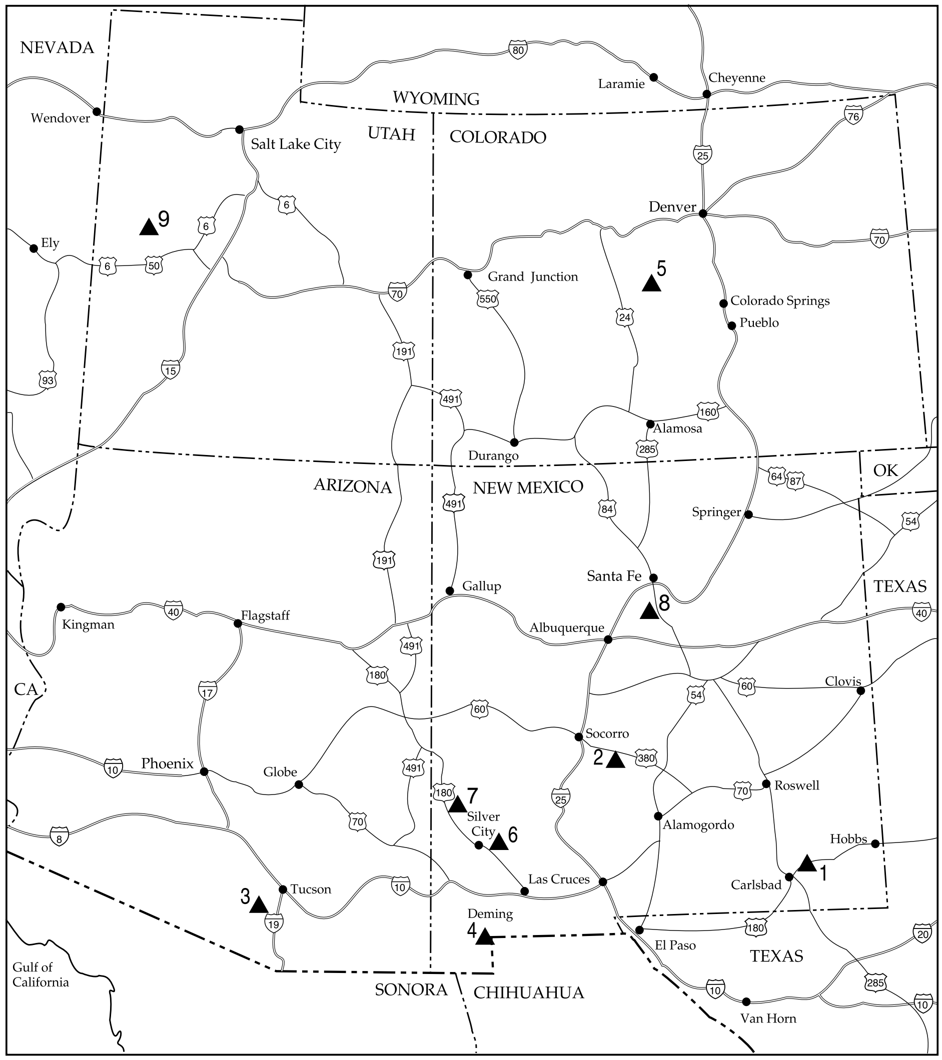
Abstracts

New Mexico Mineral Symposium

The Thirty-first Annual New Mexico Mineral Symposium was held November 13 and 14, 2010, at New Mexico Institute of Mining and Technology, Socorro. Following are abstracts from all talks given at the symposium.



Index map showing the locations referred to in the abstracts.

"BLUE ICE": COLLECTING HALITE AND ASSOCIATED MINERALS FROM THE CARLSBAD POTASH MINES, *Philip Simmons*, 2422 Mountain View, Carlsbad, New Mexico 88220

(Location 1 on the index map.)

Most people do not think of evaporite minerals as truly collectible, with halite from Poland or Searles Lake being possible exceptions. However, within the past three years an occurrence of blue and purple halite has been revisited in the Intrepid Potash East mine that has redefined the quality of colored halite that has come from New Mexico into world class material. An assortment of other interesting minerals makes the storied Carlsbad Potash district a good, if surprising, locality for collecting New Mexico mineral specimens.

Among local New Mexico collectors, blue halite has long been known as a collectible mineral from the Carlsbad Potash district in southeastern New Mexico, but until recently the majority of the available material was sparse and not of very good quality. This changed in the summer of 2007 when the author started work at Intrepid Potash LLC as a summer mining engineering intern. The author's interest was first piqued when the chief mine engineer, Tom McGuire, mentioned that blue halite had been encountered during the mining that took place in the 1970s and 1980s. One or two pieces of the blue halite were sitting on a shelf of minerals that he had collected in the 15 years he had been an engineer at the potash mines. While not of exceptional quality, the specimens were still colorful enough to trigger the author's love for New Mexico minerals. When questioned further about the halite occurrence, Tom recalled driving along in the old tunnels and seeing stringers of blue halite appear in the ribs (tunnel walls) that led into a room that was "almost solid blue halite from top to bottom." A trip to the old, worked out area was eagerly anticipated for the next 10 weeks of the internship, but it wasn't until the very last day of work that the collecting trip was arranged. Needless to say, this first trip turned out to be one of the most memorable ventures in the author's 20+ years of collecting great minerals in New Mexico.

Since that first collecting trip, the author has been on several more trips to the same area and to other levels of Intrepid's East mine and West mine that produce an array of collectible evaporite minerals such as langbeinite, carnallite, gypsum, and leonite. Although these minerals are not typically found in most collections, they provide an interesting picture into the geology and mineralogy of evaporite deposits.

COLLECTING THE MICHIGAN COPPER COUNTRY, *Tom Rosemeyer*, tajmahal@gilanet.com, P.O. Box 369, Magdalena, New Mexico 87825

The Michigan copper country, also known as the Lake Superior native copper district, is located on the sparsely populated, isolated, and scenic Keweenaw Peninsula that juts out into Lake Superior near the western end of Upper Michigan. The area is inhabited by a race of people called Yoopers that speak a strange dialect indigenous to the area. The summer season can be a mixture of cold-mild-hot weather with a short growing season. From mid-spring to mid-summer the Keweenaw "bug season" is in full swing and is an entomologist's paradise with swarms of mosquitoes, black flies, deerflies, and horseflies filling the skies. The Keweenaw winters can be long and cold with lake-effect snow accumulations of 200–300 inches not uncommon.

