the Mineralogical Record

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March–April 1988
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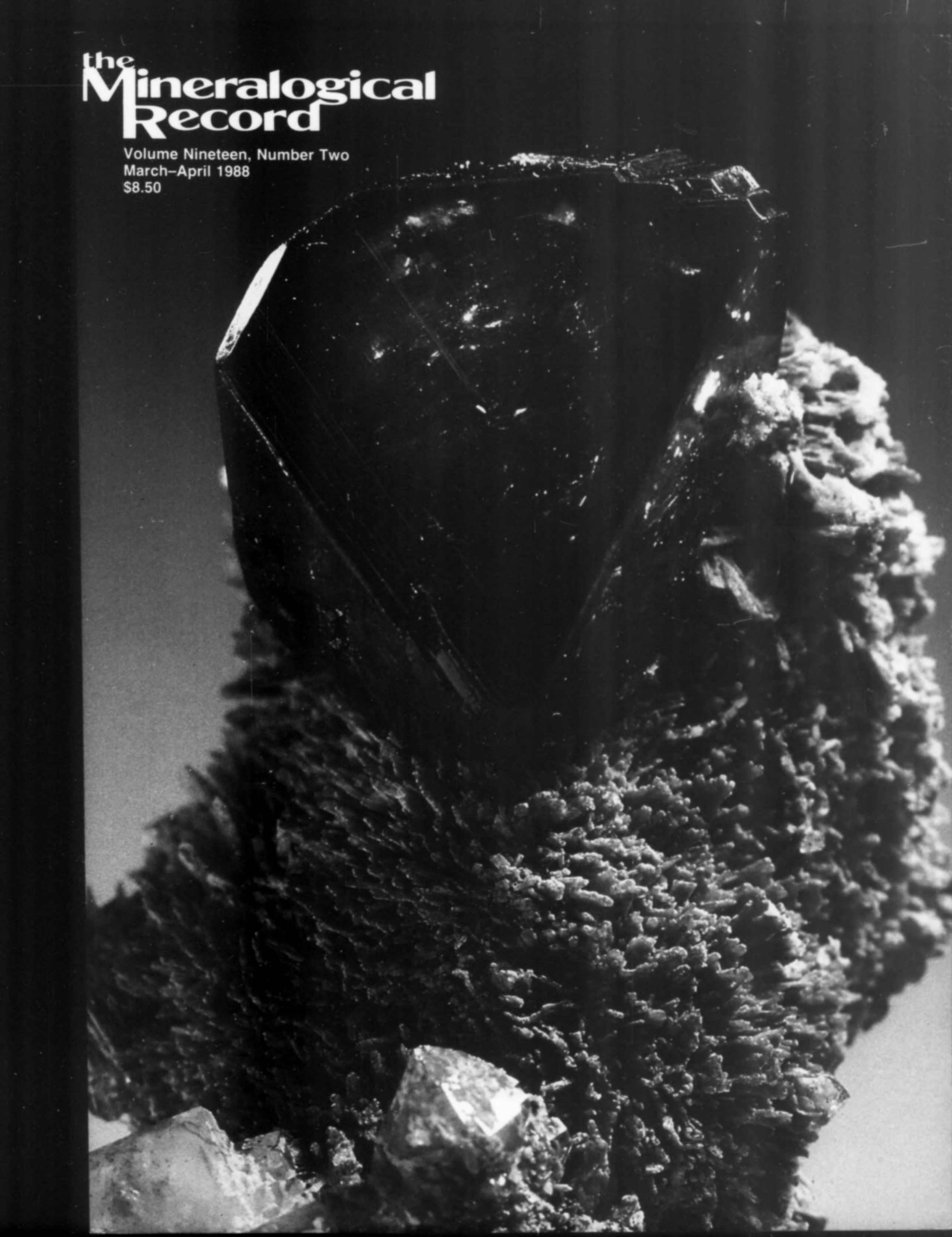

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*Continued on p. 135

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March–April 1988
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Articles

Departments

COVER: SPHALERITE crystal, 1.8 cm, on johannsenite from the Iron Cap mine, Graham County, Arizona. George Godas collection; photo by Wendell Wilson. For more on this occurrence see the article beginning on page 81.

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notes from the EDITOR

WHAT'S NEW IN MINERALS?

This issue of the *Mineralogical Record* is particularly full of news about recent mineral discoveries. Finds made in Arizona (the Iron Cap mine) and in Ouray County, Colorado, are described in three articles, and a great many other discoveries are reported from the Denver, Houston, Detroit, Pasadena, Nuremberg and Munich Shows. These are good times indeed for mineral collectors.

Those who worry about the future of mineral collecting tend to brood about whether enough "new" specimens can still be collected in the field anymore. What with the depletion of some localities and the closing or extinction, one way or another, of others, it might seem that we are in danger of having our supply cut off. We would then have to subsist forever on a dwindling number of "recycled" specimens from old collections.

Rather than wonder about this I decided to poll our American advertisers and *ask* them how many newly dug specimens they've sold in the last twelve months. Letters went out to about a hundred dealers, and fully two-thirds responded with their estimates. That's a very high return rate, and I want to thank those people for kindly helping out with this survey.

The totals were as follows: 717,000 newly dug mineral specimens, of which about 280,000 were classed as "pewter-grade" pyrite and the like (used as bases for pewter figurines sold in tourist shops). This suggests that a full response by all 100 American dealers queried would total over a million new specimens!

It is an interesting coincidence(?) that I once estimated the same number of specimens (old and new) as being for sale each year at the Tucson Show. In any case, there seems to be little cause for alarm. I hardly think that a million specimens a year were being salvaged by mineral dealers in the days of Washington Roebling, Clarence Bement and George F. Kunz.

As a footnote to the survey letter, I asked dealers to list separately a total for sales made to crystal power people. The dealers reported well over 150,000 specimens (most probably newly dug) sold to this group.

TUCSON SHOW CATALOG

Our first year of publication for the *Official Tucson Show Catalog* was a success! Thanks to support from advertisers, we were able to produce a 64-page magazine on high-quality paper stock (the same as used for the *Mineralogical Record*), with fine color photography and three major articles. The feature article is a ten-page review of beryl and its varieties, updated and expanded from the article by Richard V. Gaines which appeared in the *Mineralogical Record* back in 1976; all new color photography has been added. Another article relates the history of the Tucson Show itself, from its humble beginnings in 1955 to the enormous phenomenon it has become today. And a third article, "Insider's Guide to Tucson," tells show visitors where to find the best restaurants, most interesting museums and most highly recommended tourist attractions in the area. This latter article will become a regular feature of future editions, constantly updated and perhaps expanded to give recommendations on where to find the best lodging, where to do a little local field collecting and other useful information.

Also included in the catalog is the Tucson Gem & Mineral Society's official 8-page program for the main show at the Tucson Community Center, which includes information on the society, the lecture and symposia programs, floor plans and listings of dealers and exhibitors.

Leading off the advertising section is a map of central Tucson showing locations for the shows at the Community Center, La Quinta Motor Inn, Ramada Inn, Desert Inn, Travelodge, Sheraton Pueblo Inn, Discovery Inn, Day's Inn (formerly the Santa Rita) and the Holiday Inn Broadway. Other shows located a bit farther afield include the Doubletree Inn, Americana Hotel, the Holidome, and a huge new show organized by Herb Duke at the Pima County Fairgrounds.

Following the advertising section is a concise Dealer Index and Product Index, showing at a glance the page numbers for ads *and* the coded location of that dealer in town (e.g. "DI-315" for "Desert Inn, room 315"). Only dealers who purchase individual ads are listed in the product index (up to six categories per dealer). However, the dealer index includes all these plus all dealers at the Community Center whose names were supplied by the dealer chairmen, and all dealers at the motel satellite shows whose organizers purchased at least a one-page ad (whether or not the ad actually listed the dealers). For future editions we hope to attract more advertising by satellite show managers so that we can make the dealer index even more comprehensive.

We have been encouraging all our satellite show advertisers to include full mailing addresses for as many dealers as possible, so that the catalog will continue to be useful as a dealer reference long after the show is over.

As a service to our readers who were unable to attend the show this year, we have saved back some copies of the 1988 catalog which can still be ordered through the circulation manager ($5 postpaid).

We are scheduling next year's catalog to be ready about two weeks ahead of our January-February issue, for advance mailing to subscribers who have ordered a copy. There will be a box to check on the *Mineralogical Record* subscription renewal form, as a convenient reminder to reserve your copy of the *Official Tucson Show Catalog 1989*.

We're doing our best to make this an entertaining and useful publication which our readers will enjoy having and keeping. Minerals will naturally be the principal focus, but articles may also cover a wide range of other earth science collectibles and related items such as scientific instruments, decorator fossils, meteorites, rare books, collector-quality gemtones, mining memorabilia, and who knows what else. Practical information on prices and sources *will* be included! We're looking forward to working within this new, broader, non-technical, collector-oriented format. Authors with ideas for appropriate articles are invited to contact me. Readers are urged to order a copy of the 1988 catalog if they don't have one already, and to get their name on the list for the 1989 catalog ($6 postpaid).

Dealers are invited to make plans now to advertise in the 1989 catalog. The press run will be 25,000 copies. **Payment must accompany your order. Deadline: OCTOBER 15.**

Rates for the 1989 catalog (B&W) will be as follows:

Full page	$640	1/4 page	$160
1/2 page	$320	1/6 page	$110
1/3 page	$220	1/12 page	$ 55

These are the only sizes available (except for multiple-page ads at $640 per page). Covers are already spoken for. *No classified ads*, although all the advertising will be organized together in a general way: satellite show ads first, followed by ads for shows on other dates in other cities, then most of the mineral dealers together, then the fossil dealers, book dealers, memorabilia dealers and lapidary and gemstone dealers, in that order.

Color rate is $400 per color photo ($200 discount if advertiser supplies color separations), which charge is in addition to the above-listed space rates.

SCIENTIFIC WORD PROCESSING PROGRAM

A new program called *The Egg* promises power and ease in technical and scientific word processing. Previously known as *Hockney's Egg* and now in its 4.2 version following some extensive revisions, the program accepts *Wordstar*, *Word Perfect*, *Lotus 1-2-3* and all ASCII files. It communicates with a long list of printers from dot matrix to laser printers. *The Egg* handles complicated formulas, matrices, chemical structures and unusual text with a minimum of keystrokes. Requirements: IBM-PC or IBM compatible computer with at least 256 K, one disc drive, a color graphics or Hercules card, and PC-DOS 2.0 or higher. The price is $495. Order from Elsevier Scientific Software, 52 Vanderbilt Avenue, New York, NY 10017.

CONGRATULATIONS . . .

. . . To *Mineralogical Record* Associate Editor Dr. Pete J. Dunn, who has been honored with the naming of a new mineral, *petedunnite*. The new species is a zinc clinopyroxene from Franklin, New Jersey, chosen in part to recognize the major contributions which Pete has made to a fuller understanding of Franklin mineralogy. Reference:

ESSENE, E. J., and PEACOR, D. R. (1987) Petedunnite ($CaZnSi_2O_6$), a new zinc clinopyroxene from Franklin, New Jersey, and phase equilibria for zincian pyroxenes. *American Mineralogist*, **72**, 157–166.

IR SPECTRA AVAILABLE

Infrared spectrography is a relatively inexpensive analytical technique which many small companies and institutions employ. Minerals are identified by their characteristic spectra, and only very small samples are required. Unfortunately a systematic catalog of identified spectra for comparison with unknowns has not previously been available. Recently, however, a two-volume catalog of 300 mineral spectra has been compiled by Dr. Berthold Suhner and is being published by Christian Weise Verlag (Oberanger 6, D-8000 Munchen 2, West Germany). The set is priced at DM 148, and only 120 copies have been printed. Additional volumes containing other spectra are planned.

GOLD NEWS

For those of you who still haven't seen enough on gold, and who missed the Natural History Museum of Los Angeles County's recent exhibition, *Gold: The Quest for New World Riches:* send for a copy of the museum's magazine, *Terra*. The March-April 1987 issue is entirely on gold; it is 36 pages, with beautiful color photography on almost every page, and only three pages of ads (two of which show fine crystal specimens in color). Included is an article on "the natural history of gold" by Peter C. Keller. This is an extremely beautiful "coffee table" magazine. Copies may be ordered for $5 postpaid (in the U.S.) from the Museum Bookstore, Natural History Museum, 900 Exposition Blvd., Los Angeles, CA 90007.

Still not enough gold for you? Then you must be a true addict. You'd better get in touch with the Gold Information Center (P.O. Box 934, Madison Square Station, New York, NY 10010). They will help you feed your habit at no charge, by sending you free, full-color publications such as *Man and His Gold, An Introduction to Investing in Gold, Gold Mining and Recovery: Yesterday and Today, Gold Prospecting: A Guide for the Weekend Gold Digger, Gold in Industry*, and *Gold Coins for the Collector*. (Limit one copy of each title per person.) When you write, indicate whether you are a mineral collector, student, teacher, coin collector or jeweler. Helping them out with their demographical studies is the least you can do in exchange for all that gold literature!

If your interest in gold goes deep into the fields of geology, geochemistry and technical economic geology, you will also want to pick up a couple of new books that have recently been published. R. W. Boyle's *Gold: History and Genesis of Deposits*, is a technical tome of 676 pages consisting almost entirely of reprints of significant articles, extracts, abstracts and translations from the professional literature, each accompanied by Boyle's own introductory and closing commentaries. The book traces the progress of economic geological theories on gold genesis from ancient times through the Classical period, Middle Ages, Renaissance and right up to the twentieth century. Copies may be ordered at $54 postpaid from the Mineralogical Record Bookstore, 1601 Fairview Dr., Suite C, Carson City, NV 89702. J. J. Bache's smaller book (178 pages), *World Gold Deposits: A Quantitative Classification*, is the result of a technical study correlating gold ore deposits dimensions with their geochemical characteristics. The resulting synthesis permits a new classification scheme for gold-bearing deposits. Copies may be ordered for $45 from Elsevier Science Publishing Company, 52 Vanderbilt Avenue, New York, NY 10017-3872.

NECROLOGY

As mentioned here in vol. 18, no. 2, we must usually restrict the publication of obituary biographies to those persons who were of national or international prominence. It has been suggested, however, that we could publish a simple notice *without* lengthy biographical notes for any and every person involved in mineral collecting and mineralogy who dies. This we will be pleased to do.

The main source of such information for us will have to be notes sent in by readers. If you know of someone in the "mineral fraternity" who has passed away, please drop us a line and we'll publish it. Include the following: (1) full name, (2) age at time of death, (3) city, state and country of residence, (4) major publications or honors, such as a PhD, if any, (5) date of death.

Died, Thomas N. McKee, 41, in Scottsdale, Arizona. Winner of McDole and Lidstrom awards (1987). Specimens from his collection have been illustrated in vol. 14, p. 330–331, vol. 18, p. 300.

Died, Lee S. Areson, 71, of Middletown, New Jersey; specialist in the minerals of Franklin, New Jersey; died July 28, 1987.

Died, Pauline Armstrong, 72, of Barrington, Illinois. A graduate of Vassar, she won numerous national trophies and awards for her collection of miniatures, and also for general specimens entered jointly with her husband Julian; died May 7, 1987.

Died, Hildegarde ("Hilde") Schumann Seel, 85, of Bala Cynwyd, Pennsylvania, on August 17, 1987. Hilde was the wife of Paul Seel (see vol. 1, no. 1, of the *Mineralogical Record*; died 1982), and an enthusiastic participant in all manner of mineralogical activities. The extensive micromount collection which they built together has been donated to the Denver Museum of Natural History.

Died, H. Earl Pemberton, 85, of Lake Elsinore, California. Pemberton was a Fellow of the Mineralogical Society of America, past President of the Friends of Mineralogy, and past President of the Mineral Research Society (a Southern California mineral society). Although he wrote numerous articles on California mineral occurrences, he is best known as the author of the latest edition of *Minerals of California*. PhD (sociology); died October 9, 1987.

Died, Ruth Butzer Blakely, 57, in Tucson, Arizona. Ruth, the wife of Julian Blakely, and former partner in *Blakely Mineral Gems*, also served for many years as silent auction co-chairman for the Mineralogical Record at the annual Tucson Show.

Died, Frederic V. G. Bird, 78, in Ouray, Colorado. Fred was a skilled and enthusiastic field collector with many years experience in the Alps and the Rockies.

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for mineral collections

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No List Available

Gypsum
14 cm as shown
Santa Eulalia,
Mexico

RECENTLY ACQUIRED: several lots of attractive and interesting Mexican minerals, many of them quite inexpensive . . . lustrous Naica galenas 6-12 cm, Adamite with Hemimorphite from the Ojuela mine, pale green and purple Naica fluorites in small cabinet sizes, etc. Native silvers such as the above are a specialty, and we regularly get fine examples from classic localities. Give us a call or stop in (by appointment) to see what's new.

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HISTORICAL NOTES ON MINERALOGY

Lawrence H. Conklin

The Peter Zodac Collection

This is a story that I must tell *now*, or at least write down someplace, because it was over twenty years ago that I first saw Peter Zodac's collection, and even *my* memory fades now and again.

It was in May of 1967 that I was asked by James and Winifred Bourne to appraise the collection that had been the life-long accumulation of their recently deceased relative, Peter Zodac. Zodac had been a mining engineer early in his life, and had founded the magazine *Rocks and Minerals* in 1926. (See his biography in the January-February 1987 issue of *Rocks and Minerals*.) According to my appraisal notes I spent five days doing the examination but, according to my memory, the appraised value was still just an educated guess. The two-story house including basement and attic at 157 Wells Street, Peekskill, New York, was *literally* filled, floor to ceiling, wall to wall, with small to large cardboard boxes, presumed by me at the time to be filled with minerals. In the course of my appraisal I opened many of these boxes and found everything from sand specimens in old Mason jars (the jars far more valuable than their contents), old slate roof shingles, and in one box a lovely half-inch *green* anglesite crystal on matrix from Sardinia. Incidentally, that was the first and last time I ever saw that anglesite.

Part of my help to the Bournes was to try to find someone interested in buying this vast assemblage of varied earth materials, collectibles and who-knows-what-else. After being pressed by Jim and Winnie for help in this matter, and not having too much encouragement to offer them, I wasn't too surprised then they said "Why don't *you* buy it, Larry?" Well, here was the chance or perhaps the curse of a lifetime. How would I handle it, where would I put it? I had long been told by my uncle, the late Anthony Schumacher, of the countless gifts of mineral specimens (Zodac called them donations) sent to Peter Zodac, many of them by dealers and collectors who enjoyed getting a compensatory mention in *Rocks and Minerals* magazine. My uncle had been totalling all these up in his mind for more than 30 years and often told me how impressed and, I guess, how envious he was. Well, here it all was; what would my uncle have said? Buy it, I'm sure. My answer to the Bournes was a softly murmured, "Okay, I will." And I did.

I could not start immediately on the removal, and in any case the matters of the estate had yet to be settled. I would have three months in which to find a place to store my purchase. The three months came and went, and then another three, and still I had found no place for the collection. Now the Bournes were pressing me. After *much* local advertising I got a call from the owner of an old dairy-farm that had just shut down after 70 years in operation. I quickly made a deal to rent his largest barn at an affordable monthly rate. (It was amazing

Figure 1. **Peter Zodac (1894–1967). Photo courtesy of Marie Huizing.**

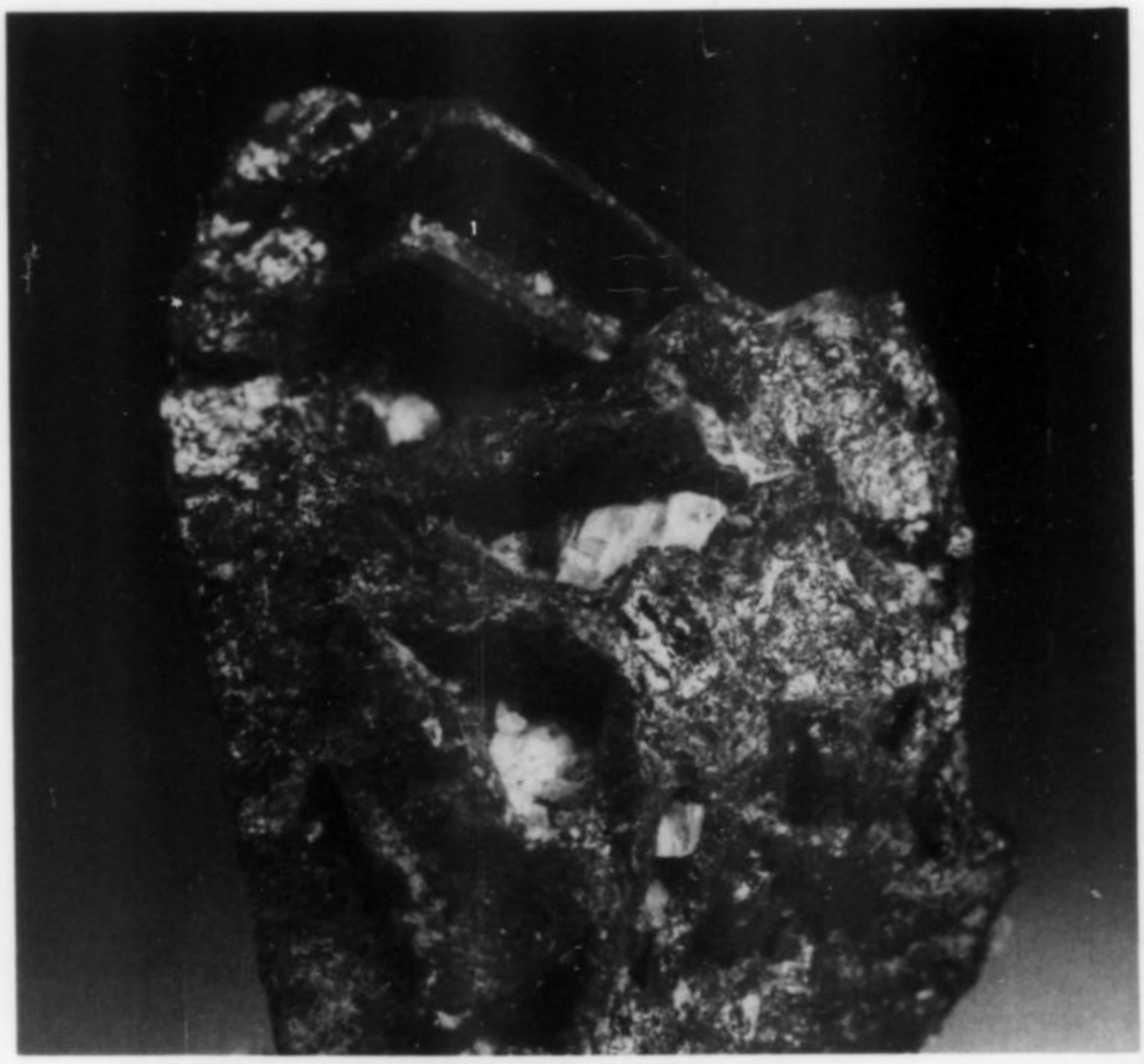
that an operation such as a dairy could have survived in suburban New Canaan until 1967!)

There was one note of emergency in the mineral removal. The weight of all the boxes had, over the years, caused a serious failure in the house structure, and the house was listing 10° as a result! Obviously the building would have to be condemned.

A moving company was engaged, and early one morning a 16-wheel, long-distance van arrived to begin the move. The minerals in the attic were easily slid down conveyors to the truck. Those on the second and first floors went easily too. But, when it came time for the, by then, tired moving-men to *lift* boxes from the basement floor up to windows on grade level, it was too much for them, I guess. Probably the first box burst by accident as it was lifted, but once they got the hang of it and banged most of the boxes against the wall, virtually all wound up broken and scattered on the basement floor. When the truck was finally filled, there remained on the 20 x 20-foot basement floor a layer at least 3 feet deep of minerals, rocks, letters and crushed cartons!

I was told that 157 Wells Street was bulldozed shortly thereafter, and the mineral-filled basement remains as part of the foundation for the building that replaced it, a lovely geological puzzle for archaeologists of future centuries.

When the Zodac material was finally moved to the concrete-floored barn, it filled a space 20 by 60 feet to a height of 10 feet! My job then was to fill my station wagon with boxes, take them to my garage, examine them and hope for the best. I had at that time the very expert and professional help of Terrence Szenics of New Jersey, who probably



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Dana No.

Chalcostibite

Rar-el-Auz,
Cherrat, Morocco.

ARTHUR MONTGOMERY
1 East 44th Street, New York, N. Y.

Figure 2. **Chalcostibite crystals to 2.4 cm, from Rar-el-Auz, Cherrat, Morocco; given to Peter Zodac by Arthur Montgomery, now in the Albert Sebela collection.**

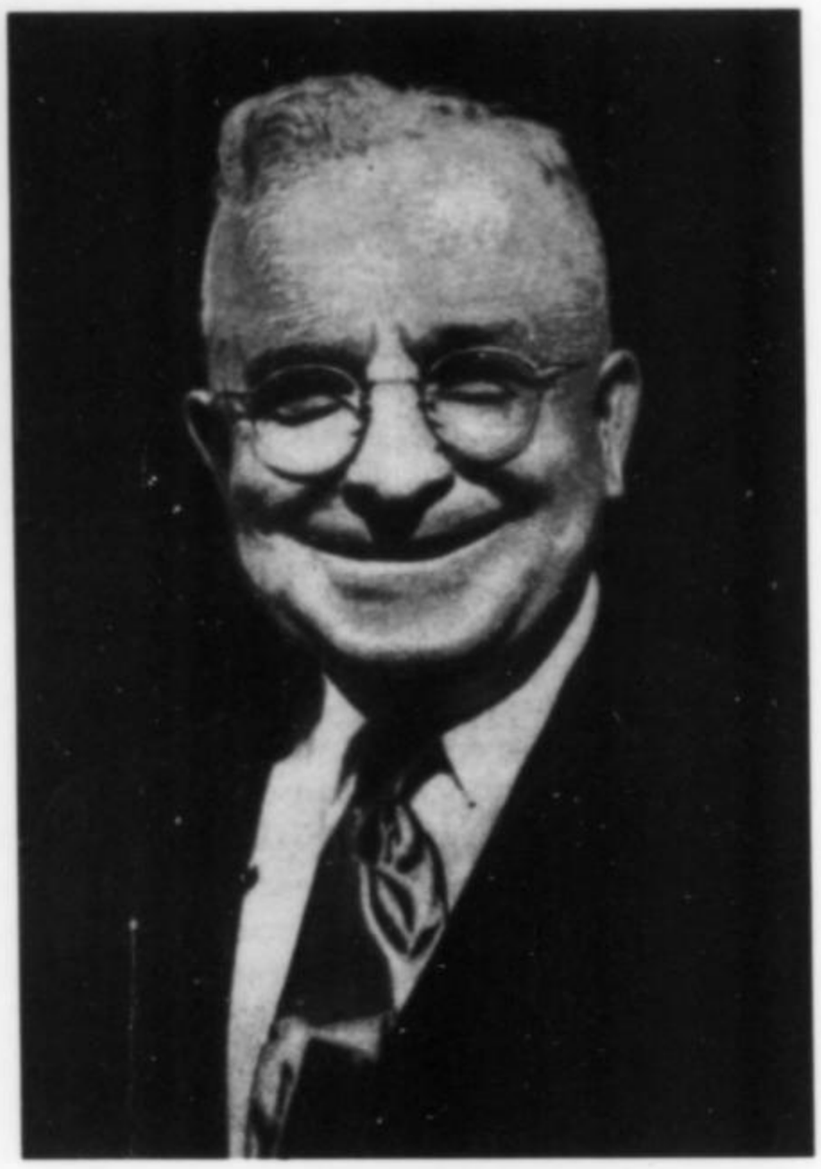


Figure 3. **Peter Zodac. Photo courtesy of Marie Huizing.**

remembers better than I the details of the collection. What was uncovered was more interesting than valuable. The single best specimen that I can recall is a superb chalcostibite. This fine specimen had been given, excuse me, "donated" by Arthur Montgomery.

Rocks and Minerals magazine had always reported to its readers on sand deposits, and even conducted a column on sand. Readers sent in sand samples from all over the world. Well, here were the sands. I got them all together, many, many hundreds of samples, and actually *found a buyer for them!*

I remember many large, heavy wooden crates filled with lower quality minerals brought back by Ed Over and Arthur Montgomery from their 1938 expedition to Prince of Wales Island, Alaska, and all with their original seaweed packing. I sold most of these crates without ever seeing their contents. This happened because I had to make a quick deal to dispose of about 25% of the Zodac material that I had not processed. After 3 or 4 years I lost my lease on the barn and had to clean it out. Perhaps that was where the green anglesite went.

Another thing I recall was a box of about 150 pounds of massive hancockite from Franklin, New Jersey, that (at least in my time) had not been checked for vugs having microscopic crystals.

One of Zodac's collecting specialties was a sub-collection centering on molybdenite. The specimens were scattered throughout the ocean of boxes, but when I finally got them all together they made an impressive display indeed. I later donated this group of about 200 specimens to the American Museum of Natural History. There are probably greater molybdenite collections in other museums, perhaps in Australia, but I wouldn't be surprised if the Zodac material represents the largest number of different molybdenite localities of any such assemblage. It even boasts a molybdenite crystal on smoky quartz from Manhattan Island!

Unquestionably the best part of Peter Zodac's collection was his books. I did not even realize that they went with the minerals until I was reminded by Jim Bourne that the room containing all the books had to be emptied by me! Zodac had the finest single copy of the first edition of Dana's *System of Mineralogy* (1837) that I have ever seen. It was in an old sheep binding that looked like it had just come from the binder, and the pages looked like a superb facsimile reprint. He also had a complete and pristine set of *The Mineral Collector*, a great rarity even in poor condition. There were countless copies of newer books that had been sent to him for review in *Rocks and Minerals*, some of them from the 1930's and 1940's, several of which are part of my reference library today.

Since I have touched on a discussion of rare books, I'll digress in that direction for the remainder of this column, even though it has little to do with Zodac.

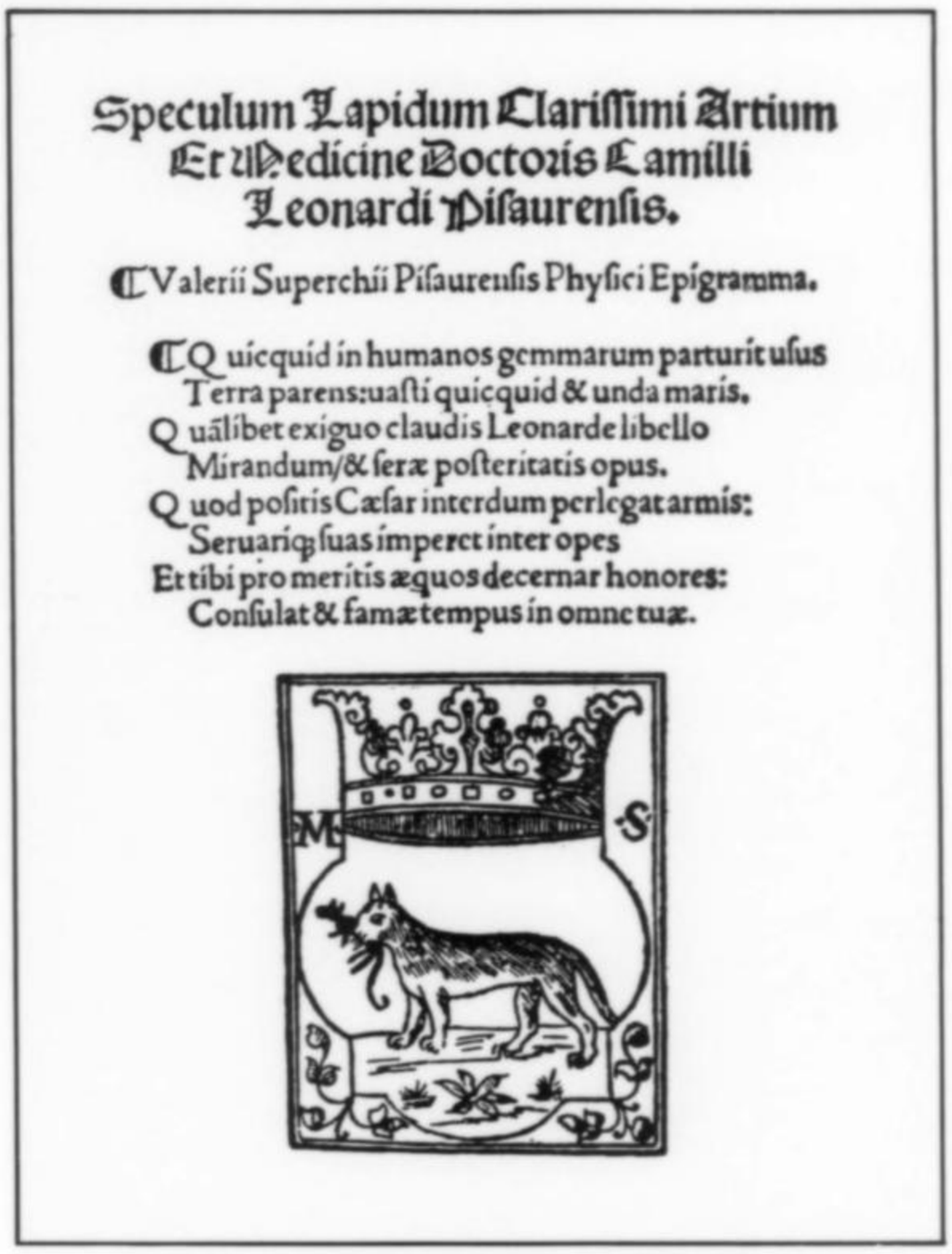
Zodac's library provoked my 1980 essay "Reflections upon perusing a 1942 bookseller's catalog" (*Mineralogical Record*, vol. 11, p. 127), and here is an addendum to that article which I wrote the following year but did not submit for publication:

— — —

It was most exciting for me to meet, at the Tucson Gem and Mineral Show last February, the person who actually purchased most of the books I discussed from Mr. Fiedler's book list. He wishes to

remain anonymous, and has resold them all by now anyway, but he did tell me that all of the important books were from a single source, the private library of a professor in New England. That information makes them seem all the more rare.

Since my last writing I have been fortunate to have had the opportunity to purchase part of a fine old library. I shared it with Richard Hauck and Joseph Gill. Gill has a great library of gem books in English, and many mineralogies too. Hauck was the purchaser of the Neal Yedlin library and has been adding to it very seriously. One of the books I obtained is called *Speculum Lapidum* by Camillus Leonardus, the second edition of 1516. The title means "Mirror of Stones," and the first edition was published in 1502. Frank Dawson Adams (1938) related a delightful anecdote about the rarity of this work. He quotes from the preface to the 1750 English edition, which speaks of the editions of 1502 and 1516:



Speculum Lapidum Clarissimi Artium Et Medicine Doctoris Camilli Leonardi Pisaurensis.

Valerii Superchii Pisaurensis Physici Epigramma.

Quicquid in humanos gemmarum parturit usus
Terra parens: uasti quicquid & unda maris.
Quãlibet exiguo claudis Leonarde libello
Mirandum/& seræ posteritatis opus.
Quod positis Cæsar interdum perlegat armis:
Seruariq; suas imperet inter opes
Et tibi pro meritis æquos decernat honores:
Consulat & famæ tempus in omne tuæ.

Figure 4. **Title page of the 1516 edition of *Speculum Lapidum* ("Mirror of Stones") by Camillus Leonardus.**

A certain nobleman who is pleased to honor me with his friendship sought for it [a copy of *Speculum Lapidum*] in vain in the most noted libraries in England; but being determined to have it if there was one in Europe, sent a gentleman to France, where he was to make the best enquiry he was able among the book sellers, and to search every library where there was any probability of its being lodged; and if his enquiries should prove unsuccessful there, he was to proceed to Italy, and so on to other countries till he should find it. After a long and expensive search he at last was so happy to light upon two of them, which he purchased tho' at an exorbitant price, and brought them to his noble master, who was so pleased with the purchase that he not only paid him generously for his time and expenses, but over and above as a gratuity and reward for his dilligence presented him with a bank note for £30.

