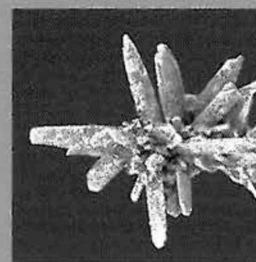
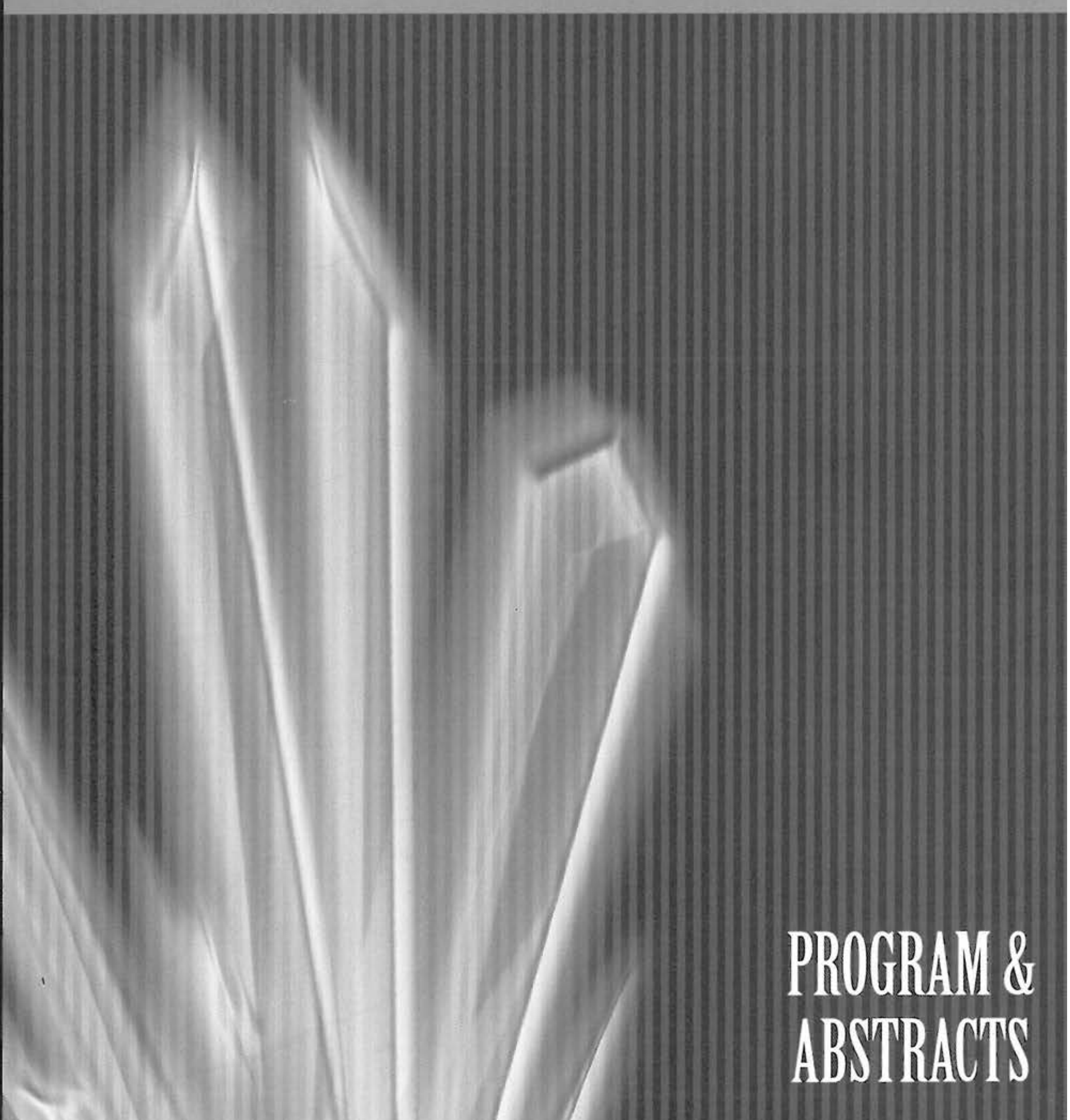
ANNUAL NEW MEXICO MINERAL SYMPOSIUM

29th Annual New Mexico Mineral Symposium

November 8 & 9, 2008





PROGRAM & ABSTRACTS

29th Annual New Mexico Mineral Symposium

November 8 & 9, 2008

New Mexico Bureau of Geology and Mineral Resources

A Division of New Mexico Institute of Mining and Technology

Socorro 2008

Welcome to

The Twenty-Ninth Annual

New Mexico Mineral Symposium

November 8 and 9, 2008

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

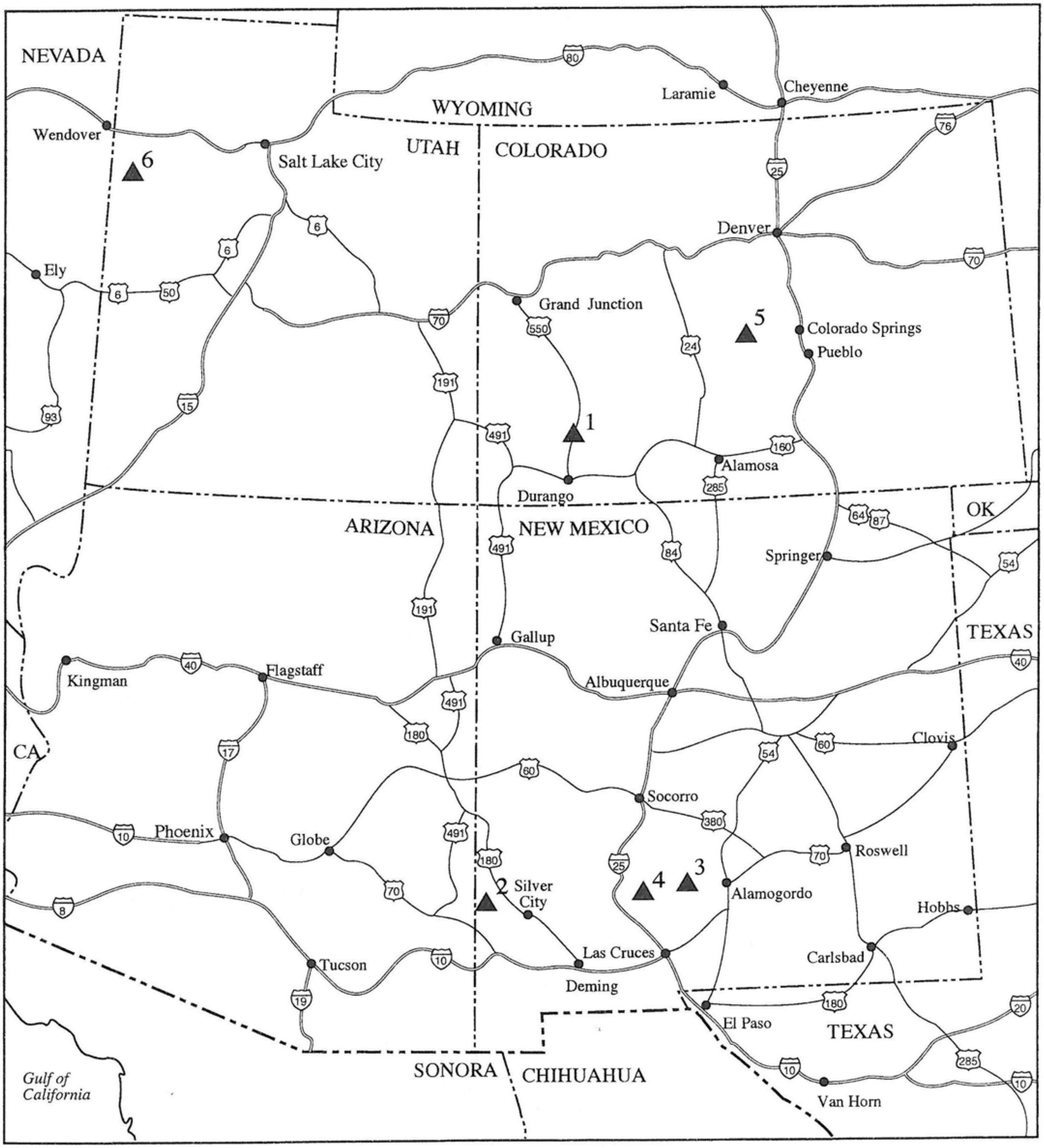
The Mineral Symposium is organized each year by the Mineral Museum at the New Mexico Bureau of Geology and Mineral Resources.