The Keweenaw Peninsula rests along the arch-shaped Middle Proterozoic midcontinent failed rift system that stretches for more than 1,200 mi in the Great Lakes region. Over a period of geologic time from 1,109 to 1,060 Ma (million years ago) the rift valley was filled with thick sequences of lava flows and intercalated sedimentary beds. The 9,000–15,000-ft-thick volcanic sequence is made up of more than two hundred individual basaltic and andesitic flows that comprise the Portage Lake Volcanics (PLV) of the Keweenawan series.

The main part of the Lake Superior native copper district lies within the band of PLV that forms the south limb of the Lake Superior syncline. Native copper was deposited in fissure veins, amygdaloidal flow tops, and conglomerate beds during the same general period of mineralization. The age of mineralization in each lode is probably the same, so the lodes themselves are contemporaneous even though the flows and conglomerate beds are of differing ages. The age of copper mineralization is about 1,060 to 1,050 Ma and corresponds to the formation of the Keweenaw fault, which produced additional faults and fractures that channeled the movement of ore fluids. Copper mineralization occurred sporadically along the full length of the PLV but is mainly concentrated in a 28-mi-long zone that extends from Painsdale, Michigan, to just past Mohawk, Keweenaw County.

The basaltic lava flows make up about 95% of the PLV by volume, and the seven major amygdaloidal lodes that were mined produced 5,966,608,021 (56.7%) of the 10,525,922,136 pounds of copper that was recovered from 1844 through 1976. The conglomerate lodes produced 4,387,258,454 pounds of copper (41.7%), whereas the early mined fissure veins produced only 172,055,661 pounds (1.6%) of the total PLV production.

The world-renowned Michigan copper district is host to 135 verified mineral species, plus another 12 that have been reported. Mining started in the district in 1844, supplying specimens to mineral collectors and museums until 1995 when the sediment-hosted chalcocite orebody at the White Pine mine ceased operations. It appears that the first collections were assembled by mine captains who were in charge of the various mining operations and who proudly displayed their specimens in "China cabinets." As the district became better known, more collectors became aware of what was coming out of the ground and sought to acquire specimens for their collections. A brisk business in high-grading specimens by bosses and miners to supply collectors' needs developed. This profitable practice continued until just a few years ago when mining came to an end in the district.

Native copper along with native silver occurred as beautiful single and groups of copper crystals in all three of the different types of lodes mined (fissure, amygdaloidal, and conglomerate). Native silver also occurred as crystallized groups and was much sought after throughout the whole period of mining. The world famous multi-colored porcelaneous datolite nodules that occurred in the fissure veins and blanket-type amygdaloidal lodes are still highly prized by collectors. Other crystallized minerals that occurred in the various lodes include quartz, calcite, epidote, prehnite, pumpellyite, analcime, apophyllite, and barite.

Today, all mining is dormant in the district, but collecting continues on the accessible mine dumps that are open to collectors. The heyday of mineral specimen production is long gone, but every year crystallized copper and silver groups along with datolite nodules are still being recovered by mineral collectors.

If you visit the copper country on a collecting trip, a must stop is the Seaman Mineral Museum, located on the campus of Michigan Technological University. The museum has on display the world's finest specimens of copper, silver, datolite nodules, and accessory minerals from the district, and the admission is FREE. On your menu should be dining on the famous Cornish pasty, which is still a staple meal in the copper country.

BLASTING FROM THE PAST, *Jack Purson*

The use of inexpensive and easy-to-obtain explosives allowed miners to explore and develop many orebodies large and small beginning in the late 1800s. Miners often left behind remnants of their activity and, together with corporate explosives history, tell an interesting story. A brief history of the major explosives companies, their products, how they were used, and where they may be found will be discussed. Blasting artifacts related to mining, especially blasting cap tins, from the western U.S. and territories will be examined and placed in a context of rarity and collector interest.

THE RARE AND UNCOMMON MINERALS FROM THE HANSONBURG MINING DISTRICT, NEW MEXICO, *Ramon S. DeMark*, 8240 Eddy Avenue, NE, Albuquerque, New Mexico 87109; and *R. Peter Richard*s, 154 Morgan Street, Oberlin, Ohio 44074

(Location 2 on the index map.)

The Hansonburg mining district encompasses the Blanchard mine group, the Mex-Tex group, the Royal Flush mine, Desert Rose mine, and the Hansonburg copper mine in Socorro County, New Mexico. Many of the minerals from this district are well known in the U.S. and around the world because of their aesthetics and availability as specimens. Fluorite, brochantite, linarite, and spangolite specimens have delighted mineral enthusiasts for decades. There are a large number of other mineral species also occurring within this district that are less well known but are also appealing and fascinating in their own right. That they are less well known is primarily due to the fact that they occur usually as micro crystals or have only been rarely encountered. Many of these species occur in well-crystallized morphologies that have not been seen by most collectors of Hansonburg district minerals. This is particularly true of collectors that may not have an inherent interest in micro crystals or that may not have recognized rare or uncommon minerals in the field.

To obviate this circumstance, the authors will present images of these minerals that we believe will inspire enthusiasm for these underappreciated species. Minerals such as murdochite, plattnerite, corkite, caledonite, fraipontite, jarosite, and pyromorphite, while not rare, do exhibit distinct habits and morphologies that have not been seen by most collectors. Other species, such as otavite, cinnabar, scrutinyite, atacamite, sulphur, cuprite, and copper, have, for the most part, rarely been observed or collected. Many of the images in this program will document the variety of habits shown by common minerals such as wulfenite, brochantite, and the nature of uncommon minerals such as plumbogummite, libethenite, tsumebite, and turquoise. It is hoped that this presentation will acquaint collectors with the rare and uncommon minerals of the Hansonburg district and motivate a more detailed surveillance for their presence. To find and identify them in the field is a thrill!

THE HUNT FOR SIERRITA MOUNTAIN AQUAMARINE, *Barbara Muntyan*, Tucson, Arizona

(Location 3 on the index map.)

Aquamarine from the Sierrita Mountains in south-central Pima County, Arizona, is a supposedly lost locale. This presentation summarizes how one goes about "refinding" such a locality. It is basically a four-step process: 1) review the literature, 2) look at available specimens in both public and private collections, 3) interview collectors who were there 40 to 50 yrs ago for clues, and 4) map out a strategy for an on-the-ground search.

Aquamarine is not abundant in Arizona, especially in large crystals. There are a few reported locales, including one in the Sierrita Mountains in Pima County. Recently, aquamarine crystals were collected in the Santa Teresa Wilderness area of Graham County, including one excellent spray of terminated crystals approximately 2½ inches wide, without matrix, now in the collection of Evan Jones.