So, the way of the collector was not easy, even back in 1750! The sum of £30 was much more than the annual wages of a working man.

As far as *Speculum Lapidum* is concerned, it is an early Middle Ages lapidary written in Latin and dedicated to Cesare Borgia by the author, who was also Borgia's physician. Virtually every mineral and gem known to that date is mentioned in this very interesting compilation.

My copy of *Speculum Lapidum* is bound in full nineteenth-century morocco leather, and I'm sometimes asked what the difference in value would be between this copy and one in an original or contemporary binding. The answer is complex. Certainly it is more desirable to have any early book in its original binding, but what if it were in ragged condition? Would rebinding be preferable? Yes, for most collectors, and no for the few who would prefer to order from a binder, a beautiful full-leather book-form case in which to store the old binding. With condition being equal, and fine, there can be a factor of ten or more in the difference of the price of the two books. In the early days of book collecting many book enthusiasts would admit no book to their shelves that did not have the exterior coeval with the published date of the book. We could do likewise today, but we would have skimpy libraries indeed!

— — —

All of the important books in my library are long gone. I sold them to a collector in Evanston, Illinois, and, after suffering fire, smoke and water damage, many are now safely ensconced in the Hauck library. Richard Hauck has accomplished miracles of acquisition, and his library is surely one of the finest in the world, with the depth of his ephemera collection being truly amazing! The wheel certainly is capable of a full turn! Gill, on the other hand, has decided to market his book collection through the auction house Christie's in New York, and has had one very impressive sale of part of his library; others will follow. Last October a copy of *Mirror of Stones*, the English translation of *Speculum Lapidum* (1750) brought Joe Gill a very hefty $1870!

One lovely book that I am sorry I sold was Zodac's copy of John Sinkankas's *Mineralogy for Amateurs* (1964). Sinkankas had dedicated this book to Zodac "for a lifetime devoted to the encouragement of amateur interests in earth sciences," and had added a very nice personal "holograph" (handwritten) inscription: "I have dedicated this book to you because I can think of no one who has done more for the amateur mineralogist in one lifetime." Such volumes (and of course, there can only be one for each book) are known as "dedication copies," and are extremely desirable collector's items.

Lawrence H. Conklin
17 St. John Place
New Canaan, Connecticut 06840

NOTE: There are several good books on the history of mineralogy. Here are a few of my favorites:

ADAMS, F. D. (1938) *Birth and Development of the Geological Sciences*. Reprinted in 1954 by Dover Books, New York.

BURKE, J. G. (1966) *Origins of the Science of Crystals*.

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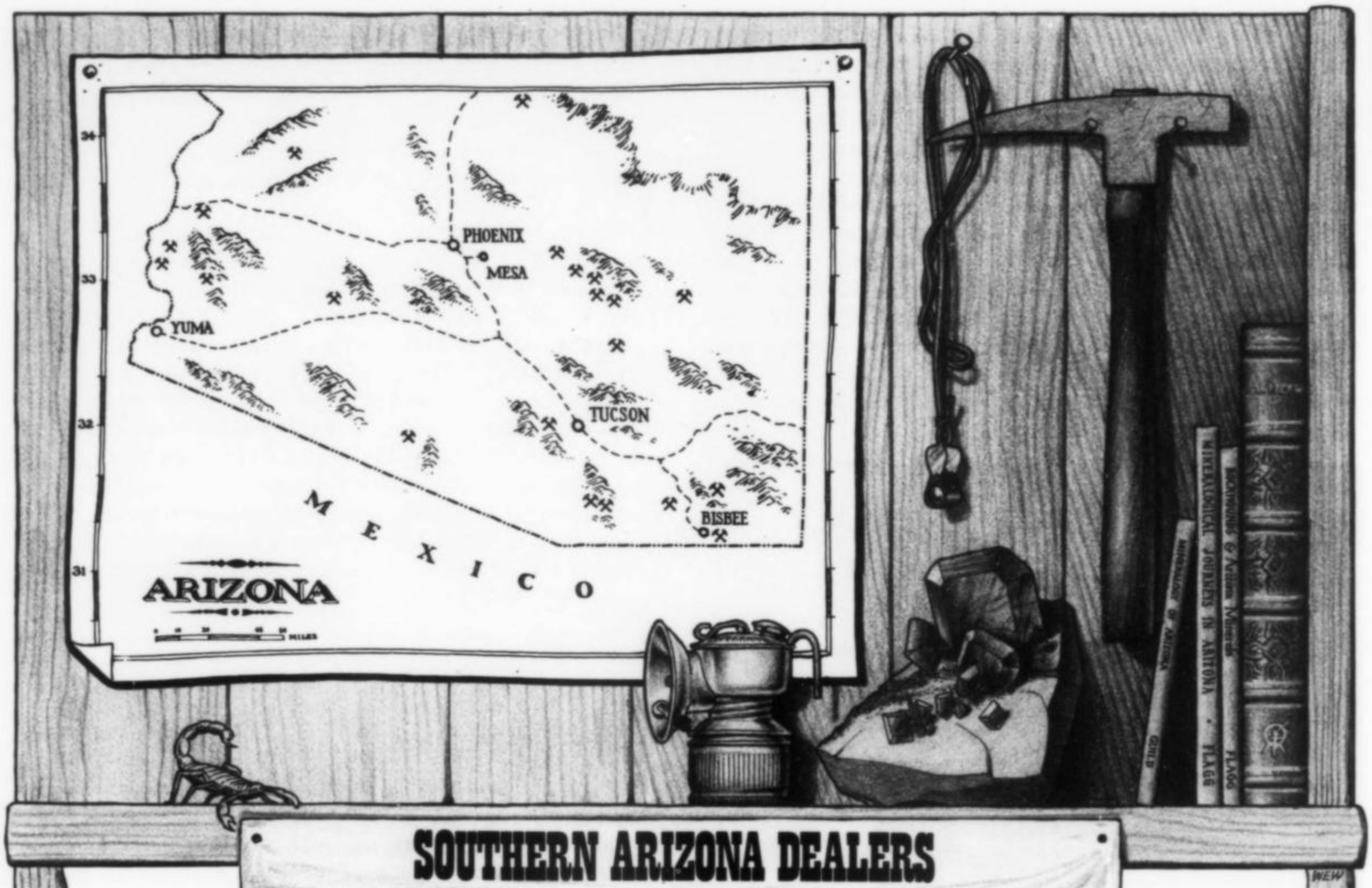
MITCHELL, R. S. (1979) *Mineral Names—What do They Mean?* Van Nostrand, New York.



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THE IRON CAP MINE

Graham County, Arizona

Wendell E. Wilson
4631 Paseo Tubutama
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In 1987 the Iron Cap mine yielded some of the finest sphalerite and galena specimens ever found in Arizona. It has also been the source of sharp, lustrous, emerald-green manganaxinite crystals and well-formed manganbabingtonite crystals for which it is the only occurrence outside the Soviet Union. The locality has not been worked out, and specimens continue to be recovered.

INTRODUCTION

The late Arthur Flagg, Arizona state mineralogist and a prominent aficionado of Arizona mineral collecting, made a prophetic remark about the remote Klondyke area back in 1958:

> *Collectors have rarely visited this east half of Graham County, which means there might be surprise finds in some of the many prospects.*

Eleven years later, in 1969, superb linarite and other minerals were discovered by collectors at the now-famous Grand Reef mine (Jones, 1980; Besse and Novak, 1988). In the late 1970's the rare mineral manganbabingtonite was found at the Iron Cap mine in good crystals. And recently, in March of 1987, another important discovery was made in the district: fine crystals of sphalerite and galena at the Iron Cap mine.

Arizona is not well known for the production of display-quality primary sulfides. These sphalerite specimens, however, rank with the best of many of the more prolific American localities, and the galenas are the best for Arizona.

The Aravaipa district is located in Graham County, Arizona, near the old towns of Klondyke and Aravaipa on the southwestern slope of the Santa Teresa Mountains. Mines include the Iron Cap, Grand Reef, Head Center, Grand Central, Cobre Grande, Sinn Fein, Arizona, Dog Water, Silver Cable, Lead King, No. 1, No. 2, and others. The Iron Cap mine is located in the SW ¼ of the SE ¼ of the SE ¼ of section 19, T5S, R20E, nearly due east of the Sinn Fein mine near the head of Arizona Gulch at an altitude of about 1735 meters (5640 feet). It is marked by an unnamed "x" on the Cobre Grand Mtn. 7.5-minute quadrangle. The Iron Cap mine is a patented claim.

HISTORY

The detailed history of the Iron Cap mine has been only partially recorded, however, the deposit may have been opened as early as the 1870's when a small smelter was built in the district by Col. C. W. Birdwell (Ross, 1925).

During the period 1925–1928 the Grand Central Mining Company acquired a group of mines including the Iron Cap and built a small flotation mill. During the years 1942–1949 the Athletic Mining Company bought a number of local claims and developed the Iron Cap and Head Center mines. The company built a flotation mill with a capacity of 100 tons per day, and operated it throughout 1948 and part of 1949 on ores taken almost exclusively from the Iron Cap mine (Wilson, 1950).

The mine has been largely ignored by Arizona mineral collectors until recently. Mineral dealer David Shannon did some blasting at the surface a few years ago and, although he did not go underground, he reports having observed signs of a major cave-in taking place in one of the upper stopes. In March of 1987, dealer Jim Vacek was exploring a stope underground and discovered many large boulders which had fallen down from the back and roof of a stope, and which could be seen to contain pockets and veins of galena and sphalerite crystals.

Vacek did not exploit this find immediately, but turned it over to collectors Bob Johnson, Bob Lane and Doug Brown. They broke apart many of the boulders using a Cobra drill and sledge hammers; over a period of five days they recovered about 14 flats of specimens. Of these, about eight flats consisted of thumbnail and miniature-size specimens.

In the following months many of the other serious Arizona field collectors visited the mine with good success, including George

Godas. Hawes and others. Hawes found what is probably the largest of the galena crystals so far, 4.6 cm. Les Presmyk and Evan Jones have acquired many of the best sphalerites, and the Arizona-Sonora Desert Museum in Tucson has also obtained a suite.

GEOLOGY

The geology of the Aravaipa district has been studied by Denton (1947), Ross (1925), Simons (1964), and, most recently, Reiter (1981).

In the area of the Iron Cap mine a Pennsylvania limestone known as the Horquilla Formation has been thrust over a gray arkosic sandstone (Cretaceous Pinkard Formation) by a low-angle fault. These rocks host an interesting, zoned lead-zinc skarn rich in manganese calc-silicate minerals.

Both veins and replacement orebodies have been found in the Iron Cap. Reiter (1981) concluded that the mineralizing fluids were relatively cool and had most likely traveled a significant distance (roughly 1 km) from their source, which he inferred to be the Goodwin Canyon quartz monzonite. Skarn mineralization took place along low-angle faults, bedding slips, fracture zones and permeable beds. Although these controls are typical of other skarn deposits, the mineralizing fluid's composition, temperature and distance from source make the Iron Cap area quite unusual.

MINE WORKINGS

The earliest workings consist of an upper adit run westerly for about 35 meters along a vein occupying a steeply dipping reverse fault in limestone. The vein appears to have been roughly a meter in width and well mineralized with lead and zinc. A sizeable glory hole now exists at the upper adit.

Subsequently an adit was run at a level about 46 meters lower, southwesterly for 200 meters; at about 146 meters from the portal it entered limestone and intersected the vein exploited by the upper adit. At 126 meters from the portal a fault was intersected which became known as the East vein and proved to be the richest in the mine. The East vein ore shoot ranged from roughly 1–5 meters in thickness and 10 to 60 meters in length and height along the fault. In the 1940's step-fault offsets of this orebody were discovered by diamond drilling.

Significant amounts of ore have been removed from the Upper Stope and West orebodies immediately south of the Upper Tunnel fault. The ore occurred as veins, thin stringers and irregular replacements in Pennsylvania limestone. According to Wilson (1950), most of the ore occurs in broad, low-angle anticlines plunging downdip. The mine does not appear to be worked out, and Simons (1964) reported seeing ore still in the bins.

According to Bill Hawes and others (personal communication) it is the East vein workings off the lower adit that have yielded all of the recently collected mineral specimens. A steeply inclined, rock-pillared stope extends upward to the right (northwest) from the adit at roughly 100+ meters from the portal. The stope is very dangerous, and only the most experienced and most circumspect collectors, if anyone, should attempt a visit to this area. The rock appears to be unstable, and rockfalls and cave-ins may be imminent.

MINERALOGY

Iron Cap ores are, for the most part, unoxidized and consist mainly of galena and sphalerite with a small amount of pyrite and chalcopyrite and local traces of chalcocite and covellite. Gangue consists primarily of quartz, calcite and johannsenite. Simons (1964) comments that galena was the principal ore mineral throughout the district, but only at the Iron Cap and Lead King mines is sphalerite present in comparable amounts; elsewhere it is subordinate to galena. The following species are the best crystallized of the assemblage.

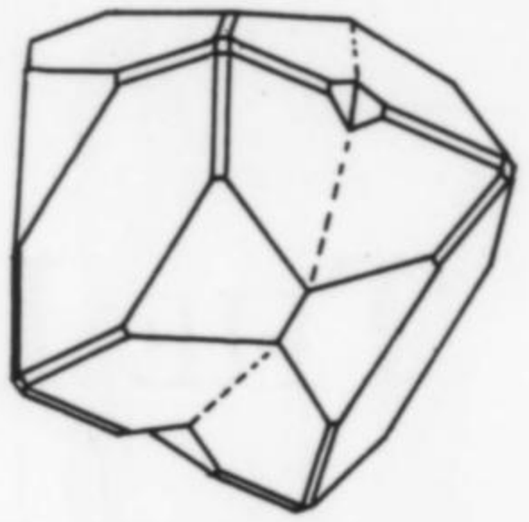


Figure 1. **Sketch of a sphalerite spinel-law twin (idealized) showing the dodecahedron, tetrahedrons, cube and tristetrahedrons. Drawn from a specimen in the Les Presmyk collection.**

Sphalerite (Zn,Fe)S

Sphalerite crystals from the Iron Cap mine are predominantly tetrahedral and dodecahedral in habit, the two forms varying in dominance from crystal to crystal. Positive and negative tetrahedrons combine to form pseudo-octahedrons. Tristetrahedrons, positive and negative, are seen as narrow faces modifying edges of the dodecahedron. Tiny cube faces are visible truncating the points of some tetrahedrons. Many crystals are spinel-law twins.

Color varies from a gemmy, transparent green and yellow-green (probably low in iron), or brown, visible in crystals 1.5 cm or smaller, to black and opaque crystals from a few millimeters to 5 cm (2 inches) across. Many larger crystals, when examined with a bright light, are actually seen to be as gemmy as the smaller crystals.

Luster ranges from frosty, particularly on large dodecahedron faces, to bright. Associations include galena crystals, quartz, calcite and johannsenite.

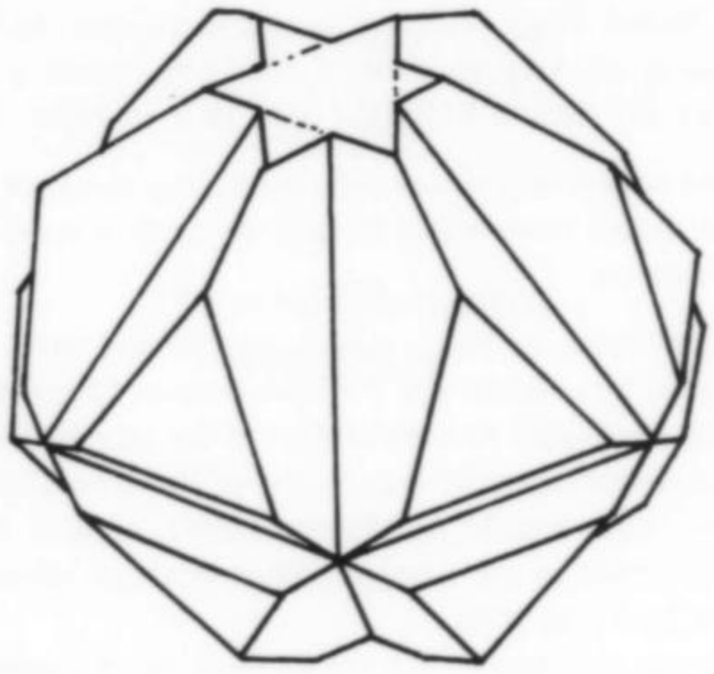


Figure 2. **Sketch of galena cuboctahedron penetration twin (idealized); after a specimen in the Les Presmyk collection.**

Galena PbS

Galena crystals from the Iron Cap mine are generally sharp and well formed, although some are rounded or etched and appear to have been partially resorbed by solutions. Sphalerite crystals adjoining galena are usually sharp but rare examples may also have a rounded, resorbed appearance. Rounded galena occurs with sharp sphalerite, but apparently not the reverse.

Crystal habit is simple, consisting only of the cube, modified in some cases by the octahedron and tiny dodecahedron faces. Some

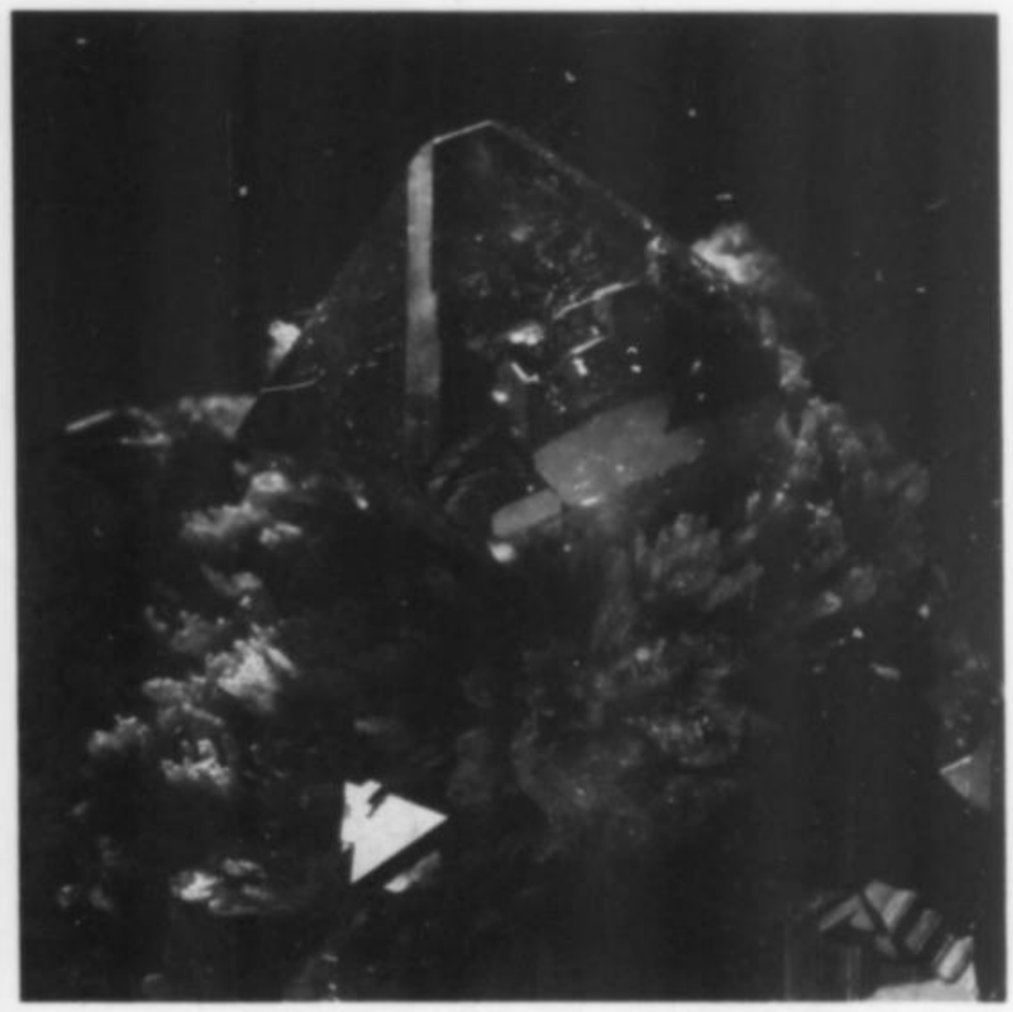
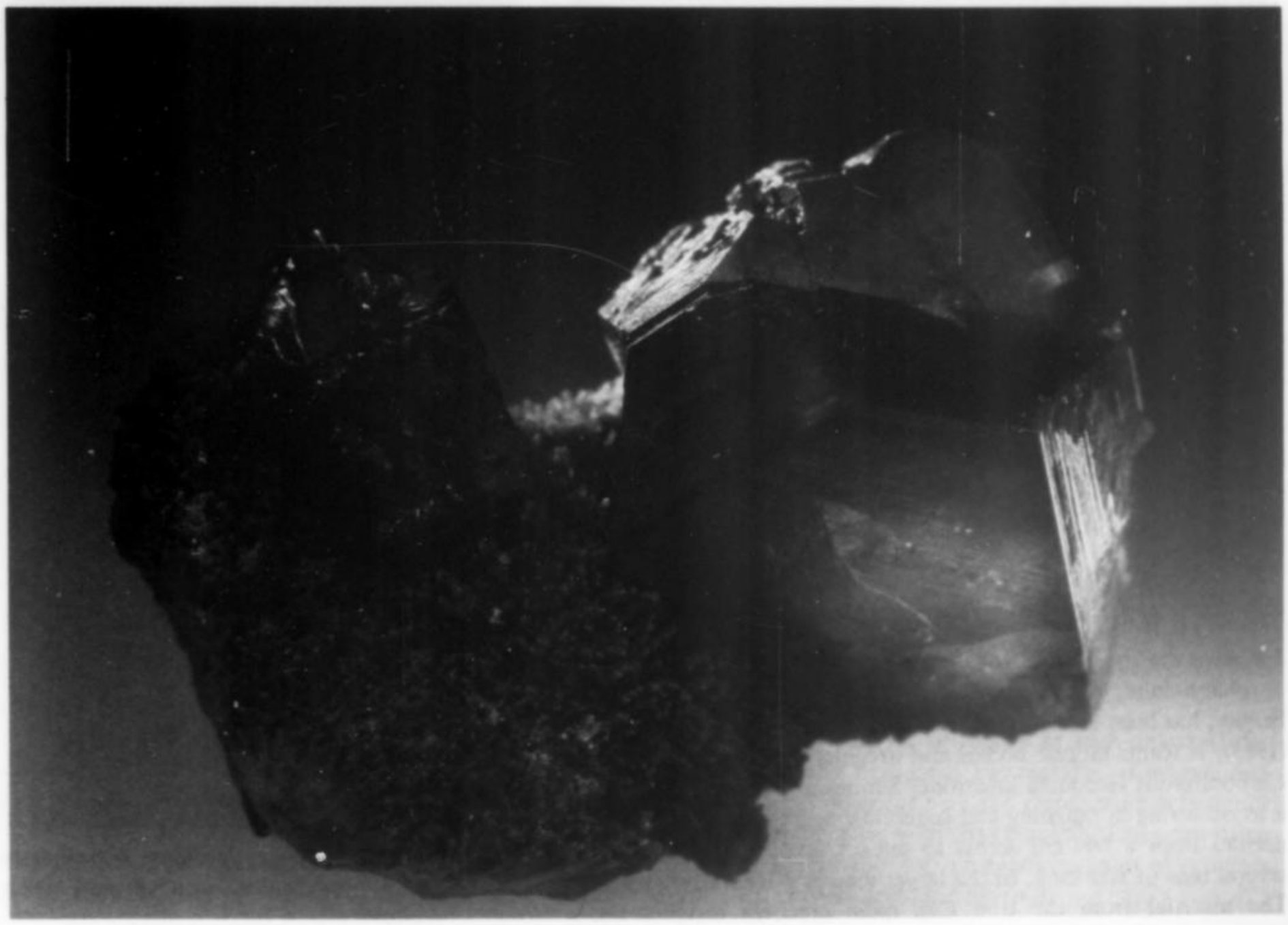


Figure 3. **Gemmy sphalerite pseudo-octahedron on johannsenite, 1.2 cm. Evan Jones collection.**

Figure 4. **Gemmy sphalerite pseudo-octahedron with quartz, 1.3 cm. George Godas collection.**

Figure 5. **Gemmy, twinned sphalerite crystal, 1.1 cm, with galena on johannsenite. George Godas collection.**



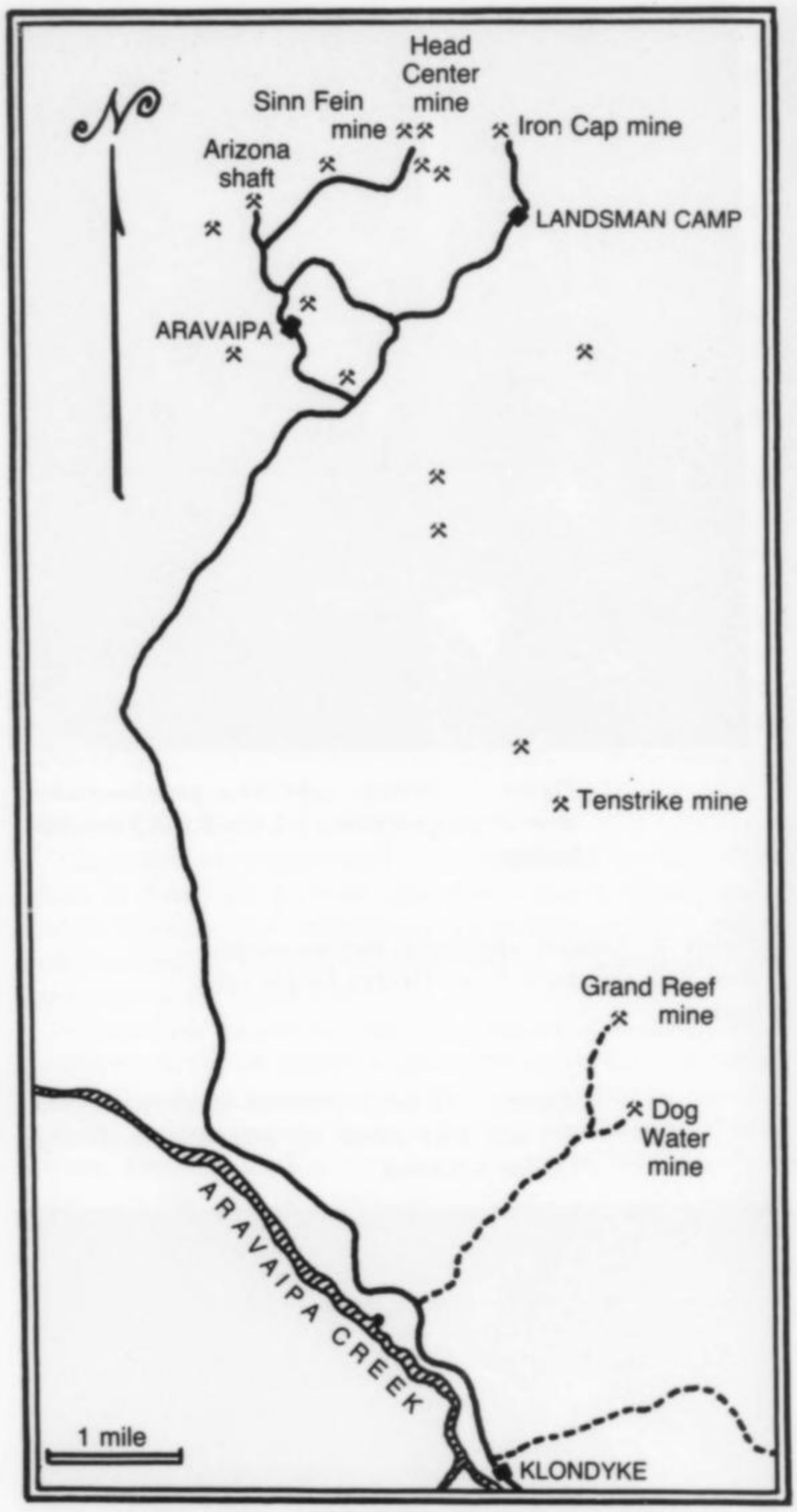


Figure 6. **Map showing location of the Iron Cap mine and some of the other mines in the Aravaipa district.**

galena crystals are penetration twins, very similar to a twin from the Harz Mountains, Germany, illustrated in Goldschmidt (1913). Crystal size varies from a few millimeters up to about 4.6 cm diagonally.

Associations include quartz and calcite in crystals up to several centimeters and also acicular johannsenite.

Johannsenite $CaMnSiO_2O_6$

Johannsenite, a pyroxene which forms a series with hedenbergite, has been identified in the district by Simons and Munson (1963). It forms tabular bodies and irregular masses replacing the Carboniferous Horquilla limestone. Simons and Munson describe it as occurring in radiating and spherulitic aggregates of prisms or needles from a few cm across to masses several feet thick and several tens of feet long. In the larger masses it is clearly layered. The material from the Iron Cap mine precisely matches this

Figure 7. **Lower adit entrance to the Iron Cap mine. Dick Morris photo.**

Figure 8. **Stope in the Iron Cap mine. Dick Morris photo.**

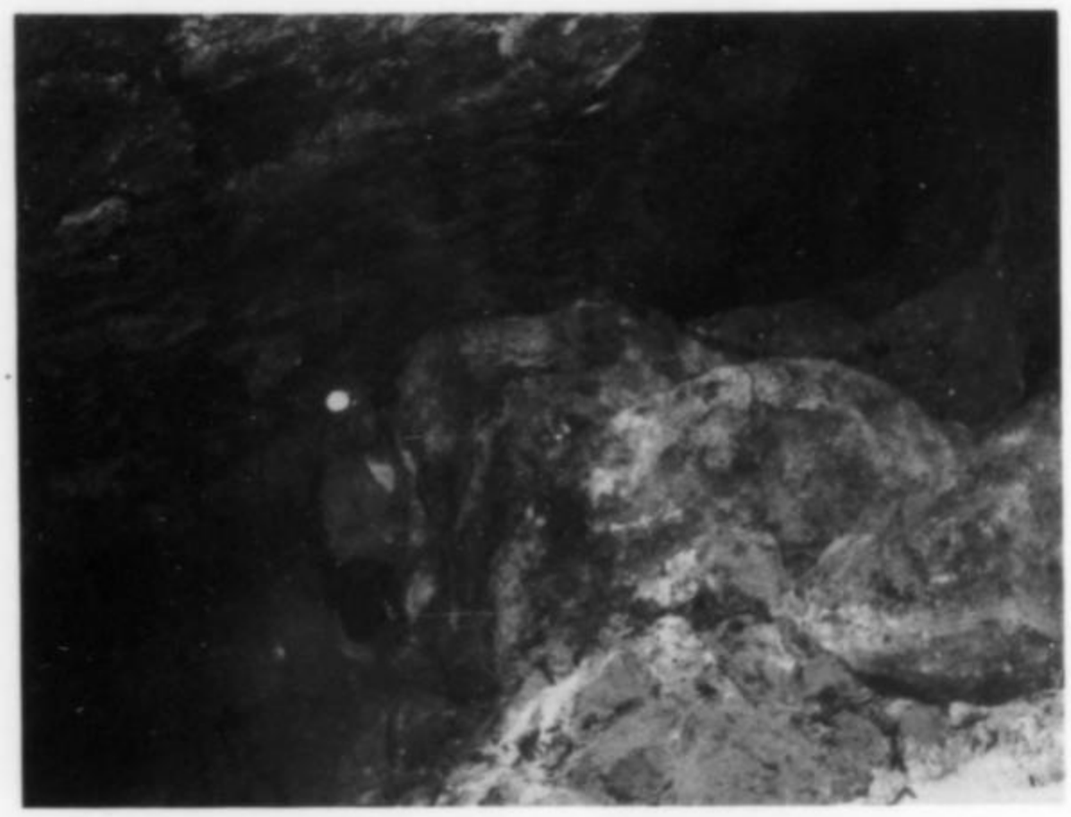


Figure 9. **Large boulders of sulfide-rich rock in a stope in the Iron Cap mine. Dick Morris photo.**

Figure 10. **Galena group on johannsenite matrix, 9.5 cm across, with quartz. Dick Morris collection.**

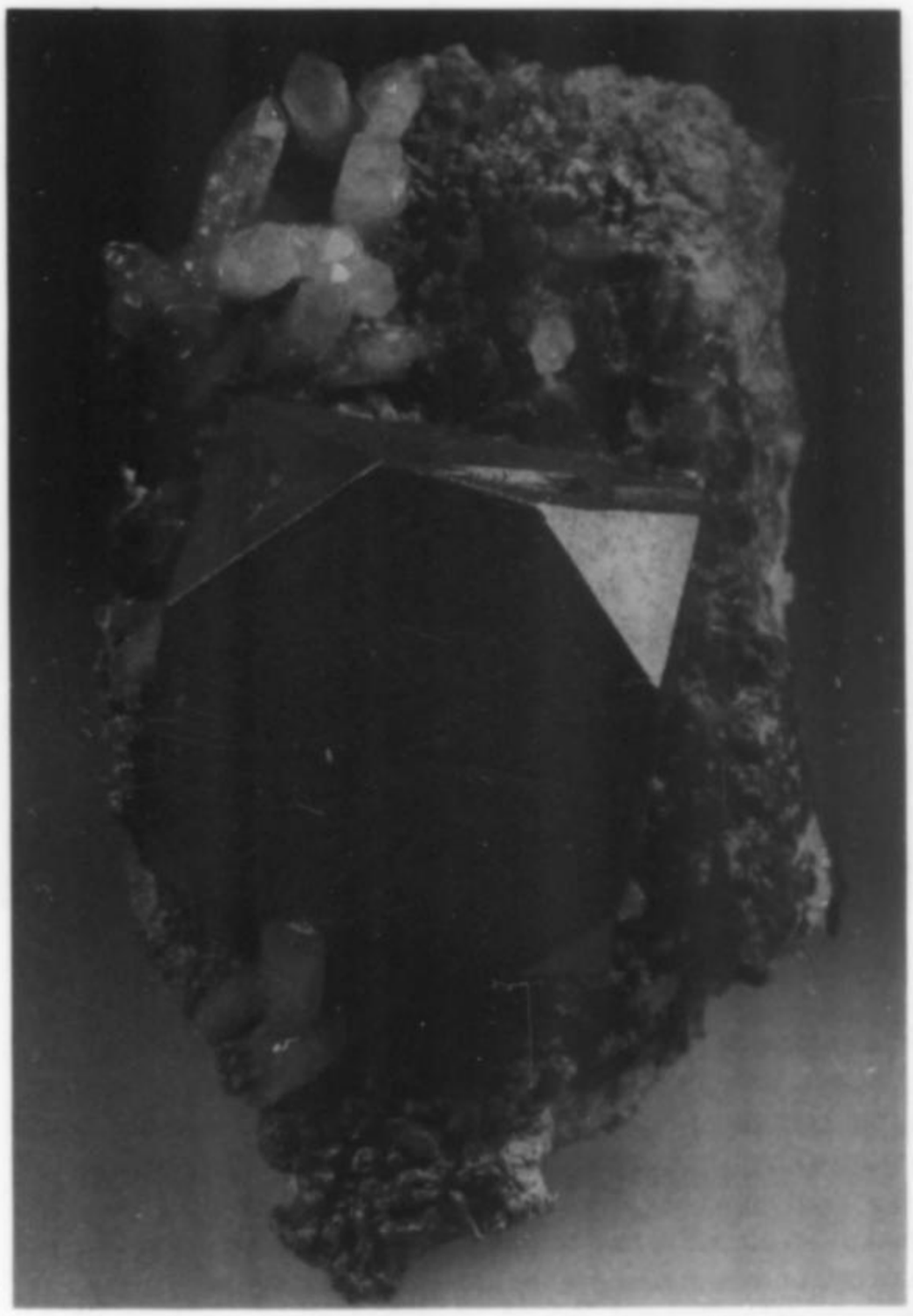
Figure 11. **Large galena crystal, 4.6 cm, on johannsenite with quartz. Bill Bowman collection.**

description. Crystals are pale to dark green and alter to white, pink or black. They form layers with columnar structure which line veinlets and serve as matrix for sphalerite and galena crystals. Individual johannsenite crystals rarely exceeed 1 cm long and 1 millimeter wide. Reiter (1981) reported finding a range of compositions in the series, from johannsenite and ferroan johannsenite to manganoan hedenbergite and relatively pure hedenbergite.