Sponsors this year include:

Albuquerque Gem and Mineral Club
Chaparral Rockhounds
Los Alamos Geological Society
New Mexico Geological Society Foundation
Friends of Mineralogy
City of Socorro

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

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



Geographic Index Map
29th New Mexico Mineral Symposium

29th Annual ***New Mexico Mineral*** *Symposium 2008*

SCHEDULE

Friday, November 7

6:00 pm Informal tailgating and social hour, individual rooms, Comfort Inn & Suites (# 1 on map—FREE

Saturday, November 8

8:30 am	Registration, Macey Center; continental breakfast
9:20	*Opening remarks,* main auditorium
9:30	*A 2007 Herkimer "diamond" dig at Middleville,* NY—Jay Medici
10:00	*New Mexico Mineral Legends: Robert H.* Weber—Robert W. Eveleth
10:30	Coffee break
11:00	*New Mexico's classic mineral localites—Peter* Modreski
11:30	*Minerals from the lesser mines of the San Juan Mountains, Colorado—* Barbara Muntyan **(1)**
12:00 pm	Lunch
1:00	Museum Tours
2:00	*New Mexico vanadinite—Ray* DeMark
2:30	*Micromineral occurrences, Steeple Rock district, Grant County, New Mexico—* Robert Walstrom **(2)**
3:00	Coffee break
3:30	*Uncommon gypsum morphologies and their occurrence in the Tularosa Basin—* Dave Love, Robert Myers, and Bruce Allen (3)
4:00	*Some highlights of 45 years of Medici family field collecting—* John Medici, featured speaker
5:30	Sarsaparilla and suds: cocktail hour, cash bar
6:30	Dinner followed by an auction to benefit the New Mexico Mineral Symposium

Sunday, November 9

8:15 am	Morning social, coffee and donuts
9:15	*Welcome to the second day of the symposium and follow-up remarks*
9:30	*Minerals of the White Sands Missile* Range—Virgil Lueth **(4)**
10:00	*Mineral strike to meteor strike: Guffey and the Freshwater mining district* — Steven Veatch (5)
10:30	Coffee break
11:00	*Minerals of the Gold Hill mine—Mystery* speaker (6)
11:30	*Open Forum on Four Corners Mineralogy*
12:00 pm	Lunch
1:15-3:00	Silent auction, upper lobby, Macey Center, sponsored by the Albuquerque Gem and Mineral Club for the benefit of the Mineral Museum (FREE)

A 2007 Herkimer "diamond" dig at Middleville, New York

Jay Medici, P.O. Box 56, Sparta, Ohio 43350

Central New York state is famous for the doubly terminated quartz crystals, known as "Herkimer Diamonds." The town of Middleville, New York, has been the source of some of the highest quality specimens and is the location of two well-known "mines" open to the public for fee digging. During the fall of 2007, the author and Jeff Fast of East Haddam, Connecticut (JBF Minerals), conducted a commercial dig at the Herkimer Diamond mines site in Middleville and extracted 38pockets of quartz. In addition, the author's father (John Medici) and brother (Brett Medici) visited in October and found four pockets in the fee digging area of the mine.

Collecting at this site usually involves removing 8 ft of overburden consisting of fairly tough limestone. Beneath the overburden is a 1-2-ft-thick layer known as the "table," which is highly silicified dolostone (Ulrich 1989) and is extremely tough. The larger pockets are found in the center of this layer and vary from 1 to 6 ft in diameter. One pocket can contain thousands of crystals, from sand grain size to "goonies" the size of grapefruit. The most desirable crystals are in the 1-2 in range and almost perfectly clear. A good rule of thumb is that it takes as long to remove the overburden as it does to lift the table.

As commercial diggers, we dug in a private area of the mine with 4 ft of overburden, which was blasted before the dig. The blast was interrupted by an electrical storm and a curious neighbor in an ultralight flying over the blast area. An excavator removed the blast pile for us, leaving approximately 2 ft of overburden and the table. Our tools consisted of standard sledgehammers, chisels made from jackhammer tips, a hammerdrill (to help set chisels), and a diamond chainsaw for removing entire pockets. By contrast, the general public is limited to 12-lb hammers and chisels.

Initial conditions were ideal, with dry weather and lots of pockets. Recovered specimens were decent but not spectacular. Removing entire pockets was a challenge. The chainsaw required an operator to stand with one leg in a stream of water and breathe exhaust for the duration of the cut. Invariably, the pocket base would fracture as it was pulled up—we compensated with duct tape and nylon cinches.

As we dug pockets, the location and shape of each was mapped. The pockets are believed to be formed after algae formations known as stromatolites were buried by sediment, which decayed to anthraxolite (a coal-like mineral), and left voids later overgrown with dolomite and quartz (Chamberlain 1988). The map does show spacing reminiscent of plant growth patterns in a shallow sea.

Late in the dig, a wet weather pattern impeded our progress. Many times we had to pump out the commercial dig, which filled with several feet of water. John and Brett Medici visited during this wet period in October and found four pockets using only 12-lb hammers and chisels in the public part of the mine. This talk will document the adverse conditions and determination involved in digging for quartz in Middleville.

The crystals recovered in the commercial dig were typical of Herkimer "diamonds," with a few outstanding ones (see the cover of *Rocks and Minerals,* May/June 2008 for a skeletal group belonging to Jeff Fast). Late in the dig, Pocket #32 had an abundance of phantom quartzes, each of which had a black core overgrown with clear quartz, which was unusual for Middleville.

References

Chamberlain, S. C., 1988, On the origin of Herkimer "Diamonds": Rocks and Minerals, v. 63, no. 6, pp. 454 455.

Ulrich, W., 1989, The quartz crystals of Herkimer County and its environs: Rocks and Minerals, v. 64, no. 2, pp. 108-122.

Remembering Dr. Robert H. Weber: Feb. 1919-Feb. 2008

Robert W. Eveleth,
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801 Leroy Place, Socorro, New Mexico 87801

Robert Harrison Weber was born and raised in the relatively small town of Wauseon in northwestern Ohio. Beginning at a very early age he displayed a fascination with all things relative to the earth and the archaeological artifacts left behind by prehistoric peoples. A bicycle provided the means to visit every quarry, sand pit, and rock outcrop within a 25-mi radius and also quick access to the local Carnegie Public Library where, as family legend has it, he devoured every book he could find on exploration, natural history, and geology. His collection of rocks, fossils, and archaeological materials grew to a size such that his father fretted over the space required to store the collection even then. Time would serve only to convert Bob from an amateur pack rat into a professional one!

Bob graduated from Wauseon High School in 1937 and followed up with a Bachelor of Science with distinction from The Ohio State University in 1941. Pearl Harbor, as it did for so many Americans, put Bob's educational plans on hold, and it wasn't until January 1946 that he was back on track at the University of Arizona where, in June 1950, he was awarded a Ph.D. in geology with minors in both mining and metallurgical engineering. Director Eugene Callaghan recognized his many talents and brought him to the New Mexico Bureau of Mines and Mineral Resources in Socorro where he embarked upon a multi-faceted and remarkable career spanning 35 yrs. Hardly a phase of the earth sciences evaded his inquisitive mind. This tribute will examine them in some detail.

New Mexico's classic mineral localities

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The theme of the 2008 Tucson mineral show and the FM-TGMS-MSA mineral symposium there was "Classic U.S. Mineral Localities." In a paper I presented at that symposium, "What is the 'most important' mineral locality in the U.S.?," I surveyed and compared prominent U.S. localities and attempted to answer my own question. As a follow-up to that presentation, here I will try to review New Mexico's most famous localities in the same way and, in the process, see if there is an obvious answer to which of the state's "classic" localities is the most renowned for mineral specimens.

To try to assess the most outstanding localities in a quantitative or "scientific" way, I had explored several methods of surveying the popular and scientific literature. These included searching for the number of times localities were mentioned in the *Mineralogical Record's* cumulative index; and in GeoRef, the American Geological Institute's comprehensive geoscience literature database; and the number of "hits" for locality names online on www.google.com.

There are, of course, a variety of criteria that one could consider as to what constitutes the "most important" locality: the quality of specimens that have been produced from the locality, the number of different species known to occur, the number of type species described, the overall contribution of studies of the locality to the scientific literature, or the general accessibility and quantity of collectible specimens produced from the locality. In comparing localities, one also faces the problem of localities that differ in geographic extent—a single mine or field site, versus a group of nearby mines or district, versus broadly distributed "localities" that encompass an entire town, county, province, region, mountain range, or geologic formation. There are also localities famed as outstanding sources of one single mineral, versus localities known for a wide variety of uncommon species, but perhaps occurring only as small, sparse, micro, or indifferently crystallized specimens.

For the Tucson talk comparing U.S. localities, I decided to base my "conclusion" on a survey of the number of times specimens from each locality were pictured in a total of 10 popular books depicting "superb" mineral specimens—recognizing, of course, that this criterion would emphasize only localities that had produced the most exquisite, showy, and valuable specimens. The 10 books were:

- Desautels, P. E., 1968, *The Mineral Kingdom.*
- Bancroft, P., 1973, *The World's Finest Minerals and Crystals.*
- Bancroft, P., 1984, *Gem & Crystal Treasures.*
- Barlow, F. J., Jones, R. W., and LaBerge, G. L., 1996, *The F. John Barlow Mineral Collection.*
- Wilson, W. E., 2000, *The Joseph A. Freilich Collection.*
- Wilson, W. E., Bartsch, J. A., and Mauthner, M., 2004, *Masterpieces of the Mineral World, Treasures from the Houston Museum of Natural Science.*
- Smale, S., 2006, *The Smale Collection, Beauty in Natural Crystals.*
- Thompson, W. A., 2007, *Ikons, Classic and Contemporary Masterpieces of Mineralogy.*
- Trinchillo, D., 2008, *The Marc P. Weill Collection of Fine Minerals.*
- Staebler, G., and Wilson, W., eds., 2008, *American Mineral Treasures.*

Illustrations from the 10 books amounted to a total of 400+ photographs from some 108 nationwide localities. (Having had access at the time to the table of contents but not a full copy of *American Mineral Treasures,* I was not able to tabulate the photos in it, so I simply tallied the localities represented therein without counting photographs.) I have to report, with regret, that in this survey, although a few New Mexico specimens were pictured in these source books, none of the New Mexico localities made it into the top nationwide localities, or even into the "top 25." Those New Mexico localities from which specimens did manage to eke out an appearance in any of the above 10 books were:

- Kelly mine (two photos, as I counted them at the time; in fact, there were 11, because 10 photos actually appeared in *American Mineral Treasures—all* of Kelly smithsonite),
- Chino mine (two photos, both of crystallized native copper), and
- Grants uranium district (one photo, uranophane)

For those interested, the result of my survey of the U.S. localities was that the localities appearing most frequently in illustrations in the 10 named books were the California gold-producing region and the Keweenaw copper district of Michigan; recognizing, of course, that both of these are regions, not a single mine, with the California districts encompassing parts of some six counties. California gold specimens appeared in photographs 37 times and were the only locality or district pictured in every one of the 10 books; photographs of Keweenaw copper and associated minerals appeared 45 times, in nine out of the 10 books. The individual locality (still not strictly a single mine, but basically one deposit) ranking the highest was Bisbee, Arizona, with 17 photos appearing in nine out of 10 books. "Runners-up" were the Pala pegmatite district of California (24 photos in seven out of 10 books), the Sweet Home mine (13 photos in eight books), the Pikes Peak pegmatite district (10 photos in eight books), and the Red Cloud mine, Arizona (10 photos in eight books).