In September 2008, I obtained a single aquamarine crystal; it was a cloudy sky-blue color, with minor mica association, 2¼ inches long, and without matrix. The specimen was labeled as having been found at the "*Palo Verde claim, Sierrita Mountains, Pima County, Arizona*." The label was one of Les Presmyk's, so I called him to find out more about the specimen's origin. He told me that it had come from the late Dick Jones, the claim designations of Palo Verde and Bella Donna claims were given by Jones, and that Jones had collected this crystal and others in the 1960s. Presmyk had no reason to doubt the information. Thus began my quest to find this lost aquamarine locality.

Neither the Bella Donna nor the Palo Verde claims were ever patented, so there is no record of location. Moreover, Dick Jones was known to rename and/or "relocate" his digging spots in order to discourage others horning in on his finds (the well-known Catron County, New Mexico, purple octahedral fluorites being an example).

Checking the literature, only one locality was found for Pima County, named the Bella Donna claim. "*Massive and crystals of blue-green...in quartz veins in granite*" were described by Galbraith and Brennan in 1959 and subsequently repeated in both editions of the *Mineralogy of Arizona* by Anthony et al. F. L. Ransome in "Ore deposits of the Sierrita Mountains of Arizona" in USGS Bulletin 725, wrote in 1921 that the "Sierrita Mountains consist essentially of an intrusive granitic core flanked by more or less metamorphosed rock of sedimentary and eruptive origin." There are a number of unpublished theses on the Sierrita Mountains in the University of Arizona libraries, but they shed no light on the actual aquamarine occurrences, although they are referenced.

The next step was looking at aquamarine specimens that were from the Sierrita Mountains in the other collections. The Arizona Sonora Desert Museum has two specimens labeled from the Sierrita Mountains. The Flandreau Museum has several specimens from different pockets in the Sierritas. Evan Jones owns a fine little matrix aqua about 1¼ inches long, deep sky blue, and quite gemmy, supposedly from the Bella Donna claim. Les Presmyk has two crystals: one is a toenail size single crystal from the same pocket as Evan's. The other specimen is a fine 3-inch crystal on massive white quartz matrix and is a cloudy medium sky blue, labeled from the Palo Verde claim. Both of Presmyk's pieces were supposed to have been collected by Dick Jones and were previously in the collection of the late Tom McKee of Scottsdale, Arizona. Yet another collector had a matrix piece in his rock garden, which contained several sky-blue crystals on massive white quartz with minor mica; he presented this specimen to me as a gift.

The only factual bit of information from the literature search was that aquamarine has been found in quartz veins in granite. This was certainly compatible with the musings of old-time collectors. Thus a review of the geology and topography of the Sierrita Mountains seemed to be the next step. Then would follow a slow, systematic program of looking for white quartz float while covering as much ground as possible. This strategy pointed the way to at least narrowing down the search area of the roughly 75 mi^2 of rugged Sierrita Mountains.

This mountain range is more or less lens-shaped, about 15 mi long from north to south and perhaps 5–6 mi wide. There are virtually no roads into the heart of the range. Mission Road bounds the mountains on the east and State Highway 286 on the west. Samaniego Peak is the highest in the mountain chain, at 6,000 ft. There are broad bajadas flowing outward in all directions, and these are cut by numerous washes and arroyos. Vegetation is sparse: grasses, ocotillo, cholla, barrel cactus, mesquite, and palo verde trees, and not much more. The San Javier section of the Tohono O'odham Reservation bounds the north side of the Sierritas. Most of the mountain range is public land (BLM or state), much of it leased out for grazing. There are several large ranching operations that run Chalois cattle, a religious commune on the east side, and a number of smaller properties including the Wrangler Ranches, Ocotillo Ranches, and the Diamond Bell Ranch subdivisions of 1 to 5 acres on both the east and west sides.

On one of the expeditions to look for aquamarine, my collecting partner, Sheila Powell of Tucson, and I stopped the vehicle on a hillside because the track we were following clearly cut a white quartz dike. As soon as we stopped and got out, I spotted telltale sky blue—small, weathered aquamarine crystals to ½ inch on white, massive quartz. By most standards, these were pretty poor specimens, but they *were* aquamarine. And they were our first personal validation of the earlier reports. A subsequent grid search of that hill produced about a dozen other example of aquamarine, all massive and all found as crack-filling between massive white quartz. Over the next two years, a lot of time, energy, and will power has been spent trying to locate more—and hopefully better—aquamarine (and perhaps the "lost" Bella Donna and Palo Verde claims).

The quartz float in the Sierritas is generally flat-lying and masked by tall grasses and is not easy to spot until you are right on it. As the grid search was extended, we did come upon several zones with scattered pegmatite outcrops. This basically meant finding concentrated white quartz float. From experience, we knew that white quartz alone without coarse feldspar and mica, preferably coarse mica, was less likely to contain aquamarine crystals, although some have been found enclosed in massive white quartz alone and several aquamarine crystals occurred in massive feldspar and even in the granite itself.

To date, we have located and inventoried approximately 300 separate quartz outcrops in 12 distinct pegmatite regions. They occur from the northwest side of the Sierrita Mountains all the way around to the middle of the east side of the range. So far, we have found ten pegmatite outcrops that contain aquamarine crystals. That is slightly more than 3%. Years ago, writing on the Pikes Peak granite in Colorado, I estimated that for every ten holes dug, one contained a crystal pocket, and for every ten such pockets, only one contained good crystals. This is a 1% success ratio, so we are having somewhat better luck in Arizona.

It would be nice to think that we had found either the lost Bella Donna or the Palo Verde claim, and we probably have. In fact, some of our specimens look very similar to the matrix piece owned by Les Presmyk and labeled "Palo Verde claim." We have collected several flats of aquamarine specimens on matrix from various crystal pockets. However, neither Dick Jones nor the Bella Donna operators likely would have left that much material in plain sight. While it is possible the pegmatites further weathered and broke down, thereby exposing these specimens, it is unlikely, given the dryness of the area (no frost heaving).

My opinion is that there is surely more aquamarine "out there," assuming you search in the right geology and are persistent enough. That may also be true for other Arizona aquamarine locales. And for all mineral locales. Proper research and a lot of persistence will yield results.

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COLLECTING COAL MINERS' CARBIDE LAMPS, *David Thorpe*, 130 E. Tierra Buena Lane, Phoenix, Arizona 85022

Open flame miners' carbide cap lamps were used in American coal mines during the first quarter of the twentieth century. The presentation briefly reviews the initial manufacturing history and then focuses on aspects important to today's collector. This will include a discussion of which lamps are most collectible and what lamps are less so. It will discuss the fine points one should look for in terms of typical flaws and missing parts. It will also discuss cleaning techniques and how this may reduce or improve value. Dave Thorpe has written two books relating to miners' carbide lamps and is considered an expert in the field.