Figure 12. **Quartz crystal showing oscillatory rhombohedral habit; 2 cm. Tom Gressman collection.**

Quartz SiO_2

Quartz is present as colorless to pale amethyst crystals from micromount size up to several centimeters. Most crystals appear to be prismatic in their proportions but on close inspection are seen to have no prism faces. These crystals consist only of termination forms, the positive and negative rhombohedrons, which form a pseudo-bipyramidal termination and an oscillatory sawtooth surface where the prism faces should be. Because of this morphology and the poor luster of some of the crystals it is tempting to speculate that they crystallized originally as high-quartz (beta-quartz), and are actually hexagonal bipyramidal. However, tiny portions of prism faces do occur here and there, and a very minor difference in development between the rhombohedrons can often be detected. So it is probably just an eccentric habit of ordinary quartz. Some such crystals are quite lustrous.



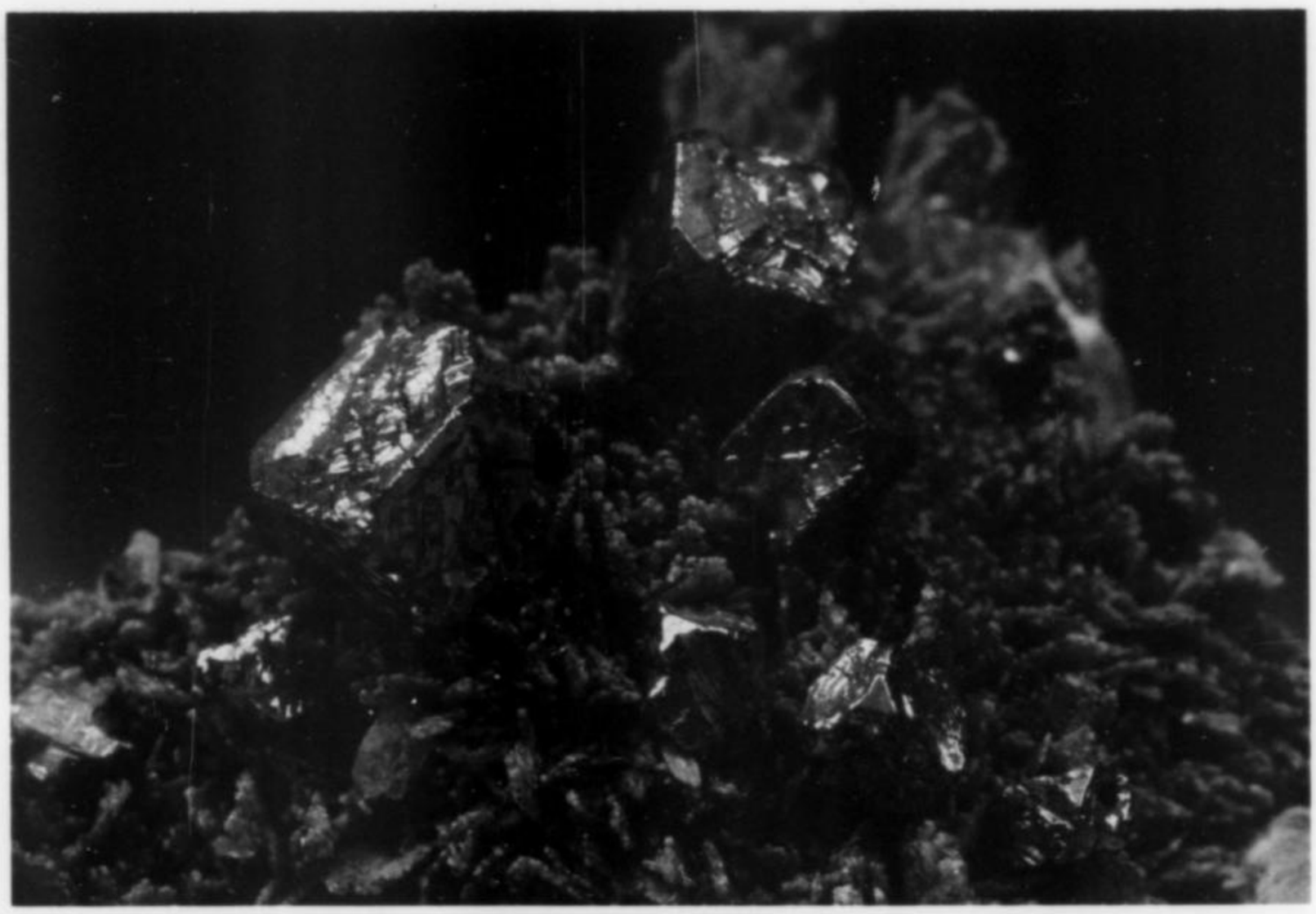


Figure 13. **Lustrous galena crystals to 6 mm on johannsenite. George Godas collection.**

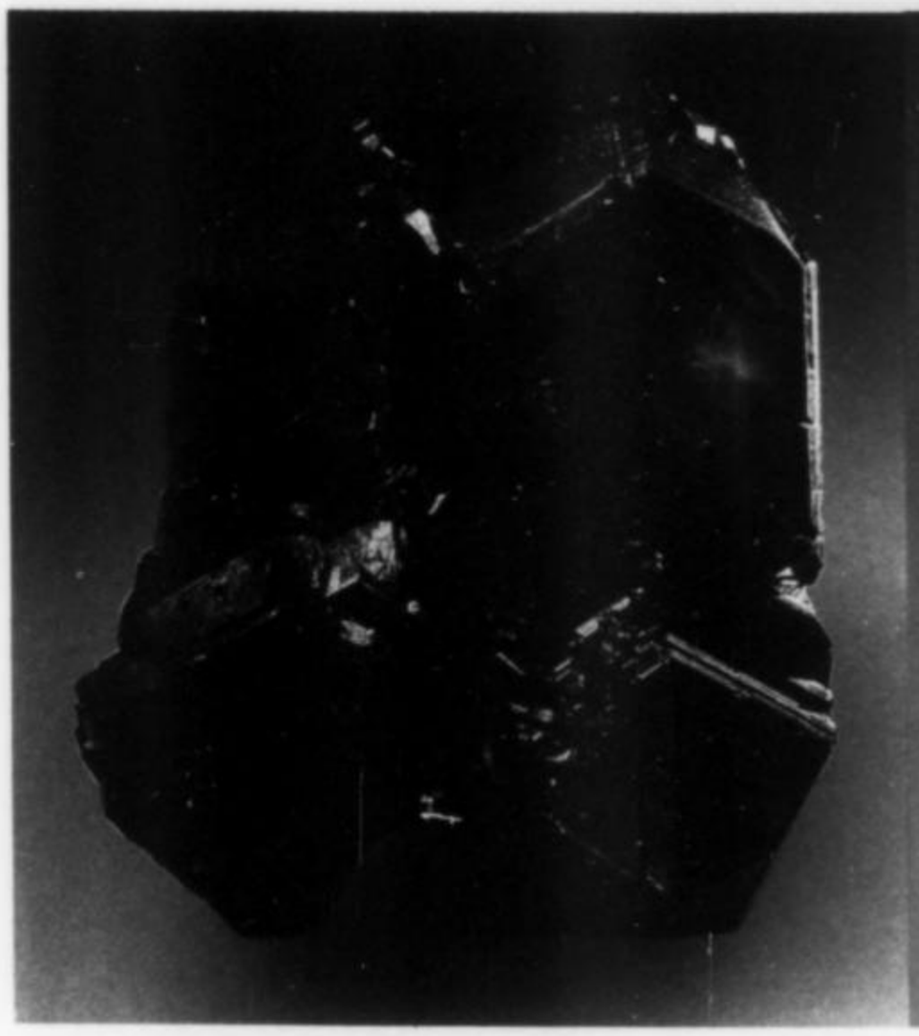


Figure 14. **Twinned sphalerite crystal, 3.3 cm. Evan Jones collection.**

Figure 15. **Gemmy, complexly twinned sphalerite crystals. Evan Jones collection.**

Manganaxinite $Ca_2Mn^{+2}Al_2BSi_4O_{15}(OH)$

Sharp, lustrous, yellow-green to sea-green and bright emerald-green crystals of manganaxinite occur on some specimens, associated with quartz, sphalerite and johannsenite. These crystals are of typical chisel-like, triclinic habit and rarely exceed 1 mm, but make very attractive micromounts. Reiter (1981) reported that crystals had only been found in the upper open cut. But with the recently collected sphalerite crystals from the East vein have come numerous green axinites (confirmed as an axinite group mineral by X-ray diffraction).

Manganbabingtonite $Ca_2(Mn,Fe^{+2})Fe^{+3}Si_5O_{14}(OH)$

Manganbabingtonite is the manganese analog of babingtonite. Described by Vinogradova and others in 1966 and 1967, it is a very rare species formerly known only from the Soviet Union. At the Iron Cap mine it has been reported as dark amber and dark blue to black, bladed, striated crystals, usually of small size but in some cases measuring up to 1 cm (Burt and London, 1978; Reiter, 1981). These were found in the lower stope (East vein?). Burt and London report the composition as being 77% manganbabingtonite end-member, making these the purest known manganbabingtonites. Associations include massive black ilvaite and andradite.

PREPARATION

Specimens commonly (but not always) carry a coating or vein filling of calcite which collectors have been dissolving off with hydrochloric acid.

Galena crystals typically carry a crusty white alteration coating which is unsightly. Where it is thin this coating can be gently

Table 1. **Minerals reported from the Iron Cap mine (Reiter, 1981).**

Sulfides	
Chalcocite	Cu_2S
Chalcopyrite	$CuFeS_2$
Covellite	CuS
Galena	PbS
Pyrite	FeS_2
Sphalerite	$(Zn,Fe)S$
Manganese Minerals	
Hedenbergite	$CaFe^{+2}Si_2O_6$
Manganoan Hedenbergite	$Ca(Fe^{+2},Mn)Si_2O_6$
Johannsenite	$CaMnSi_2O_6$
Ferroan Johannsenite	$Ca(Mn,Fe)Si_2O_6$
Kutnohorite (?)	$Ca(Mn,Mg,Fe^{+2})(CO_3)_2$
Manganaxinite	$Ca_2Mn^{+2}Al_2BSi_4O_{15}(OH)$
Manganbabingtonite	$Ca_2(Mn,Fe^{+2})Fe^{+3}Si_5O_{14}(OH)$
Other Gangue Minerals	
Andradite	$Ca_3Fe_2^{+3}(SiO_4)_3$
Aragonite	$CaCO_3$
Calcite	$CaCO_3$
Creedite	$Ca_3Al_2(SO_4)(F,OH)_{10}\bullet 2H_2O$
Epidote	$Ca_2(Al,Fe^{+3})_3(SiO_4)_3(OH)$
Fluorite	CaF_2
Gypsum	$CaSO_4\bullet 2H_2O$
Hematite	Fe_2O_3
Ilvaite	$CaFe_2^{+2}Fe^{+3}(SiO_4)_2(OH)$
Magnetite	$Fe^{+2}Fe^{+3}{}_2O_4$
Nekoite	$Ca_3Si_6O_{12}(OH)_6\bullet 5H_2O$
Quartz	SiO_2
Thaumasite	$Ca_3Si(CO_3)(SO_4)(OH)_6\cdot 12H_2O$

rubbed away with powdered bathroom cleanser, leaving a fairly lustrous surface. Heavier coatings have been removed using abrasive equipment, but such coatings are representative of more severe alteration and the galena crystal surfaces thus revealed tend to be pitted and veined.

OTHERS

Dave Shannon (personal communication) reports acicular white nekoite and aragonite, colorless octahedral fluorite, octahedral magnetite and colorless crystals of creedite, all very rare.

ACKNOWLEDGMENTS

I am indebted to Les Presmyk, Dave Shannon, Bob Lane, Bill Hawes, Dick Morris, George Godas, Bob Jones, Evan Jones, Bill Bowman and Bob Johnson for information on the mine and the discovery and for the loan of specimens to study and photograph. Pete Dunn confirmed our sight-identification of the axinite-group mineral, by X-ray diffraction. Richard Thomssen, George Robinson, Les Presmyk and Bob Jones kindly reviewed the manuscript and offered several helpful suggestions.

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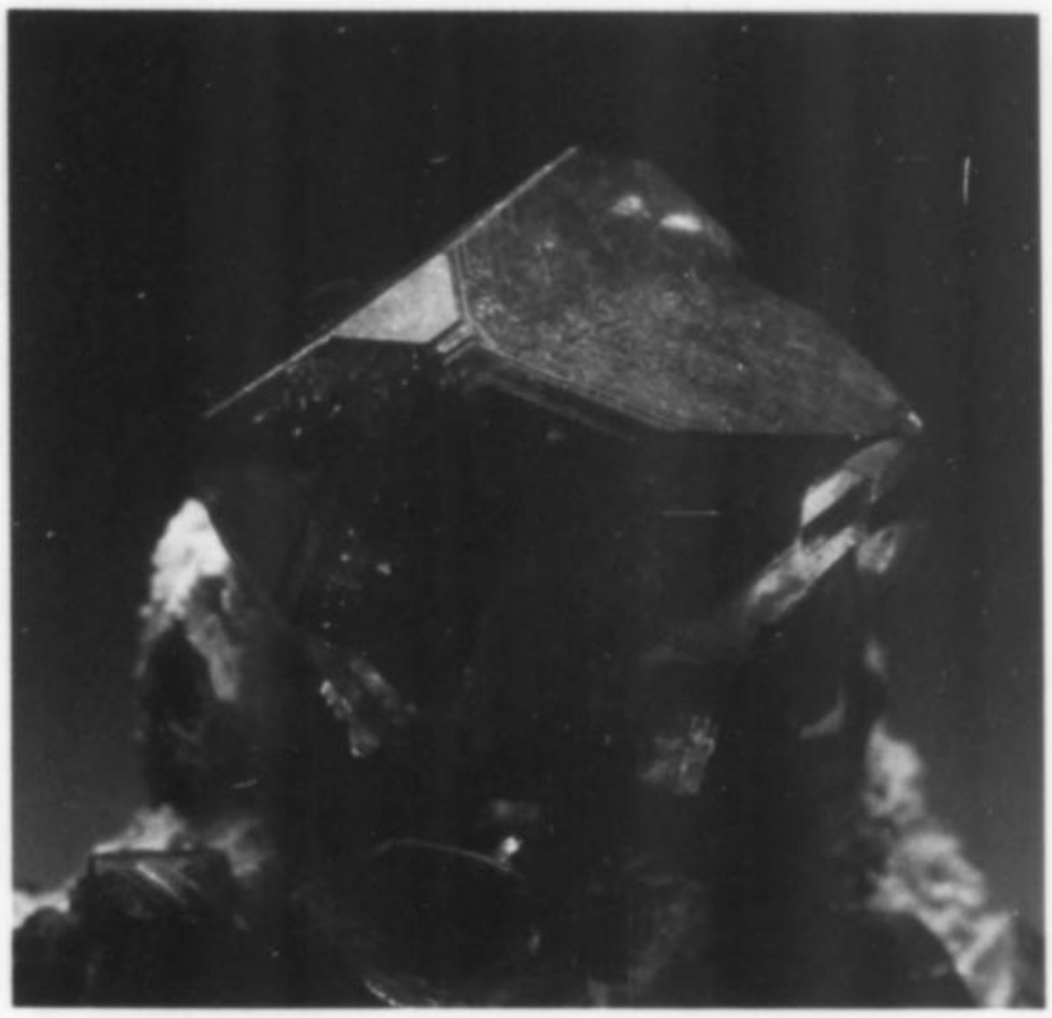

Figure 16. **Gemmy, twinned sphalerite crystal, 1.2 cm. Les Presmyk collection.**

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Recent Mineral Discoveries in Ouray County Colorado

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Boulder, Colorado 80301

Ouray County contains some of Colorado's richest mines, many of its highest mountains, and some of the most spectacular scenery found anywhere. The area has also yielded some of Colorado's most significant mineral specimens for the collector market, and specimens are still coming out today.

INTRODUCTION

Since the closing of the Camp Bird mine at the end of the last decade, the opinion is often voiced that the era of great mineral production has passed for Ouray County. Although it is true that the major mines are now all closed, a considerable amount of small-scale mining continues in the region, much of it for the specific purpose of mineral specimen recovery. In fact, a number of Ouray County mines have produced high-quality material during the last decade.

Ouray County lies in extremely rugged mountain terrain. A number of the peaks in the area, which are part of the San Juan Mountains, are over 4200 meters (14,000 feet) high. Many of the mines are at or above timberline. At this altitude mineral recovery is difficult, and the production season is limited because many of the mines are engulfed in snow for eight or nine months of the year. It is not uncommon for snow to fall in June or September. At the tops of these peaks, it can (and does) snow in any month of the year. There are only two towns in the entire county, Ouray and Ridgeway, and each has a population of well under 1000. Ouray County is one of the last pristine outposts of frontier America.

GENERAL GEOLOGY

Ouray County is quite complex geologically. It is situated along the northwest rim of the great Silverton Caldera, and much of the mining in the district has tapped veins which formed along great radial and concentric fissures associated with this ancient volcano. Most mining activity in Ouray County has taken place in these fissures which formed in the high mountains to the south, east and west of the town of Ouray. Mining activities to the north of town, however (the Dexter and Cutler Creek districts), tap ore deposits which occur in sedimentary formations beyond the limits of the Silverton Caldera (see Henderson, 1933).

Ore deposits of two general ages have been recognized in the Ouray mining district. The older deposits are Eocene in age and are found in the sedimentary formations. The younger deposits are Miocene or post-Miocene and are found in the high volcanic mountains.

During the earlier phase, the conditions which favored volcanic intrusions also favored the formation of replacement orebodies in the sedimentary beds which lie north of Ouray. During this period, the Ouray quartz monzonite porphyry stock penetrated Mancos shale, caused fissures in the surrounding rock, and produced gases and clastic (explosive) dikes which are composed of fragments of the underlying rock injected into the surrounding stock. The sedimentary beds with the greatest permeability became the depositional focus of metal-rich solutions. These solutions formed blanket-type, or flattened, horizontal ore beds (Henderson, 1933). The Senorita mine is located in this area and taps this kind of deposit, as does the Bachelor mine, the American Nettie mine, and numerous others.

The younger ore deposits, found to the west, south and east of Ouray, are more typical of the deposits of the San Juans generally. These are for the most part fissure veins, some of which extend for great distances. The veins typically contain silver, gold and base metals. The Mountain Monarch, Michael Breen and Grizzley Bear

Figure 1. **Ore bin at the Mountain Monarch mine.**

Figure 2. **View looking to the east toward the Amphitheatre across Ouray. The Million Dollar Highway snakes its way toward Red Mountain Pass in the lower right.**

mines, as well as many of the others discussed in this article, are of this type (Henderson, 1933). Thus, similarities in the mineral suites found in these mines are understandable, at least in part, because the origins of these deposits are related.

MOUNTAIN MONARCH AND MICHAEL BREEN MINES

History

The Mountain Monarch and Michael Breen mines lie about 2 km east of State Highway 550, up Engineer Pass. The Breen is sometimes referred to as the "Mickey Breen," which is the local nickname for the mine.

The Monarch/Breen complex is composed of sixteen claims, both patented and unpatented. These include the Royal Albert, Duke of Edinburgh, Royal Consort, Pioneer Lady and Mountain Monarch, among others (Everett, 1961; Kelly, 1946; King and Allman, 1950).

The original claims for the group were located in 1874 by Milton W. Cline, one of the early pioneers of Ouray County and the town's first mayor. Serious production was underway by 1890, when a mill, a bordinghouse and a power plant had already been constructed (Gregory and Smith, 1984). These mining claims were later owned by a former Colorado governor, Frederick W. Pitkin, and his partner; hence, these claims were at one time referred to as the "Sherman-Pitkin mine" (Kushner, 1973).

Both mines have been intermittant producers of silver ore, some of it quite rich. An early mining report states that hand-picked ore assayed as high as 658 ounces of silver per ton (Woodward and Tyson, 1880). Lead ore has also been shipped; gold is present in small amounts. In 1891, for example, the Director of the Mint reported that the Monarch shipped $86,241 in silver but only $56 in gold; in the same year the Breen produced $37,209 in silver and $3,988 in gold. Production statistics for the following years show similar ratios (Leech, 1891, 1892).

The Monarch/Breen complex has been controlled by Standard Metals Corporation (Rice, 1980) which, until recently, also operated the American Tunnel near Silverton. The Monarch/Breen has been maintained under a lease arrangement by a group from Ouray which includes the Nordlander brothers of Ouray, Don and Ken. These two miners have been responsible for many of the rhodochrosite specimens that have come from these mines in recent years.

Specimen recovery appears to have all come from the main

Figure 3. **Mine cars standing in front of the portal to the Mountain Monarch mine in 1983.**

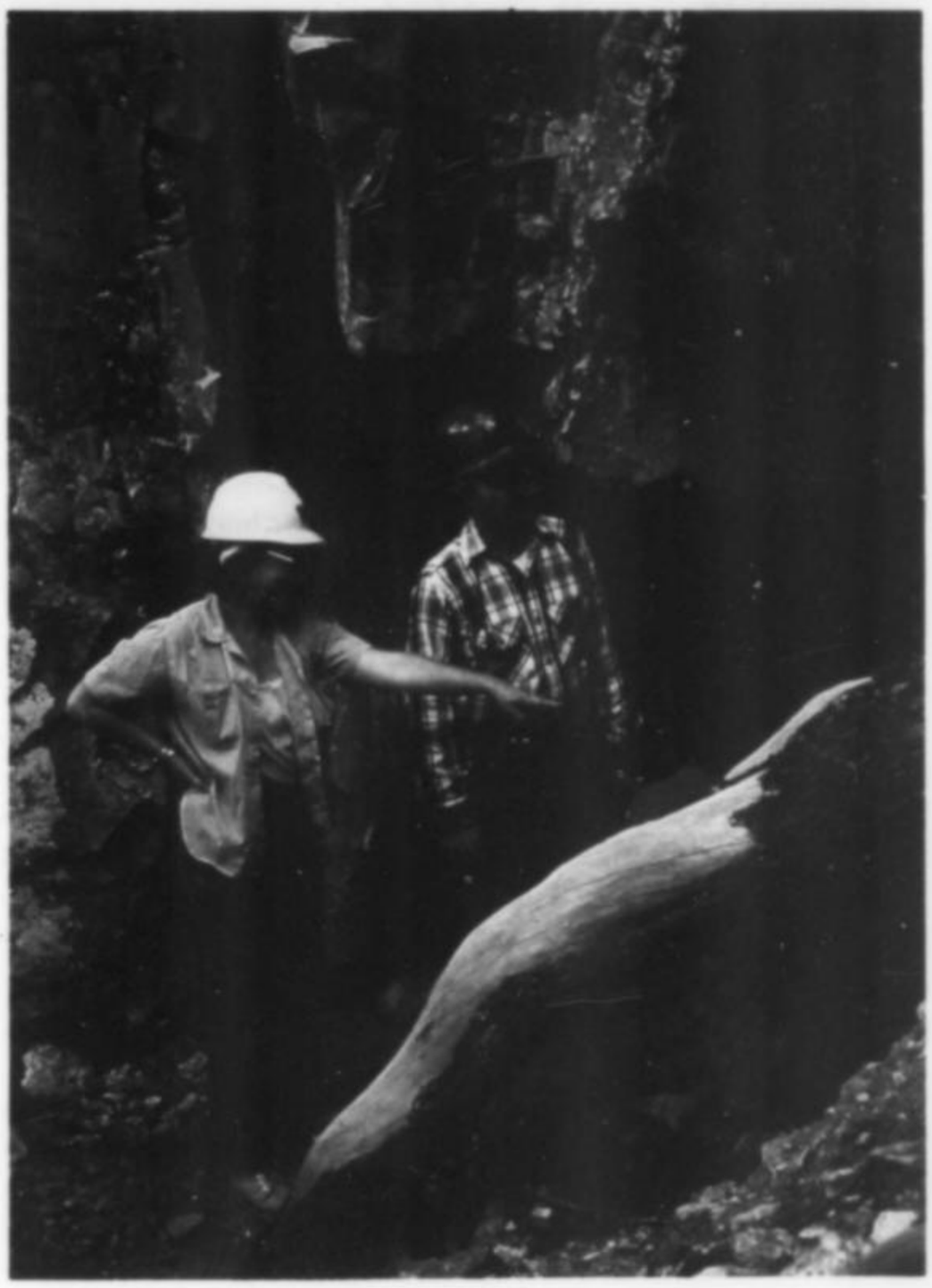


Figure 4. **Dr. Gene Tribbey and one of the authors examining the entrance to the Silver Point mine south of Ouray.**

haulage level of the Mountain Monarch. There are six levels in the Mountain Monarch mine and nine levels in the Breen, reached by six separate portals, three for each mine (Kelly, 1946).

The first rhodochrosite specimens originating from this complex in recent times appeared on the market in 1981 and were labeled as having come from the Michael Breen mine. In the summer of 1982, Harvey Gordon, mineral dealer and field collector from Reno, Nevada, and Carl Faddis of Belleview, Washington, obtained a sub-lease on the Mountain Monarch (where the earlier specimens most likely were collected) for the specific purpose of recovering rhodochrosite for the collector market.

Gordon's group worked the mine for several weeks in June and July, 1982, with the assistance of the Nordlanders, and they collected several hundred specimens. Most of the material is thumbnail or miniature in size; there was only one pocket which produced a few small cabinet specimens of high quality. Unfortunately, no vugs of larger material were encountered during the rest of the operation.

During the winter of 1983–1984, a major snowslide seriously damaged several buildings on the property and destroyed much of the equipment in those structures. In addition, major cave-ins now block the main haulages in both mines. Considering the low price of silver and the apparent scarcity of fine specimen material in the mine, it appears unlikely that further recovery projects will take place at either the Mountain Monarch or the Michael Breen without considerable expense and effort.

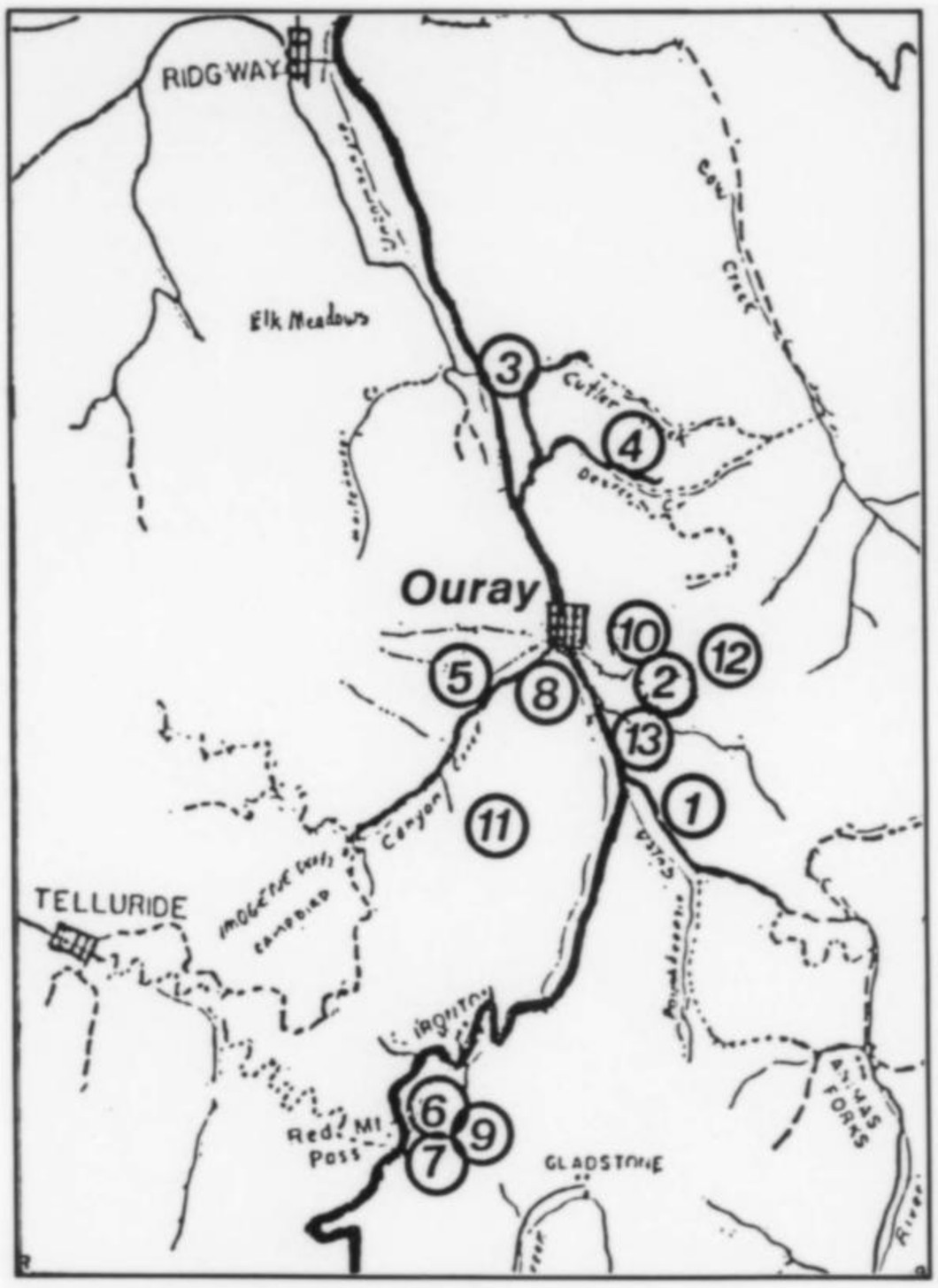


Figure 5. **Location map.**
(1) Mountain Monarch/Michael Breen mines
(2) Grizzley Bear mine
(3) Senorita mine
(4) Bachelor mine
(5) Crystal Cave mine
(6) Gennessee-Vanderbilt mine
(7) Longfellow mine
(8) Mineral Farm mine
(9) National Belle mine
(10) Ohio mine
(11) Ores and Metals mine
(12) Portland mine
(13) Silver Point mine

Minerals

Chalcopyrite $CuFeS_2$

Chalcopyrite occurs as small, brilliant, twinned crystals to about 5 mm, liberally sprinkled over many specimens from the Mountain Monarch mine. In fact, this species is so common, that its presence can almost be used as an indicator of specimens coming from this mine, which might otherwise be mistaken for rhodochrosite specimens from the American Tunnel. The chalcopyrite occurs on both the drusy quartz matrix as well as on the rhodochrosite rhombs themselves.

Fluorite CaF_2

Fluorite is extremely rare as specimen material from these two mines, having been reported with certainty on only a few specimens from the upper workings of the Mountain Monarch. These specimens occur associated with baby-pink, small rhodochrosite rhombs on typical drusy quartz matrix, forming pale green, water-clear

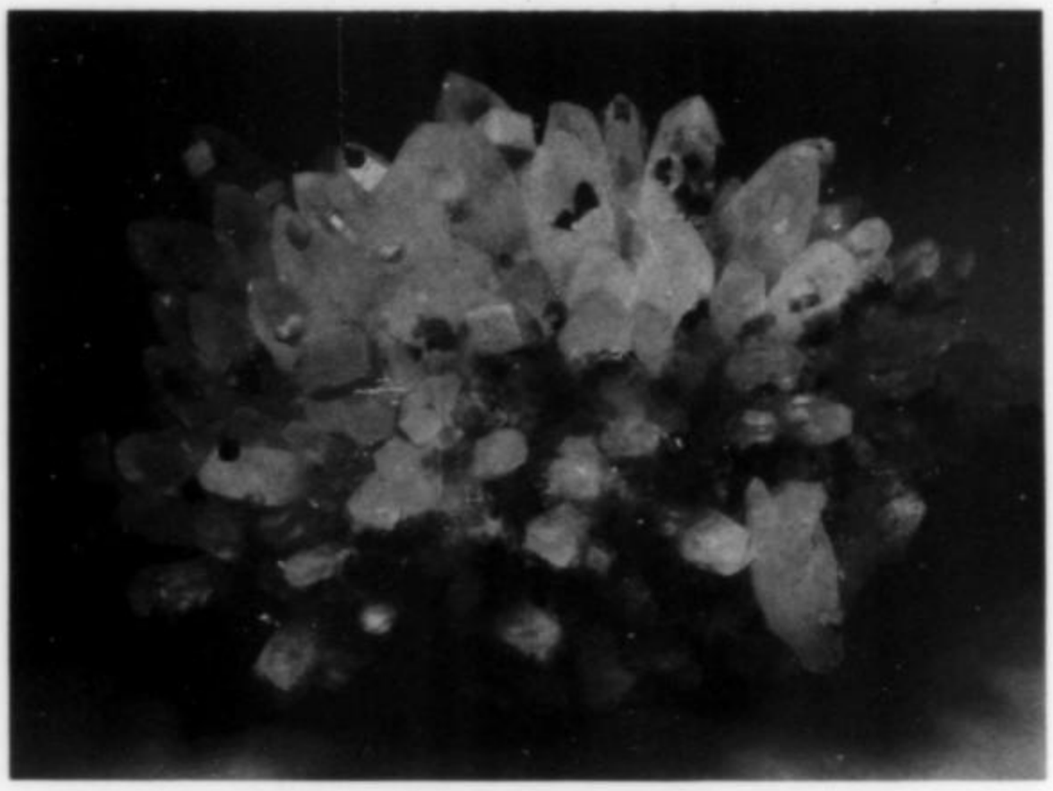


Figure 6. **Rhodochrosite and quartz; Mountain Monarch mine. A cluster of quartz with light pink rhodochrosite and associated chalcopyrite. Specimen size: 5 x 7 cm.**

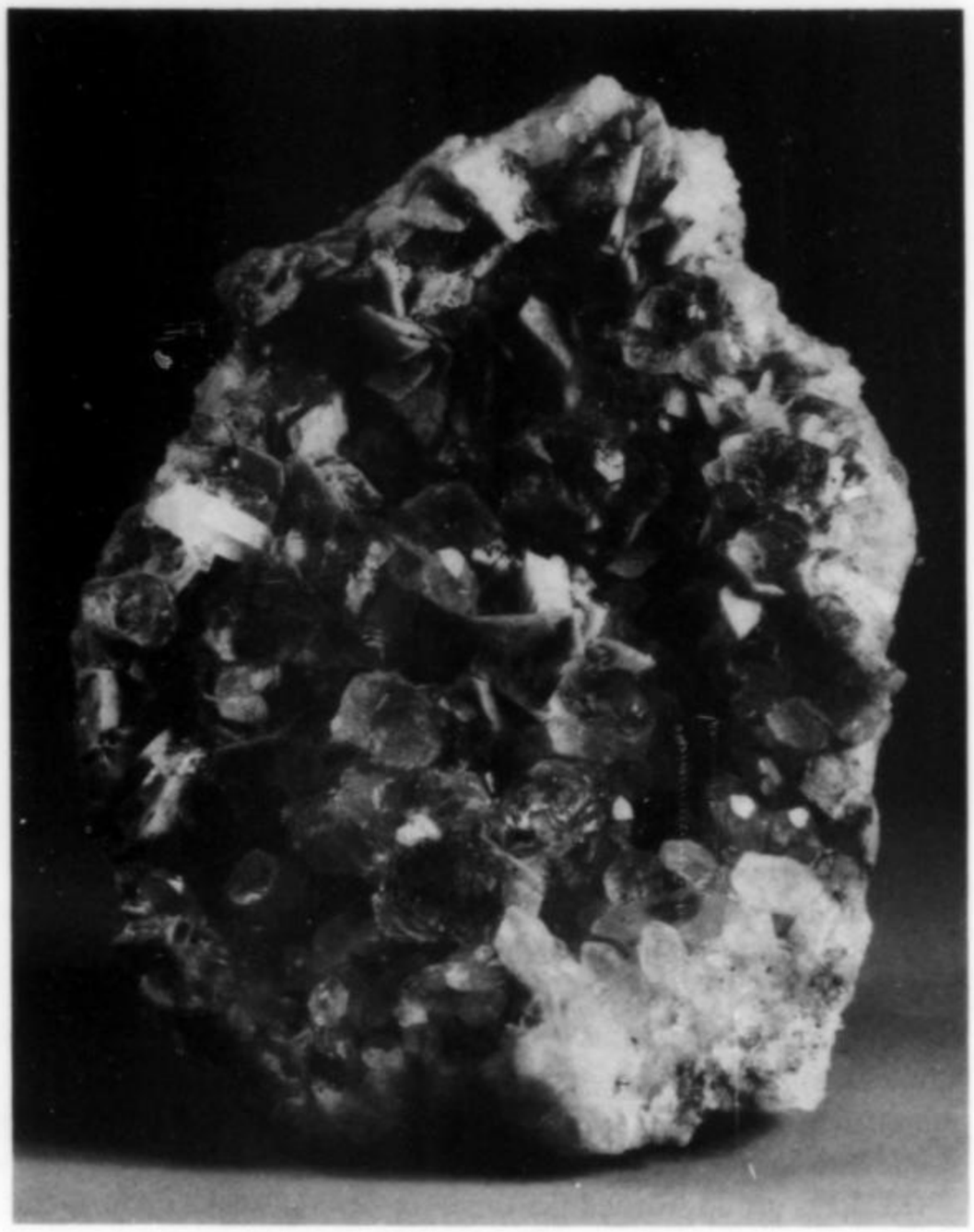


Figure 7. **Fluorite and rhodochrosite; Mountain Monarch mine. Small, light green cuboctahedrons associated with small rhodochrosite rhombs. Individual crystals to 7 mm.**

cuboctahedral crystals to 6 mm. Although larger green octahedrons have been reported from this mine, the authors have not been able to verify the claim.