Focusing the discussion back to New Mexico, localities that might rank as classic and which come to the fore as candidates for a "best" New Mexico locality could be:

- Kelly mine, Magdalena district, Socorro County
- Blanchard mine, Hansonburg district, Socorro County
- Stephenson-Bennett mine, Organ district, Dona Ana County
- Harding mine, near Dixon, Taos County
- Chino mine, Santa Rita, Grant County

Some New Mexico "honorable mentions" might also include

- Groundhog mine, Central district, Grant County
- San Pedro mine, Santa Fe County
- Grants uranium district, Cibola and McKinley Counties
- Tyrone mine, Burro Mountains district, Grant County
- Judith Lynn claim, Burro Mountains district, Grant County
- Mina Tiro Estrella, Capitan district, Lincoln County
- Smoky Bear "claim", White Mountain Wilderness, Lincoln County
- Point of Rocks Mesa, Colfax County
- Staurolite occurrences, Picuris Range, Taos County

As well, some of the other mines included in districts named above may have a claim to outstanding specimen production in their own right, for example, the Mex-Tex and Royal Flush mines in the Hansonburg district, and the Waldo-Graphic and Juanita mines in the Magdalena district. Attendees at this symposium may have their own good suggestions for further additions to this list.

Minerals of the lesser mines of the San Juan Mountains

Barbara L. Muntyan, 3500 S. Beryl Avenue, Tucson, Arizona 85735

The San Juan mountain range is located in the southwest quadrant of Colorado at the end of the Colorado mineral belt. These mountains are relatively young by geologic standards, being about 15-20 m.y. old. With the exception of the Red Mountain mining district's breccia pipes, massive quartz veins contain gold, silver, pyrite, galena, fluorite, barite, sphalerite, and less common species such as rhodochrosite, hübnerite, chalcopyrite, and tetrahedrite. These species commonly occur in large, well-formed crystals, generally as much as 2 in long, but sometimes found as long as 12 in.

Three counties contain the San Juan Mountains: Ouray, San Juan, and San Miguel. There are approximately 10,000 patented and unpatented mining claims in each of these counties but only a handful of large mines. The Camp Bird, the Sunnyside, and the Idarado mines were the largest (and best-known) mines of the region, each employing more than 300 miners during their peak production years. But dozens of smaller mines employed anywhere between 5 and 50 miners, and many more were merely one-man holes, running more on hope than on production. Public and private mineral collections world-wide have specimens from the three largest mines; very few collections, however, have specimens from the lesser mines.

Many mines in the San Juans, even though having limited ore production, did contain many vugs of fine, large crystal groups. Whereas a few of these mines are located near Telluride and Ophir, most are found in Ouray and San Juan Counties. Many of these mines still had accessible workings during the last 30 yrs, including:

Ouray County		San Juan County	
Bachelor	Mountain Monarch	Adams	Highland Mary
Black Girl	News Boy	Bandora	Keystone
Boney Hensel	Ohio	Ben Franklin	Kittimack
Crystal Cave	Ores and Metals	Brooklyn	Little Dora
Daniel Bonanza	Pony Express	Bullion King	Maggie Gulch
Gertrude	Portland	Esmeralda	Osceola
Goodfro #2	Senorita	Eureka Gulch	Pride of the West
Grizzly Bear	Silver Mountain	Galty Boy	Rochester
Longfellow	Silver Point	Genoa	Ransom(e)
Mineral Farm	Thistledown	Gold Lakes	Ruby
Morning Star	Topeka	Growler	Yukon
Mother Cline		Hematite Gulch	

Ouray County

Bachelor mine—Located in the Pacquin mining district north of Ouray, this blanket-type deposit contained some notable cream-colored scalenohedral calcite crystal groups found on a matrix of dark, silicified limestone, as much as 5 in wide, in vugs near rolls in the silver-bearing veins.

Black Girl—This mine is located in the Pacquin mining district, directly south of the Senorita mine. Milk-white, tabular barite crystal clusters, in association with small, clear quartz druses, were recovered here. Also, in one zone in the main haulage tunnel, limonite-impregnated calcite crystals were found as "wheat-sheaf" doubly terminated rust-colored crystals to 2 in on near-black silicified limestone. Nice selenite clusters to 3 in wide have also been found.

Boney Hensel—Located on the north end of the Pacquin mining district, this mine has produced clusters of white barite blades as large as 8 in on edge, some with inclusions of manganese oxide on one side, from a tube on the main haulage.

Crystal Cave—This is a huge solution cavity in the Leadville Limestone, perhaps 50 ft wide, along the north side of Canyon Creek. Scalenohedral, gray to light-brown calcite crystals as much 2 in long are found covered with a druse of clear quartz crystals. Some larger water-clear quartz crystals to one-half inch are found as sceptered crystals.

Daniel Bonanza—This mine is located high above the west side of the Uncompahgre Gorge. It is reached via a precarious trail blocked by fallen timber and slide shoots. Rose-pink rhodochrosite crystals to 1 in, covered with a druse of gemmy quartz crystals in groups as much as 5 in wide, were found at the bottom of one shaft, as well as a few on the mine's dumps.

Gertrude—Located at the north end of Ironton Park on the west side of Red Mountain Creek, this small mine has produced fine quartz-coated octahedral fluorite crystals to 3 in on edge from the two adits.

Goodfro #2—In an exploration shaft, large groups to 12 in wide of chocolate-brown scalenohedral calcite crystals (looking like furry hedgehogs) were recovered. One vug in this shaft had cream-colored calcite crystals of the same habit. Another nearby vug contained smooth scalenohedra of calcite coated on one side with a brown overgrowth of calcite.

Grizzly Bear—The original claims for this mine were located in 1875 along Bear Creek, now in a wilderness area. There was a tunnel driven from outside of Ouray to intersect the old workings of this gold/silver mine in recent years. The mine's vein system is similar to that of the Sunnyside mine, and the specimen material is also comparable. Fine rhodochrosite rhombs to 4 in on edge, green octahedral fluorite clusters implanted on large, barrel-shaped white quartz crystals in plates to 18 in wide, dark-resin color to black sphalerite crystals to 1 in diameter, light-brown calcite scalenohedra, and small chalcopyrite and hanerite crystal groups have come from the Grizzly Bear.

Longfellow—Located on the most southerly breccia pipe in the Red Mountain mining district, this mine is notable for fine large enargite crystals to almost 1 inch in plates as much as 5 in wide. It also produced hopper-terminated white quartz crystals to approximately 2 in.

Mineral Farm—One of the earliest mines near Ouray, it was so-named because the mineral-rich veins cropped out along the surface and could be extracted using a hoe, rather like harvesting potatoes. It produced blocky, cream-colored barite crystals to 2 in on edge, as well as very fine pseudomorphs of quartz after scalenohedral calcite crystals to 3 in, implanted on gemmy quartz point clusters.

Morning Star—Located near the better-known Mother Cline mine, this mine contains nice groups of gemmy quartz crystals to approximately 1 in long.

Mother Cline—Named for the wife of Ouray's first mayor, the mine is located on the south mountainside above Engineer Pass. It has produced white barite crystals commonly edged with a gemmy quartz druse. Also large clear quartz crystals to 3M long have been found, and also nice clusters of bone-white quartz crystals as much as 3 in long.

Mountain Monarch (Mickey Breen)—This mine is located aproximately 1 mi from the mouth of Engineer Pass. Lovely rose-red rhodochrosite rhombs to 2 in wide sometimes coated with a fine-grained quartz druse and dotted with small chalcopyrite crystals have been found implanted on white quartz crystals. Some specimens recovered in the 1980s were labeled from the "Mickey Breen" mine, which is the name of another of the dozen patented and unpatented claims of this mine.

News Boy—Located north of the Bachelor mine, this mine produced clusters to 5 in wide of white barite crystals to 1.5 in on edge with tiny, gemmy quartz crystals growing on one side of each barite.

Ohio—A large solution-cavity cave in the Leadville Limestone on the east side of Ouray, this mine is located just below Ohio Park, a lovely meadow in the Amphitheatre. Large, milk-white, slightly barrel-shaped quartz crystals as long as 12 in are found in doubly terminated sprays. Most groups that have been recovered have been found under large limestone slabs that have sloughed off the ceiling. A few quartz casts after calcite have also been found.

Ores and Metals—This mine is reached via a punishing cross-country trek on the east side of Canyon Creek. Nicely formed, clear quartz scepter crystals to 2 in are found sprinkled with small, perfect blue-black anatase crystals at this mine.

Pony Express—Located just north of Ouray, this large silver mine has produced plates to 12in wide of metallic brown scalenohedra of calcite, as well as white barite bladed groups to 4 in near the main portal.

Portland—Located in the large cirque known as the Amphitheatre just east of Ouray, this mine has produced clear quartz groups, white quartz scepters, pale amethyst crystal clusters, and outstanding lime-green sphalerite crystals dotted with small pyrite crystals perched on thin plates of calcite.

Senorita—One of the better-known mines in the Pacquin mining district north of Ouray, the Senorita contains excellent milk-white, complex barite crystals, found singly or as crystal clusters on dark limestone covered with quartz druses. Micro-crystals of azurite and malachite, the result of decomposition of chalcopyrite, have been found on the mine's dumps.