GEOLOGY AND MINERALOGY OF MONT SAINT-HILAIRE, QUEBEC, CANADA, *R. Peter Richards*, Morphogenesis, Inc., Oberlin, Ohio

Mont Saint-Hilaire is one of the Monteregian Hills, a series of igneous intrusions of Cretaceous age that form an arc across the Saint Lawrence Valley, a rift valley of Precambrian to Paleozoic age. The Monteregian Hills have been interpreted as resulting from a mantle "hot spot," though consensus about this hypothesis is lacking. Rocks relatively rich in silica are confined to the eastern end of the arc, while silica-poor rocks are typical of the western end. Mont Saint-Hilaire is near the western end of the arc, and is composed generally of syenites and other silica-poor igneous rocks. Oka, the west-most "hill," is composed primarily of carbonatites. Mont Saint-Hilaire was formed by several intrusive events, each of which influenced the mineralogy of the older intrusions. In addition, the rising magma passed through various sedimentary units, including limestones and evaporates, which altered the chemistry of the magma and yielded xenoliths to the rising melt.

The geological complexity of Mont Saint-Hilaire's origin has led to an extremely varied and unusual mineralogy, rich in rare earth elements, titanium, zirconium, beryllium, and boron. More than 400 mineral species have been described from the Poudrette quarry alone, and approximately 50 unknowns are yet to be described. A number of species are found only at Mont Saint-Hilaire, or are found only there as well-formed crystals. The sequence of intrusions produced conditions that favored a wide range of crystal habits among many minerals, as well as the development of pseudomorphs and epitactic relationships. An appropriate New Mexico comparison would be Point of Rocks, where rocks of similar chemistry but simpler genesis are found. Point of Rocks has 52 species (according to Mindat.org). All but four of them are also found at Mont Saint-Hilaire.

This talk will provide an overview of the geology and systematic mineralogy of Mont Saint-Hilaire, and illustrate selected species that are characteristic of the unusual minerals found there. It will not cover all 400 species!

THE GREATER ALMA MINING DISTRICT: A COLORADO MINING LEGEND, *Steven Wade Veatch, C. Robert Carnein, Dan Alfrey, Jo Beckwith, Marge Breth, Christie Wright, Robert Kane, Jean Kane, Norma Engleberg, Willie Hoffmeister, Connie Hoffmeister, Mary O'Donnell, Lorrie Hutchinson, Brent Geraughty, Wayne Johnston, Jessie Springer*, Lake George Gem and Mineral Club, Lake George, Colorado 80827

(Location 5 on the index map.)

The greater Alma mining district occupies an area in northwestern Park County, Colorado. The crest of the Mosquito Range, with four peaks over 14,000 ft, forms the western boundary of the district, and the valley of the South Platte River lies on the east.

Gold prospecting by Spanish explorers dates to before the 1850s (Misantoni et al. 1998). The first wave of mining in the area was for placer gold, which started in 1859 at Buckskin Gulch and lasted through the early 1860s. The second wave of mining was for silver and started in the 1870s.

Most of the district's more than 100 adits, shafts, prospects, and named mines are above tree line and were developed in the 1860s and 1870s. These high-elevation mines were called "aerial mines" by newspapers at the time. Mining at these elevations required new mining methods and technologies to be developed. Miners also had to adapt to the extreme winter conditions at high elevations.

The small town of Alma, established in 1873, is the only important community in the district, though Park City and a few other towns had significant populations during the boom years that extended from 1860 to the early 1940s. Significant production of gold, silver, lead, and zinc extended into the 1950s and later in some mines.

General geology

The Mosquito Range is an east-dipping tilted fault block consisting mostly of Paleozoic sedimentary rocks and Cretaceous and Tertiary felsic sills and stocks (Scarbrough 2001). Thrust faults, reverse faults, and normal faults offset the sedimentary rocks and act as loci for gold-silver-lead-zinc mineralization dating to about 35 Ma. Major faults include the steeply northeast-dipping London fault, a reverse fault in the southwest corner of the district, and the northeast-dipping Frontal fault, a reverse fault in the northeast corner of the district. The London fault is flanked by an anticline to the northeast and a syncline to the southwest, both of which preceded and were modified by the faulting. Many of the highest gold and silver values in the district occur within a few tenths of a mile to a few miles of the major faults. Placer deposits occur in both Quaternary and Pleistocene deposits along streams draining the east flank of the Mosquito Range.

Mining subdistricts

Scarbrough (2001) divided the greater Alma mining district into six smaller units: the Alma placers, Consolidated Montgomery, Buckskin, Horseshoe, Mosquito, and Pennsylvania subdistricts. Boundaries of these subdivisions are somewhat arbitrary, and the deposit types overlap from one subdivision to the next. Of the six, we will focus on those that were most productive: the Mosquito, Alma placers, Buckskin, and Consolidated Montgomery subdistricts (arranged in order of decreasing gold production). Production figures came from Scarbrough (2001).

Production from the **Mosquito subdistrict**, 5–7 mi west of Alma, included at least 570,296 ounces of gold, 446,698 ounces of silver, 331 tons of copper, 7,237 tons of lead, and 300 tons of zinc through 1956. (Production figures for the periods between 1860 and 1932 and after 1956 are not available for the district as a whole.) Paleozoic sedimentary rocks, including the Mississippian Leadville Limestone and Pennsylvanian Minturn Formation, host most of the individual deposits. Included are veins, fault/fissure deposits, and mantos associated with Tertiary (?) porphyry sills (Scarbrough 2001). Minor production came from placers and some vein-type uranium deposits in Proterozoic granite and metamorphic rocks.

Major mines of the Mosquito subdistrict include those of the London mine group (London, North London/Vienna, South London, London Extension, and Butte mines), the Hock Hocking, Orphan Boy, and the Fanny Barret.

Mining commenced in 1873, and intermittent production continued through 1989. Johansing and Misantoni reported proven, probable, and inferred resources of 502,000 short tons of ore ranging between 0.10 and 0.41 ounces per ton of gold (Scarbrough 2001).

The **Alma placers** occupy an area on the east side of the South Platte River immediately northeast, east, and southeast of the town of Alma. Total production is estimated at 20,271 ounces of gold and 4,140 ounces of silver between 1932 and 1953. Gold occurs mainly in till and outwash related to the Wisconsin Stage of glaciation. Concentrations of gold occur in localized channels and at the boundary between Pleistocene gravels and Paleozoic shale and sandstone bedrock. Currently, production at the Alma Placer mine averages about 600 ounces per year of 82% gold and 18% silver.