Galena PbS

Galena occurs in limited amounts in the Mountain Monarch. It forms small, simple cubes to about 1 cm, in association with lustrous black sphalerite on the usual quartz matrix.

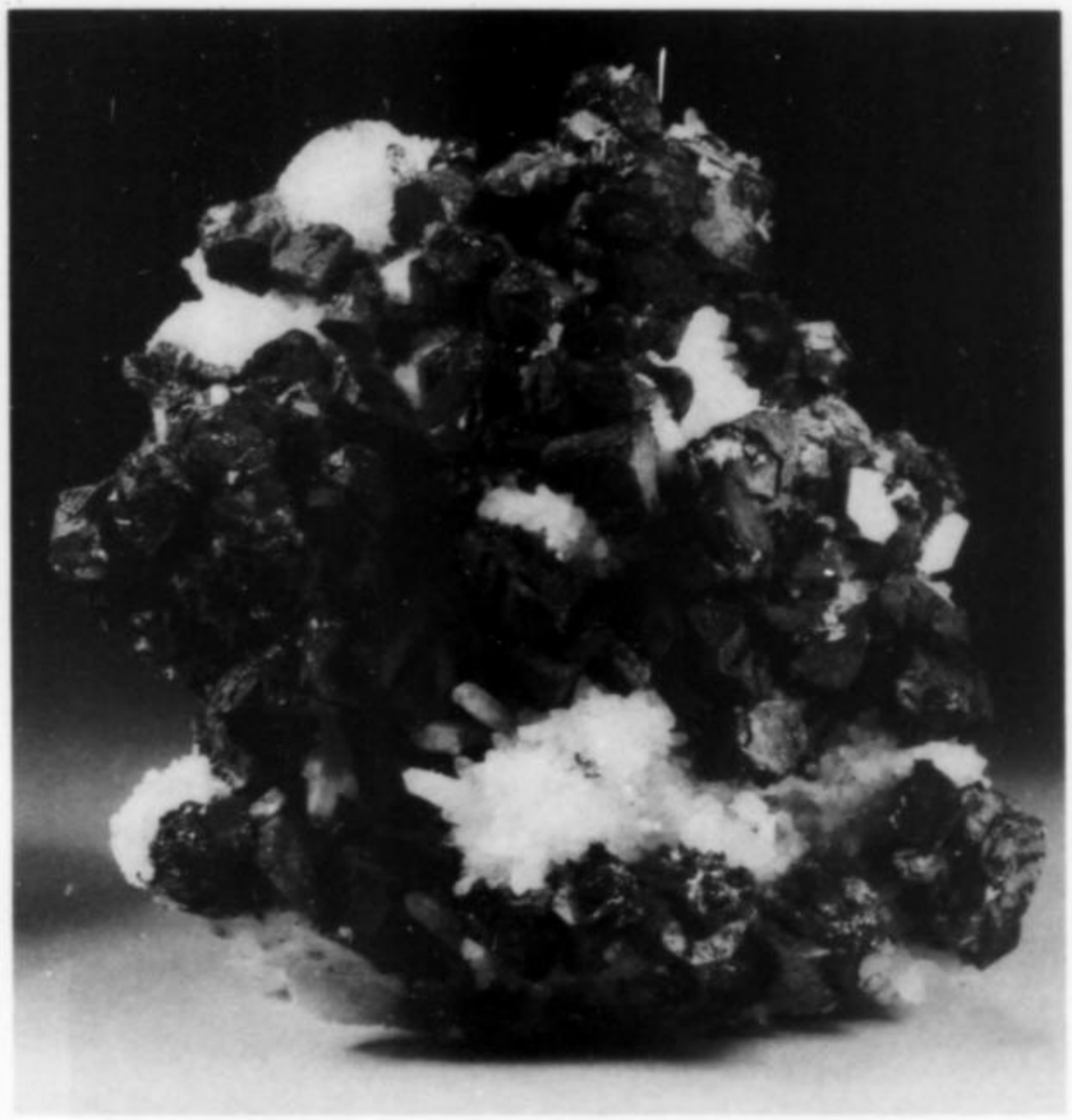


Figure 8. **Galena and sphalerite; Mountain Monarch mine. Small cubes modified by octahedral faces. Individual crystals to 7 mm; 6 x 7 cm overall.**

Pyrite FeS_2

Pyrite, like chalcopyrite, occurs as small, bright crystals to about 5 mm, sprinkled over both rhodochrosite and quartz. It rarely forms somewhat larger crystals to perhaps 1 cm. Pyrite should be considered as only a minor accessory mineral from this mine.

Quartz SiO_2

Quartz occurs as drusy material, very similar to the quartz matrix of American Tunnel specimens, and as fine individual prisms to 2.5 cm and occasionally larger. These prisms are slightly milky in appearance and commonly have sharp, very pale rhodochrosite rhombs growing on them. The original specimens from this complex appearing on the market in 1981 were labeled as coming from the "Micky Breen mine" and were of this type. It is likely that this early material, as well as all later specimens which also had larger quartz crystals, have all come from the Mountain Monarch.

Rhodochrosite $MnCO_3$

Rhodochrosite is the most important collector species from the Monarch/Breen mines. It forms rhombs up to 2 cm on edge, and intergrown groups in sub-parallel arrangement to 6 cm. The color varies from baby-pink in small specimens to a deep rose or strawberry shade in large crystals. Many of the rhodochrosite rhombs have a tell-tale sprinkling of extremely small, clear quartz crystals (in association with tiny chalcopyrite and/or pyrite crystals) on at least two adjacent surfaces of the rhodochrosite, giving a somewhat "crusty" appearance to those faces. This feature is so characteristic that it can be used to distinguish these specimens from similar ones from other mines.

Sphalerite (Zn,Fe)S

Sphalerite forms small, black, lustrous crystals to about 7 mm, commonly in association with galena. It is not a particularly plentiful species from either of these two mines. It occurs only rarely with rhodochrosite, and then forms extremely small crystals.

GRIZZLEY BEAR MINE

History

The true Grizzley Bear mine lies several kilometers east of State Highway 550 in Bear Creek Canyon, south of Ouray. The only access to this mine is a steep, difficult hiking trail. Because of the limited access, the Grizzley Bear mine has never been fully productive since it was first located in 1875 by L. W. Balch and F. W. Sitterley. It was later relocated in 1894 by George and Edward Wright (Gregory and Smith, 1984).

Peak production from this mine seems to have been reached in the 1890's, when the total value of silver ore was placed at about $600,000 (Gregory and Smith, 1984). But access to the mine was always a problem, particularly since the original trail was on the north face of the canyon and snowslides were a frequent hazard. The 1890 census reported the existence of a tiny town with 24 inhabitants at the mine site, consisting of miners and their families who perhaps found "commuting" from Ouray an impossibility, especially in winter.

During the 1950's, ASARCO is reported to have evaluated the property but abandoned any idea of a development project as being too costly, given the grade of remaining ore and the lack of a suitable road (Rice, 1980). In spite of this—or perhaps as a result—a group of developers from Ouray, including several members of the Zanett family, some of Ouray's longtime miners, began to drive a tunnel from the other side of the mountain toward the Grizzley Bear mine. This tunnel began in the Amphitheatre, the large cirque east of Ouray which contains the Forest Service campground. The idea was to extend the tunnel southeast through the mountain to intersect the orebody of the Grizzley; since there is a good road up through the Amphitheatre, it was believed that access to the Grizzley Bear would be facilitated and that it would become a paying mine. The contemplated tunnel was to extend approximately 1950 meters (6400 feet). When financing for this ambitious project gave out in early 1982, the tunnel had been driven 1370 meters and no significant ore had been encountered.

Resumption of work on the Zanett Tunnel, as it is called, will probably have to await a rise in silver prices. The Grizzley Bear mine itself remains untapped. The Zanett Tunnel, however, has already produced a quantity of fine specimens for the collector market. Virtually all such specimens are labeled as coming from the "Grizzley Bear mine."

Minerals

Ore minerals from the Grizzley Bear mine include chalcopyrite, galena, polybasite, pyrite, sphalerite and tetrahedrite; gangue minerals reported include barite, calcite, chlorite, quartz, rhodochrosite and sericite (Holmes and Kennedy, 1983). Not all of these species have as yet been encountered in the Zanett Tunnel, but the assemblage is very similar.

The specimens thus far obtained from the Zanett Tunnel of the Grizzley Bear mine suggests that there may be great promise for this mine as a source of fine collector material. If the tunnel is ever completed as far as the orebody, and the mine at last becomes a paying operation, we can hope that there will be a steady stream of fine specimens from this Ouray County mine rivaling some of the great producers of the past.

Calcite $CaCO_3$

Calcite is of limited occurrence in the Grizzley Bear mine but does occasionally form brown scalenohedrons or cream-colored "bubbley" druses on quartz specimens.

Fluorite CaF_2

Fluorite forms rough, water-clear, pale green octahedrons composed of built-up and etched cubes. Crystals to 2 cm on edge typically form on a matrix of white quartz prisms in plates as large

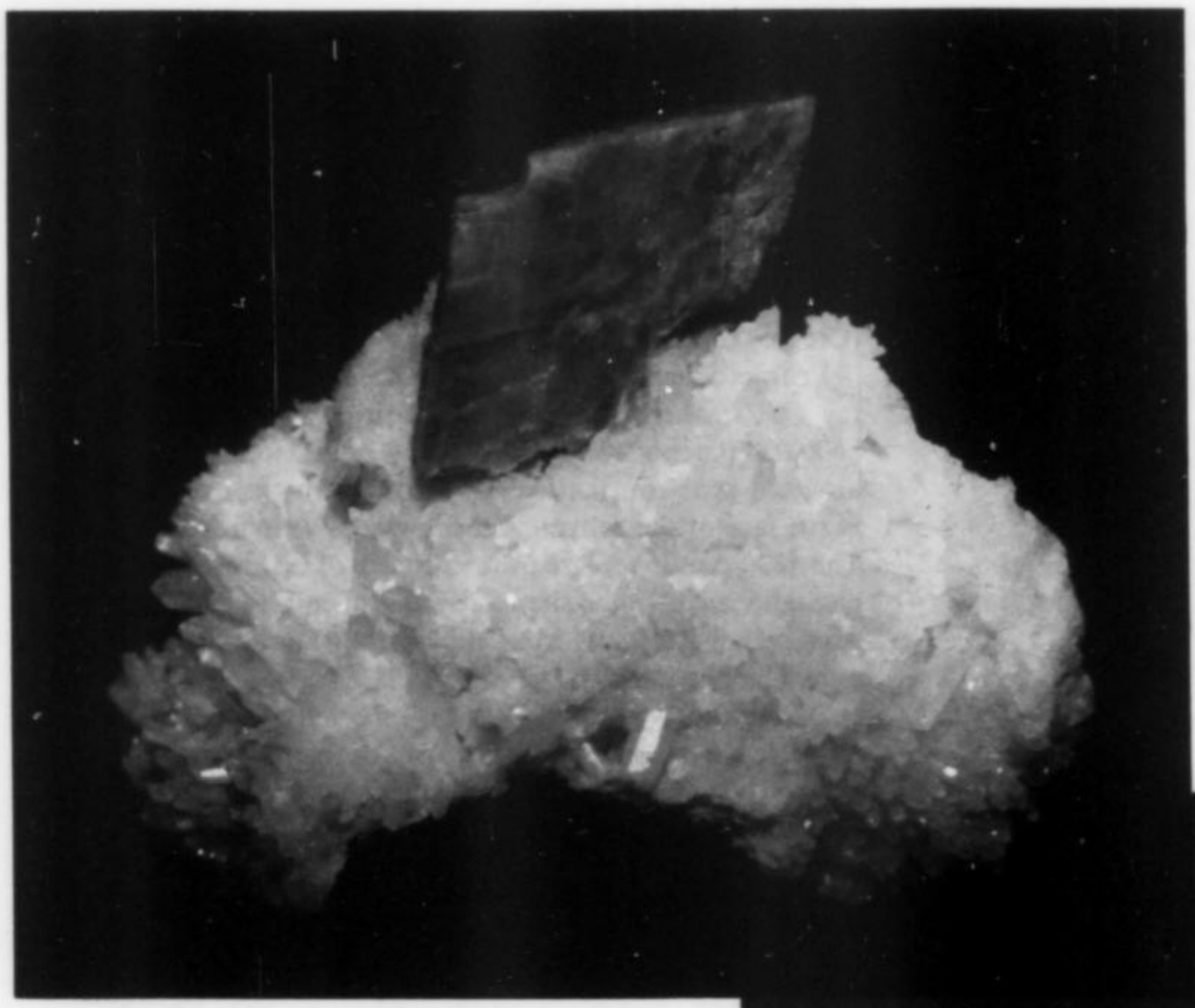


Figure 9. **Rhodochrosite and quartz; Grizzley Bear mine. Sharp single rhomb, 3.5 cm on edge, on quartz knob. Overall size of specimen: 5 x 6 cm.**

Figure 10. **Rhodochrosite and quartz; Mountain Monarch mine. Intergrown rhombs on white drusy quartz, with minor chalcopyrite. Collected by Harvey Gordon and Carl Faddis.**

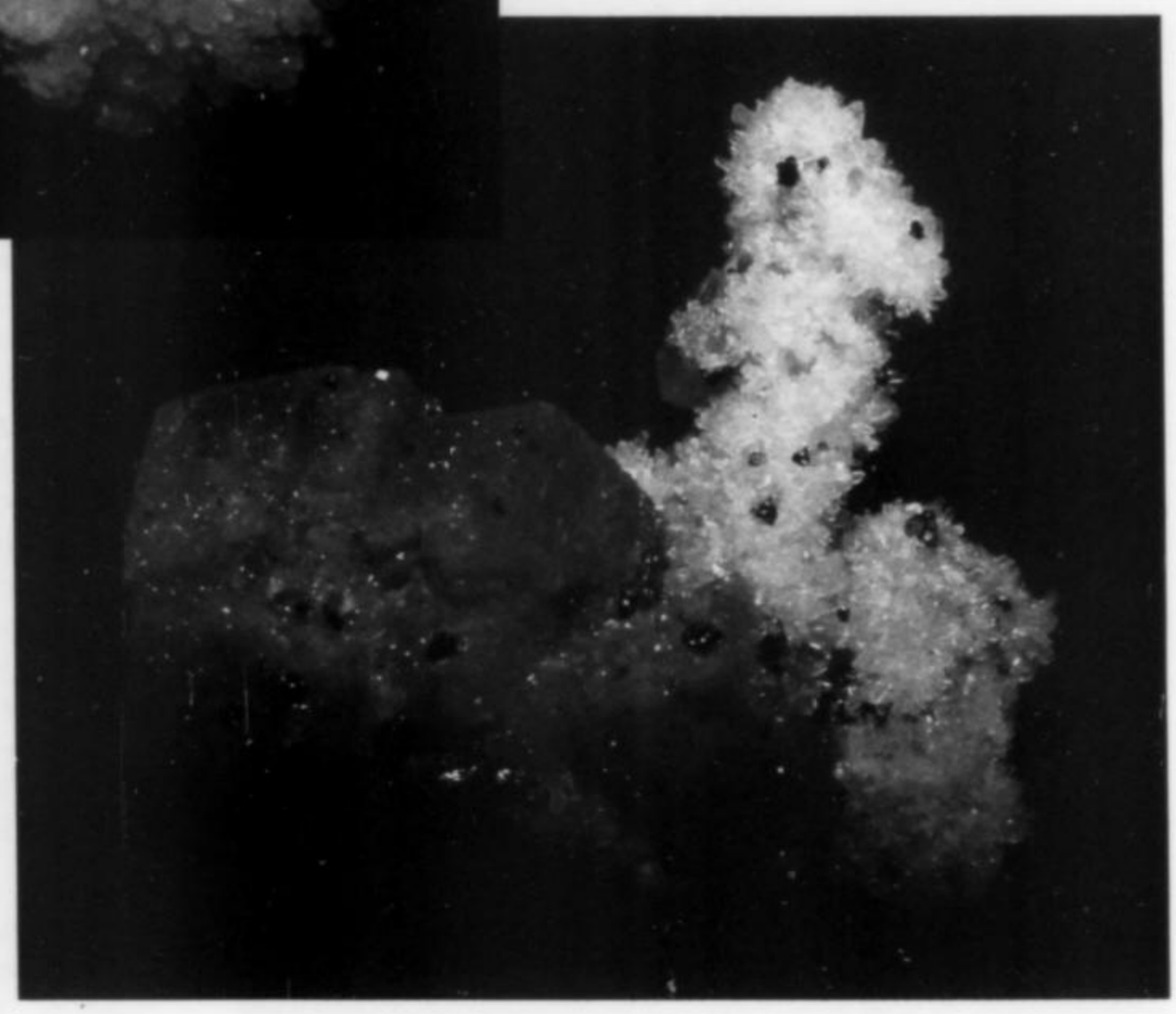


Figure 11. **Rhodochrosite and quartz; Grizzley Bear mine. A large, pale pink single rhomb on quartz. Rhomb measures 3.5 cm across. Overall size 3.5 x 5 cm.**

as 35 cm across. Small, etched rhodochrosites are also associated, as well as tiny pyrite cubes. The fluorite appears to come from only one zone in the Zanett Tunnel, toward the end of the present workings.

Galena PbS

Galena forms small cubes in association with pyrite and sphalerite crystals from about mid-way in the present Zanett Tunnel. It is otherwise not a well-represented species.

Pyrite FeS_2

Pyrite occurs with some frequency as a minor association mineral in the Grizzley. In one area of the tunnel it forms rather nice cubes approximately 1 cm on edge, in clusters as much as 2–3 cm long on clear quartz crystals. Minor calcite is also associated.

Quartz SiO_2

Quartz occurs in a variety of distinctive habits in the Grizzley. The most unique occurrence is the chloritic quartz, which can vary from pale fern-green to a medium moss-green. Typically, small clusters of bright pink rhodochrosite rhombs form rosettes across the chloritic quartz, creating striking and distinctive specimens. Quartz also forms plates of slender, clear prisms to 2.5 cm long (without associations), very large plates of white, barrel-shaped prisms almost 5 cm in length, and druses of white quartz in association with large rhombs of rhodochrosite. In some rhodochrosite vugs, quartz also forms replacement casts after rhodochrosite.

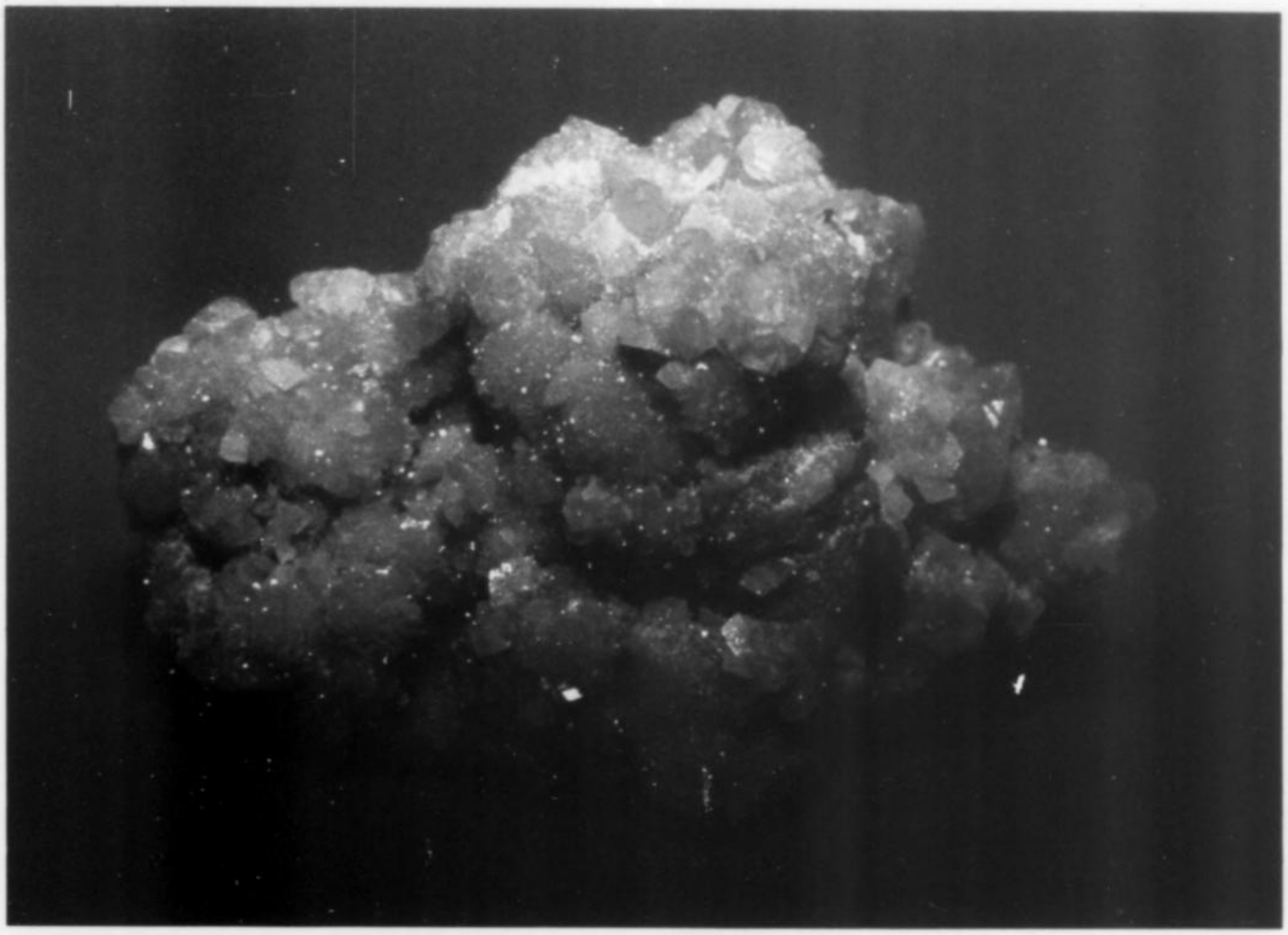


Figure 12. **Quartz and rhodochrosite; chloritic quartz plate, medium green color, with rosettes of rhodochrosite. Specimen size: 4 x 5 cm.**

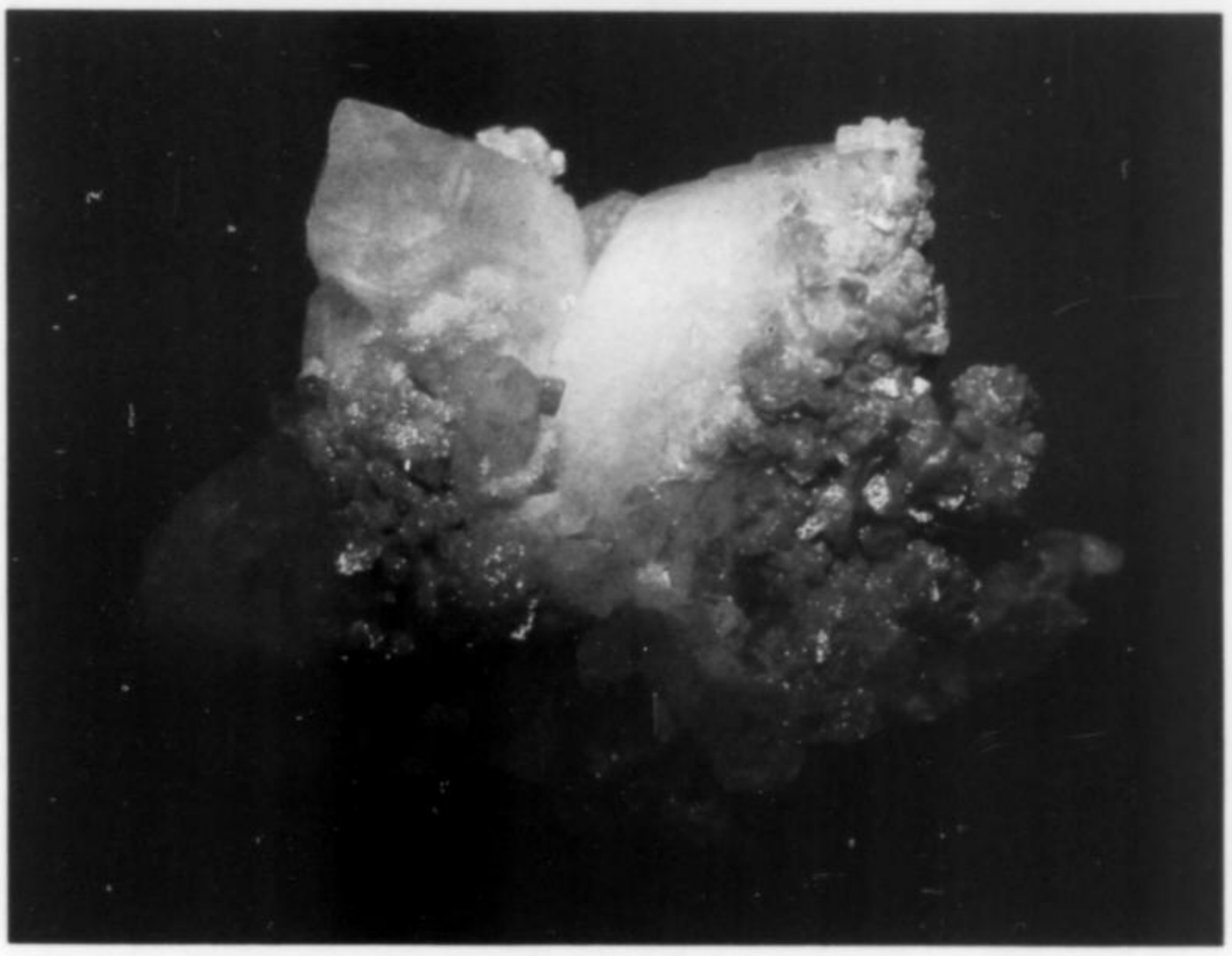


Figure 13. **Rhodochrosite and quartz; Grizzley Bear mine. Group of small, pale pink rhombs on stout quartz prisms. Overall size, 3 x 4.5 cm.**

Rhodochrosite $MnCO_3$

Rhodochrosite occurs in several habits in the Grizzley, depending on the specific location in the Tunnel. In association with chloritic quartz it forms rosettes to about 1 cm of bright baby-pink, lustrous little rhombs. Elsewhere, it forms very pale pink rhombs on white, barrel-shaped quartz prisms. In one cleft, rhodochrosite formed rhombs to more than 5 cm on edge, implanted on plates of drusy quartz as much as 35 cm across. Unfortunately, this cleft was apparently once a watercourse, and many of the rhodochrosite rhombs from this area exhibit etching on at least two of the crystal faces. Additionally, on many specimens a further deposit of quartz has partially coated the rhodochrosite, forming either crusts or actual casts after rhodochrosite where the underlying rhombs have subsequently etched away. Minor sulfides also occur on specimens from this zone.

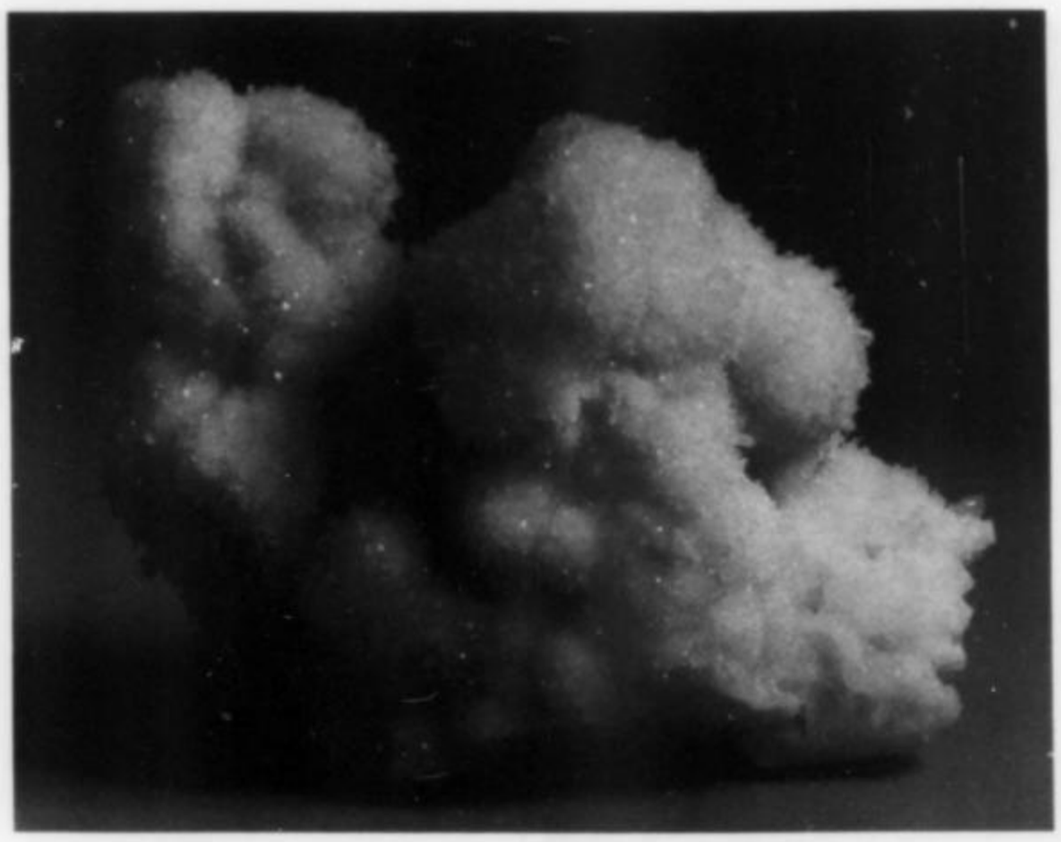


Figure 14. **Quartz; Grizzley Bear mine. Quartz casts after rhodochrosite. Overall size: 5 x 6 cm.**

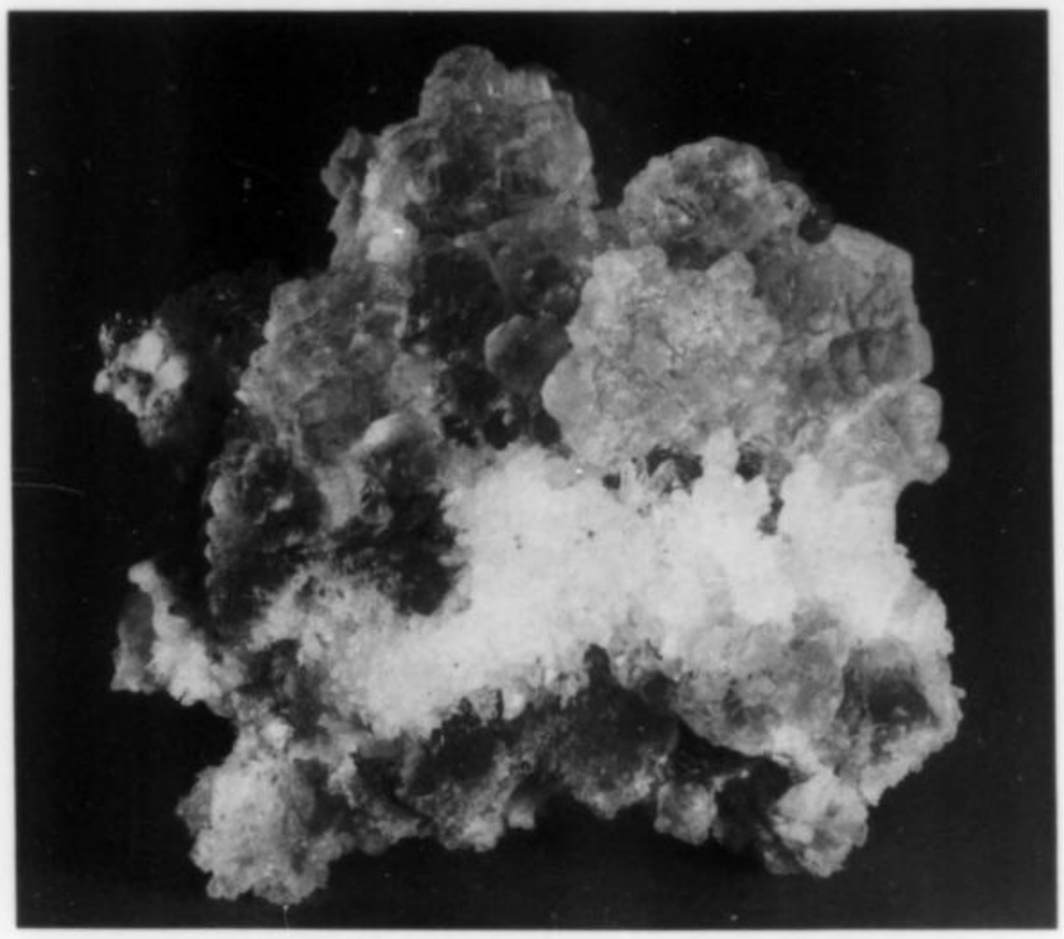


Figure 15. **Fluorite and quartz; Grizzley Bear mine. Pale green cuboctahedrons of fluorite to 1 cm on white drusy quartz. Overall size: 6 x 8 cm.**

SENORITA MINE

History

The Senorita mine lies just north of Ouray on the Cutler Creek Road. It is one of a series of mines located high on the side of a mountain overlooking State Highway 550 below and to the west. The Senorita is the most northerly of these properties, which also include the Black Girl, Yellow Girl and Newsboy mines. All of these mines work sedimentary ore deposits which are quite different from the two mines discussed previously.

These mines were silver producers of varying success. All have been worked intermittantly since the turn of the century. There was some development work at the Senorita as recently as the 1970's; the Black Girl was last worked in 1984.