Silver Mountain—Located on the slopes of Brown Mountain, the dumps contain light-green tetrahexahedra of fluorite coating clusters of large, white quartz crystals. Small selenite crystals less than one-half inch long, the result of post-mining water seeps, are found on some fluorite groups.

Silver Point—Located high on the east side of the Uncompahgre Gorge's Ruby Cliffs north of Engineer Pass, the mine is owned by Benjy Kuehling of Ouray, well-known field collector and mineral dealer. The mine's lower working contains extraordinary, large groups of small, gemmy quartz crystals forming incrustation pseudomorphs after barite, with purple-red hematite dusting on the inner sides of the casts. Groups more than 12 in wide were lowered from the mine to Highway 550 on ropes and pulleys. The upper workings contain larger individual quartz crystals and rough galena cubes approximately one-half inch wide.

Thistledown—Located above timberline on the east side of Canyon Creek, this mine was operated as recently as World War II for its fluorite. A very few grass-green fluorite octahedral perched on clusters of etched, crystalline quartz have been recovered. One 4-in octahedron on matrix, one of the largest fluorite crystals known from Ouray County is in the speaker's collection.

Topeka—Located on Brown Mountain just above the Silver Mountain mine, this one has produced fine, complex fluorite crystals to 1 in on edge of a nice dark-green color.

San Juan County

Adams—Located above the American tunnel of the Sunnyside mine, this property is well-known for large sprays, to 3-4 in long, of hübnerite crystals on quartz matrix. Most groups have been etched out of quartz, but a few have been found growing free in vugs.

Bandora—Located along South Mineral Creek outside of Silverton, the mine's Little Todd vein contains spectacular chalcopyrite crystals to 1in, perched on sprays of gemmy quartz crystals, often associated with fine one-half inch black sphalerite crystals, small bladed barite crystals, and small galena cubes. The lower mine workings contain small azurite, wulfenite, cerussite, and linarite crystals, all formed as a result of decomposition of chalcopyrite in this wet mine.

Ben Franklin—Found in Eureka Gulch, an outcrop near the road contained well-developed, clear quartz crystals to 6 in long, with a pronounced trigonal cross section, caused by overdevelopment of alternating prism faces.

Brooklyn—Located just east of Highway 550's Chattanooga turn, this mine has had a checkered history of altered geologic reports, stock scams, and dashed hopes. Nice pyrite cubes to one-half inch on edge, bladed rhodochrosite coating chalcopyrite and sphalerite, and a few native gold wires growing on sphalerite have all been found at this mine.

Bullion King—Located in Porphyry Basin north of Chattanooga, this mine is well known for fine, large milk-white quartz crystals to 3 in (some sceptered), waxy-lustered sphalerite crystals, and sharp pyrite cubes to 1 in on edge.

Esmeralda—Located nearly at the end of Minnie Gulch, white quartz crystals to 3 in have been found coated on one side with mounds of black-brown siderite.

Eureka Gulch—At the very end of Eureka Gulch, above the original workings of the Sunnyside mine is a wide vein of rhodonite. Small sprays of hübnerite in quartz veinlets, intermixed with the rhodonite, have been found there.

Galty Boy—Found near the trail to Lark Basin, this mine contains lustrous bladed black hübnerite crystals to 1.5 in, quartz druse pseudomorphs of fluorite cubes to 1 in on edge, and beautiful mounds, as much as 4 in wide, of quartz crystal points colored light brown by inclusions of micro-hübnerite.

Genoa—Found just off the Animas River road on the path to Arrastra Basin, this small prospect produced wonderful plates of white quartz encrustation pseudomorphs after green fluorite, and a few octahedral of uncoated, apple-green fluorite crystals to 2 in on edge, as well as pseudomorphs after tabular barite.

Gold Lakes—Little Giant Basin is reached from a trail off Arrastra Gulch and was the site of some of the earliest gold workings in the region. The Gold Lakes mine can be found high above timberline in a hanging valley with spectacular views and wild flowers, as well as two small lakes fed from glacial runoff. In various dumps and outcrops can be found large amethyst scepters to 6 in, groups of clear reverse scepters, quartz pseudomorphs after rhombic calcite, and quartz pseudomorphs after tabular barite to 2 in.

Growler—This small mine is found just north of the Brooklyn mine. Resin-colored sphalerite crystals to 2 in perched on pyrite pyritohedra have been collected here.

Hematite Gulch—The locale is found on the west side of the Animas River, opposite the mouth of Cunningham Gulch. Large, somewhat rounded, tabular white barite crystals to 2.5 in, coated with quartz crystals on one side, have been found in a short adit about halfway up the gulch.

Highland Mary—Located high above the end of Cunningham Gulch, the gold from this mine was pinpointed (supposedly) with the aid of a psychic. Nice calcite clusters, both as scalenohedra and as hemispheres of tan color, have been found here.

Keystone—Located near the mouth of Cunningham Gulch, this mine has produced fine amethyst crystal clusters to 5 in wide and fine-grained drusy quartz pseudomorphs after elongated barite crystals, some 2 in long.

Kittimack—Found at the end of Maggie Gulch, this mine contained small, reddish hübnerite sprays to approximately one-half inch long on a matrix of massive white quartz.

Little Dora—A small mine just outside Silverton along Highway 550. Small hübnerite sprays, implanted on pale-green to colorless fluorite cubes, have come from this mine.

Maggie Gulch—About one-half mile from the mouth of this gulch is a tall outcrop pocked with many cavities containing quartz pseudomorphs after barite, some as large as 4 in long.

Osceola—A large mine located in Cunningham Gulch, near the turnoff to Stony Pass. This mine has produced specimen material for many years. Clear quartz crystal sprays have been found in association with black sphalerite crystals to .75 in, cream-colored calcite sprays, and small chalcopyrite crystals. In a lower drainage tunnel very fine calcite scalenohedra in groups to 4 in wide have been recovered.

Pride-of-the-West—Located next to the Osceola mine, these mines may exploit the same vein system. Similar specimen material comes from both mines.

Ransom(e)—The lower portal to this mine was found just above the ruins of the Sunnyside mill near the mouth of Eureka Gulch but has now been deliberately caved and contoured to discourage mineral collecting. Wonderful octahedrons as much as 4 in on edge and cubo-octahedra to approximately 1 in of water-clear, pale-green fluorite crystals perched on white, barrel-shaped quartz crystal plates have been found here. They were found in a huge vein that spanned the entire width of the tunnel, rising at least 12ft above and below to an unknown depth. When collecting, one was standing on sloughed quartz plates that jammed the lower opening.

Rochester—Located on the west side of the Animas River just north of Hematite Gulch, this mine contains sharp quartz pseudomorphs after tabular barite crystals to 4 in long.

Ruby—Located about halfway up Maggie Gulch, this mine produced fine, ruby-red hübnerite crystals to about .33 in long, densely coating quartz plates. Some pale-green fluorite crystals have been found on the dump.

Yukon—Located up Cement Creek about a mile below the American tunnel, this mine contained green cubo-octahedra of fluorite to 1.5 in with rust-brown hübnerite sprays.

New Mexico vanadinite

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Vanadinite is highly sought after by mineral collectors due to its wide range of brilliant colors and high luster. Usually in well-developed, hexagonal crystals, it is a widely distributed and relatively common mineral in orebodies mined for lead, particularly in arid regions.

The occurrence of vanadinite in New Mexico was first noted by Dr. Benjamin Silliman in 1882, in a paper describing the mineral regions of southern New Mexico (Silliman 1882). The Sierra Grande and Sierra Bella mines of Lake Valley were specifically mentioned. Material from these mines was studied by Genth and Rath (1885) and determined to be a new mineral intermediate between vanadinite [$Pb_5(VO_4)_3Cl$] and mimetite [$Pb_5(AsO_4)_3Cl$]. It was named endlichite in honor of Dr. F. M. Endlich, superintendent of the Sierra mines at Lake Valley. Endlichite in more recent years has been determined to be an arsenic-rich variety of vanadinite and its species status discredited.

Vanadinite specimens from Lake Valley reached prominent eastern mineral dealers George English of New York and A. E. Foote of Philadelphia by 1896 and 1897, and ads for "endlichite" were run in *The Mineral Collector* by 1897. About this same time, miner William F. Hall from Hillsboro found similar material from the mines at Hillsboro and sent shipments of 1,250 lb to A. E. Foote in Philadelphia (Leatherbee 1911). Specimens were advertised in *The Mineral Collector* and sold world-wide as the "finest known."

Mining for vanadinite as ore has only been conducted at two locations in New Mexico. The first of these was the Lucky mine near Bayard in Grant County. The Lucky mine is situated near the village of Vanadium and was mined before World War I and mentioned in a report on *North American vanadium deposits of commercial importance*, published in Boulder, Colorado, in 1920. "Two shipments of lead vanadate ore were made to Hamburg, Germany from the Lucky Bill vanadium mine located near Fort Bayard, New Mexico, before the world war, and some ores were shipped to eastern markets." The ore was described by Larsh in 1913: "The smaller seams and cracks in the porphyry are filled with an asbestos-like lead vanadate."

The second location is in the vicinity of Palomas Gap in the Caballo Mountains district of Sierra County. Before 1909, vanadinite from this district was mistaken for cerussite (Northrop 1959), but with this recognition, mining operations commenced in 1910. A mill to process the ore was constructed at Cutter (12 mi east of Palomas Gap), but by 1911 it was shut down. "It produced not more than a few hundred pounds of vanadium oxide" (Harley 1934).

Significant vanadinite occurrences in New Mexico are primarily in Grant and Sierra Counties in the southern part of the state. Vanadinite has, however, been reported from seven other counties, most of which are also in southern New Mexico. As of November 2008, 66 locations in New Mexico are reported to have vanadinite. Additional sites will undoubtedly come to light in the future.