The Snowstorm dredge was built in San Francisco between 1939 and 1941 and assembled at the mining site in Park County. The four-level dredge was in use by 1941 and then shut down during World War II, and then resumed operations after 1947 for 16 months. The dredge operated briefly in 1976. The Snowstorm dredge is the largest and last dragline dredge in Colorado. It processed 600 tons of gravel an hour in the goldfields between Alma and Fairplay.

The **Buckskin** (or **Buckskin Joe**) **subdistrict** includes the mines of the Phillips group, the Excelsior, the Ten-Forty, and the Criterion. The Buckskin subdistrict is located approximately 2–2.5 mi west of Alma. Settled in 1860, the area produced at least 19,782 ounces of gold, 131,219 ounces of silver, 182 tons of copper, 730 tons of lead, and 4,500 tons of zinc between 1932 and 1957. Deposits include mantos in the Leadville Limestone; veins and mantos in the Devonian Parting Quartzite, the Cambrian Sawatch Quartzite, and the Peerless Shale; and minor placers.

The **Consolidated Montgomery subdistrict** occupies an area at or near the crest of the Mosquito Range, approximately 5–7 mi west and northwest of Alma. Important mines include the Russia, Moose, Dolly Varden, Atlantic-Pacific, the Ling, and the Magnolia. Production came mainly from precious- and base-metal-sulfide veins in the Sawatch Quartzite; silver-lead mantos and veins in the Leadville and (Ordovician) Manitou limestones; and minor oxidized deposits and placers. Metals recovered between 1932 and 1957 included nearly 6,000 ounces of gold, 79,131 ounces of silver, 19 tons of copper, 100 tons of lead, and 41 tons of zinc. Today the Montgomery Dam, part of Colorado Springs water supply, fills the valley with water where the town of Montgomery once stood.

Minerals

A search of Eckel 1997; MINDAT.org; articles in *The Mineralogical Record* (including Murphy and Hurlbut 1998 and Misantoni et al. 1998); and other sources suggests that more than 87 minerals have been reported for the deposits of the greater Alma mining district. Of these, at least 60 are reported to occur in the Sweet Home mine (Moore et al. 1998). In part, the variety of minerals in the Sweet Home probably reflects the careful collection of samples by Collector's Edge Minerals, who exploited the spectacular rhodochrosite finds of the 1990s. Relatively few documented samples are preserved from other Alma district mines, and most of those are not aesthetically attractive.

The following minerals are reported to occur in the district, but more exhaustive research would no doubt add more to the list.

The district's mining activity, combined with other mining camps in the region, contributed to the growth of Colorado and accelerated the settlement of the West. Today old mining headframes, abandoned tramways, deserted mills, and rusting mining equipment remain as symbols of Colorado's mining heritage.

acanthite	dickite	jalpaite	scheelite
actinolite	digenite	jamesonite	serpierite
aikinite	dolomite	jarosite	silver
allanite (?)	enargite	kutnahorite	smithsonite
altaite	epidote	lanarkite	sphalerite
anglesite	ferrimolybdite	luzonite	spionkopite
ankerite	fluorapatite	malachite	stephanite
azurite	fluorite	matildite (?)	stromeyerite
barite	freibergite	mawsonite	sulfur
beaverite	galena	melanterite	svanbergite
biotite	goethite	metatorbernite	sylvanite
bornite	gold	molybdenite	tennantite
brannerite	goyazite	muscovite	tetrahedrite
calcite	greenockite	orthoclase	topaz
cerussite	helvite	petzite	tremolite
chalcanthite	hematite	"plagioclase"	triplite
chalcocite	hemimorphite	polybasite	uraninite
chalcopyrite	hessite	pyrite	xenotime-Y
chlorite	hornblende	pyrrhotite	zinkenite
chrysocolla	hübnerite	quartz	zircon
copper	hydrozincite	rhodochrosite	
covellite	illite	rutile	
cuprite			

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MT. WATSON FLUORITE, GRANT COUNTY, NEW MEXICO

Travis Cato, Little Burro Gems & Minerals, 1808 N. Highway 1, P.O. Box 481, San Antonio, New Mexico 87832

(Location 7 on the index map.)

I was sitting on a boulder finishing lunch, reading the ingredients of a can of potted meat (Parts? What kind of parts? Some things are best left unknown.) I was thinking that it was a long way into the collecting location for nothing, when I heard my friend, John, yell he'd found a pocket. This was in the early 1980s and we had been going through the book, Fluorspar Resources of New Mexico, Bulletin 21, looking for possible places to collect. We came to this place, among others, known as the Last Chance and Watson Mountain prospects. Except in winter, this is a great place to camp, and it provided many years of good collecting.

The area is located on the west side of the Mogollon Mountains, and the rocks consist of finely porphyritic and agglomeratic andesite. The area is highly faulted with one fault parallel to the Gila River. Much of the ground is brecciated. It is in this brecciated volcanic rock that most of the specimens were collected.

The fluorite is crystallized in the octahedral form with dodecahedral and cub-dodecahedral overgrowths. Some crystals exhibit cube overgrowths. Crystals up to two inches were found. Colors of the fluorite include: green, purple, zoned green-purple, white, and some pink. Some, but not all of the octahedral fluorite is covered with a thin, ugly layer of drusy quartz. This can be stripped off with hydrofluoric acid. We developed a technique to cover the matrix with raw bee's wax, stripping the quartz, then removing the wax. The luster on the octahedrons is very bright. The color seems to be stable. Some of the crystals are sensitive to ultrasonic cleaning.

After I cleared up my lunch mess, (tossed the empty potted meat can), I went over to see what John was collecting, not bad stuff. I then found a pocket of my own.

THE MINA DEL TIRO, "THE LOST PAGES,"

Craig Pearson, capgun_hunter@msn.com, Albuquerque, New Mexico, "You claim Jumpin' bum" music by, Grez Green

(Location 8 on the index map.)

Earlier this year I spent the morning collecting specimens at the Mina del Tiro. I found several unusual minerals that I could not identify. I was aware of the "black wulfenite" that was previously reported there, but did not know much more. I searched the Internet to locate information on the occurrence from the prehistoric workings, but only found historical information about the mine. I did find the mineral data listed on www.mindat.org. I also found that wulfenite from the locality was mentioned by Ray DeMark, at the 1998 New Mexico Mineral symposium. The Internet did not reveal much more about the mysterious "black wulfenite." Several weeks later I traveled to Socorro to New Mexico Tech, to plunder the dusty files of symposiums past. All I was able to find was the title page of an abstract presented by Robert R. Cobban in 1983. "Black wulfenite from the Mina del Tiro, Cerrillos Hills, New Mexico"; that was it, just the title, nothing else. Only those persons present during this talk may still recall what Mr. Cobban had to say about the mysterious habit and color of this occurrence of wulfenite. I was unable to locate the author; I'm sure Mr. Cobban could answer several questions I still have on the subject.