Relatively little is known about the early history of the Senorita mine. It was operated for many years by A. W. F. Warde of Ouray, and ownership of the mine eventually passed to his daughter. Dur-

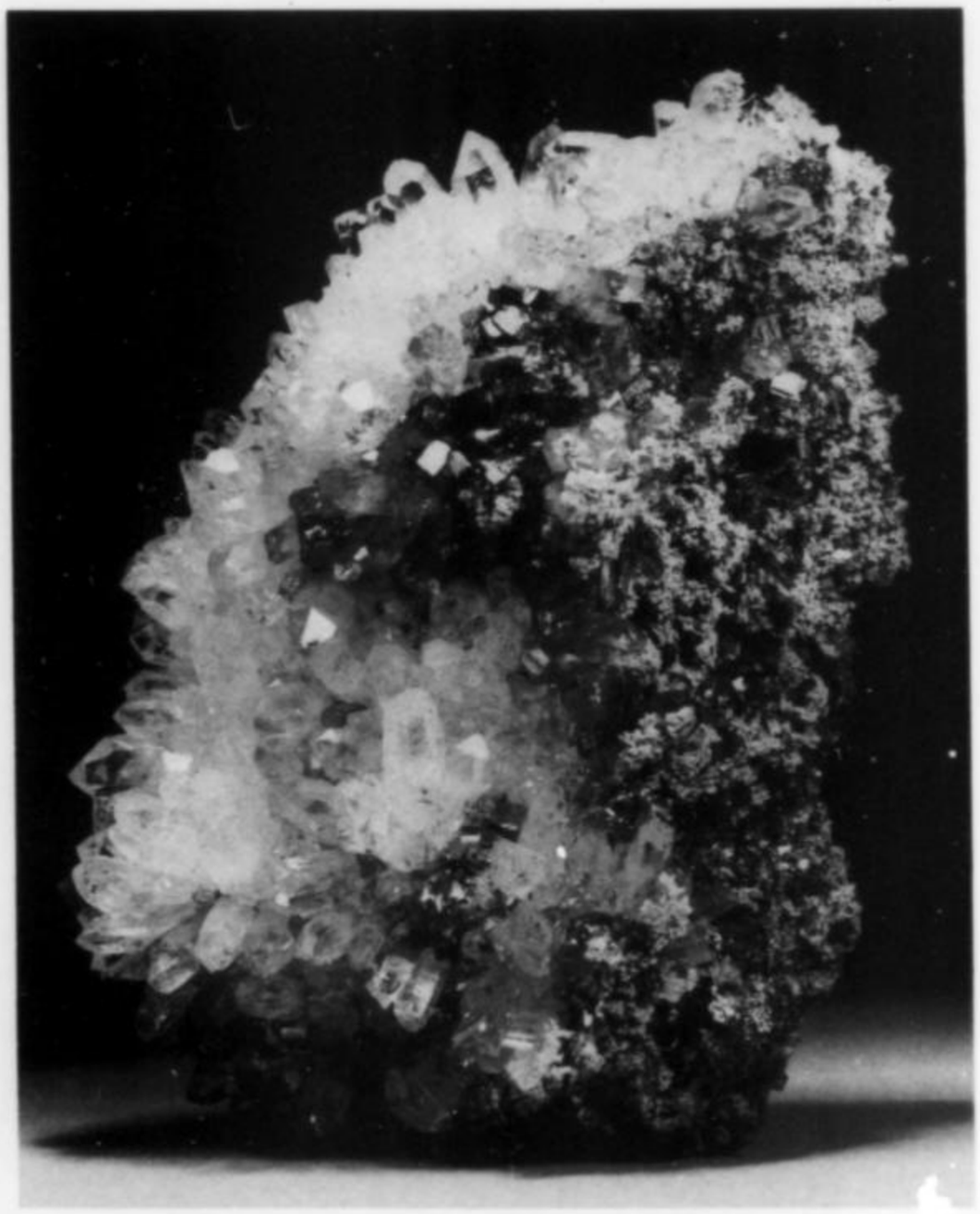


Figure 16. **Pyrite and quartz; Grizzley Bear mine. Pyritohedrons and cubes to 5 mm on clear quartz crystals. Overall size: 7 x 9 cm.**

ing the 1940's, the Senorita was operated almost single-handedly by Ouray's "lady miner," Belle Hersinger (see Mining Yearbook for 1941 and 1942), who managed to ship several truckloads of ore annually.

Minerals

Azurite $Cu_3(CO_3)_2(OH)_2$

Azurite, like malachite, forms thin coatings on waste rock, and is particularly visible on the dumps of this mine.

Barite $BaSO_4$

Barite is the outstanding collector species from the Senorita mine. It forms milk-white individual spears to 5 cm on edge, and probably represents the best examples of this species from Ouray County. These spears typically stand upright on the matrix, making some very showy specimens. Barite from this mine often has smaller barite crystals growing in sub-parallel arrangement along the surface of the blades, imparting a rough-textured appearance to the crystals. The Senorita barite can thus easily be distinguished from the small barite roses found at the Camp Bird, Idarado and Osceola mines. It is also different from the smooth, white, thick spears found at the Mineral Farm and at the National Belle mines.

Calcite $CaCO_3$

Calcite forms white to creamy masses on drusy quartz, generally best described as botryoidal, in association with barite. Occasionally, small, sharp scalenohedrons are coated with quartz, or are entirely replaced by quartz. These casts are extremely delicate. They form to a maximum of about 7 mm and are almost never complete and perfect, perhaps owing to the thinness of the layer of quartz which forms them.

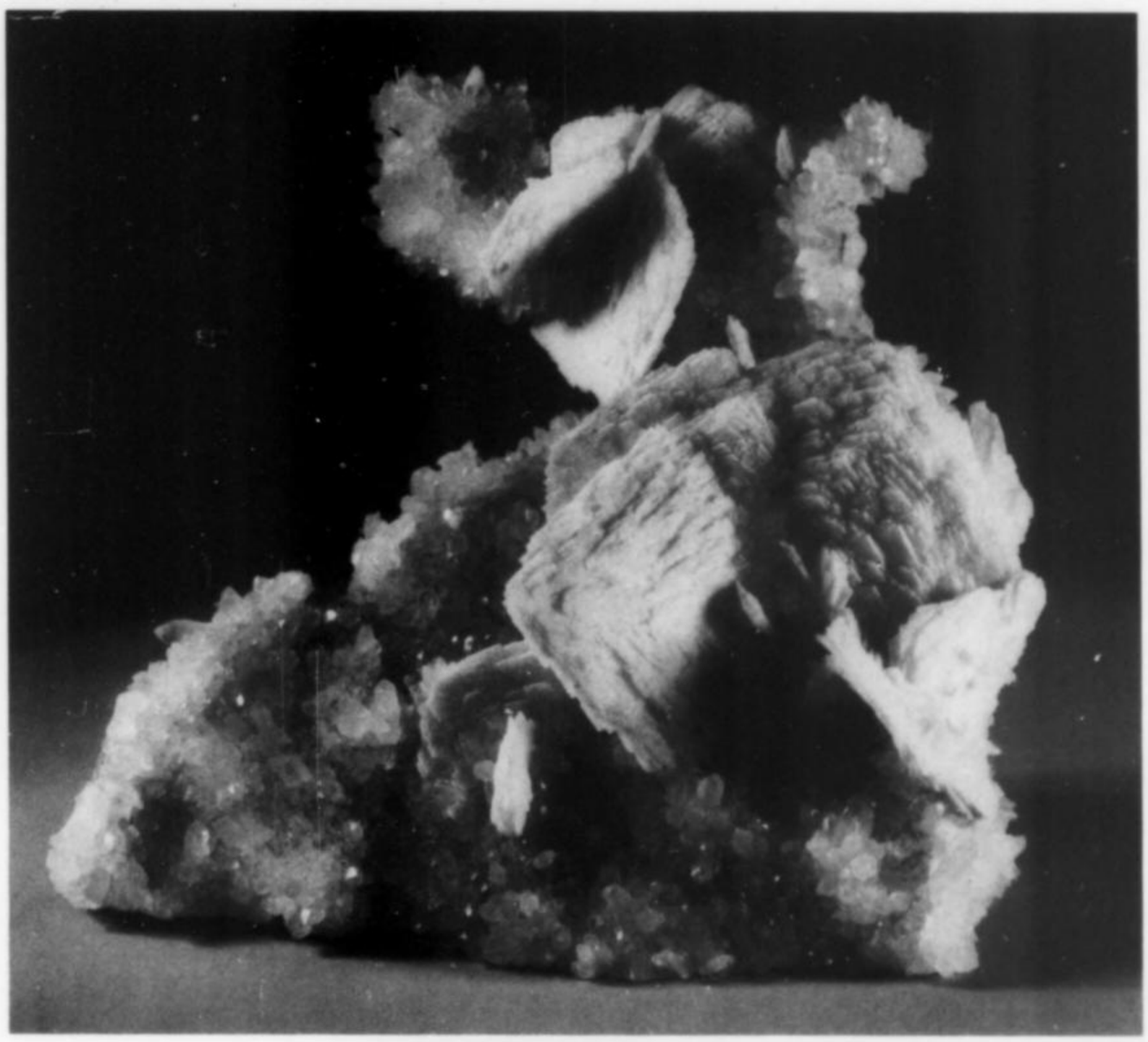
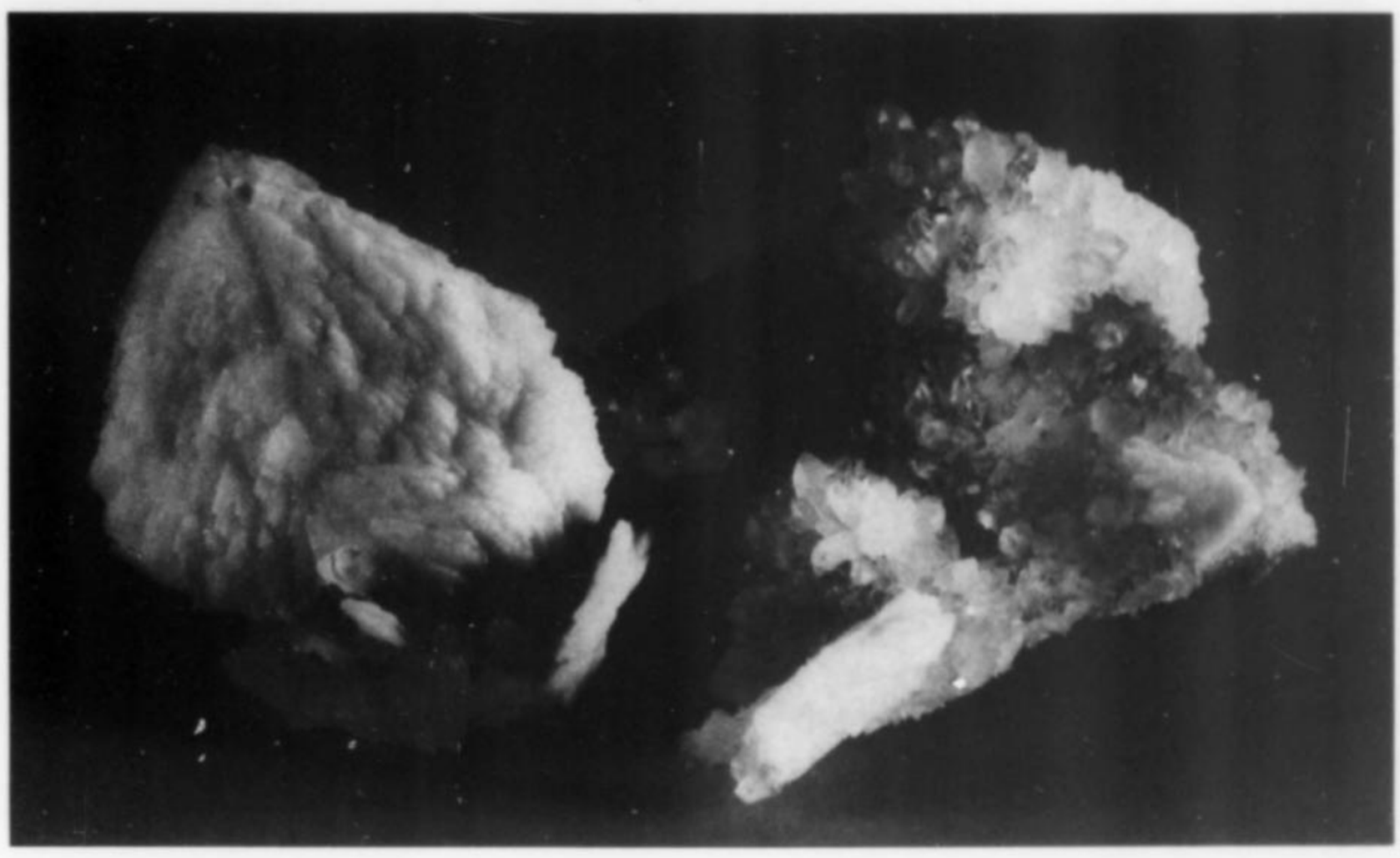


Figure 17. **Barite and quartz; Senorita mine. Barite crystals 3 cm across on a matrix of drusy quartz. Overall size: 6 x 7 cm.**

Figure 18. **Barite and quartz; Senorita mine. Barite spear 2 cm high on quartz matrix. Overall size: 2.5 x 4 cm.**



Malachite $Cu_2(CO_3)(OH)_2$

Malachite, like azurite, can be found easily on the dumps of the Senorita mine. Malachite is also found in many parts of the underground workings as a green smear on the timbers. It appears to be an alteration product resulting from the decomposition of chalcopyrite.

Quartz SiO_2

Quartz is significant primarily as matrix material for barite specimens in the Senorita mine. It forms druses of clear, small "points" which are implanted on black, dark gray or chocolate-brown rock. The underlying rock coloration in turn imparts a charcoal or dark chocolate-brown color to the quartz. It makes for very showy specimens in contrast to the stark white of the barite. In some specimens, individual quartz crystals in druses have experienced additional growth and have formed rather nice sprays on the flatter drusy background. No large, individual crystals of quartz have come from this mine.

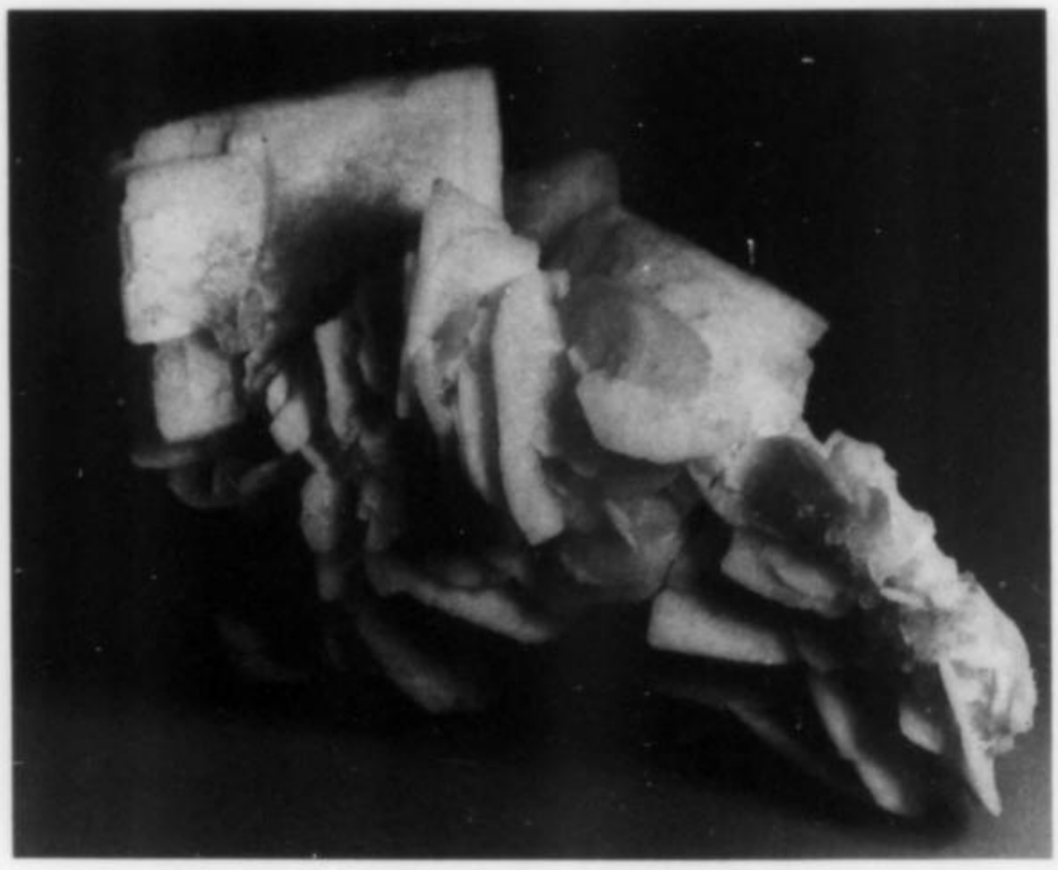


Figure 19. **Barite: Senorita mine. Cluster of intergrown barite blades, with minor quartz. Overall size: 5.5 x 6 cm.**

Figure 20. **Quartz after calcite; Senorita mine. Delicate cast of calcite scalenohedrons. Overall size: 1.5 x 2 cm.**

OTHER OURAY COUNTY LOCALITIES

Although the three previous mines have produced by far the largest quantity of fine material in recent years, there are a number of other mines in Ouray County which have also contributed to the flow of specimens for the collector market, though perhaps on a more limited scale. An alphabetical summary of these mines follows.

Bachelor mine

The Bachelor mine, located on the Dexter Creek Road north of Ouray, was begun in the early 1890's by three bachelors (hence the name). This mine was one of the great silver producers of Ouray County, giving up in excess of $3,500,000 in high-grade ore. The main tunnel extends over 200 meters, with drifts extending another 300 meters (King and Allman, 1950). Some of the pockets of ore encountered during the last century assayed at 15,000 ounces of silver per ton – almost 50% silver (Holmes and Kennedy,

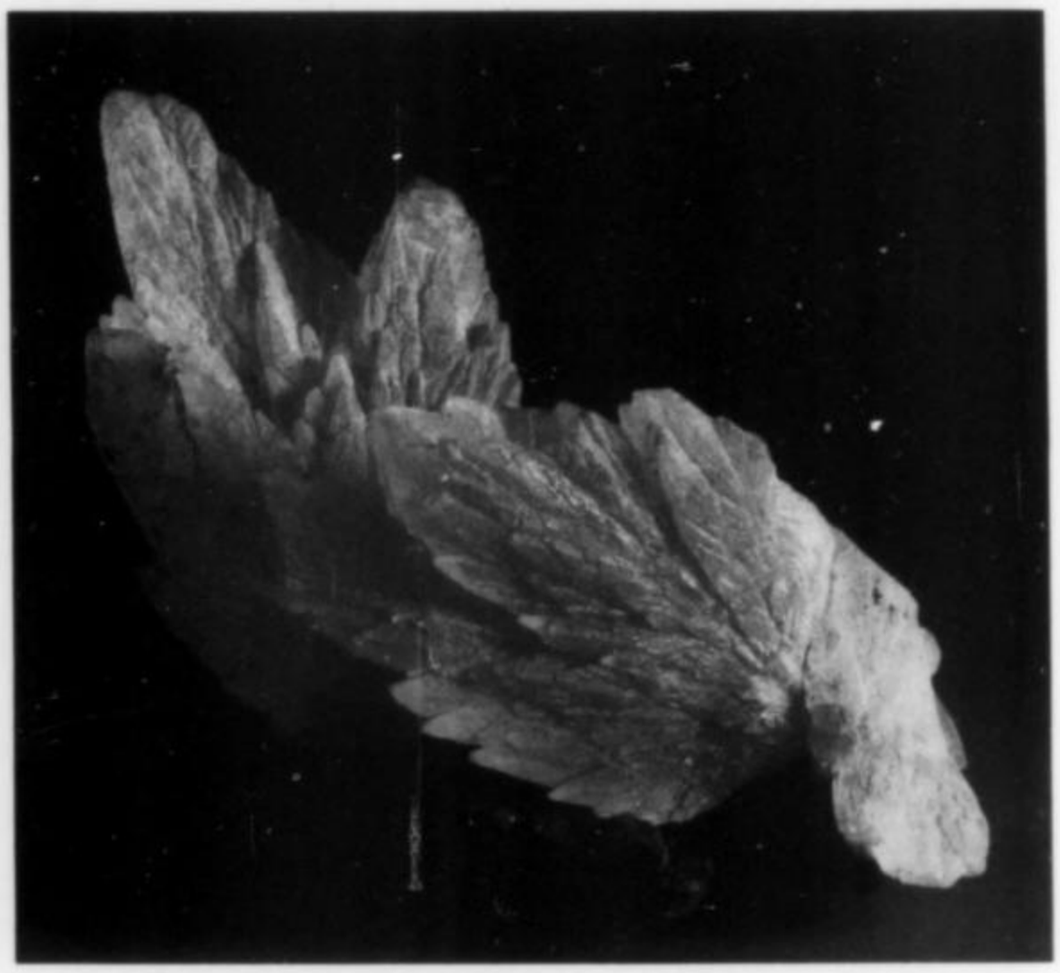


Figure 21. **Calcite: Bachelor mine. Sprays of milky calcite crystals on black, fine-grained matrix. Sprays measure about 2.5 cm across.**

1983)! At the present time, the Syracuse Tunnel of the Bachelor mine is being operated as a tourist attraction, offering tours into a "real mine." Recent improvements to make the mine safe for tourists have also produced a limited number of attractive fans of calcite crystals, translucent, pale blue to cream color, on a black, fine-grained matrix. These fans somewhat resemble the better-known manganocalcite sprays from the Camp Bird and Idarado mines obtained in the past. The Bachelor mine operators have not allowed any further collecting activity, and thus it is unknown whether more material of a comparable nature remains in the mine.

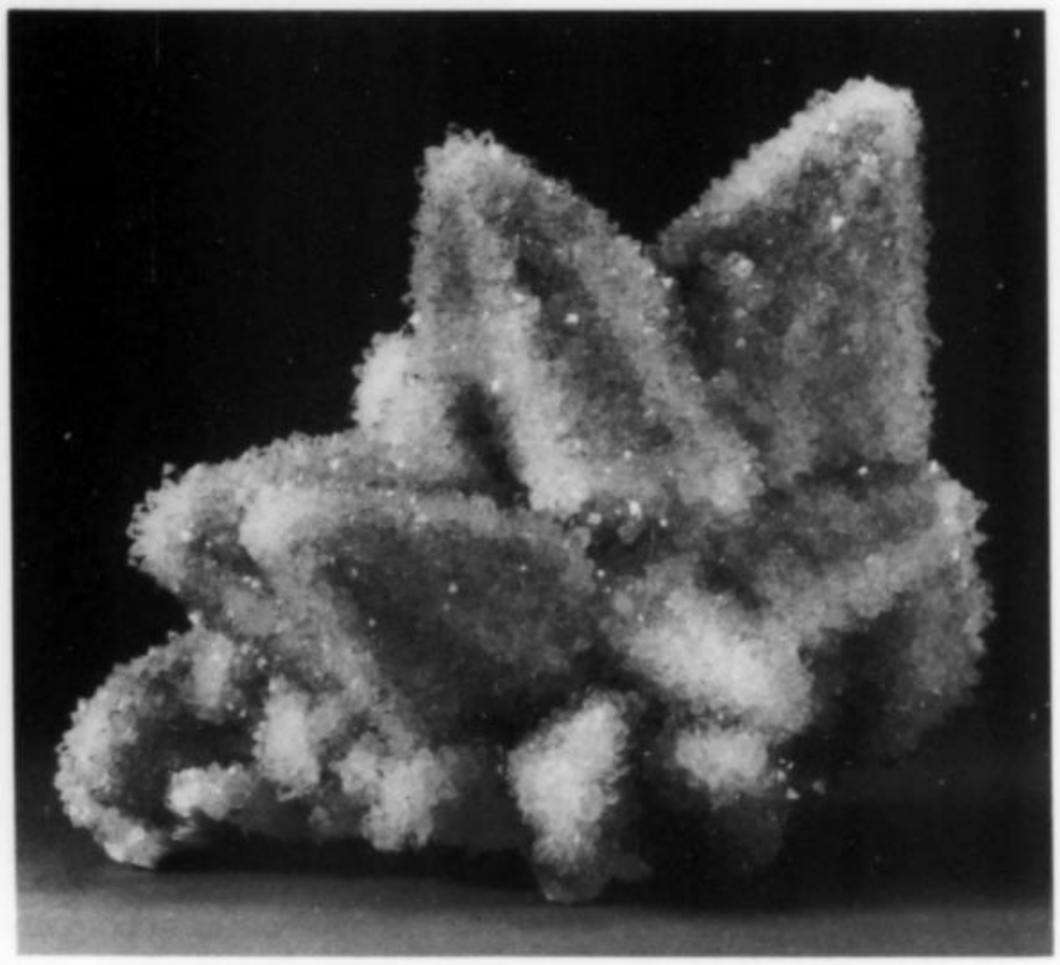


Figure 22. **Quartz and calcite; Crystal Cave. Group of scalenohedrons of calcite coated by quartz. Specimen size: 5 x 6 cm.**

Crystal Cave

The Crystal Cave really should not be called a mine, since it is actually a natural formation on the north wall of Canyon Creek, southwest of Ouray. It has produced some very nice calcite clusters

with individual scalenohedrons to 3 cm, coated by a white quartz druse. These form very attractive casts after calcite. A number of such specimens have recently become available for collectors, but the supply is limited, in part by the poor accessibility of the location and in part because of the relatively small size of the cave.

Genessee-Vanderbilt mine

The Genessee-Vanderbilt was one of the great mines of the Red Mountain District near the southern border of Ouray County. During its heyday, the mine produced in the millions in silver values. During the 1940's, ASARCO reworked the mine, and a limited amount of ore was found. However, the ore deposits of the Red Mountain District are vertical volcanic pipes and become very difficult to mine at depth. The dumps of the Genessee presently yield some very nice covellite crystals in specimens as large as 6 cm across. Other species include pyrite, galena and sphalerite.

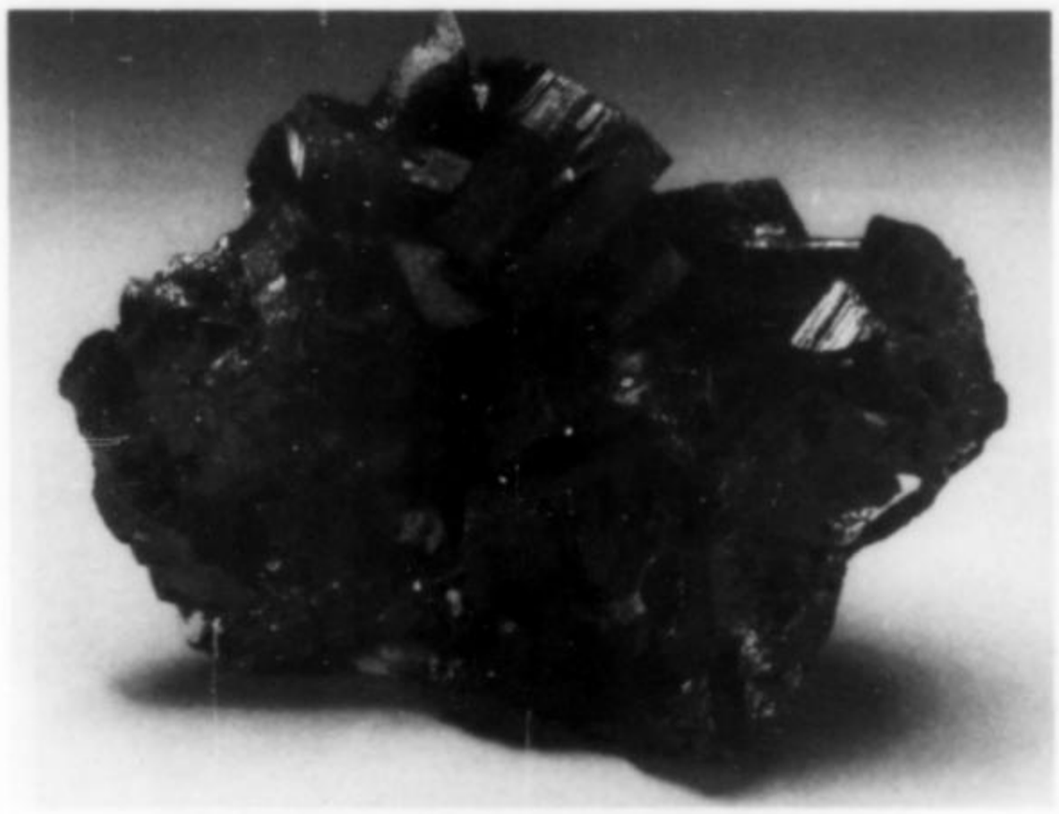


Figure 23. **Enargite; Longfellow mine. Cluster of crystals about 7 mm long. Overall specimen size: 2.5 x 3 cm.**

Longfellow mine

The Longfellow mine is located almost at the border between Ouray and San Juan counties, on Red Mountain Pass. In the early 1950's, this mine produced one outstanding pocket of large enargite crystal groups, as well as some tetrahedrite specimens. As recently as the summer of 1985, several fine specimens to 8 cm across with individual enargite crystals to 1 cm were obtained by a careful reworking of the dumps. These specimens show very little damage, considering that they were exposed to adverse conditions for more than a quarter-century. A few sceptered quartz crystals and pyrite specimens were also reported, although only the enargite specimens are significant.

Mineral Farm mine

The Mineral Farm mine, just southwest of Ouray off the Camp Bird Road, is the mine which began the boom in Ouray County. The mine was discovered in 1875 by A. W. Begole (Rice, 1980). Total production was valued at over $1,000,000. The mineralized zones in this mine occur as pods in stratified layers which crop out, giving rise to the belief that one could simply harvest the ore like onions, hence the name "Mineral Farm" (King and Allman, 1950). In later years this mine became a tourist attraction. Since by that time most of the likely-looking ore-bearing rocks were rather scarce, the ambitious promoters constructed make-believe papier-maché (!) boulders with suitable metallic sparkles. The remnants of these pseudo-rocks can still be seen rotting along the main pit of the mine, their wooden frames fully exposed to view—truly a sight to

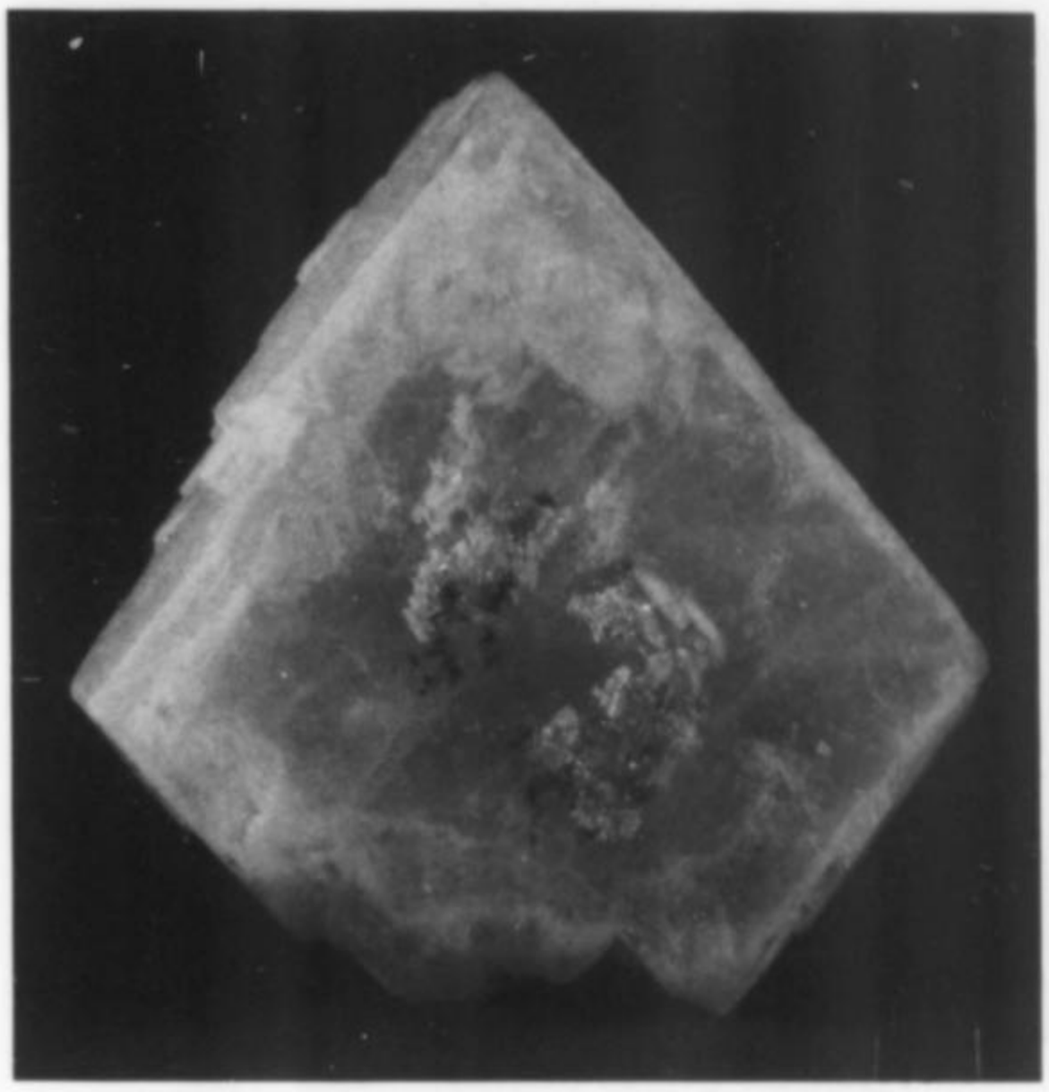


Figure 24. **Barite; Mineral Farm mine. Single spear of white barite, 4 cm high. Minor quartz.**

behold! Real minerals can nevertheless also be found on the mine dumps, in particular nice tabular sprays of bone-white barite, as singles to 5 cm and in smaller bladed intergrowths. Clusters of quartz crystals are also found, as well as minor azurite, copper, malachite, ankerite and galena.

National Belle mine

The National Belle mine stands at the southern end of the Red Mountain District. Several of its ore bins are still standing, along with the remains of the hoist. The mine is said to have produced between one and two million dollars in ore from a huge volcanic pipe which stands almost 60 meters above the surrounding terrain. A number of different species can still be found on the dumps of the National Belle, including nice enargite crystals in little sprays to 1.5 cm, barite crystals to 5 cm and weathered galena cubes to 2 cm, altering to anglesite (Smith and Rosemeyer, 1986).

Ohio mine

The Ohio mine, located in the Amphitheatre east of Ouray near the plateau called Ohio Park, is barely more than a prospect. It consists of an adit of perhaps 50 meters long which ends in one small chamber. Some very fine and unusually large quartz groups have recently been obtained from this locale. Individual crystals as large as 12 cm and groups measuring as large as 40 cm across have been reported. The crystals always have a milk-white color and are slightly barrel-shaped. They have a very high surface luster (apparently caused by a layer of clear quartz on the surface), followed by little "bumps" on the lower portions of the prisms. Under magnification, these growths are actually tiny rosettes of microquartz crystals. The Ohio mine has also produced some rather sharp casts of quartz after scalenohedral calcite, normally along the tops of the larger quartz clusters. No other species appears to be present in this mine.