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New Mexico vanadinite locations

Counties

Doña Ana
Grant
Hidalgo
Lincoln
Luna
Santa Fe
Sierra
Socorro
Taos

Mining districts/Mines

Doña Ana County

Bear Canyon district
Fairview mine

Black Mountain district*

Organ district
Stephenson-Bennett mine
Memphis mine*

Grant County

Central district
Betty Jo mine
Ground Hog mine
Lion #2 mine
Bull Frog mine
John claim
Lucky Bill mine
Denver shaft
Lion mine
Slate mine
Tiger mine

Georgetown district
Commercial mine
McNulty mine
Naiad Queen mine
McGregor mine
"Mimbres" mine
Redbird prospect
Satisfaction mine

Steeple Rock district

Lone Mountain district

Hidalgo County

Steins Pass district
North Star claim

Lordsburg district
Bluebird Draw prospect
Randal prospect
Roadside prospect

San Simon district
Mineral Mountain mine
World's Fair group

Eureka district
Dodge group

Red Hill district
Red Hill mine

Lincoln County

Gallinas Mountains district
Buckhorn mine
Red Cloud Copper mine

Jicarilla district*

Luna County

Cooks Peak district

Jose district
Faywood mine

Tres Hermanas district
Cincinnati vein

Old Hadley district
Copper mine
Rock Island mine

Santa Fe County

Cerrillos district*

Sierra County

Black Range Tin district

Grandview Canyon district

Caballo Mountains district
Billiken mine
Gladys mine
Red Top mine
Dewey mine
Owl mine
Red Top annex
White Swan mine

Hermosa district

Macho district
Old Dude mine

Cuchillo Negro district
Big Chief mine
Macy mine
Confidence mine
Petroglyph mine
Dictator mine

Lake Valley district
Sierra Bella mine
Sierra Grande mine

Socorro County

North Magdalena district
Jack Frost group
Night Hawk group
Pleasant View group

Socorro Peak district
Maine tunnel
May Flower mine
Dewey Load mine

Taos County

Harding Mine district
Harding mine

Red River district

*Questionable occurrence

Micromineral occurrences, Steeple Rock district Summit Mountains, Grant County, New Mexico

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In 1846 Lieutenant William H. Emory led a detachment of topographical engineers across an area southwest of Santa Fe for the purpose of establishing wagon roads. After visiting the Copper mines at Santa Rita, the group moved to the Gila River and down that waterway to camp at a point at what is now the border between New Mexico and Arizona. To the north the group observed a distinctive rock formation and by consensus named the edifice Steeple Rock. The name was duly noted in the margin of their survey map. It was not until the 1860s that mineralization was noted northwest of Steeple Rock. However, it was not until 1880, after the Indian threat had abated, that the Steeple Rock district was organized and mining begun. The district is located about 15 mi northeast of Duncan, Arizona, approximately 3 mi inside Grant County, New Mexico. The district, from 1880 to 1993, produced approximately 151,000 oz of Au, 3.4 million oz of Ag, 1.2 million lb of Cu, 5 million lb of Pb, 4 million lb of Zn in addition to commercial amounts of fluorite and manganese. At present the Summit mine is being prepared for commercial mining. Production is projected to start in early spring of 2009 with milling taking place at a locality near Lordsburg.

Rocks exposed in the Steeple Rock district are essentially a sequence of Tertiary units consisting of andesite, basaltic andesite, and dacite lavas. Mineralized epithermal quartz veins are structurally associated with generally northwest-southeast trending faults. Vein matter consists of quartz as much as 10 ft wide with some reaching several miles long. Ore minerals include: gold, silver, acanthite, galena, sphalerite, chalcopyrite, pyrite, and associated minerals. Published mineral species for the district include: acanthite, albite, alunite, augite, azurite, barite, biotite, calcite, chalcocite, chalcopyrite, chlorite sp., chrysocolla, dufrenite, epidote, fluorite, galena, gold, hematite, jarosite, kaolinite, limonite sp., magnetite, muscovite, orthoclase, plumbojarosite, pyrite, pyromorphite(?), quartz, silver, tetrahedrite, and vanadinite(?). Species new to the district include: aurichalcite, brochantite, cerussite, chalcanthite copper, cuprite, descloizite, dolomite, duftite, goethite, gypsum, libethenite, malachite, mimetite, mottramite, pyrolusite, siderite, smithsonite, vanadinite, and willemite.

Mines	Significant microminerals
Alabama	acanthite, gold, descloizite, mottramite, silver
Bilali	gold
Carlisle	gold, barite, siderite, brochantite, chalcanthite
Copper	libethenite, copper, cuprite, brochantite
Center	gold, fluorite, barite
East Camp:	
Blue Bell	azurite, chalcopyrite, malachite
Davenport	descloizite
East Camp	descloizite
Golden Nugget	malachite
McDonald lode	descloizite
Hilltop	descloizite, chlorargyrite, mimetite
Hoover tunnel	fluorite
Jim Crow	duftite, descloizite, mottramite, gold, willemite
Imperial	acanthite, mottramite, descloizite, aurichalcite
Laura	silver, descloizite, mottramite, chlorargyrite
Mohawk	fluorite
Mount Royal	quartz v. acicular
Norman King	fluorite
Ontario	fluorite, cerussite, chalcopyrite, azurite
Pennsylvania	gold, fluorite, smithsonite, azurite, cerussite
Summit	gold

Most of the larger mines have been patented or otherwise are located on private property, and permission to collect must be obtained for access. Roads are gravel or compact dirt and include Carlisle Road approaching from the southwest and Bitter Creek Road approaching from the northwest, both of which are well marked and county-maintained.

Although the Steeple Rock district did not appear to have many possibilities for collectable mineral specimens when researching the published data, on the ground searching of the dumps and mines turned up a surprising number of collectable items. However, only a cursory examination was conducted during the current study for some of the more than 60 significant mines around the district. Additional systematic examination is sure to turn up many more interesting minerals. As a reminder, this is an active mining area, and caution should be exercised to avoid mining activity on the haulage roads and mine sites. It should be additionally noted that several large rattlesnakes were encountered during this study, all in the southern part of the district.

Acknowledgments

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Gypsum crystal morphologies and diverse accumulations of gypsum and other evaporites in the Tularosa Basin

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Many varieties of evaporite sulfate and halide minerals occur in the Tularosa Basin, and other sulfates occur in the surrounding mountains. Gypsum is by far the most common and exhibits many forms, including standard euhedral monoclinic tabular clear to milky selenite crystals, swallowtail and fishtail twins. These are most common in the shallow subsurface near Lake Lucero and Alkali Flat. The largest gypsum crystals, as much as 60 cm wide, are amber-colored plates with a "habit...of a negative hemi-bypyramid and a basal pinacoid, the latter showing a vicinal formation...The crystals are tabular and have their greatest dimension along the *b* crystallographic axis" (Needham 1932). Sand and silt-sized gypsum takes this same disk-shaped lenticule form and makes up the bulk of gypsum in Pleistocene Lake Otero beds and in wind-blown "White Sand" dunes. This growth habit has been replicated in laboratory conditions in brines with a clay medium and organic acids (Cody 1991; Cody and Cody 1988). Both natural and lab-grown crystals fluoresce bright yellow due to included organic matter.

Other forms of gypsum include "sand crystals," in which sand grains are cemented together by euhedral or subhedral gypsum crystals, and "croute de nappe"—tabular plates of subhedral gypsum crystals that grew subvertically upward and cemented overlying sediment. Crystalline gypsum root casts 5-10 mm wide and as much as 30cm long mimic the meandering paths of roots. Satin-spar gypsum is found locally in fissures in soils. Ramshorn gypsum is found in a cave in the northern Tularosa Basin. In archaeological sites in the gypsum dunes, clumps of gypsum surrounding fire pits show that the heat turned gypsum into Plaster of Paris (bassanite), and rehydration cemented the masses together. Gypsum layers in Pleistocene Lake Otero beds exhibit crinkles from algal mats and disturbances from megafauna tracks such as camels and mammoths. The lake beds also contain many microfossils, including fish bones and scales.

Accumulations of gypsum crystals besides obvious sand dunes and lake beds include 3-m-high "mounds" of breccia of uncolored gypsum cleavage fragments with euhedral amber plates in them. These mounds are exposed where lake beds are deflated and are aligned in several directions. Scholars disagree as to how they formed, so research and arguments continue.

Finer-grained accumulations of gypsum include spring mounds, precipitated gypsum levees along streams, marshes, platform marshes, and megamounds. Gypsum springs in the northern Tularosa Basin create mounds of rock-hard gypsum as much as 6 m high and 200 m wide, with spring-orifice craters at their tops as much as 15 m wide. These mounds take thousands of years to build. Gypsum levees as much as 1.5 m high have precipitated along the meandering discharge channel from Malpais Spring. Adjacent to that channel is a marsh that has precipitated gypsum and raised itself as much as 3 m above the surrounding playa-like deflation basins and covers about 1 km'. Larger late Pleistocene–Holocene gypsum-depositing marshes (sediments 1.5-2 m thick) are evident over tens of square kilometers and include fossil aquatic gastropods, ostracodes, and fish. Megamounds are even larger accumulations of gypsum that cover tens of square kilometers and are thick enough to have developed sinkholes and caves.

Other evaporite minerals reported from the Tularosa Basin include halite, anhydrite, bassanite, mirabalite, hexahydrite, thenardite, bloedite, and possibly trona and bischofite. Other evaporite minerals are expected to be found in this complex basin. Anhydrite is most common in the subsurface as part of the Permian Yeso Formation near Carrizozo.

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Some highlights of 45 years of Medici family field collecting

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In writing a two-part article on our family for *Lapidary Journal* (April and May issues, 1990), Dorothy Stripp titled it "Mineral odyssey." I had never thought of my mineral collecting, which has always emphasized collecting in the field, in this way. I had been too busy with three boys in the family, a full time job, and occasional competition in triathlons and swimming, besides mineral and fossil collecting, but on looking back, it has been sort of an odyssey.