So I decided, as a novice mineral collector, to study and report on the subject myself. I employed the assistance of, The Eveleth Encyclopedia of Mining History. Bob quickly located a box full of data on the Mina del Tiro, (Mine of the Shaft) also known by Mina de la Tierra, (Mine of the Earth). The file also contained a study by A. H. Warren, archaeologist for the Laboratory of Anthropology at Museum of New Mexico. In her report to Occidental Minerals Corporation she details the geology and the significance of the mine's prehistoric past. Her work pointed out the archaeological importance of the site and the fact that the native miners did not mine for the riches buried there, but for wealth, the minerals added to their culture. The first miners' only interests in the mines, were for the clay, galena, and turquoise deposits. Her work in 1974 helped contribute to recent discoveries as to how the mineral was used. Archaeological studies show that the ore was heated, then ground into a fine powder, and sodium carbonate also found in the area was added. This combination was then used as glaze in pot decoration. The bulk of her work still sits unpublished at the Museum of Santa Fe waiting to reveal more secrets from the past. The Mina del Tiro also carries the distinction of being one of only a few mines worked by three cultures, for riches hidden beneath the earth. The prehistoric Indians of the area worked the mine for galena to be used as glaze for pottery. The pueblo Indians also mined the beautiful blue-green turquoise, prized for trading and decoration, from the ridge north of the Mina del Tiro and from nearby Mt. Chalchihuit. The native peoples mined the area uninterrupted from 1300 to 1580.

In 1581 Spanish explorers located the mines and quickly exploited the ancient claims, enslaving the native population for nearly 100 years and forcing them to work the mine for the rich silver ore discovered there. The conquistadors broke the backs of the slaves to fill the coffers of the King of Spain. At a nearby turquoise mine several Indian slaves were buried alive in a rock slide. It was reported that the Pueblo revolt of 1680 came about from this tragic incident. The Indians killed the Spaniards and drove out their monasteries, and the native peoples also tried to obliterate any sign of mining activity and their enslavement by caving in and backfilling all known workings. The Indians vowed that the Spaniards would never engage in mining activities again, and they kept that promise for two centuries. In the late 1870s American settlers began to arrive in the Los Cerrillos mining district, and prospectors discovered the abundance of mineral resources in the land surrounding the small community.

Many prospectors and mine speculators became wealthy working the mines of the Cerrillos district of Santa Fe County .This period continued from 1870 to the early 1950s. In that time the American miners discovered and removed tons of gold, silver, zinc, turquoise, and coal. In 1896 prospectors and investors were lured to the state by the Territorial Bureau of Immigration, with statements like this, "The mines of New Mexico, a mineral belt unequalled on the face of the earth for quality, quantity, or extent: four hundred miles of gold, silver, copper, lead, and coal." Today's real estate agents refer to statements like that as "PUFFING." As a result of those wildly exaggerated statements, the population of New Mexico increased by 35,000.

The very last mining activity to take place at the Mina del Tiro was a sand and gravel operation. Today the mine has been safeguarded for future archaeological study, and the surrounding area was purchased by the county of Santa Fe and turned into Cerrillos Hills Historic Park.

Geology

Between the Mina del Tiro and the Cash Entry mines and the surrounding area, a small, primary disseminated copper deposit is located. This copper deposit lies about 1 mi north of the town of Cerrillos. Rocks in the Cerrillos district consist of latitic flows and monzonitic and syenitic intrusive probably from early Tertiary age. The disseminated copper mineralization is located around a small, circular coarse-grained monzonite stock that has invaded monzonite porphyry and pink syenite. Spectrographic analysis of 1,600 surface rock samples shows that a copper anomaly forms an annular ring up to 600 ft wide nearly encircling the coarse-grained monzonite formation. This unusual area contains more than .02% copper-in-rock. In the area of the copper occurrence, the mineralization at the surface consists of green copper carbonates and silicates, malachite, and quartz. Core drilling has revealed that the mineralization consists of thin veins and disseminated grains of chalcopyrite and rare bornite. The best grades of copper mineralization are found in silicified monzonite that also contains secondary biotite. The grade of the oxidized portion of the deposit is essentially the same as that in the unoxidized portion, and virtually no secondary enrichment has occurred. As a consequence, the deposit is considered to be a primary disseminated copper deposit, the upper part of which has been slightly modified by surface oxidation. A zone of pyritization associated with strong argillic alteration and turquoise is found outside of the zone of copper mineralization.

Mineral list for the Mina del Tiro

Cerussite, descloizite, galena, hemimorphite, jarosite,linarite, plattnerite, pyromorphite, sphalerite, tetrahedrite, turquoise, and quartz.

MINERALS FROM THE THOMAS RANGE, JUAB COUNTY, UTAH, *Klaus Fuhrberger*, Schneeburg, Germany

(Location 9 on the index map.)

The Thomas Range is internationally known to mineral collectors. Although it is the type locality for bixbyite, weeksite, and holfertite, it is more well known for its sherry-colored topaz crystals. The best crystals of pseudobrookite are found in the Thomas Range. Other mineral species include almandine, red-colored beryl crystals, calcite, ferrocolumbite, fluorite, hematite, ilmenite, quartz, and opal. With some exceptions, most of these minerals are found in a lithophysae-rich rhyolite.

There are numerous places in the range where specimens can be found. A few small books and many articles have been written about the occurrences.

Maynard Bixby, a good prospector, discovered bixbyite in the range in the late 1800s. The type location is "Maynard's claim," located on the east side of the range. Some of the range's finest topaz has come from here, with crystals and groups over 5 cm. Associated minerals are acicular microscopic topaz, drusy quartz, specular hematite, and hematite pseudomorphing garnet. This is an active claim and is posted with "keep out" signs.

There is a shallow gray knob of rhyolite immediately east of this claim. Some prospecting has taken place resulting in the finding of quartz-included topaz crystals to 3 or 4 cm with small bixbyite crystals to 3 mm and occasional very small holfertite prisms. At least 2 small 3–4 mm red beryls were also found.

The Autunite #8 mine, a uranium prospect, is located on the southeast side of the range. The rock here looks more like a welded rhyolite or andesite. There is local faulting, mineralization, and alteration. The uranium mineral weeksite was discovered there associated with highly fluorescent hyaline opal.