Ores and Metals mine

The Ores and Metals mine is located on the Hayden Trail near the Thistledown mine. The Hayden Trail is a Forest Service trail which connects Canyon Creek with Ironton Park by going over the top of Hayden Mountain. The mine, which consists of a single adit

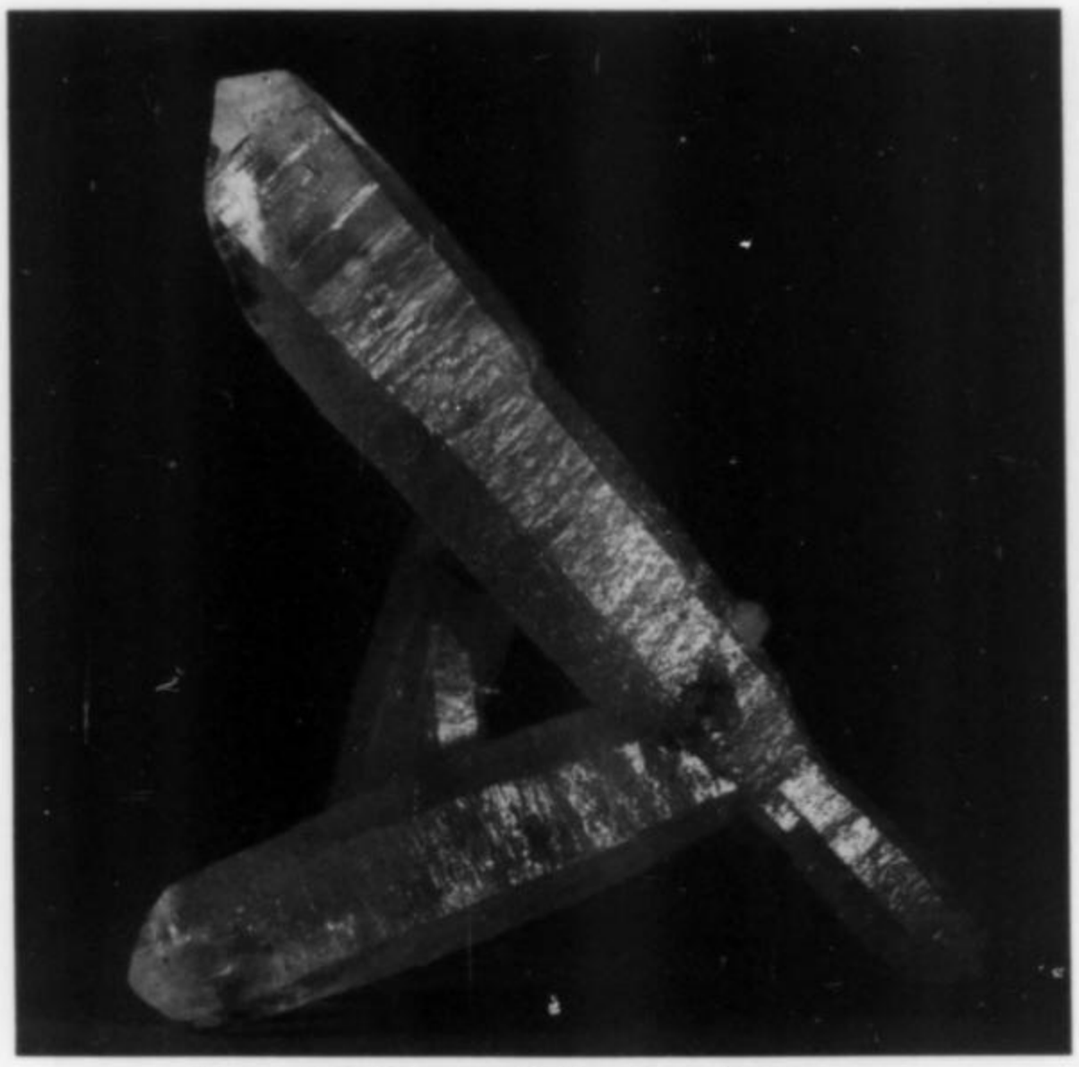


Figure 25. **Quartz; Ohio mine. Small group, 3.5 x 5.5 cm, of typical quartz crystals from the Ohio mine. No associations.**

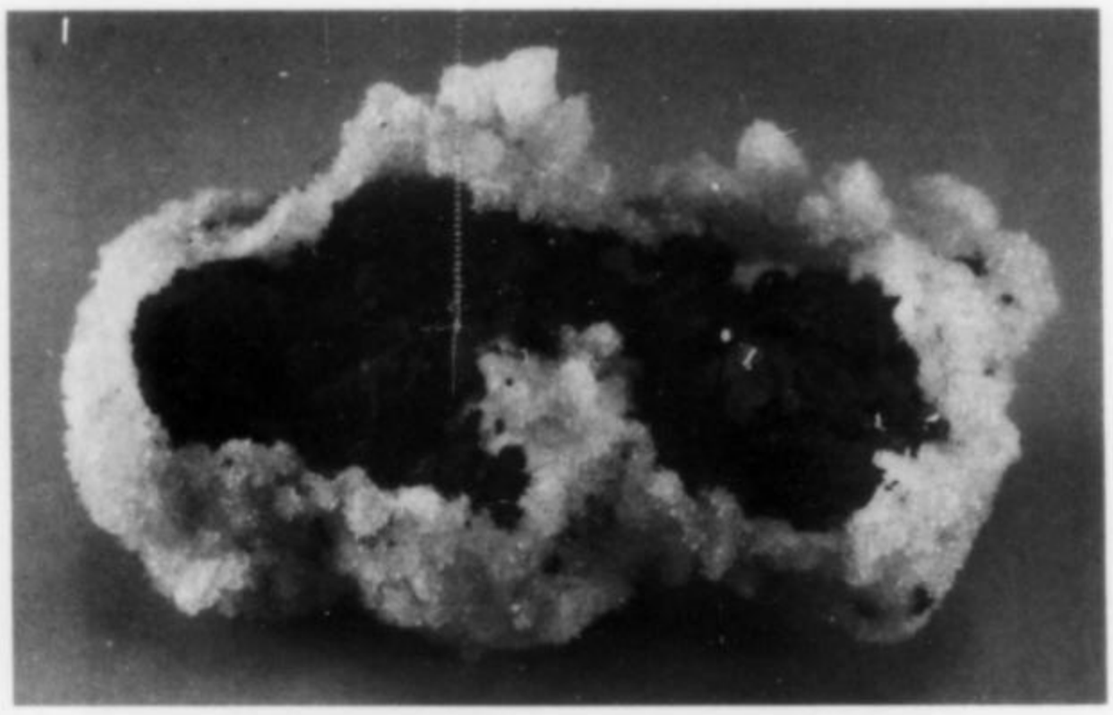
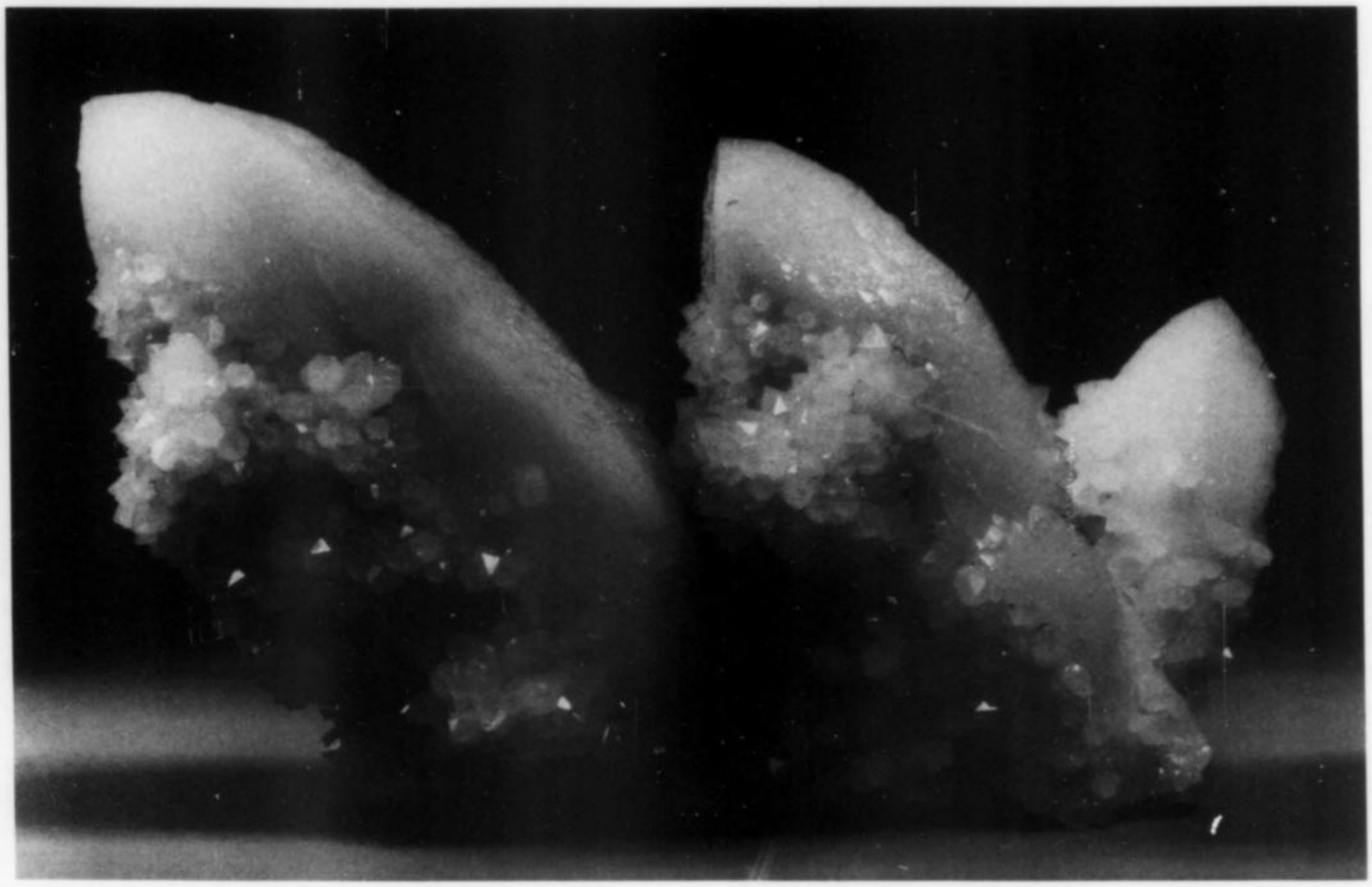


Figure 26. **Sphalerite and quartz; Portland mine. A "skull" of quartz enclosing sphalerite; minor pyrite, 2.5 x 4 cm.**

Figure 27. **Quartz and anatase; Ores and Metals mine. Cluster of doubly-terminated quartz crystals to 6 cm. Microcrystals of anatase to 1 mm sprinkled on lower half of each quartz crystal.**



with track, extending perhaps 75 meters, has recently produced some microcrystals of anatase on clusters of attractive quartz crystals. The anatase is extremely small, requiring magnification to be spotted by any but the most sharp-eyed. However, anatase is a very rare mineral from Colorado, and this is the first reported occurrence for Ouray County (identification by Ed Raines and Tom Rosemeyer).

Portland mine

The Portland mine is located in the Amphitheatre east of Ouray, higher and to the east of the Grizzley Bear mine. The Portland has had a long and unprofitable history since being located in the 1880's by Percy Weston (Rice, 1980). In 1884, the Director of the Mint reported that there were already drifts running 50 meters in the mine. At one point in this century, the mine was controlled by the American Zinc, Lead, and Smelting Company. Ore minerals are reported as pyrite, sphalerite, galena and chalcopyrite; gangue minerals include quartz, barite, rhodochrosite and manganocalcite—in other words the usual assemblage (Holmes and Kennedy, 1983). Fine, lime-green sphalerite to 2 cm came from this mine in the 1970's, when the Portland mine was actually worked for its specimens. This sphalerite is implanted on cream-colored calcite

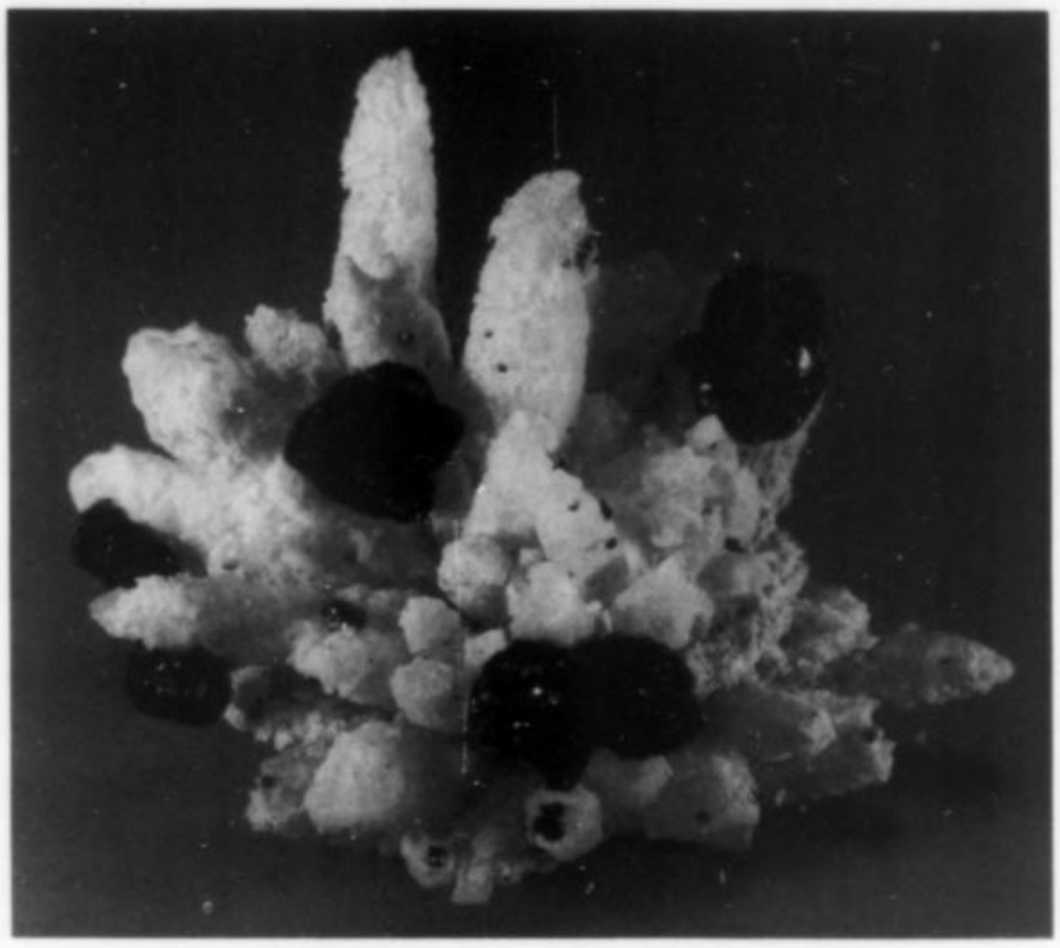


Figure 28. **Sphalerite, quartz and rhodochrosite; Portland mine. Etched quartz crystal spray with lime-green sphalerite dotted along the prisms. Minor rhodochrosite and pyrite.**

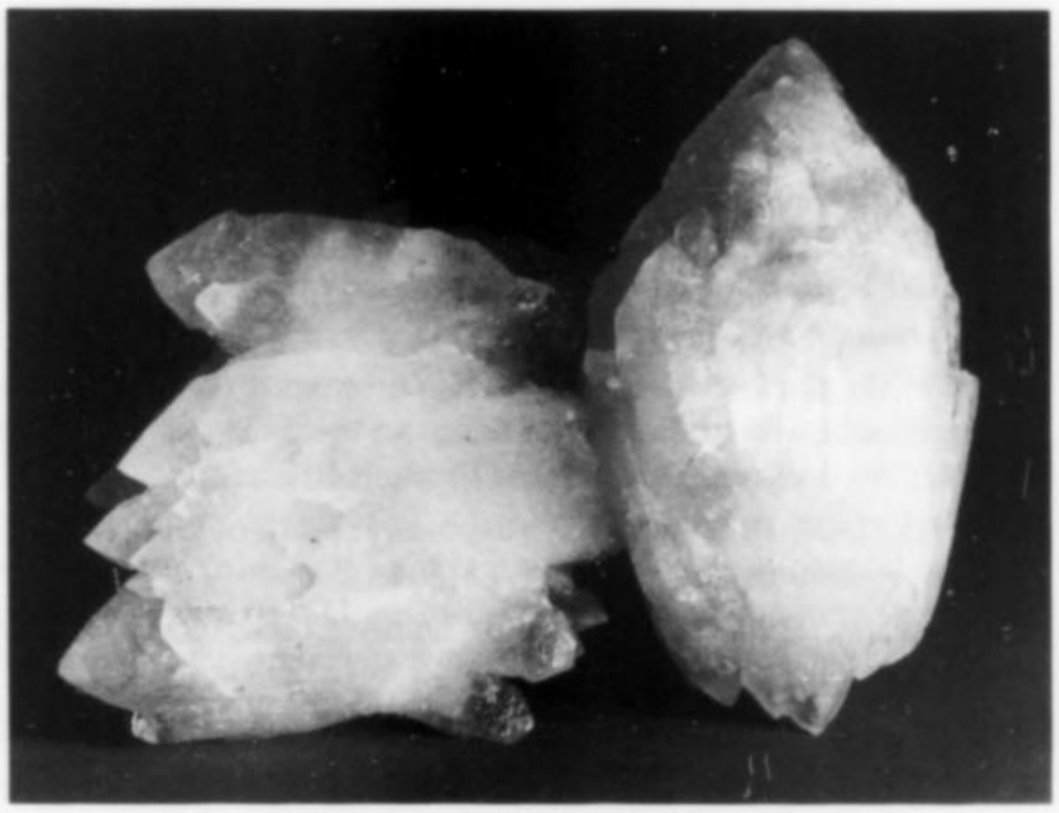


Figure 29. **Quartz; Portland mine. Group of doubly terminated barrel-shaped quartz crystals. Overall size: 4 x 4 cm.**

casts of barite or anhydrite, and commonly has small pyrite crystals associated, growing epitaxially on the sphalerite. Other sphalerite formed directly on clear, large quartz prisms. Some sphalerite specimens also have minor galena cubes to 5 mm. In other areas of the mine, fine, large, clear quartz crystals occur coated with tan calcite scalenohedrons. In still other vugs, plates of clear quartz of slender habit, commonly doubly-terminated and sprinkled with little brown calcite crystals to 1 cm, were found. In one large vug, doubly-terminated quartz crystals formed clusters and individuals to 6 cm. A few amethyst crystals have also been collected from this area of the mine. Nearby, etched, white quartz sprays are topped with the typical lime-green sphalerite, topped by pink crusts of rhodochrosite. In order to stop highgrading several years ago, the mine owners had a heavy metal plate placed across the portal and then bulldozed over it. While this has greatly curtailed collecting, it has not stopped highgrading altogether. If production at this mine resumes on a commercial basis, we may reasonably hope for a renewed flow of fine collector material.

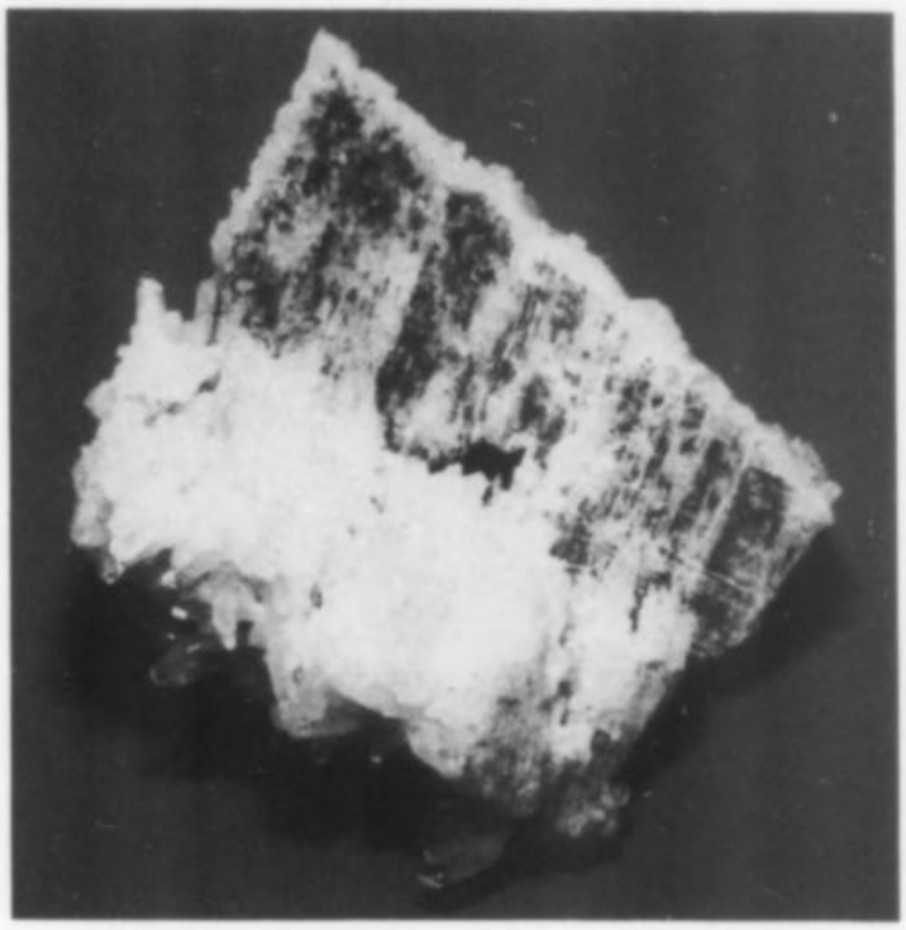


Figure 30. **Quartz; Silver Point mine. Cast of quartz after barite with hematite dusting, 6 x 7 cm. Gift of Benjamin Kuehling to the authors.**

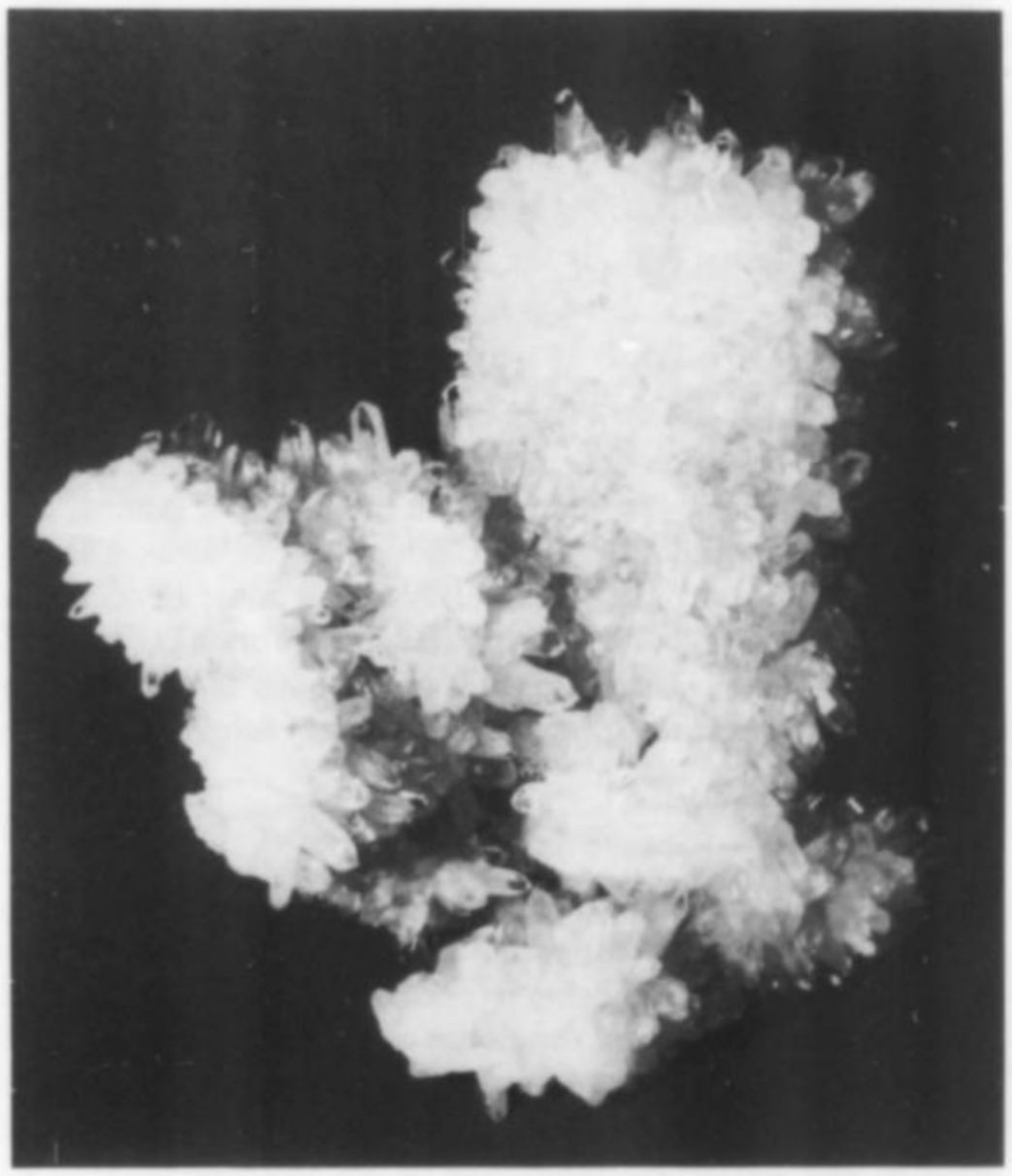


Figure 31. **Quartz; Silver Point mine. Cast of quartz after barite, showing complete crystal cast on matrix of clear quartz crystal sprays; 6 x 6 cm. Gift of Benjamin Kuehling to Dr. Gene Tribbey.**

Silver Point mine

The Silver Point mine is located just south of Bear Creek Falls along the east side of State Highway 550. This is a patented mine owned by Benjy Kuehling, a mineral dealer from Ouray. The mine is worked by his people for collector specimens. Many spectacular pieces have been obtained. These specimens consist of very large casts of quartz after barite or anhydrite, along with "starbursts" of clear quartz crystals. These casts frequently have an attractive

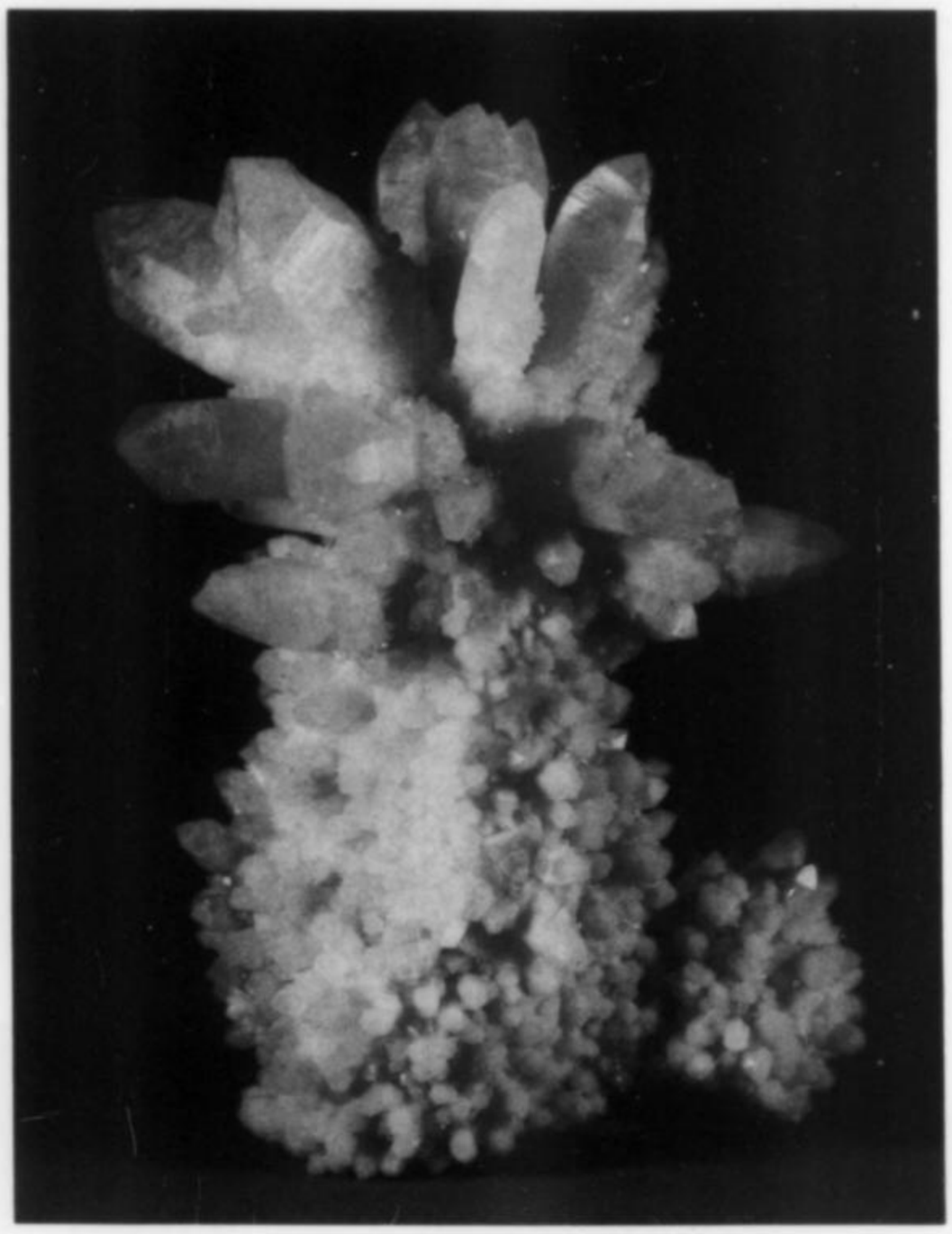


Figure 32. **Quartz; Silver Point mine. Spray of larger quartz crystals with a faint amethyst cast from the upper workings of the Silver Point mine.**

purplish dusting of hematite included in the quartz on the insides of the casts, forming a nice contrast with the druses of gemmy, clear quartz clusters which form the outsides of the cast shells. There do not seem to be any other species at this small mine; an occasional amethyst crystal is recovered from the upper workings, where the crystal habit of the quartz also tends to be stouter than in the lower workings. The best casts, however, have been found in the lower level of the mine.

CONCLUSION

Although major mining activity has come to a virtual halt in Ouray County in recent years, a significant amount of fine specimen material is still being recovered for the collector market. As time goes by, however, these once-active mines will continue to deteriorate, and further specimen recovery will become less practical. We can only hope that true commercial mining activity will resume, and that the associated flow of fine specimen material will thus be assured for years to come.

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INTRODUCTION and HISTORY

During the 1984 collecting season in the San Juan Mountains a new occurrence of anatase was discovered in the abandoned workings of the Ores and Metals mine near Ouray, Colorado. There have been two previous reports of anatase in southwestern Colorado. The first was from near Powderhorn, Gunnison County, where the mineral forms thin veins along joints in a diorite dike (Larsen and Hunter, 1914). The second occurrence is as a detrital mineral in the heavy mineral placer deposits of several Upper Cretaceous sandstones of the San Juan Basin (Chenoweth, 1957). Neither of these locations is particularly near the new location, nor is either a geologically similar occurrence.

The Ores and Metals mine is located near the head of Squaw Gulch at an elevation of 3340 meters. Squaw Gulch, a tributary of Canyon Creek, cuts the northwestern flank of Hayden Mountain (Ironton Quadrangle). The vein's date of discovery is unknown, but development work took place in the 1890's (Kelly, 1946). In the old days all supplies were hauled to the mine on mules via the Hayden Pack Trail (shown on older topographic maps of the Ouray and Ironton Quadrangles). This trail starts on the Camp Bird Road (Colorado #361—Ouray Quadrangle) at a point 2.4 km southwest of Ouray, crosses over Hayden Mountain, and ends at Ironton Park. The mine is located 2.8 km along the trail. Because of the remote location, heavy snows and avalanches, the mine was worked only in the summer months. No ore was ever shipped.

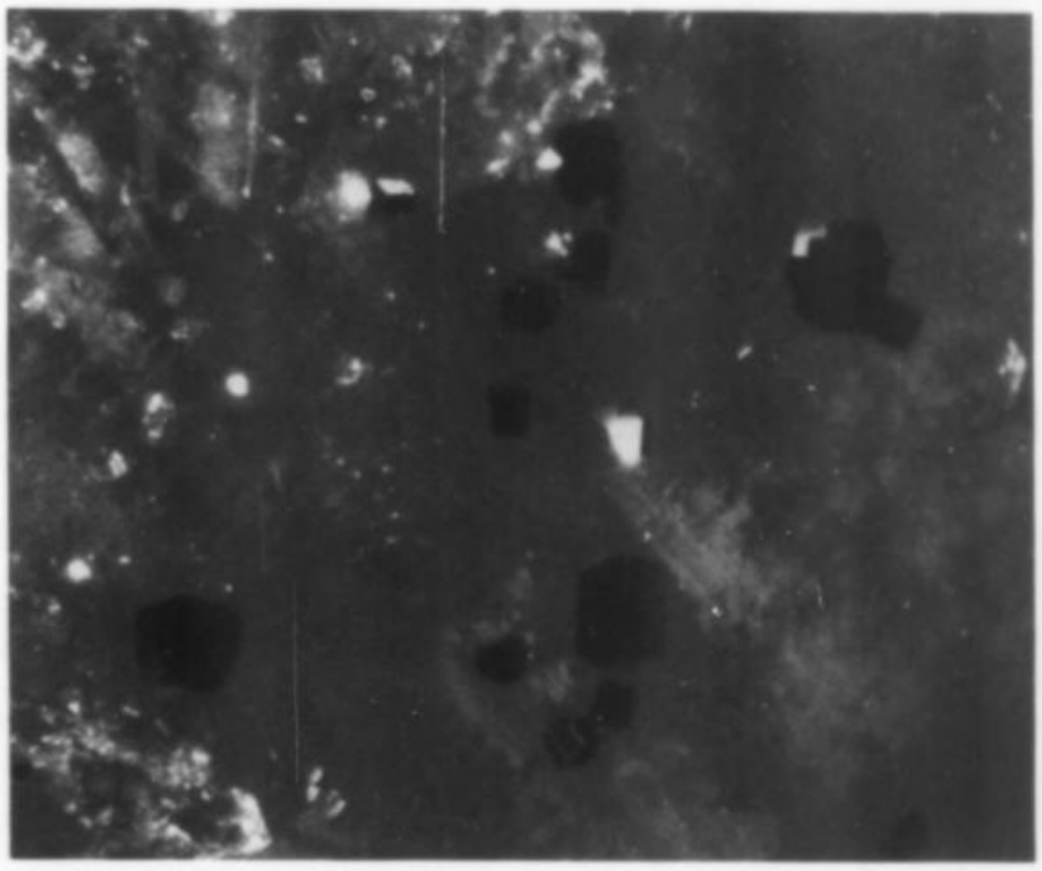

Figure 1. **Anatase (blue-black crystals to 0.1 mm) on milky quartz, from the Ores And Metals mine. Rosemeyer collection; photo by Arnold Hampson.**

GEOLOGY

The drift of the Ores and Metals mine follows a narrow quartz vein trending N 85° E and dipping 80° to the south. The vein is barren—no precious or base metal mineralization was found.

The country rock in the mine area is the San Juan Tuff. This volcanic rock is a predominantly massive, rudely bedded, rhyodacitic tuff breccia (Burbank and Luedke, 1964). Hydrothermal alternation, common throughout the area, has affected the tuff adjacent to the vein. Routine thin-section examination of samples from this area usually discloses rutile and/or titanite as minor accessory minerals. Chemical analysis for the San Juan Tuff show an average titanium content of around 0.75% (Larsen and Cross, 1956).

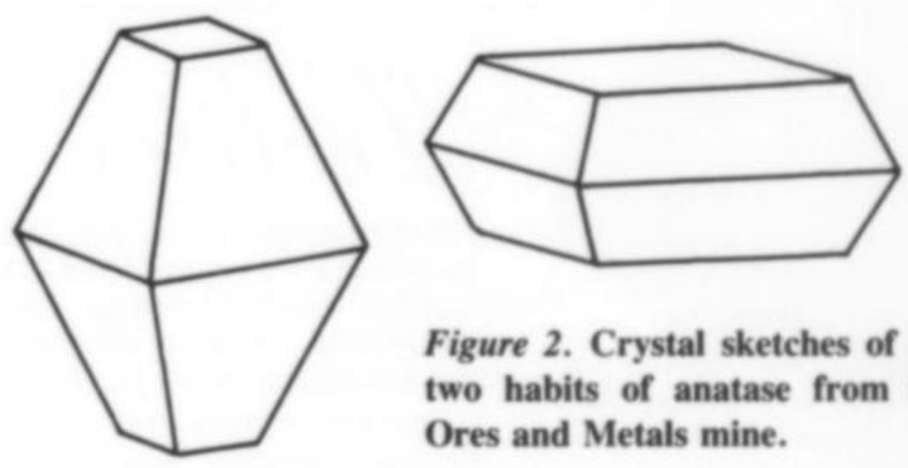

Figure 2. **Crystal sketches of the two habits of anatase from the Ores and Metals mine.**

MINERALOGY

Exploration of the mine workings revealed a crystallized quartz vug measuring 2 meters long, 1.5 meters high, and 25 cm wide. The vug was lined with quartz crystals up to 8 cm in length, heavily coated with manganese oxides.