Having lived in New Jersey for many years, South Carolina for one year, Baltimore, Maryland, for three years, and Ohio from 1968 to date, I have had many opportunities for field collecting and meeting other collectors and have occasionally found myself involved in bonanza type finds. I was a geology major at Middlebury College in Vermont for about half a year, but never took a geology course. An extensive aptitude test led the college to strongly recommend a 3/2 yr plan with MIT for engineering. I chose not to do that because I wanted to be more involved in a liberal arts education, with some skiing and ice hockey, etc., instead of keeping my nose to the grindstone for five years for two equivalent degrees (BA/BS). I still kept a latent interest in geology, which had been kindled with family trips to the American Museum of Natural History gem hall in New York, along with such gifts as the book *Getting Acquainted with Minerals* and a fluorescent mineral set with UV light. A chemistry major at Middlebury led to graduate school at Rutgers University in New Jersey, and an interest in competitive swimming, which started in my last year at Middlebury and continued at the Ridgewood YMCA in New Jersey and Rutgers that led to daily workouts of more than 3 mi (sometimes more than 5 mi) of swimming. After quitting swimming in 1964,I became so fidgety that a swimmer friend's father, who was a rock collector in New Jersey, gave me a Herkimer "diamond" and suggested some places where I could expend some pent up energy; those places included Stirling Brook (for carnelian) in New Jersey and Middleville, New York for quartz.

A move to South Carolina the next year led to exposure to rutile, amethyst, and other localities in the southeastern states, including the Foote lithium mine in North Carolina. A move to Baltimore the next year led me to jump with both feet into mineral and Miocene and Eocene fossil collecting, including stints as president and bulletin editor for the Chesapeake club in Baltimore. My job was great but potentially hazardous, involving the nutritional details of life support for space travel (potential manned NASA trip to Mars) and extraterrestrial life detection. My first major find was of apophyllite on prehnite at Centreville, Virginia, in 1967. I had checked after the key blast, last one in the quarry next to a road, and seen nothing, but a later intuitive visit showed a rock doorway dropped out by removal of some of the blast material, exposing what would eventually be an approximately 60-ft tube of prehnite with associated minerals in a fault zone that had produced similar material in the upper layer of the quarry more than 10 yrs earlier. My camera jammed after only a few pictures were taken, and was sent away for repairs for much of the digging that ensued over a five-month period. After her interview with us for the *Lapidary Journal* story, Dorothy Stripp gave us a strand of thaumasite beads cut in Germany from Centreville thaumasite nodules and originally given to Hilde Seel of Philadelphia, the strand to accompany the prehnite in our collection. The Medici apartment in Baltimore ended up with well over half a ton of prehnite from this find, which was transported to Ohio the next year. A trip to the 1967 World's Fair in Montreal led me to request a room with a French-speaking family, which placed us at Frank Melanson's mother's house; this led to a long lasting relationship with Frank and eventually Wendy Hawthorneden (who was not married to Frank at the time). The largest Centreville specimen I collected ended up being traded to Frank for a Mont St. Hilaire siderite that he was collecting as curator at the Ecole Polytechnique in Montreal. Frank, and eventually Mike Ridding (Silverhorn) who I met shortly afterward, and George Robinson, who was still a student at the time, are responsible for suggestions on Canadian collecting sites, which led to many interesting trips to the north country, including a couple involving my son Jay and me as safety men for Darryl MacFarlane (Grenville Minerals) during blasting excavations. Betafite, thorite, uraninite, sphene, edenite, spinel, and other minerals were the result.

Reflecting on our Baltimore times, I realize how involved I became with field collecting and other things. Due to collecting and club activities, I became acquainted with Paul Desautels, John White, and Peter Leavens at the Smithsonian, June Zeitner (through bulletin editing), Neal Yedlin, Lou Perloff and other micromounters (Baltimore Mineral Society), and Herb Duke (originator of "International Shows," an outgrowth of the 1967 National Gem and Mineral Show in Washington, D.C.). Another acquaintance, Joey Galt, a very enthusiastic collector from the Toronto area, asked me to accompany her on a trip into the Faraday uranium mine near Bancroft, Ontario. A bit of trivia: Her husband, Eric, was the person whose identity papers were stolen by Martin Luther King's assassin when he escaped to Canada.

Our move to Ohio in 1968 made for easier access to the fluorite, calcite, celestine, and pyrite localities and trilobites and other Devonian and Ordovician fossils of Ohio and Michigan and the Halls Gap millerite locality, although visits to New England (e.g., Eden Mills for garnets) and Canada continued sporadically also. Exceptional luck involved our family in both of the major finds of celestine at Portage, Ohio, (1985 and 2000-2002), and a number of fluorite finds at the Auglaize quarry at Junction, Ohio have been associated with a sixth sense that I can't completely explain. The quarry is more often barren than not, good finds separated often by years, and my visits have sometimes been many months apart but lucky much more often than would be expected.

In 1969-1971, visits to the tri-state area (Oklahoma-Kansas-Missouri) to hunt in the old lead-zinc mines with Chink Enders and other friends were quite memorable. In 1972 a short workout period leading to a national masters swim meet, and a warm-up for one of my races in the same lane with Buster Crabbe, gave me incentive to get into top shape for the championships the next year in Chicago, with the help of John Bruce, retired Oklahoma State University (OSU) coach, to see what I could do, with great success. That same year, on a hint from OSU, I found parts of a mastodon, including a skull (which I found with a probe) and a tusk approximately 10 ft long (in pieces however). The next year, we opened What on Earth, a natural items shop in Columbus, Ohio, and in 1977 tried a professional field trip to the Spruce Peak area in the North Cascades area of Washington. A pyrite and quartz pocket more than 22 ft long that our group found in the breccia pipe there rejuvenated that area as a collecting, site and it has been worked since then to date (Medici et al. 1978; Lapis International 1996). This digging experience was quite eventful, including the burning of a large propane tank and the cabins next to it and a helicopter crash and burning.

In 1978 after my aunt moved to Carlsbad, New Mexico, my sons and I occasionally visited her and collected smoky quartz at Sierra Blanca. Our first trip there was the most memorable. Within a half hour, Eric and I removed a little dirt near small roots of a tree and opened an obvious pocket of crystals (although nothing was visible at first because the whole mass of crystals had sunken into what turned out to be a refrigerator-sized pocket). That pocket produced a large amount of material, requiring the four of us to each make two trips down the mountain with specimens, and we left the whole area nearby covered with specimens for other collectors. This material had all been completely removed by other visitors to the site by the time of our next visit the following year.

Regardless of finding crystals, this area near Ruidoso is one of the nicest backpacking areas we've visited!

In the mid 1980s my three sons and I did quite a bit of digging at the Herkimer "diamond" areas of New York (Wilson 2008). At one point, John White from the Smithsonian asked us to be on the lookout for a crystal pocket that could be exhibited in the museum. My son Eric found such a pocket while collecting with a friend, and our family dug it out in pieces and reassembled it for the museum (900+ pounds of rock), with the contents of more than 500 quartz crystals. It is now an island display in the new gem hall at the Smithsonian. During the same time period, I had been rooming with Art Grant, one of the country's top facetors, at mineral shows, and Art offered to teach Jay to facet. Jay took him up on this and has had quite good success in handling materials especially difficult to facet.

The pyrites of Ross County in Ohio have been quite interesting to dig, although obtaining access to the localities, all of which are on private land, is quite difficult of late. One locality in particular has produced both a 40-lb sea serpent-like piece now in the Cincinnati Natural History Museum, and a meter-long piece, now in the Smithsonian, (Stripp 1990; Lapis International 1996). We hope to include some of our specimens in the Mineral Oddities display at Tucson 2009.

I will mention one last site that we recently visited. Approximately 40 yrs after my first visit to Graves Mountain, Georgia, we went there to look for ruble. Although only small ruffles were found, some very nice stalactitic "turgite" (iridescent goethite/hematite) specimens were found, and a visit the next year (2005) yielded a spectacular iridescent pocket with a white mound in it, causing it to be named the Mt. Fuji pocket. This is a good example of typical field collecting in that one does not always find the desired material, but alternatives might prove to be just as exciting finds if one keeps open eyes and an open mind! As a last note, Dorothy Stripp's article in *Lapidary Journal* describes some of the ups and downs of field collecting, including some major hazards. My attitude is to not let the downsides be too worrisome; after each such occurrence, one starts with a clean slate statistically as long as rules of safety are always followed and kept in mind.

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Minerals of the White Sands Missile Range

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The Alamogordo Bombing Range (ABR) was created on what is roughly 3,200 mi^2 of south-central New Mexico. On July 9, 1945, the White Sands Missile Range (WSMR) was established on what was the ABR, and on July 16 the first atomic bomb was detonated at the Trinity Site, near Mockingbird Gap. The entire San Andres Mountain chain, from San Agustin Pass (near Organ) to Mockingbird Gap, is included in the WSMR. This highly mineralized area, including the salt beds of the Tularosa Basin, has been off limits to mineral collectors ever since.

The San Andres Mountains are a horst block running roughly down the center of the Rio Grande rift. The mountains are composed mainly of westward-dipping Paleozoic limestones that rest on crystalline Proterozoic intrusive and metamorphic rocks. Two significant Tertiary intrusions are present in the range. The largest is the Organ batholith on the southern margin, and another large sill-like intrusion can be found at Salinas Peak. The most mineralized area is around the Organ batholith, although significant mineralization is known around Salinas Peak. Metal mineralization, not necessarily related to Tertiary volcanism, is also documented in the Proterozoic rocks along the entire length of the range. The diversity of geology present in the San Andres Mountains, and adjacent Tularsosa Basin, suggests a high probability of a large number of mineral species that are quite collectable.