Holfertite was recently described from a pit on the west side of the range, in Searle Canyon, recently renamed "Starvation Canyon." It occurs as yellow to orange long prisms, to 2 mm, which are sometimes hollow. Most of the holfertite crystals are found on quartz-included topaz crystals that are usually 2–4 cm in size. Sometimes the holfertite is found attached to, or near, specular hematite or bixbyite cubes. Pseudobrookite is found here, but the crystals are usually < 1 mm. Rare dull-black prisms of ferrocolumbite were also found. An adjacent pit had specimens of drusy amethyst. A couple of decades ago Eugene Foord wrote a partial description of a Ti $>$ U silicate mineral from Topaz Valley. Because holfertite has U $>$ Ti could the crystals found in Topaz Valley be a different species or were the data incorrect?

Three or four years ago someone blasted out an area on the north side of the range, about 3 mi west of Dugway Pass. This fresh white rhyolite is easily seen from the road. Apparently the name of this place is the "Solar Wind" claim. Pseudobrookites to 1.5 cm were found with small pink-colored topaz. Small bixbyites were found, although it is rumored to have had some crystals that reached 2 cm!

A place called "Topaz Valley," at the southeast corner of the range, is an area frequented by most collectors. Most of the crystals are small, but there are rumors of red beryl to 3 cm, topaz to 5 cm, etc. Other minerals are pseudobrookite, specular hematite, the holfertite-like critter, and rumored almandine. Countless sun-bleached colorless topaz crystals have been picked up off of the ground in the last century. These are now harder to find. There also used to be countless specimen-rich boulders that could be broken up with heavy sledge hammers. Most of the convenient boulders have now been reduced. However, the valley has its name for a reason, and countless specimens remain to be collected. It just takes more work and more patience.

The range's best bixbyite is reputed to be from a claim somewhere south of Dugway Pass. That, and the world's best durangite locality, were not visited by the writer because he could not find them. Sometimes getting lost can have its own rewards. For instance west-northwest of the holfertite pit an area rich with topaz was found. South of Dugway Pass a less-rich topaz area was found. Basically, if one goes hiking about in the Thomas Range you will eventually come across something interesting.

WULFENITE AND HEMIMORPHITE OCCURRENCES OF MONTANA, *Michael Gobla*, 9055 East Bethany Place, Aurora, Colorado 80013

In the past 10 years several collectors including this author have made an effort to search out wulfenite occurrences throughout southwest Montana. Nearly all of these finds are of microcrystals, and many of the finds have been limited to just a few specimens. Many additional locations have yet to be investigated. Wulfenite is found at lead-silver mines and prospects containing oxidized ores. These lead deposits typically occur at or near the contact of igneous intrusive rocks with limestone sediments. In the early days of mining the zinc minerals hemimorphite and sphalerite were considered worthless and were thrown out onto the waste rock dumps. A common factor in nearly all of the wulfenite finds is the presence of hemimorphite, which can be used as an indicator mineral. Whenever hemimorphite is present the locality bears further investigation, if sphalerite is present the mine was not in an oxidized zone and little of interest is likely to be found. Although wulfenite is not always present at locations containing hemimorphite, there are a few mines that have other interesting secondary minerals associations. In particular the Black Pine, Elkhorn, and Scratch Awl mines are worthy of mention.

While most of the wulfenite finds have been very limited in size and quantity of specimens, there are a few localities that have been very productive of specimens. Beaverhead and Broadwater Counties in particular have several localities that continue to yield wulfenite and other interesting minerals including cerussite, chlorargyrite, descloizite, mimetite, rosasite, pyromorphite, and vanadanite. A summary of the occurrences that the author has visited is presented in the following table; it is about half of the known wulfenite occurrences in the state. More finds continue to be made.

For the field collector I would recommend the Bob Ingersoll, Gar, Stapleton prospect, Santa Anita, and Jo Dandy mines as being the most likely for finding more specimens of wulfenite.

Locality	Wulfenite occurrence	Other minerals
Beaverhead County		
Goodview mine, Argenta district	Two specimens of yellow-brown tiny micros on quartz	A very small waste dump containing micros of cerussite, hemimorphite, and quartz.
Iron Mountain mine, Argenta	Orange tabular micros, only a few specimens	Small waste dump with cerussite, chrysocolla, hemimorphite, malachite, mimetite.
Stapleton prospect, Argenta district	Amber to orange tabular crystals up to 1/16″ with malachite and hemimorphite	Micros of cerussite, chlorargyrite, jarosite, brochantite, malachite, tsumebite, pyrite, and macro specimens of rosasite and hemimorphite.
Charter Oak mine, Blue Wing district	A few specimens with a single 1/8″ red tabular crystal in a small vug.	Massive cerussite, galena, and micros of descloizite, hemimorphite, pyromorphite, and quartz.
Bob Ingersoll mine, Blue Wing district	A few dozen specimens of orange pyramidal crystals to 1/4″, a few tiny tabular crystals.	Micros of cerussite, chlorargyrite, descloizite, hemimorphite, pyromorphite, quartz, romanchite, and vanadanite.
Gar mine, Elkhorn district	Yellow to orange tabular and prismatic micros.	Micros of cerussite, mimetite, linarite, leadhillite.
Cleopatra mine, Hecla, Bryant district	A few specimens of yellow blocky to tabular crystals	Micros of cerussite, aurichalcite, azurite, hemimorphite, malachite, mimetite, and rosasite.
Indian Queen mine, Utopia district	A single find of yellow tabular micro crystals with malachite	Azurite, chrysocolla, malachite, and quartz. A single find of japan law quartz.
Radersburg district, Broadwater County		
Blackhawk mine	Small orange to yellow crystals tabular to pyramidal habit often with red vanadanite	Massive galena with micros of cerussite, descloizite, mimetite, plattnerite, and pyromorphite.
James R. Lee mine	Prolific source of cabinet specimens with yellow to orange tabular crystals to 1/8″	Micros of hemimorphite, cerussite, plattnerite, and vanadanite.
Jo Dandy mine	Orange tabular crystals to 1/8″, dumps are still productive	Micros of cerussite and quartz.
Jo Jo mine	Yellow to orange tabular micros	Cerussite, vanadanite.
North Home mine	Red, yellow, orange blocky to pyramidal crystals.	Cabinet specimens of vanadanite, micros of chlorargyrite, descloizite, cerussite, hemimorphite, willemite.
Santa Anita mine	Small tabular to pyramidal crystals, dumps are very productive	Micros of aragonite, calcite, vanadanite (rare).
Summit mine	A few specimens of yellow tabular crystals	Prolific source of micro descloizite, mimetite, rosasite and large crystals of hemimorphite, and quartz epimorphs on hemimorphite.
Granite County		
Ivanhoe mine, Pioneer district	Tiny yellow tabular crystals.	
Madison County		
Broadway Victoria mine	Tabular yellow crystals to 1/2″	Micros of aragonite, calcite, mimetite, malachite, pyromorphite, and vanadanite.
Meagher County		
Cumberland mine	Orange pyramidal micros	Cerussite micros.
Blackhawk Alice mine	Orange tabular micros	The wulfenite is found in vugs in galena.