The quartz is somewhat unusual in that the crystals show scepters and phantoms as well as healed and re-terminated broken crystals. Doubly terminated "floater" crystals were recovered from the bottom of the now mined-out pocket. The healed crystals serve as evidence that the hydrothermal environment was structurally active during mineralization. In fact, such activity commonly helps both to create and then keep open the fissures through which mineralizing fluids travel and in which deposits ultimately form.

After the quartz was cleaned in oxalic acid to remove the manganese oxides, a dark, resplendent, unknown material was noticed on a few of the crystals. Subsequent microscopic examination (by Raines) indicated that the unknown was probably anatase. This identification was later confirmed by microprobe examination. It should be pointed out that the anatase occurs only on a small percentage of the quartz crystals from the vug.

The anatase typically occurs as extremely small, isolated crystals that reach 0.1 mm in size. Some are uniformly opaque with a brilliant blue-black color. Others exhibit a subtransparency to translucency with a color zonation of lighter yellow or blue toward the center of the crystal and darker blue zones developed as a "framework" along the edges where two faces meet. Still others show the more typical core to rim zonation pattern.

Only two crystal forms were observed—the tetragonal dipyramid and the pinacoid. All crystals show the pinacoid developed to a greater or lesser degree. Some of the crystals show an elongated habit in the direction of the *c* axis, while others are more tabular in habit. Typical anatase striations at right angles to the *c* axis are only weakly developed or are absent.

Some anatase is completely included within, but near the surface of the quartz. Most of the crystals, however, lie on the surface or are only slightly imbedded in the quartz. Thus the paragenetic position of the anatase begins near and continues beyond the end of quartz crystallization.

The presence of pervasive hydrothermal alteration in the area leads to speculation that titanium was leached from the country rock during the alteration process and then was redeposited as anatase by hydrothermal fluids near the end of quartz crystallization. The nature of this anatase/quartz mineralization suggests that other locations may yet be found in the San Juan Mountains.

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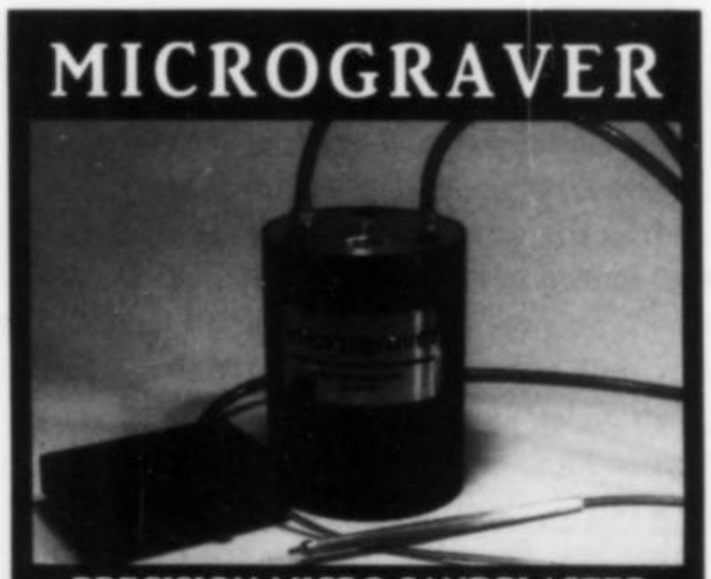

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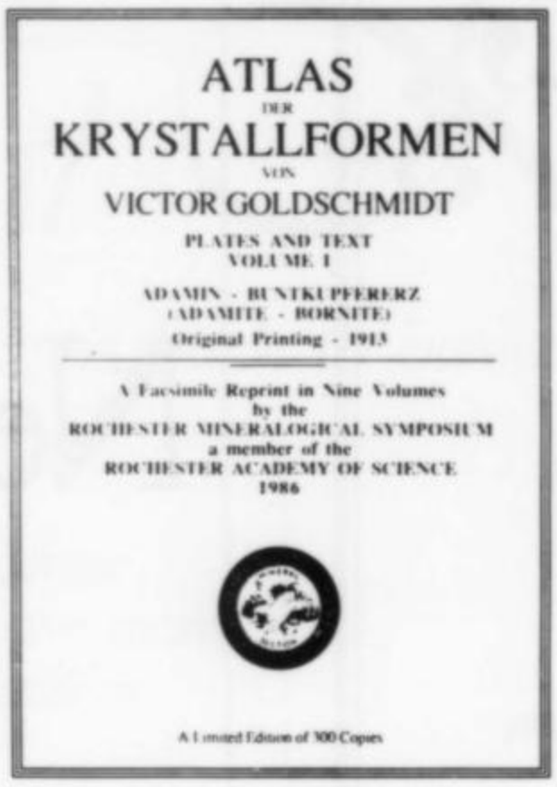

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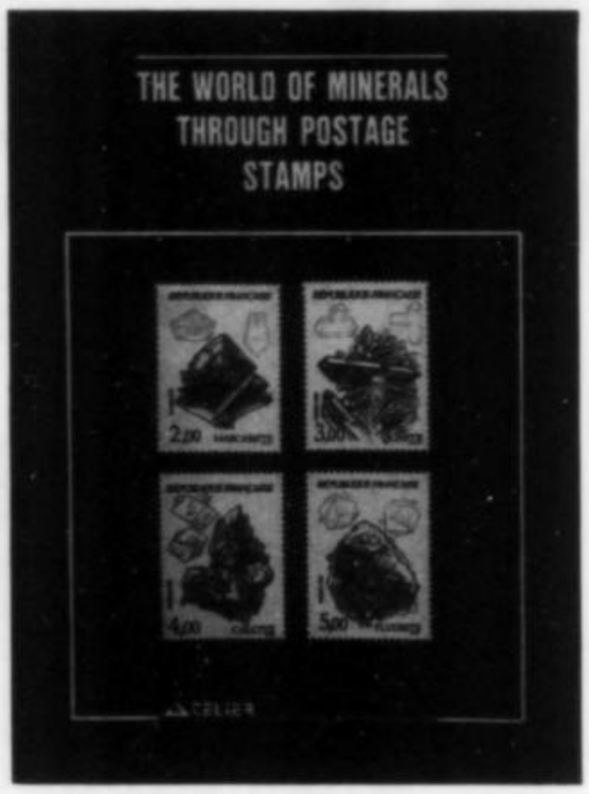

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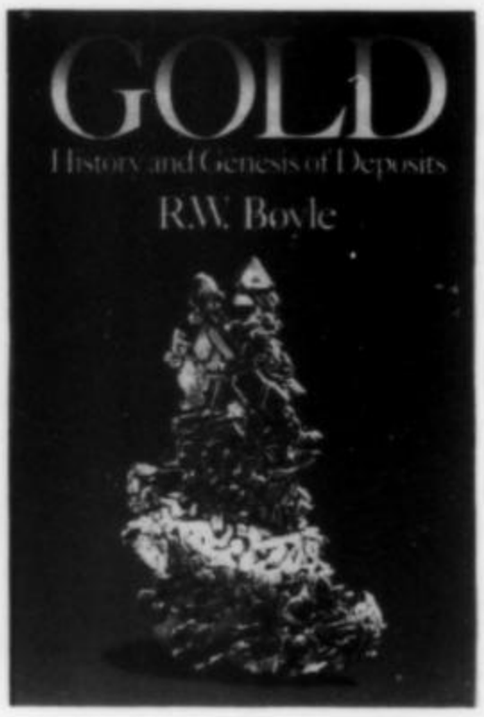

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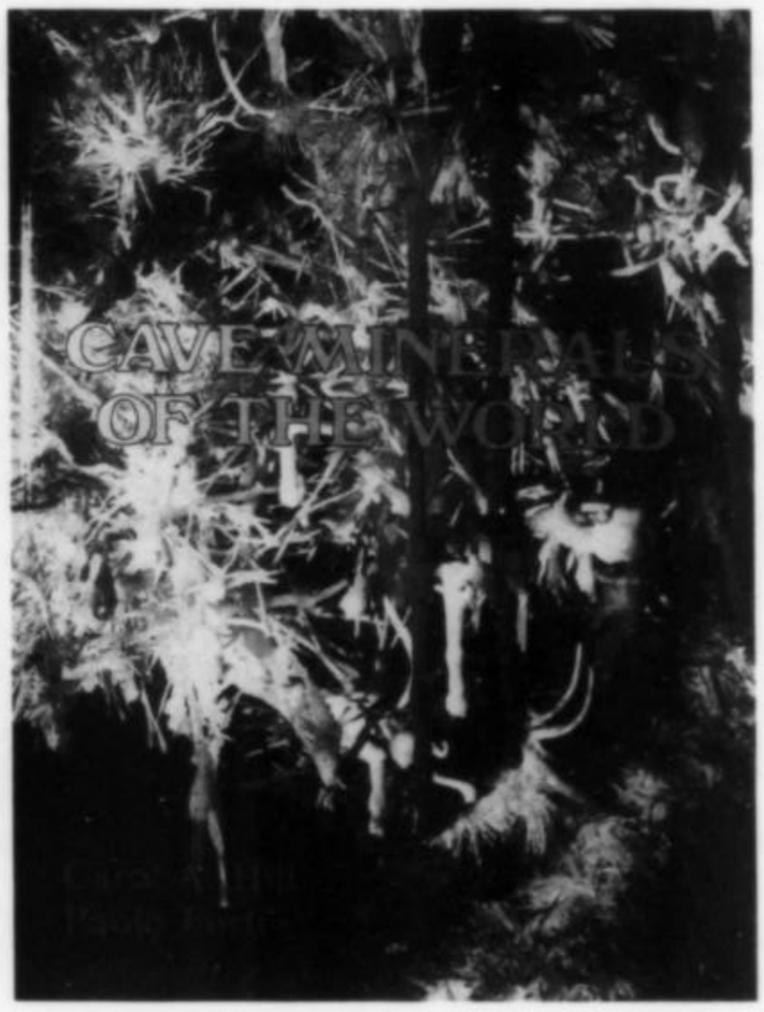

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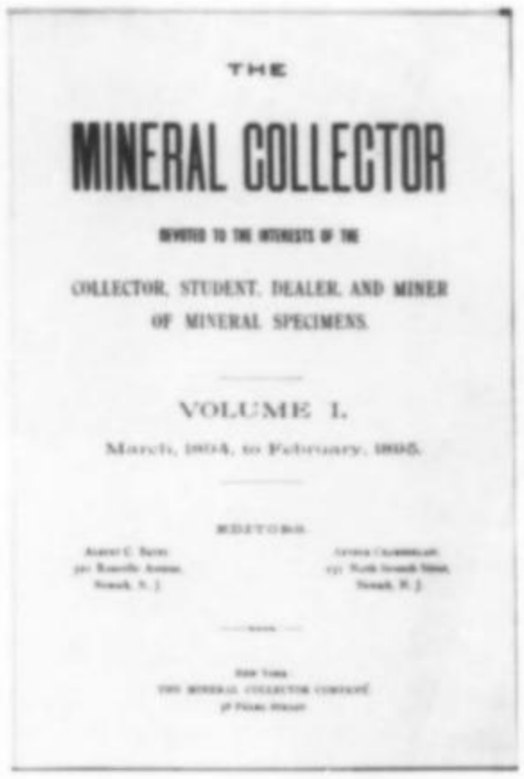
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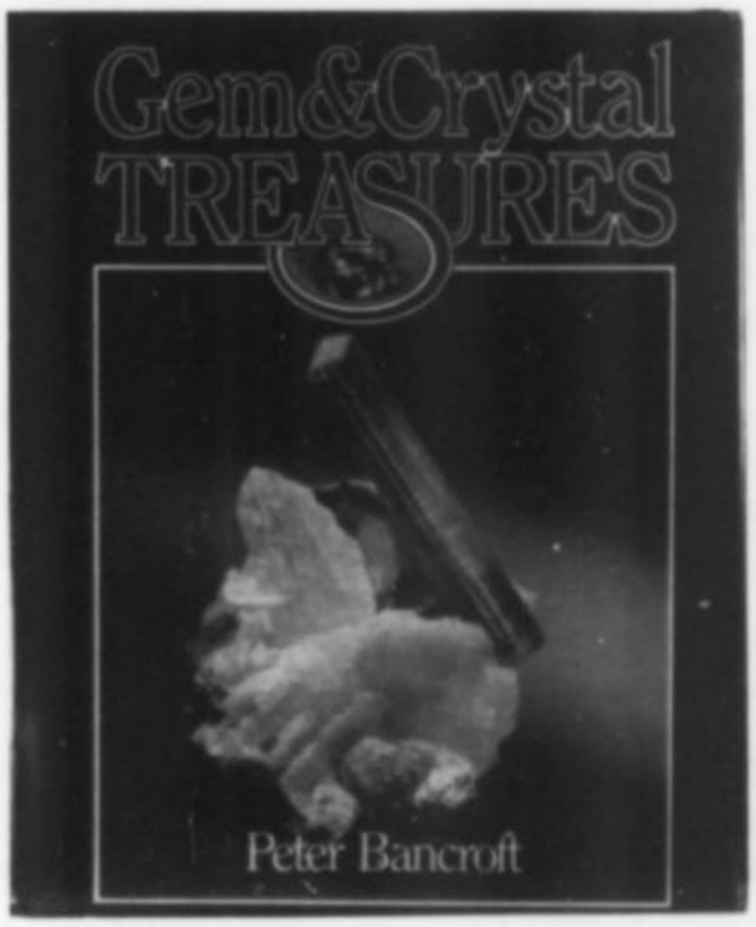

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What's New in Minerals?

by Wendell E. Wilson

DENVER SHOW 1897

Each September the Denver Council of Gem and Mineral Societies sponsors the Denver Gem and Mineral Show, which in 1987 was produced under the chairmanship of Lance Cook. A satellite show ("the Colorado Mineral & Fossil Show") takes place more or less concurrently at the nearly Holiday Inn North, under the management of Martin Zinn III.* These two shows have, in recent years, grown in quality and prominence, attracting an ever-increasing number of collectors, dealers and curators.

The Denver Show (by which I mean both events considered together) is today considered one of the top American shows, vying for the number two spot (after Tucson) with Pasadena and Detroit. Why should this be so? For one thing, it is ideally situated in time and space. Denver is a fine large city with excellent facilities, an agreeable climate and magnificent views. Tourist attractions in the city and the adjacent mountains are abundant. Denver is centrally located for the western two-thirds of the country, and is within driving distance for a large population. The Denver Museum of Natural History and the Colorado School of Mines Museum in nearby Golden, with their interesting mineral collections, are right at hand. And mid-September is an ideal time for a major mineral show. Weather is generally pleasant, and it's been seven months since the last major show (Tucson). The summer field-collecting season, both here and in Europe, is just drawing to a close and diggers are coming down from the mountains with new discoveries to sell. Consequently, the pick of the summer's crop often arrives in Denver before appearing at the subsequent Detroit (October) and Pasadena (November) shows. Furthermore, Colorado is a well mineralized state, with numerous local collector/dealers who may not carry their stock to out-of-state shows. Even the gemstone and gift-item businesses are at a peak in September, when jewellers, dealers and shop owners are stocking up for the holiday season.

The Denver Show could not capitalize on these advantages were it not for an enthusiastic, friendly and well-organized local group willing to put in the necessary work. Fortunately the Denver area is a hotbed of interest in minerals, and plenty of well-qualified people have become involved.

The main show at the Denver Merchandise Mart looked better this year than it ever has before, due in large part to a major improvement in the exhibitors list. Whereas in previous years the displays were drawn almost entirely from local museums and collections, the line-up for 1987 included the Smithsonian Institution, the Cleveland Museum of Natural History, the Houston Museum of Natural Sciences, the Harvard Mineralogical Museum, the New Mexico Bureau of Mines Museum, the Seaman Mineralogical Museum (Houghton, Michigan), the Los Angeles County Museum of Natural History, the Lyman House Memorial Museum (Hilo, Hawaii), and the Canadian National Museum of Natural Science (Ottawa), not to mention the local Denver museums and some excellent local private collections.

Too much space would be required here to discuss the various guest exhibits. One specimen among the many fine pieces can be mentioned, however: a barite crystal, about 6 to 7 cm by 3 to 3.5 cm, on matrix of drusy brown calcite, from Otero County, Colorado. What makes it extraordinary are the glass-smooth faces, complex termination, waterclear interior, and pale smoke-gray color with a distinct *purple* tint. The specimen was self-collected during the past year by Dan Kile.

Approximately 50 mineral dealers (not counting the numerous excellent fossil dealers and a few lapidary dealers) were set up at the satellite show; another 30 or so mineral dealers were part of the main show, although nearly half of these were in the wholesale section and relatively inaccessible to the average collector. Nevertheless, 80 mineral dealers in one place (well, two places) means a lot of interesting material to look at, especially considering the increasing number of European dealers present. And everyone agreed that there were perhaps more different *new* discoveries available than at any other mineral show in recent memory, Tucson included. Sales were brisk, and some dealers at the main show commented that their first-day sales were comparable to their first day at the last Tucson Show.

Now to the minerals, beginning with the satellite show:*

Mineralien & Fossilien Galerie (Fahrgasse 88, 6 Frankfurt 1, West Germany) had a number of exquisite **smoky quartz crystals and gwindels** found on Mont Blanc, France, about a month before the show. Roughly 200 specimens including *50* gwindels, with crystals up to 15 cm, were recovered. Just ten meters from this pocket another was found; it contained large, octahedral **pink fluorite** crystals to 5 cm, at least ten excellent specimens, on smoky quartz. As if this weren't enough, another pink fluorite pocket was discovered some distance away, this one yielding 30 smallish specimens and three cabinet pieces having a cube-octahedron-dodecahedron combination of forms in about equal development. The crystals are smaller, typically 1 cm or less, and are pink in color but with some blue or purple zones inside. Cabinet pieces show matrix completely covered on one side with such crystals.

Keith Williams had some pale **green fluorites,** in crystals 1 to 7 cm, from two new localities on Kuiu Island and Zarembo Island, Cornwallis Peninsula, west of Wrangell, Alaska. The fluorite veins were found standing out in relief along the shoreline, and one geologist has reported finding a walk-in cavern or pocket completely lined with fluorite crystals. More developments may be forthcoming with the next field season.

Several dealers including Jim and Irene Walker (*The Rock Hut*, P.O. Box 976, Leadville, CO 80461) had interesting specimens of **dark yellow barite** in tabular, modified, almost rounded crystals to more than 5 cm in size. These were found at the Black Cloud mine near Leadville, Colorado, and are very distinctive.

Bill Hawes (P.O. Box 4535, Grand Junction, CO 81502) had a fairly large number of nice **galena** specimens from the recent discovery at the Iron Cap mine, Graham County, Arizona. See the article on this locality elsewhere in this issue, and also the cover photo.

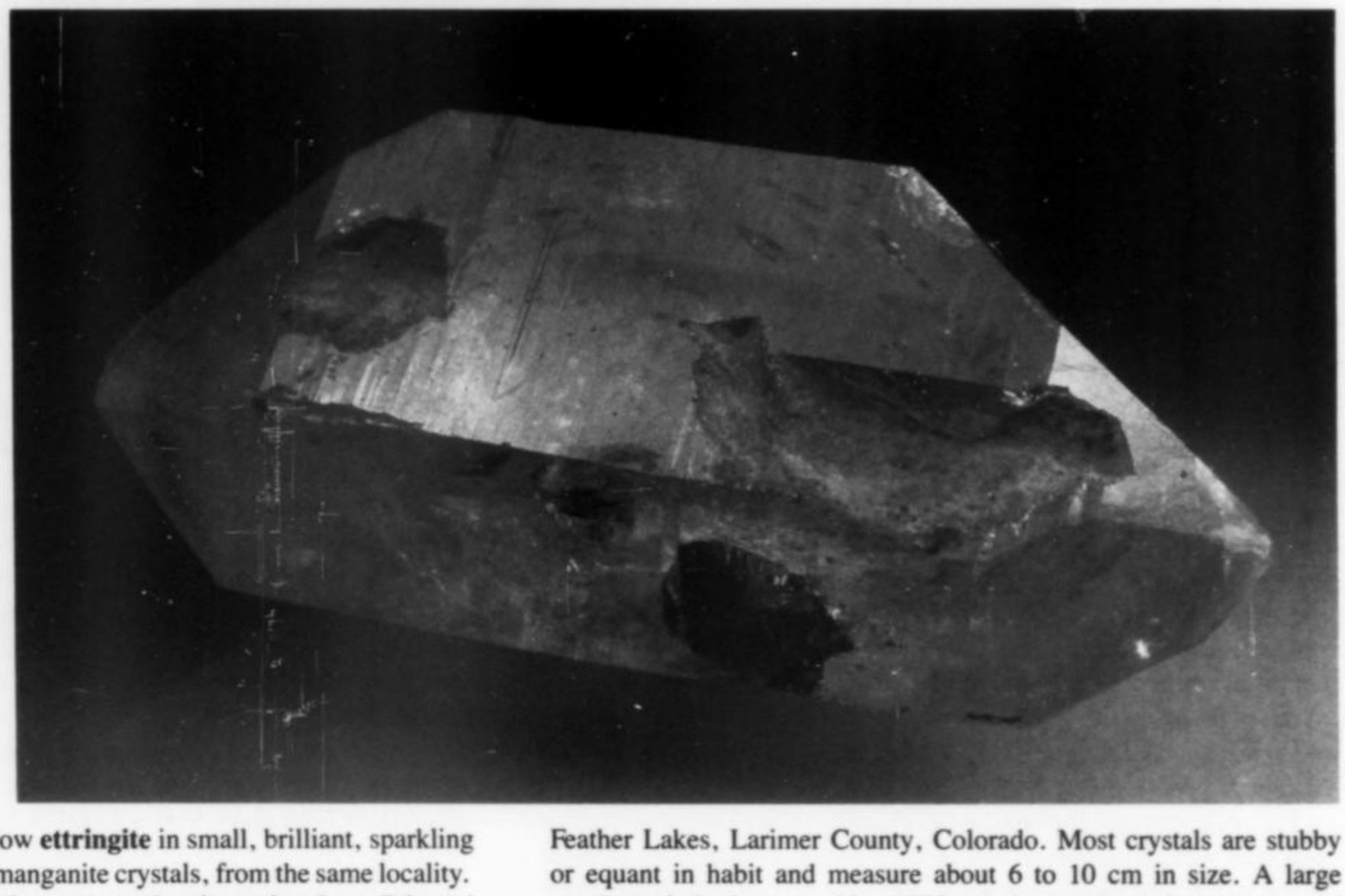
Michael Haritos and Tom Loyte (*S.T.D. Mineral Company*, 22 Spring Hill Road, Hyde Park, MA 02136) had fine specimens of **thaumasite** from the recent discovery at the N'Chwaning mine, Cape Province, South Africa. The specimens consist of individual, hexagonal prismatic crystals, palest yellow in color, and free of matrix. Most crystals are around 1 cm in size, although crystals 2.5 to 5 cm have been reported. About 100 specimens were available, along with

*Marty's mother, Betty Llewellyn, sponsored the publication of the English edition of *Mineral Museums of Europe* (1986).

*Addresses provided only for those dealers who are not advertisers in this issue.

Figure 1. **Twinned cinnabar crystal, 1.6 cm, from Guizhou province, China. Edward Tripp specimen.**

Figure 2. **Cinnabar crystal entirely enclosed within a 7.4 cm quartz crystal, from Guizhou province, China. Edward Tripp specimen.**



an attractive lot of new, yellow **ettringite** in small, brilliant, sparkling crystals with lustrous black manganite crystals, from the same locality.

A small number of very fine, **green titanite twins** from Felsertal in the Swiss Alps showed up in the room of Mike Bergmann, courtesy of a German friend of his who was sharing the room. The crystals are up to 4.5 cm in size, some on matrix, and are a cleaner green (as opposed to yellow-green) than has been typical of Alpine titanite in the past.

Nick Finnell (223 Linden, Suite 100, Ft. Collins, CO 80524) has made a spectacular new find of **amethyst** crystals, groups and scepters at what he calls the "Rainbow's End Amethyst Lode," near Red Feather Lakes, Larimer County, Colorado. Most crystals are stubby or equant in habit and measure about 6 to 10 cm in size. A large number of singles, roughly 4,000 specimens, have been recovered along with fine cabinet-size and museum-size groups up to 150 kg. Some scepters consist of several amethyst crystals in parallel growth forming a knob on the end of a white quartz crystal. Some crystals are doubly terminated, and reach a maximum size of more than 30 cm.

Duane Johnson (P.O. Box 761, Butte, MT 59703) had an extraordinary lot of about 50 superb **veszelyite** crystals and groups found last year at the Black Pine mine, Phillipsburg, Montana. Sharp bladed

and pointed crystals to 2 cm, as singles and small groups to just over thumbnail size, were available for $200 to $3500.

Amazonite (green microcline) is one of Colorado's most famous products, and the mountains are constantly being searched for new pockets. Lee McKinney had some attractive specimens from Park County, in thumbnail to cabinet sizes, a few with smoky quartz crystals.

Bob Turner (*Natural Connection*) has been making regular trips to Mexico and turning up quite a few interesting finds. Among these was a flat of **arsenopyrite** miniatures from a single pocket encountered at the San Antonio mine, Santa Eulalia, six months before the show. The crystals are tabular, very lustrous and diamond-shaped just like the crystals found ten or 15 years ago, but are up to 5 cm in size. Most were very reasonably priced at under $100. Bob also had some fine **mimetite** groups with white dolomite rhombs from the same locality. Excellent specimens in miniature to small cabinet size could be purchased for $6 to $25! I must say that Bob's prices on quality Mexican specimens were generally so low that I felt I'd been sent back in time about 15 years. He also had some attractive Naica calcite, Santa Eulalia rhodochrosite, and other Mexican minerals at equally low prices.

Thumbnail collectors found a bonanza of **British fluorites** in the room of Don Edwards (*Tideswell-Dale Rock Shop*, Commercial Road, Tideswell, Derbyshire, England). Most of these, in the typical green-with-purple-zones twins, were collected from a quarry adjacent to the famous Heights mine, Weardale. I like the way Don subtitles himself on his business cards: "fossilist and petrifactioneer."

J. Chaver (Breton de los Herreros, 11, 28003 Madrid, Spain) had his usual pristine array of fine pyrite cubes and groups from Logroño, Spain, and also a very large selection of waterclear anglesite-like **gypsum** crystals in pockets cut out of massive alabaster at Zaragoza, Spain. Cabinet pieces were spectacular, and priced at over $500. Chaver also had a new batch of yellow fluorite with white calcite from Asturias, Spain, all cabinet pieces.

Chinese cinnabar specimens continue to emerge along various commercial channels. Edward Tripp (Route 1, Box 161, Blue Ridge, TX 75004), who manages the Desert Inn dealers during the Tucson Show, had an extremely fine lot of new specimens, all in the fancy cloth-covered boxes that the Chinese like to use. Several habits and associations were available, which I have seen variously labeled as coming from Hunan, Guizhou and Kweichow Provinces (we hope to straighten this out in a future article). One type consists of sharp, blackish red penetration twins on drusy quartz. Similar crystals, though not quite as dark and lustrous, occur on fine drusy quartz with scattered while dolomite rhombs. Another type occurs as bright red *un*twinned crystals in and on white to cream-colored dolomite. And a recently seen type consists of very gemmy, blood-red, highly lustrous untwinned crystals on or in yellow calcite or dolomite. These most recent specimens show an interesting range of crystal habits, from flattened to elongated on the *c* axis. One unique quartz crystal 6 cm long has included within it a sharp, single cinnabar crystal 1 cm in size. Certainly these specimens are expensive, typically *starting* at around $1000 for good examples and going way up from there. But we are in a period that will historically be considered the heyday of Chinese cinnabar, far more productive of fine and varied specimens than the "classic" years around the turn of the century. Collectors *and museums* should think long and hard before passing up this opportunity to select from a wide range of new, "fresh" specimens. Production may not continue for much longer, and these gorgeous pieces are first-rate classics.

For gemstone aficionados, Ed Tripp also had what is apparently the largest faceted Burmese **peridot,** 4.7 cm and 280 carats.

Diamonds are among the most consistently available crystallized minerals, although it has not always been easy to find a dealer specializing in fine collector-quality crystals. Dave Wilber (P.O. Box 269, Ouray, CO 81427) had some excellent and reasonably priced South African examples, including well-formed, sharp, partially transparent, lustrous crystals to 12 carats (over 1 cm). Octahedrons, contact twins and penetration twins were available at $25 to $35 per carat. I was surprised at the size and quality $400–500 will buy.

Steve Green (*Rough and Ready Gems*, P.O. Box 10404, Denver, CO 80210) has come up with a new **amethyst** locality in Mexico, in the State of Mexico. The crystals have a good color and very distinctive stair-step multiple growths along the sides. Other crystals from the same locality are smooth-faced, and several hundred pieces have been recovered with the promise of more to come.

John Mediz (*Copper City Rock Shop*, 566 Ash Street, Hwy. 60-70, Globe, AZ 85501) has the mineral recovery concession for several major Arizona mines including the 79, Christmas, and Ray mines, among others. He had a nice selection of various minerals from these famous localities, including kinoite (Christmas) and dioptase from a new locality near Superior, Arizona. John used to have the concession on the Apache mine near Globe, but the property was recently sold to Richard Dale and Associates, of Globe, and they have not yet announced their plans for the mine.

Somewhere in the motel, I was told, a German dealer was showing off some attractive **green uvite** specimens from Brumado, Bahia, Brazil . . . the same locality that for several years has produced some striking *red* crystals of uvite. I was never able to meet up with this dealer, however, and can only report second-hand what I heard. Apparently the specimens are quite nice; the species, color and locality were confirmed by telephone with Carlos Barbosa in Brazil (according to another dealer), who said the green uvites were the only new discovery of much interest to be made in Brazil lately.

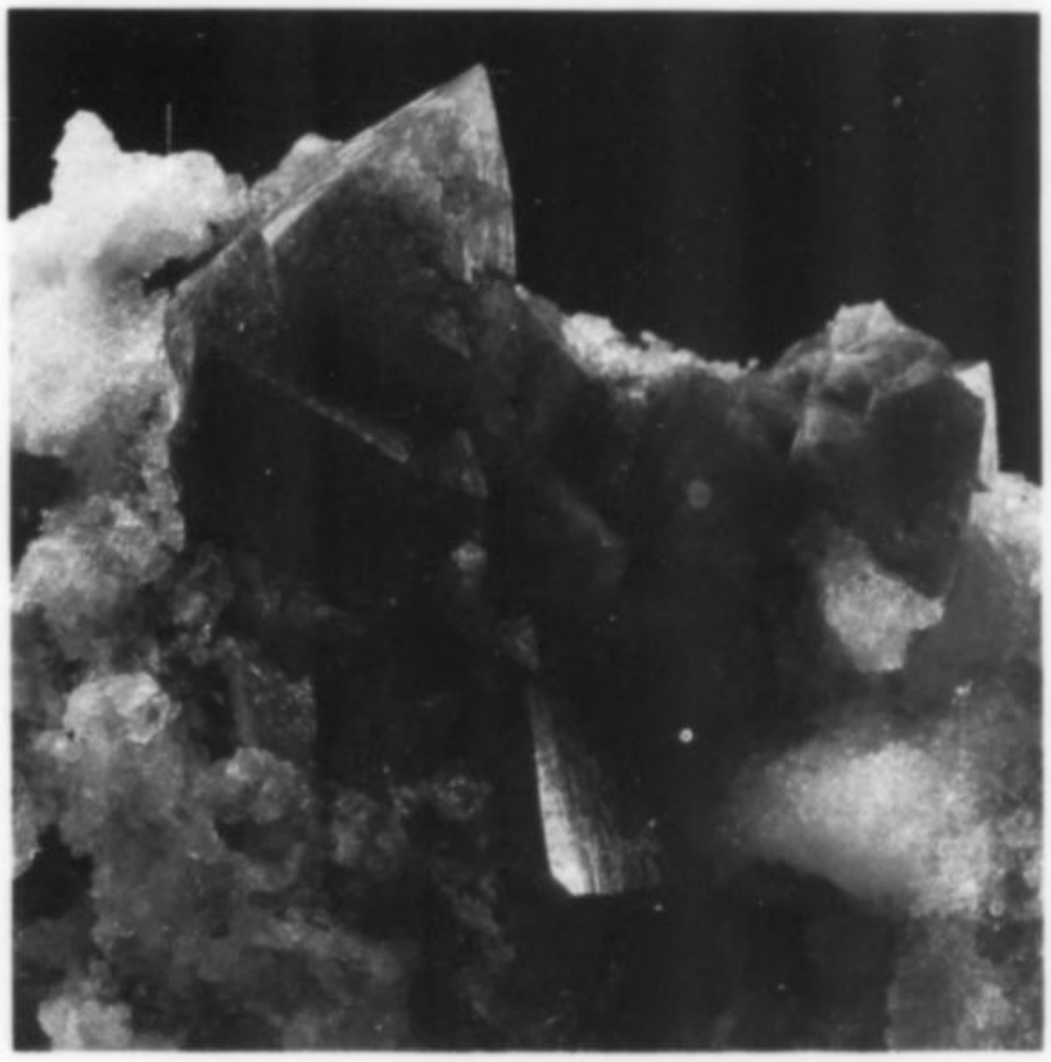


Figure 3. **Caramel-colored scheelite crystals to 2.8 cm, on granular white fluorite matrix, from the Camp Bird mine, Colorado. Bryan Lees specimen.**

As Barbara Muntyan reported here briefly in the November-December issue, a truly remarkable find of **scheelite** was recently made at the famous Camp Bird mine, Ouray County, Colorado. A wide range of habits and sizes was available from Bryan Lees. Although one might at first think these crystals look like Korean specimens, a closer examination shows them to be unique in habit and matrix. Considering how rare scheelite has been in Colorado up to now, the

discovery is a major surprise. Specimens are not inexpensive, but the quality is high, the locality is famous, and the specimens are instant classics which no comprehensive Colorado collection can afford to be without. An article on the occurrence is in preparation.

Moving from the Holiday Inn show over to the main show at the Merchandise Mart (which opened a couple of days later than the satellite show), one was tempted to wonder what else could possibly be new that had not already appeared somewhere in the motel. The answer was: plenty.

Southwestern Minerals (see the November-December issue) had specimens of the newly discovered New Mexico **smoky quartz,** including cabinet-size plates thick with lustrous, gemmy, sparkling crystals to several centimeters, and other cabinet pieces with large, thick singles amid the smaller crystals. Some of the specimens coming out of this find are *highly* attractive and very distinctive . . . another example of an instant classic, which is no small feat considering how many fine smoky quartz localities exist worldwide.

Perhaps it's due to the high demand for quartz crystals from the holistic healing crowd, or maybe it's just coincidence, but a remarkable number of new discoveries at widely separated locations happen to be quartz, especially amethyst. *El Paso Rock Shop* in the whole section had an incredible museum-size specimen of **Veracruz amethyst** measuring about 50 x 60 cm and covered with excellent, deeply colored crystals to 4 or 5 cm. The price for the lot which includes this piece is reportedly well over $30,000. The specimens were found about six months prior to the show and hauled out on mule-back.