A review of Stuart Northrop's book, *Minerals of New Mexico,* reveals over eight localities (Fig. 1) that have produced "museum quality" mineral specimens that are now isolated on the WSMR (Northrop 1959). He also lists more than 16 mineral species that occur in the range as "outstanding." More recently, escorted visits to the WSMR have produced a number of new species that were previously unrecorded.

This presentation will review the mineral holdings of the New Mexico Bureau of Geology and Mineral Resources Museum as they pertain to the White Sands area (Table 1). Most of these pieces were collected before the establishment of the WSMR. The author will share what has been learned on the half dozen research and collecting trips onto the WSMR over the last 15 yrs. Highlights will include mineral occurrences of the northern Organ Mountains, Mockingbird Gap, Sulphur Canyon, and White Sands.

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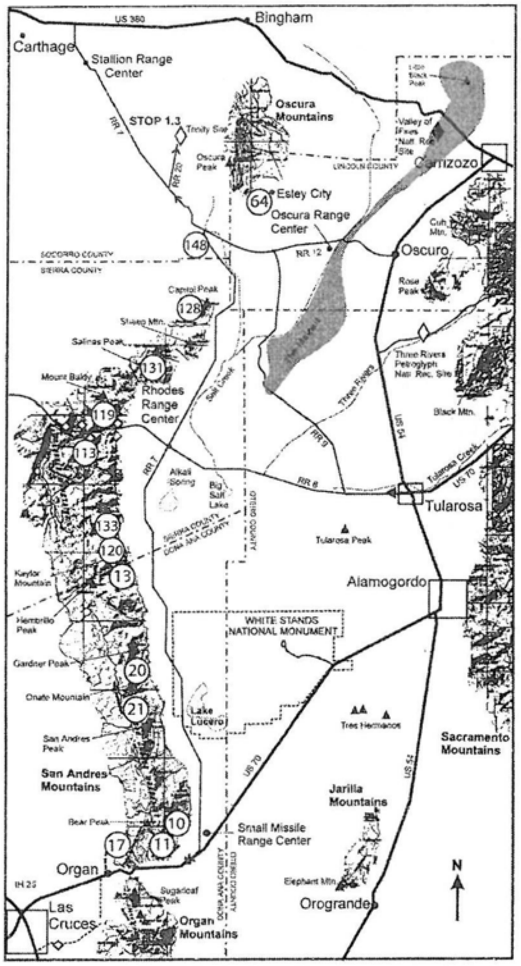

Figure 1. Map of mining districts on the White Sands Missile Range, New Mexico. Base map adapted from Lueth et al. 2002. Numbers correspond to district numbers assigned by Northrop, 1959, and listed in Table 1.

Table 1. Mining districts encompassed by the White Sands Missile Range, New Mexico
(from Northrop 1959)

County	District No.	Name	Notable Minerals
Doña Ana	17	Organ (north)	Altaite, Rickardite, Quartz, Silver, Tellurium
	10	Bear Canyon	Vanadinite, Wulfenite
	11	Black Mountain	Gold, Topaz, Pyrite
	13	Hembrillo	Talc, Chalcocite
	21	San Andres Canyon	Galena, Gold
	20	San Andrecito	Cuprite
Sierra	120	Grandview Canyon	Bismuthinite, Endlichite, Scheelite, Fluorite, Wolframite, Jarosite
	133	Sulphur Canyon	Fluorite, Barite
	113	Bearden Canyon	Copper, Barite, Galena
	119	Goodfortune Creek	Chalcocite, Jarosite
	131	Salinas Peak	Bismutite, Galena
	128	Lava Gap	Fluorite, Calcite
Lincoln	64	Estey	Chalcocite
Socorro	148	Mockingbird Gap	Fluorite, sphalerite, Raspite?

From mineral strike to meteor strike: Guffey and the Freshwater mining district, Colorado

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This paper focuses on the geology, mineralogy, and mining history of the Guffey region. For the purpose of this study, the Guffey region defined by Bever (1953) will be used: "[A]n area of about 125 square miles in north-central Fremont County and southeast Park County in the Front Range of central Colorado. Its center is 34 miles by road northwest of Calton City." The town of Guffey is located 35 mi northwest of Cation City near Currant Creek in Park County, Colorado. The town of Guffey and the surrounding Freshwater mining district are central to this discussion.

The first people thought to occupy the Guffey area, based on lithics they left behind, were Early Paleo-Indians (before 5000 B.c.). Spear and arrow points, reflective of the Archaic Period (5000 B.C. to A.D. 500) and the early part of the Late Prehistoric Period (A.D. 500-1500), were discovered in the Guffey area.

Flaked stone debris ("chips"), or debitage, was found in various locations and represents Ute camping areas in the Guffey area. In addition to the debitage, there are culturally peeled trees in the Guffey area that record Ute harvesting of the cambium layer during late spring. The Utes harvested sweet-smelling bark from the ponderosa while on their way to summer camping areas, such as the fringes of South Park (A. Kane, pers. comm. 2008).

The Guffey area was explored by John C. Fremont when he was returning from California in 1844 (McConnell 1966). A few early settlers began to arrive in the vicinity in the late 1870s.

The town of Guffey and the Freshwater mining district are situated in a very scenic area near the base of three ancient volcanoes that have been deeply eroded. These volcanoes erupted 34m.y. ago, sending lahars flowing down their flanks, burying large redwood trees, and damming the river in the valley below. This dam created Lake Florissant, where a large deposit of Eocene plant and insect fossils formed.

The Guffey area is underlain primarily by Precambrian igneous and metamorphic rocks, which have been covered to the north, east, and west by post-Laramide extrusive rocks, forming the Guffey volcanic center. The Guffey volcanic center is part of the Thirtynine Mile volcanic area, the largest remnant of the Central Colorado volcanic field. The Guffey volcanic center—the largest volcanic center within the Thirtynine Mile volcanic area—is characterized by shallow plutonic rocks, ranging in composition from basalt to rhyolite, that form a central complex of domes near the town of Guffey (McIntosh and Chapin 2004; Wobus and Kroeger 1994). Students of the Keck Geology Consortium (Venzke 1988) have characterized the rocks of the Guffey volcanic center as latites, trachytes, and quartz trachytes, covered by a thick series of trachybasalt, shoshonitic flows, and lahars. The area is intruded by basalt dikes and small rhyolitic plutons.

One mile south of Guffey there are two mineral springs, Iron Spring and Yellow Soda Spring. Sediment from Yellow Soda Spring has formed a large mound more than 50 ft in diameter and more than 20 ft high. Spring waters bubble in the center of the apex of the cone. Anecdotal records mention that spring water once gushed out in a column 8 ft above the top of the cone. This phenomenon ended when several cowboys threw stones in the spring and obstructed the force of the flow. The water of Yellow Soda Spring at the apex of the cone was analyzed by the authors. The temperature was 63°F, had a pH of 7.1, and a salinity of -4,000 ppm. Using standard testing procedures, a Geometrix Scintilometer obtained the readings listed in Table 1. The highest readings were obtained over the pool of bubbling water (thought to be radon gas).

Table 1. Scintilometer readings at Yellow Soda Spring, Guffey , Colorado

Counts per second	Location
20-25	Background radiation.
30-40	Down at road below the spring.
150-250	Around different areas at the top of the spring.
250 and greater	The highest reading over the pool of bubbling water.

Today, Guffey is an unincorporated town with a post office. Guffey has a population of about 26 and is famous for electing various animals as the mayors. A cat named Monster was elected as the mayor of Guffey in 1998.

Guffey was founded by prospectors on a chance there might be another rich gold strike like the one in the nearby mining camp of Cripple Creek. The town was originally called Idaville and then Freshwater. Because there was another Freshwater in California, the town was then named after James McClurg Guffey (1839-1930), who was an oilman and capitalist *(History of Pittsburgh and Environs* 1922). By the time Guffey was incorporated in 1895 it was a bustling mining, lumbering, and ranching town (Eberhart 1969; McConnell 1966). There were several sawmills on the south end of town that did maintenance work on state fencing, telephone poles, and railroad ties. The Woodmen of America built the town hall. Guffey was also known far and wide for its dances, which included lots of fiddlers and other musicians. Cattle rustlers and outlaws operated in the nearby Black Mountain and Thirtynine Mile Mountain area. There was quite a mix of activity in this beautiful mountain setting.

Guffey became the center of activity in the Freshwater mining district where copper, lead, zinc, mica, feldspar, and other minerals were produced. It was during the gold rush years from 1895 to 1902 that the Freshwater mining district reached its high point and when Guffey had more than 500 residents and more than 40 businesses.

Although enormous gold discoveries were forecasted, it was the mining of other minerals that kept the small town going. Nearby cattle ranches and lumber operations sustained the small community during periods when mining brought in little money.

The Freshwater mining district was in the general area of Guffey. Production from the Freshwater mining district had not been recorded until the 1945 Minerals Yearbook reported production of 64 tons from two mines that yielded one ounce of gold, 83 oz of silver, 5,600 lb of copper, 100 lb of lead, and 2,600 lb of zinc (Vanderwilt 1947).

The Precambrian rocks in this district are host to the copper-tungsten-gold-zinc-lead occurrences of the Guffey district. A variety of ore and other minerals occur in the area (Table 2).