PAPER TREASURES, *Ross Arrington*, P.O. Box 85, Hanover, New Mexico 88041; and *Larry Crotts*, P.O. Box 481, Central, Arizona 85531

So much of the history of mining is contained in paper documents. These documents for the most part have been thrown away over 100 years ago, and the few surviving documents are well hidden.

Some paper such as stocks certificates, photos, postcards, newspaper articles, and books are things that people have kept for financial or sentimental reasons, so they have survived better than other mining-related paper. We will talk about how and where to find these paper documents associated with the all but forgotten mines of the West. What you can find in the old boxes stored away in attics and basements can be both amazing and profitable.

We plan to show some of the variety of documents during this presentation and encourage others to look for and save these papers.

Mining history is written on these paper treasures.

THE KEARNEY MINE, 1942–1967, *Jack W. Burgess*, Mining Engineer, P.O. Box 992, Corrales, New Mexico 87048

(Location 6 on the index map.)

In response to the World War II strategic metals effort, the Kearney mine shaft was sunk 650 ft in 1942 to access zinc deposits north of the historic Chino copper mine, at Santa Rita, New Mexico. The underground mine was operated by the Peru Mining Company throughout the war and periodically until 1967, when reserves were exhausted.

The mine was one of a small number of prominent zinc producers in the Central mining district of Grant County, New Mexico. With head grades of 6–15% zinc, mineralization occurred as limestone replacement pods in the Hanover Limestone of Mississippian age. It is classified as a skarn deposit associated with the Santa Rita Quartz Monzonite porphyry stock. Minor lead and silver were also recovered.

Mined high-grade ore was shipped by rail to the Peru Mill at Deming, New Mexico, and the produced concentrate was sent to the American Zinc Smelter at Dumas, Texas.

The author worked at the Kearney mine as a geologist, engineer, shift boss, mine foreman, and mine superintendent from 1960 to 1966. Several photos of mineral specimens, crystals, and maps will be included in the presentation.

APACHE HILLS MINERALS: THE REST OF THE STORY, HIDALGO COUNTY, NEW MEXICO, *Robert E. Walstrom*, walstromminerals@gilanet.com, P.O. Box 1978, Silver City, New Mexico 88062

(Location 4 on the index map.)

The Apache Hills are located approximately 6 mi southeast of the small village of Hachita (population 50+/-), which is located on Highway 9 in southern Hidalgo County, New Mexico. It is aptly named hills as it is barely 3 mi wide and 6 mi in length. Geologically, the hills consists of a central core of quartz monzonite porphyry surrounded at the base with Tertiary volcanics consisting of rhyolite, andesite, and basaltic rocks with interspersed units of limestone and scarn deposits. The Apache mine, located on the south slope just west of Apache Peak, is the most well-known mine in the area with a lengthy history dating back to the last half of the 19th century. Production was in the form of rich silver ore along with copper and lead values. The mineral list for this mine is well known and can be found in the references.

It became obvious when looking in the literature for other mines and lists of minerals in the district (Apache No. 2 district), available information was seriously lacking. As a result, it seemed a promising enterprise to examine the other mines and prospects to determine "the rest of the story" for the Apache Hills. The following is the result of that endeavor.

Locality	Location	Minerals
Christmas Tree mine	N31.85883° W108.29323°	Alunite, cerussite, chrysocolla, goethite, jarosite, malachite, mottramite, quartz
Luna mine	N31.86116° W108.25958°	Calcite, cerussite, chalcopyrite, galena, linarite, malachite, pyrite, quartz, sphalerite, wulfenite
Owens mine	N31.84161° W108.23774°	Calcite, cerussite, galena, hemimorphite, malachite, mottramite, quartz, rosasite, sphalerite
Owens prospect	N31.84027° W108.23584°	Calcite, cerussite, chalcopyrite, galena, goethite, quartz, vanadinite
Queens Taste mine	N31.84730° W108.23749°	Cerussite, chalcopyrite, chrysocolla, galena, hemimorphite, malachite, mottramite, quartz, sphalerite, vanadinite, wulfenite
Mammoth mine	N31.84335° W108.23482°	Anglesite, barite, calcite, cerussite, chalcopyrite, chrysocolla, galena, goethite, malachite, mottramite, quartz, vanadinite, willemite, wulfenite
Daisy mine	N31.82886° W108.23179°	Azurite, calcite, chalcopyrite, chrysocolla, galena, gypsum, malachite, quartz, wulfenite
Summertime mine	N31.83096° W108.27360°	Andradite, calcite, chalcopyrite, chrysocolla, diopside, malachite, pyrite, quartz, scheelite, sphalerite, tremolite
Twin shafts	N31.82622° W108.28122°	Calcite, cerussite, chalcocite, chalcopyrite, chrysocolla, descloizite, galena, goethite, hematite, hemimorphite, linarite, malachite, mottramite, quartz, sphalerite, vanadinite, wulfenite
Prospect	N31.82470° W108.28014° (sse of Twin shafts)	Calcite, cerussite, chalcopyrite, chrysocolla, galena, hemimorphite, malachite, mottramite, quartz, rosasite, vanadinite
Last Chance mine	N31.82210° W108.28459°	Barite, cerussite, chalcopyrite, chrysocolla, galena, hemimorphite, malachite, mottramite, pyrite, quartz, rosasite, vanadinite
Big Shiner mine	N31.82296° W108.27603° and N31.82382° W108.27393°	Azurite, brochantite, calcite, cerussite, chalcocite, chalcopyrite, chrysocolla, galena, goethite, hemimorphite, malachite, mottramite, quartz, wulfenite
Mariland mine	N31.82520° W108.26603°	Barite, calcite, cerussite, chalcopyrite, chrysocolla, galena, goethite, malachite, quartz

While most of the material collected, with one or two exceptions, would rightly fit into the micromineral category the range of species encountered should encourage collecting along with further exploration. Most of the larger mines and workings were sampled. However, numerous small localities scattered throughout the mineralized areas were not.

Access to the Apache Hills is fairly open with only two private in-holdings surrounded by public BLM land. However, one should use caution as records show active mining claims in several areas of the hills. Roads are unpaved but passable with high-clearance vehicles. The area is active cattle country, and while gates are unlocked, they should be left as found.

Credits and acknowledgments

Robert E. Walstrom: Mineral collection, photography, and PowerPoint. Richard Faulkner: Landowner (access). Dr. Anthony Kampf: Mineral Analyses (SEM/EDS). Robert Eveleth: Archives New Mexico Tech. Equipment: Camera = Nikon D80 and Microscope = Meiji TR8.

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