Table 2. Selected mineralogy of the Guffey Area

Mineral occurrences associated with pegmatites	
Euxenite	This rare radioactive mineral occurs as bladed crystals as much as 1 in long in the core margin unit of a zoned pegmatite near the Mac Gulch drainage, approximately 3 mi southeast of Guffey. Associated minerals include biotite, magnetite, and tantalite.
Monazite	Small crystals of monazite were found approximately 1 mi west-northwest of the Meyers Ranch pegmatite.
Magnetite	Individual magnetite octahedrals are as large as 1.25 inches in the Micanite district and near the margins of other pegmatites in the Guffey area.
Minerals occurrences associated with metamorphic rocks	
Cordierite	Blue-violet cordierite was found in the Climax pegmatite of the Micanite area. Selected boulders contain small crystals of glassy gray-violet cordierite. The gemstone variety of cordierite is called iolite.
Kayanite	Small blue blades of kyanite are located on the north bank of Dicks Gulch approximately 2 mi west of Currant Creek.
Sillimanite	Sillimanite occurs in various locations throughout the area.
Minerals of ore deposits	
Scheelite	Milky-white scheelite occurs as disseminated grains and crystals one-quarter mile northeast of the West ranch, which is at the junction of Colorado State Highway 9 and the Guffey road. The centers of the crystals fluoresce blue-white whereas the margins exhibit a yellow fluorescent color. (Bever, 1953)
Gold	A small amount of native gold was found at the Carbonate King Mine.
Minerals at the Betty mine	Malachite, azurite, chalcopyrite, pyrite, bornite, galena, and sphalerite are present, along with minor amounts of covellite. Spinel is also present.
Minerals of the Rose Dawn, Star Girl, Rosemont, and Climax mines	Beryl, muscovite, and schorl (black tourmaline), pink microcline masses as much as 10 feet across, cordierite, white albite, biotite, apatite, and rose quartz occurs in the mines of the Micanite pegmatite district.
Meyers Ranch	Niobium (columbium), muscovite, feldspar, rose quartz and are from this area. Trace amounts of tantalum, bismuth, thorium, titanium, uranium, and tin

The Guffey area had many mines and prospects; however, the total production recorded for the district is minor—less than 10 tons of base metal and less than 200 oz of silver and gold combined.

The Betty mine, named after the owner's sister, was the most significant producer of the district. Bever (1953) reports a 300-ft-deep shaft "near the junction of a rhyolite breccia dike and a diabase dike, both of which have been intruded into injection gneiss." The Betty mine has malachite, azurite, and chalcopyrite. There are also significant amounts of pyrite, bornite, galena, and sphalerite and minor amounts of covellite (Bever 1953). Green spinel is abundant in the quartz-calcite-garnet amphibole rock. The spinel occurs as small, disseminated grains that create a greenish cast to the host rock (Bever 1953). Some octahedral of spinel attain a size of 1 in on edge. The mine machinery at the Betty mine was powered by a burro walking around in circles. Mr. Thiebold, the mine geologist in those early days, examined the mine's rocks in an ore house.

Other prospects near the Betty mine include the Copper King and Copper Queen mines. The host rocks of these mines are the gneiss unit. South of Guffey are several small tungsten prospects associated with a gneiss rock unit. Local pegmatites within the gneiss units have been mined for feldspar, mica, and beryl.

The Walter mine and the Charity mine were east of Guffey; the Annie Laurie was north of town. Other area mines included the Venture mine, which had a steam plant; the Black Diamond mine; and the Bessie mine, with a shaft more than 150 ft deep. The Mable Grace mine produced gold, copper, and mica. The Marguerite mine, 2 mi east of town, returned an assay of $594 per ton across a 3-ft vein in 1896.

Gold Hill mines, close to the town of Guffey, included the Hillside lode, Jim Crow lode, Daisy Douglas, Gypsy Queen, Daydream, Black Mule, Bellevue mine, and Dora V. The Carbonate King, next to Gold Hill boasted a 185-ft shaft and a 4-ft vein of high-grade carbonate ore carrying free gold in 1896. Ore from the Carbonate King was shipped to the Dell mill on Four Mile for processing.

One and a half miles west of town is the Moonlight Gulch area, where a number of good prospects were located, including the Liberty Bell (produced the first sylvanite ore in the camp). The Liberty Bell was owned by C. T. Case, nephew of J. I. Case, manufacturer of threshing machines. *The Denver Times* (August 7, 1896) described the vein as "29 inches in width, at a depth of 40 feet and from 50 samples assayed at over $3,000 a ton." Case was also reported to have shipped 2,640 lb of ore to the cyanide mill at Florence where he received $439.60. Case speculated in the district mines. He sold the Little-Ruth group, located on Little Ruth Mountain, to B. R. Glidden of Glidden Barb Wire Company and W. F. Lipke of Kansas City for $16,000 *(The Denver Times,* August 7, 1896). B. R. Glidden's relative, Joseph F. Glidden of DeKalb, Illinois, reshaped the American West with his 1874 patent for a simple wire technology (barbed wire) that helped ranchers tame the land.

Several prospects are known in the volcanic rocks of the Guffey volcanic center in the area north and west of the town of Guffey. They are mentioned by Vanderwilt (1947); however, there is no recorded information on the geological nature of these deposits.

The Freshwater mining district had a number of prospects, including the Little Jewel, Sweetheart, Little Beauty, Little Darling, Yellow Peril, Oro Find Lode, Black Beauty, Irine, Little Elsie, Little Susie, Emma B, Mary S, Willard, Pearle and Everlasting mines. Two brothers from Cincinnati, Ohio, organized the Andesite Gold mining and Town Company in the Freshwater mining District. The company owned 10 lode claims and held 160 acres of placer claims. *The Denver Times* reported in 1896 that more than 1,200 ft of development work was done in the claims and considerable ore had been exposed.

Located southeast of Guffey is the Micanite pegmatite district. This district, covering approximately 4 mi^1, is dominated by metamorphic rocks, mostly biotite-cordierite-sillimanite gneiss and schist (Wobus et al. 1979). In 1902 the United States Mica Company located several pegmatites and was in production from 1904 to 1907 (Hanley et al. 1950). The district remained inactive until 1934, when Colorado Feldspar Company of Canon City renewed activity. From 1934 to 1942 approximately 2,000 tons feldspar and 175 tons scrap mica were produced.

In November 1907 two cowboys were running their cattle in the hills around Guffey when they discovered what they initially thought to be an immense silver nugget (Pearl 1964). The men were J. T. Witcher, a Guffey-area rancher, and Robert L. Pope of Cation City. In fact, what they had found was a 682-lb iron meteorite.

This meteorite was eventually purchased by the American Museum of Natural History in New York (AMNH), but its exact path to that destination remains somewhat unclear. AMNH curator Edmund Hovey reports the acquisition in 1909 and states that the finders removed the meteorite from the mountains of Cripple Creek (Hovey 1909). However, a front page article from the *Fairplay Flume* (January 22, 1908), states that the meteorite was displayed for several days in front of Tanner's Grocery (presumably in Fairplay). It was then shipped (for $60) to the museum in New York. The AMNH records the purchase price as $1,500 (about $30,000 in

2008 dollars; today this meteorite would have a value of at least several hundred thousand dollars). The Guffey Meteorite remains prominently displayed in the AMNH Meteorite Hall.

In entering the meteorite into the AMNH collection, Hovey (1909) described it as a siderite, a "wholly metallic meteorite 36.5 inches long, 15 inches in maximum height and 8 inches wide." He gave its weight as 682 lb. The first published analysis of the meteorite was by William P. Headden, professor of chemistry at the Agricultural College of Fort Collins. Haedden identified the body as containing 89.8% iron, 10% nickel, and trace amounts of cobalt, manganese, chromium, copper, phosphorus, calcium oxide, and magnesium oxide (Headden 1908). Hovey entered a similar analysis into the AMNH records.

In the modern nomenclature, the Guffey meteorite is classified as an ungrouped iron, meaning it does not fit well into any defined category. It is sometimes considered an ataxite, an iron with high nickel content and not showing Widmanstatten patterns (Murphy 1999). This represents a rare type of meteorite. The Guffey is the largest meteorite that has been found in the state of Colorado.

At least 79 meteorites have been documented in Colorado. This is exceeded only by three other states: Texas, Kansas, and New Mexico (Matthews et al. 2003).

It took a special kind of person with strong determination and self-reliance to survive the boom and bust of mining and to make a living in Guffey and the Freshwater mining district area. Today this quiet little mountain community has fewer than 30 residents. The people still living there today reflect this pioneering spirit of independence. And Monster the cat is still serving as "Mayor."

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Minerals of the Gold Hill mine, Tooele County, Utah

Mystery Speaker__________________________

The Gold Hill mining district was discovered in 1857, and the Gold Hill mine itself was producing ore by 1871. Metals recovered from the district include gold, silver, copper, lead, zinc, tungsten, arsenic, bismuth, antimony, vanadium, tin, and molybdenum. In 1892 a mill was constructed to process ores from the Alvarado, Cane Springs, and Gold Hill mines. From 1892 to 1895, the mill produced $208,000 in gold. During WWI production peaked. Mining activity was inconsistent and the last ore produced was in 1945.

The mine has been "discovered" by collectors of mineral specimens. It has been one of the most popular field collecting sites in the American West. The Gold Hill mine's various pits, adits, and intermediate levels have produced many colorful secondary arsenate minerals, for which the mine is famous.

Currently, www.mindat.org lists approximately 91 minerals from the mine, although some species have not been listed on the Web site, such as vesuvianite from the main dumps, pharmacosiderite from the 150-ft level, and segnitite from the 110-ft level.

It is the type location for two minerals; austinite, $CaZn(As0_4)(OH)$, and juanitaite, $(Cu,Ca,Fe)_{10}Bi(As0_4)_4(0H)_{11}.H_20$. It can be considered as the co-type locality for barahonaite(Al), $(Ca,Cu,Na,Fe^{+3}A1)_{12}Al_2(As0_4)_2(OH,Cl)_x{\cdot}nH_20$, which was recently published.

In 2007 the Utah Mined Land Reclamation Program closed off holes located within the Gold Hill mining district, including the Gold Hill mine. The Gold Hill mine's underground workings are now inaccessible, but the mine's open pits and dumps can still produce nice specimens.

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