Horst Burkard (Dornheckenstrasse 20, D-5300 Bonn, West Germany) had a lot of superb, lemon-yellow, waterclear **anglesite** crystals from the Touissit mine, Morocco, in thumbnail to miniature size. Touissit anglesites, at their best, are easily the finest in the world for the species, and here again collectors and curators would be wise to acquire one while they're available. The orange-colored fakes of a few years ago are easily distinguished from the clean yellow crystals of legitimate color, and should not inhibit collectors. Burkard also had a large selection of Chinese cinnabars which, together with the aforementioned Tripp specimens and some available from Kristalle and other dealers, surely comprised the largest quantity of fine Chinese cinnabar ever assembled for sale in one place.

Ken Roberts (*Roberts Minerals,* P.O. Box 1267, Twain Harte, CA 95383), whose home base narrowly escaped incineration by one of California's worst forest fires in history just before the show, recently acquired an old gibbsite-impregnated mass of **crocoite** from Dundas, Tasmania, and etched away the gibbsite. The result was like discovering a new pocket at the mine. A large and superb cabinet piece plus 17 smaller specimens having single crystals to 8 or 9 cm emerged from the acid bath. The crystals have irregular, cavernous terminations but are very lustrous and brightly colored.

The mine which has for several years been yielding fine crystalline octahedral **gold** in the Michigan Bluff district, Placer County, California, has finally been closed, according to Wayne Leicht (*Kristalle*). The miner who worked it has moved on to a different mine in the district and is now producing more fine gold specimens of a distinctly different habbit. This miner, whose name is Dick, never did get around to *naming* his first claim, so specimens have been identified simply as "Michigan Bluff district." The new location has been named the Eagle's Nest claim. To avoid confusion, I suggest that collectors refer to the *earlier* location as "Dick's claim, Michigan Bluff district," and the new discovery as "Eagle's Nest claim, Michigan Bluff district." The specimens from Dick's claim typically occurred as floaters easily separated from a white, sugary, loose quartz vein material. Gold from the Eagle's Nest claim occurs tightly enclosed in narrow (1 cm or so), solid veins of milky quartz which must be carefully dissolved away so as to properly expose the gold but leave enough quartz for an aesthetic matrix. (See their ad in this issue for some examples.) Crystals are typically very flattened and sinuous, in places developing a fishbone habit or a spongy to seaweed-like texture which is recognizably different from the relatively sharp octahedral intergrowths and branching groups characteristic of Dick's claim specimens. All sizes, from thumbnail to large cabinet, were available in Denver, at prices which are surprisingly reasonable (for gold), at least for the small ones. At the risk of sounding like a broken record, I must point out that we are also living in the heyday of crystallized California gold, or at least the closest approach to one in this century. Even gold can temporarily become rather reasonable in price when the supply is, for the time being, high.

Erich Haiderer (Scherpegasse 1-A, 1190 Vienna, Austria) had many remarkable specimens of gray **dyscrasite** and silver after dyscrasite in thickly integrown prismatic-acicular groups on and off matrix. Specimens with crystals to several centimeters, from thumbnail to cabinet size, were available. Erich says these were collected at Pribram, Czechoslovakia, by a miner about five years ago and held in secret until an opportunity arose to transport them out of the country. Specimens of polybasite, stromeyerite and gudmundite, all etched out of enclosing calcite like the dyscrasite, have also come from Pribram and were available in small numbers.

Don Olson (P.O. Box 766, Cedarburg, WI 53012) returned from a trip to Africa just before the show and had some attractive specimens of **dioptase** from the recently (2 or 3 years ago) discovered locality near Kaokoveld, Namibia. About a hundred specimens, mostly thumbnails and miniatures, comprised the lot. Don also had 80 or 90 nice **quartz** crystals to 7 cm or so, with maroon-colored hematite phantom inclusions from the Messina mine, Transvaal, South Africa, and various odd Tsumeb pieces including some interesting, bright green mottramite in calcite.

Diversified Minerals had a sizeable display of Elk Creek, South Dakota, **barites** on matrix. Here is another old American classic that has been consistently available in excellent specimens during the last few years (see vol. 18, no. 2, p. 125).

Victor Yount had a fine suite of **liddicoatite** slabs for sale, all of them quite large (to 15 cm) and multicolored, with complete circumferences and no internal fracturing. These come from the Anjanabonoina pegmatite in Madagascar; we have a completed article on this locality ready for publication in a future issue.

Vic also had some interesting specimens from Mont St-Hilaire, Quebec: sky-blue crystals of **carltonite** to 6 mm, leifite, rhodochrosite and leucophanite.

There were many other items of interest at the Denver Show; it seemed as if every other booth and motel room held something new and interesting somewhere. Wandering collectors soon developed a slight paranoia about the possibility of missing something, and tended to look over all dealer stocks with rather more care than usual once it became clear that this show was something special. I suspect that many people have already committed themselves to visiting the show again next year (September 14–18, 1988). And considering that the Merchandize Mart has ample space for more dealers, as does the Holiday Inn, I will not be surprise if this show continues its steady growth.

In the meantime, copies of the attractive show poster for 1987 (depicting a bright green octahedral Colorado fluorite) are still available at $6.50 postpaid from the Denver Council of Gem and Mineral Societies, P.O. Box 621444, Littleton, CO 80162. Information on the Holiday Inn satellite show can be obtained by writing to Marty Zinn, P.O. Box 2433, Evergreen, CO 80439. A second satellite show is also developing across the street from the Holiday Inn, at the Viscount Hotel; this one is being organized by George Topham, P.O. Box 8862, Tucson, AZ 85728, who also manages the Sheraton dealers during the Tucson Show.

MEXICAN RHODOCHROSITE

Art Smith, writing in *Mineral News,* reports additional discoveries

of "cathedral" rhodochrosite from the Santa Eulalia district, Chihuahua, Mexico. The crystals occur in a staggered or stepped habit reminiscent of cathedral spires, in sizes up to 1 x 7.5 cm. Color ranges from pale to medium pink and translucent to opaque. About 60 pieces comprised the lot, all single crystals or composite crystals without matrix (sold by *Collector's Choice*).

Santa Eulalia has yielded periodic small discoveries of rhodochrosite crystals over the last year or so. In some cases the crystals are more stubby in proportion, but still with multiple rhombohedral terminations bounded by faces of very steep scalenohedron forms. Some specimens occur on a matrix of black, crystalline manganese (?) oxides (sold recently by *Natural Connection*).

HOUSTON SHOW 1987

[The following notes were kindly provided by Art Smith and Joel Bartsch. Ed.]

Chris Wright (*Wright's Rock Shop*) had some interesting marcasite crystals to more than 1 cm in size, spear-shaped and etched from a fossiliferous limestone. The crystals form compound groups. The locality is in Bell County, Texas.

Bill Owen (410 Baker, Bacliff, TX 77518) had some very gemmy epidote crystals from his own Lizzy claim in Riverside County, California. The crystals are very choice, well formed, dark green individuals to more than 1 cm.

Ben de Wit had a recent (May 1987) lot of a dozen etched yellow beryl crystals from Wolodarsk in the Ukraine, USSR. The crystals are all very gemmy and lustrous, generally doubly terminated (if that term can be used for etch faces developed over possibly broken crystals), and measure up to 12 cm. Cal and Kerith Graeber obtained an extraordinary *sceptered* crystal at the Denver Show, probably also from the May find.

Ken Roberts (*Roberts Minerals*) had some recently found specimens of smithsonite and aurichalcite from the Kelly mine, New Mexico. These are mostly miniatures and small cabinet pieces of typical sky-blue color, having rounded smithsonite crystals perched on densely packed aurichalcite.

Miriam and Julius Zweibel (*Mineral Kingdom*) had a very attractive offering of dioptase mined in May of 1987 from the 30th level of the Tsumeb mine, Namibia. These are mostly miniatures, and include several specimens of dioptase crystals on white calcite.

DETROIT SHOW 1987

[The following notes were kindly provided by Gloria Ludlum. Ed.]

The Greater Detroit Gem and Mineral Show was held October 9–11, 1987, at the Light Guard Armory on Eight Mile Road in Detroit, Michigan. The selection of dealers, many interesting speakers, and numerous fine displays again made the show an exciting one to attend. This year the new Detroit Satellite Gem and Mineral Show, held only a few miles away, was a welcome addition to the events of the weekend.

The featured exhibit at the main show was the Ontonagon Boulder, a 3000-lb native copper boulder which was found in the Upper Peninsula of Michigan during the early 1800's and now resides at the Smithsonian Institution (see vol. 7, no. 5, p. 207). There were many other exceptional displays by collectors, dealers, and museums including the superb display of sapphire crystals and gemstones from the Smithsonian, beryl crystals from the American Museum of Natural History, specimens from the Thomas Edison mineral collection housed at Wayne State University, and fluorite specimens from the Royal Ontario Museum.

At the Detroit Show one can always count on wonderful displays of copper and other minerals from Michigan. This year there were again many such exhibits including fine specimens from the collections of Don Pearce (Calumet, Michigan), Gary Richards (Germantown, Wisconsin), Wayne State University, the A. E. Seaman Mineralogical Museum, Harvard University, and Cranbrook Institute of Sciences. One display that attracted much attention contained large recently collected clusters of quartz crystals from the Herkimer, New York, area. These quartz specimens were collected by John Medici (Dublin, Ohio) and range in size up to about 18 cm. Many other Herkimer specimens of assorted sized were available for purchase in John's booth at the show. Probably the most colorful display consisted of many fine rhodochrosite stalactites from Argentina, now in the collection of Paul Cory (Columbus, Ohio).

At the main show, *The Rocksmiths* had an attractive selection of rose quartz specimens from Itinga, Minas Gerais, Brazil. Their display was part of a collection of over 200 rose quartz specimens which they recently obtained. Most of the specimens are miniature to small cabinet in size; some are associated with eosphorite.

Sierra Contact Minerals had a large quantity of coquimbite specimens which were collected during July of 1987 by Harvey Gordon, Steve Rose, and John Seibel at the Dexter No. 7 mine, Emery County, Utah. The gray to purple hexagonal coquimbite crystals range in size up to 1 cm and are associated with black voltaite crystals, fuzzy blue melanterite, halotrichite, roemerite, copiapite and ferricopiapite.

Chris and Neal Pfaff (Columbus, Ohio) had a few dark red rutile crystals from Hiddenite, North Carolina. These crystals were part of a collection of about 100 rutile specimens which they recently obtained. The largest crystals are approximately 5 mm wide and 5 cm long.

At the satellite show, Leonard Himes of *Minerals America* had a small but showy selection of selenite crystals from Raura, Lima Department, Peru. These transparent blades of selenite from 7 to 20 cm are perched aesthetically on plates of pale pink manganocalcite.

Darryl MacFarlane and Brad Wilson of *Grenville Minerals* (P.O. Box 453, Kingston, Ontario K74 4W5) had a large quantity of recently collected specimens from Canada. Among them were many specimens from their claim at the classic apatite locality, the Yates mine, Otter Lake, Quebec (see vol. 12, no. 6, p. 359). The brown to green apatite crystals, 3 to 20 cm in length, are associated with purple fluorite and massive orange calcite. Also in their room were dozens of spinel crystals from the Parker mine, Notre-Dame-du-Laus, Quebec. These black octahedral crystals occur up to 3 cm in size and are available as single crystals and on matrix.

A recent find of transparent gypsum from Hagans, West Virginia, was being sold by *K & L Minerals* (236 Christiana Pike, Christiana, PA 17509). The gypsum occurs as mounds of colorless, yellow, or brown acicular and bladed crystals up to 2 cm in length, and is found as a post-mining mineral in a coal mining area. A large quantity (approximately 100 flats) of these specimens ranging in size from about 5 cm to 40 cm have been collected by Gene Lammey and Dave Phillips.

Show dates for 1988: October 14–16.

ARIZONA PSEUDOMORPHS

[The following report was kindly supplied by Bob Jones.]

A new discovery of copper-mineral pseudomorphs was made recently (September 1987) at the Bluebird mine, an open pit near Miami, Arizona, operated by Inspiration Consolidated Copper Corporation. Good specimen material was first spotted by a company engineer in a cut near the bottom of the pit. He called in John Mediz (*Copper City Rock Shop*, Globe), who has a specimen recovery contract with Inspiration.

Mediz subsequently collected a large quantity of the pseudomorphs, which occur at the junction of two small mineralized joints. Unfortunately the outcrop is directly underfoot in the roadbed, and uninterrupted collecting could not be carried on while mining and hauling operations were under way.

The pocket was found to be filled with clay and water. The copper-stained felsic rocks are typical of the area.

Figure 4. **Rhodochrosite crystals to nearly 1 cm, on black manganese (?) oxide matrix, from the Santa Eulalia district, Chihuahua, Mexico. Bob Turner specimen.**

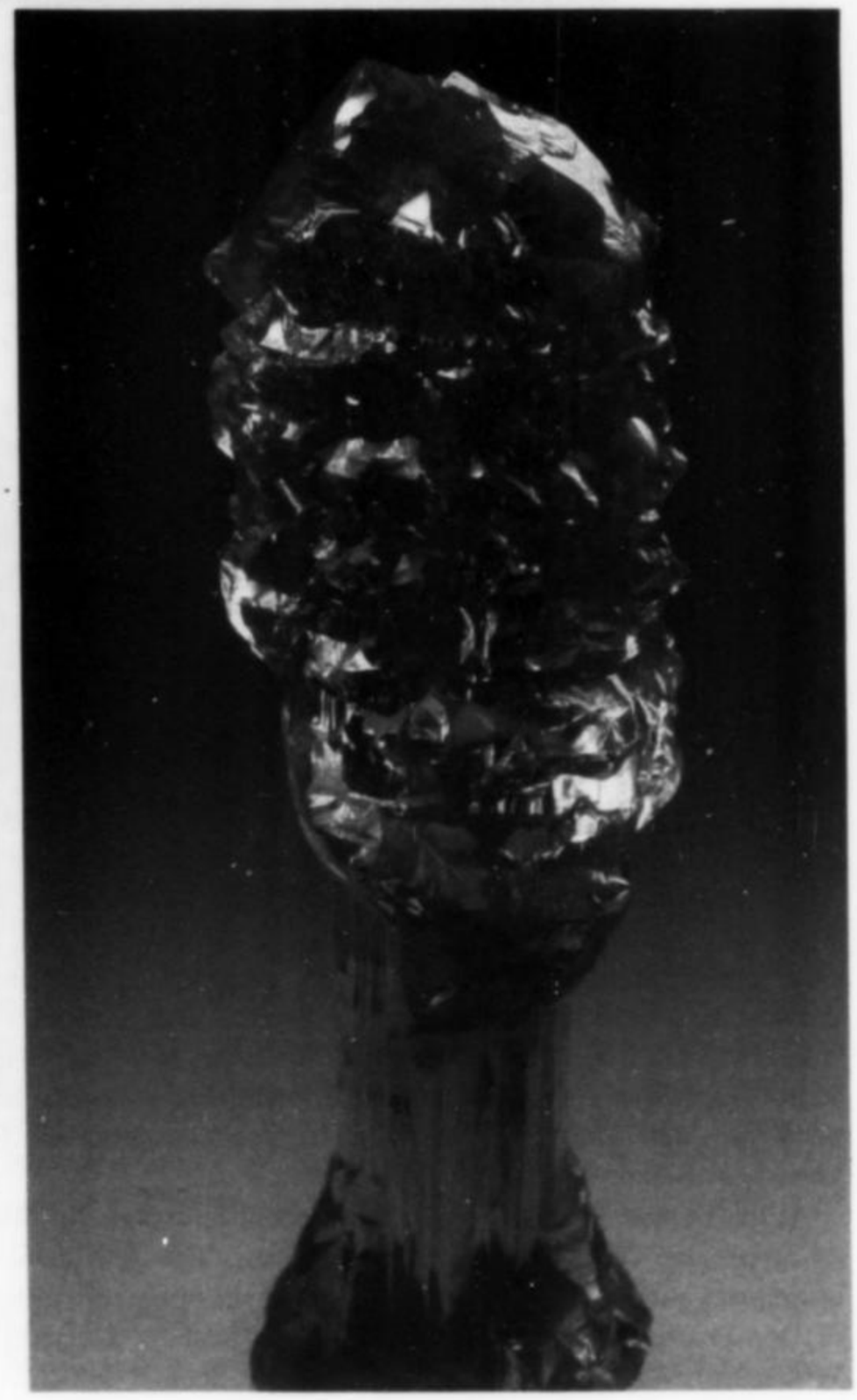


Figure 5. **Sceptered beryl crystal, 5.5 cm tall, from Wołodarsk, Ukraine, USSR. Cal and Kerith Graeber specimen, acquired from Anna Chrapowicki at the Denver Show.**

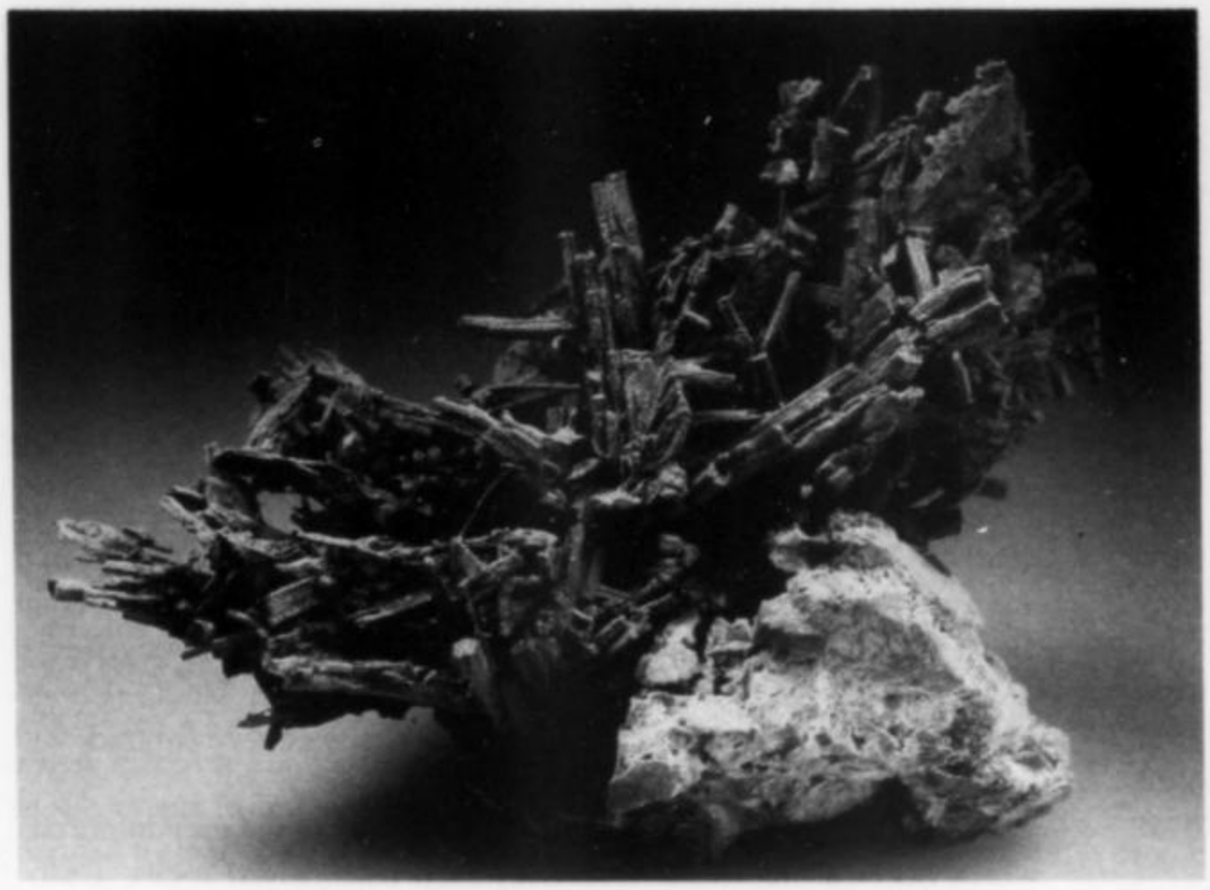


Figure 6. **Silver pseudomorph after stephanite, 11 cm, from Pribram, Czechoslovakia. Herb Obodda specimen. Dyscrasites of similar habit were also available at Denver, Munich and elsewhere.**

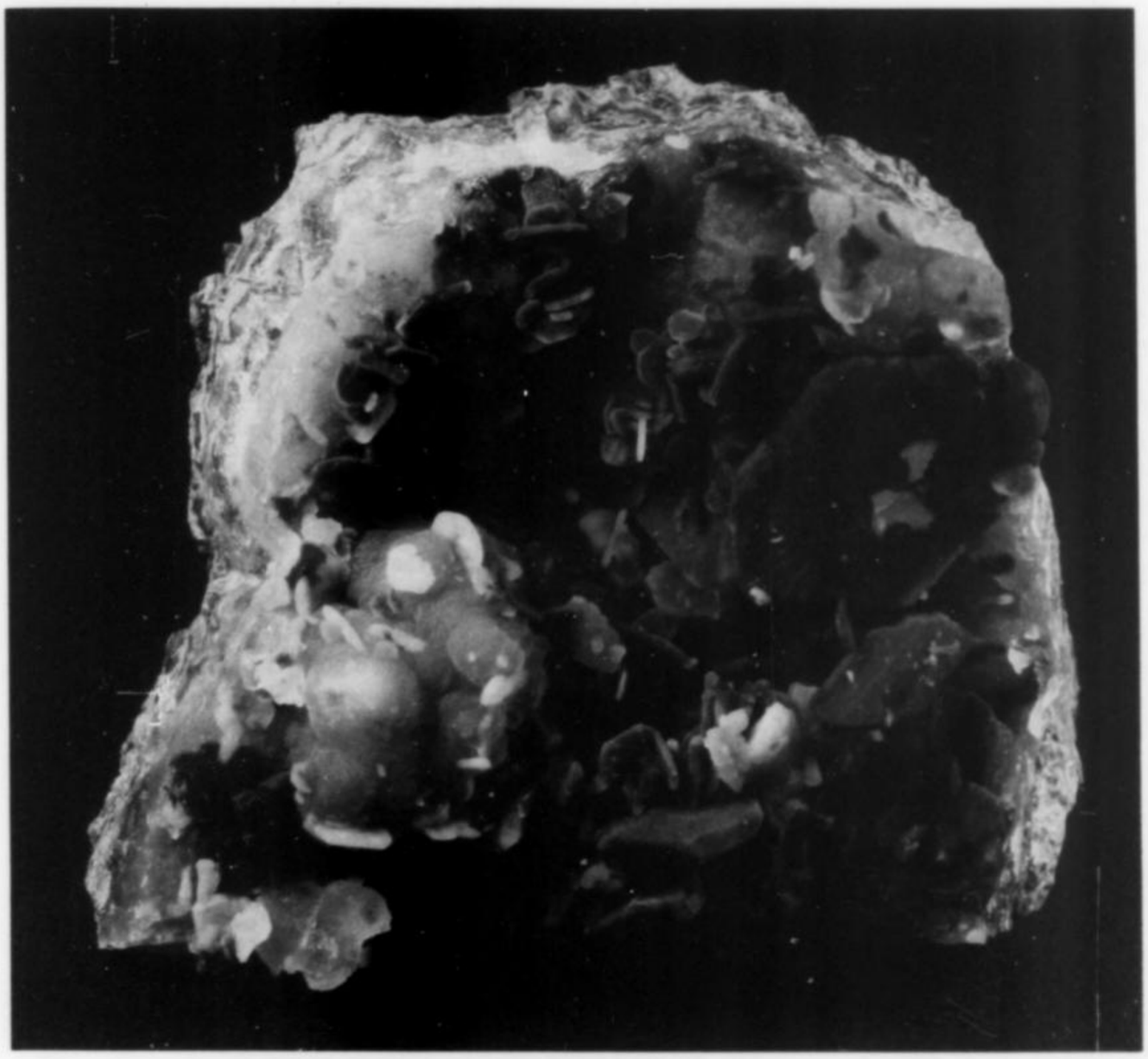


Figure 7. **A small vug (9 cm) of malachite pseudomoprhs after azurite crystals to 3.5 cm. A few of the pseudomorphs consist entirely of white or chrysocolla-stained quartz, all on botryoidal chrysocolla covered by drusy quartz. From the Bluebird mine, Miami, Arizona; Evan Jones collection, photo by Bob Jones.**

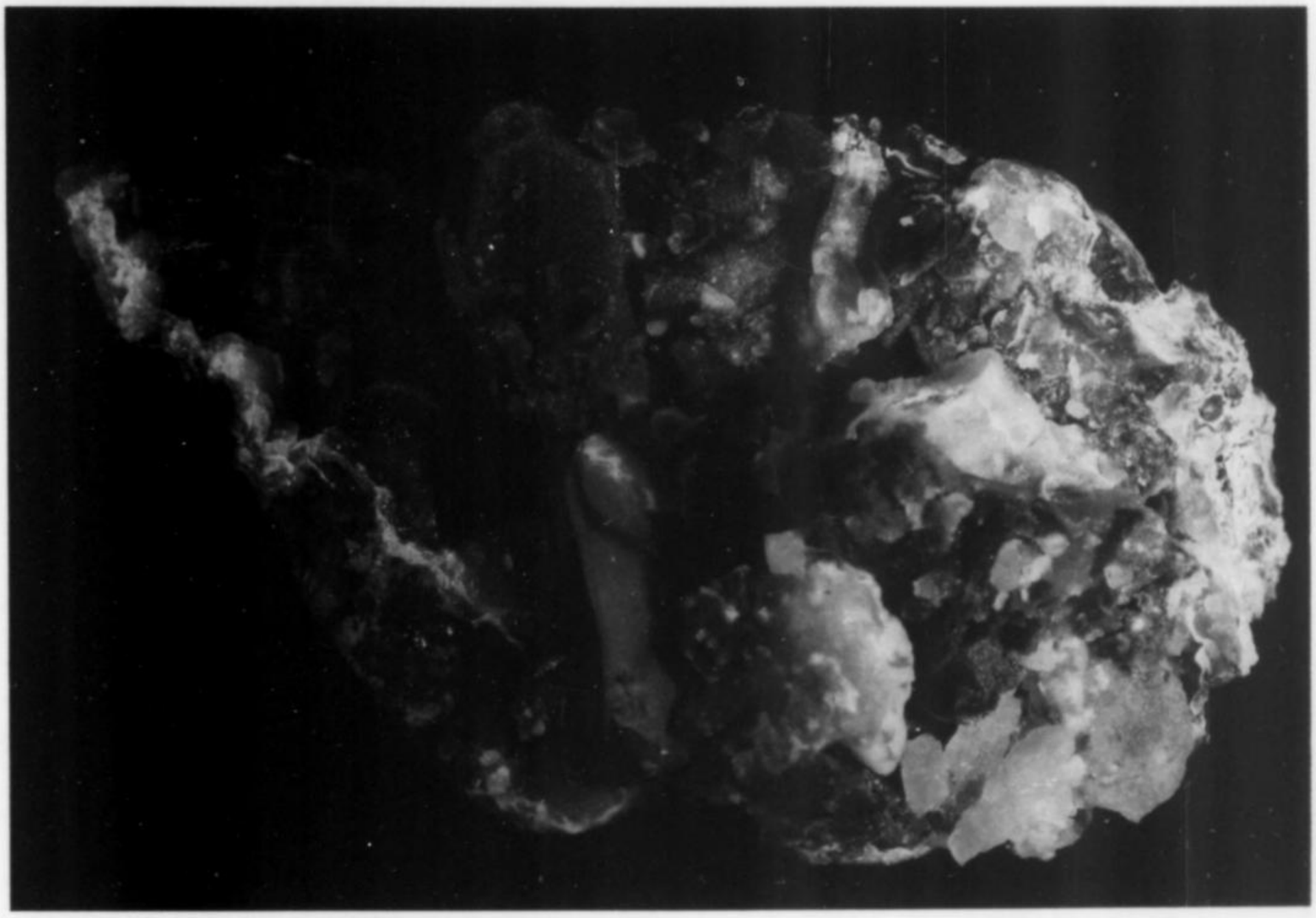


Figure 8. **Largest of the malachite pseudomorphs after azurite found at the Bluebird mine. The doubly terminated "crystal" measures 4.5 cm. Evan Jones collection, photo by Bob Jones.**

Apparently the pre-alteration crystals were azurite, some of them nearly 5 cm long and doubly terminated. Most have been replaced by pale to dark green malachite. In some cases the malachite pseudomorph has been overcoated by a sparkling druse of quartz. In other cases the entire pseudomorph has been replaced by blue chrysocolla-stained chalcedony, the popular gem material known as "gem silica" which is often found in the Miami area. The color of the chalcedony varies from dark blue to very pale blue and nearly colorless, depending on chrysocolla content. (X-ray identification was made of the chrysocolla, courtesy of Arizona State University.)

Some exceptional specimens show all three pseudomorph types. Single, more or less equant crystals generally not exceeding 2.5 cm were recovered. The largest of the chrysocolla-chalcedony pseudomorphs is a good blue "crystal" measuring about 3 cm, on a 6-cm matrix (Evan Jones collection). The color within the pseudomorphs is irregularly distributed, giving an interesting effect.

The largest malachite pseudomorph is nearly 5 cm long and doubly terminated, with a nice variegated pale to dark green color. The best of the colorless quartz pseudomorphs is a sharp, 2.5-cm "crystal" on matrix. Perhaps the best remaining malachite pseudomorph with drusy quartz coating is a 3-cm "crystal" blade on matrix.

A total of seven flats of material were collected, about a third of which had pseudomorphs of varying quality. All of the matrix specimens have an attractive base of drusy quartz over blue chrysocolla. The entire lot probably consisted of about 100 specimens.

The original pocket has been cleaned out and additional exploration has not yet been carried out because the mine road is in such heavy use. However, mineralized showings can be seen above and below the road area, and it is hoped that later bulldozing of the roadbed will bring more specimen material to light.

PASADENA SHOW

[The following notes were kindly provided by Gloria Ludlum. Ed.]

The Mineralogical Society of Southern California held its Pasadena Show of Minerals and Gems on November 14–15, 1987, at Pasadena Center. This show has maintained its reputation as one of the best mineral shows in the country by continually being able to attract dealers in top-quality mineral specimens and by assembling many (almost 100 this year) fine displays from the collections of collectors, dealers and museums. This was also the first year for a concurrent satellite show, held in the nearby Holiday Inn.

At the main show, several dealers had fine beryl crystals from Wolodarsk-Wolynsky, Wolyn, Ukraine, USSR. Top-quality specimens were being displayed at the booths of Ben De Wit, Brad Van Scriver, and Pala International. Ben De Wit had about two dozen doubly terminated crystals ranging in length from 6 to 15 cm. The color of these crystals varies; some are pale pastel green and others a yellow to olive-green. Brad had a couple of aquamarine crystals from the same locality. All of the crystals are transparent and very clean internally. Many of them exhibit interestingly etched surfaces. Beryl crystals currently being mined from the only operating shaft in the area are usually no longer than 3 cm.

Ben De Wit also had a few lazurite specimens from Sar-E-Sang, Afghanistan. The dark blue, opaque, dodecahedral crystals vary in size up to about 3 cm and are associated with a white nepheline matrix. A few of the specimens were also seen in the room of *MacDonald Gems and Minerals* (48697 Eisenhower Dr., Indio, CA 92201) at the satellite show.

A small but wonderful collection of Korean amethyst scepters was recently obtained by Peter and Bobbi Flusser of *Overland Gems* (550 S. Hill St., Los Angeles, CA 90013) and was on display in the booth of Cal and Kerith Graeber. The scepters have colorless stems and dark purple knobs. The specimens ranged in size from miniature to small cabinet and the crystals from about 3 to 10 cm in length. All of the crystals are stocky in appearance, the length of the crystals being only about $1^1/_2$ times the width of the sceptered overgrowth. The locality of these amethyst scepters is Onyang, Gyeong, Sang Buck Do, Korea.

Tony Jones of *California Rock and Mineral Supply* had 70 fine rose quartz specimens from Lavra da Ilha, Taquaral, Minas Gerais, Brazil. These specimens were mined over an eight-month period during 1987. The specimens vary in size from miniature to cabinet with the largest crystals being close to 2 cm in length; some specimens are associated with eosphorite, roscherite and possibly collinsite. This is the first time that this locality has been mined in about 13 years. Collecting at this time was made possible only because of an unusual and temporary drop in the river level which made access possible.

Pala International had a large selection, about 100 specimens, of aquamarine clusters and single crystals from Jos, Nigeria. The lovely dark blue crystals range in length from 4 to 8 cm. Pala also recently obtained about 300 sapphire crystals from Ratnapura, Sri Lanka. These crystals, some of which are twinned, vary from 2 to 5 cm in length and occur in a variety of colors—pink, blue, colorless and purple.

The show had so many fine displays that we cannot even begin to discuss them in this column. I will only mention one two-case display that has taken a lot of years to assemble. That is the very interesting and unusual display of minerals from Hungary (and Hungarian mineralogy books) from the collection of Joseph Simon, Woodland Hills, CA.

The satellite show seemed to be well-managed and for its first year was able to attract foreign dealers from Spain, Brazil, Norway and Canada.

The Pasadena Show will be held next year on October 8–9, 1988, at Pasadena Center. For more information, contact MSSC, P.O. Box 811, Arcadia, CA 91006. You may find out more about the satellite show by writing to Gerald Clark, *California Mineral, Gem and Fossil Trade Show*, P.O. Box 11090, Costa Mesa, CA 92627.

ERRATUM

Photos of the New Hampshire specimens pictured in the November-December issue were kindly supplied by Ken Hollmann (not Carlton Holt).

HAWTHORNEDEN

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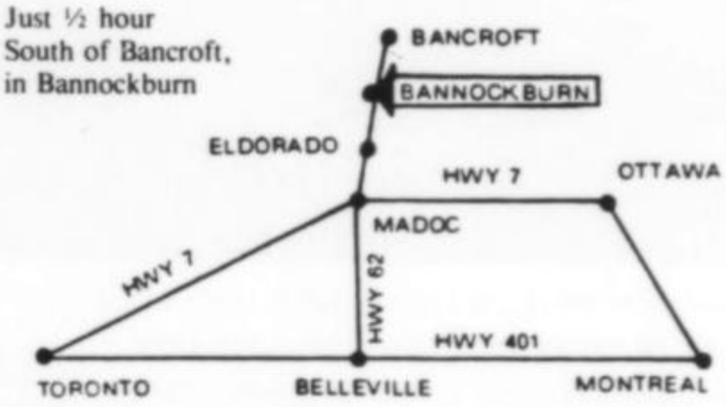
in Bannockburn



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Notes from Germany

by **Thomas Moore**

MUNICH SHOW 1987

For opening day of this year's *Münchner Mineralientage* the weather was, predictably, gray and bleak—and (let's get it said right now) one needs a word bleaker than "bleak" to characterize the dollar/Deutschmark exchange rate in this post–Black Monday autumn. Our U.S. currency, that plaything of fate, farce and mismanagement, having earlier this year fallen through the floor, seems headed now for the underground catacombs where traditionally the oppressed and violated of history have huddled. "For financial reasons not many Americans made the Show this year"—it's a catch-statement and a depressing cliché by now.

All *that* out of the way, though, I'll say that Europe's top mineral show seemed better this year than last, both in general quality of material offered and in physical ambiance. The event now fills three large rectangular halls at the Munich Fairgrounds, having moved from the single, if cavernous, *Halle 16* of old. The new quarters are shaped in a long dogleg by removal of partitions between the halls, and so the new (and much wider) aisles seemed endless to walk, and one's feet at day's end seemed twice as sore this year as last. The number of dealers, however, rose only modestly (from 335 to 375), so the impression that the size of the Show had at least doubled was an illusion that must have resulted from the more spacious arrangements, and from those aching feet.

To my taste the best thing of all about the ampler accommodations was a very large sit-down restaurant (full to capacity for most of Friday) that finally put the barbarically cramped, stand-up snackbar of *Halle 16* out of its long misery. And there was also a "Siegerland Cafe," a typical example of the friendly German beer-bar, adjoining the alcove where the "Minerals of Siegerland" display was housed. A well-deserved close look at this display follows shortly. With "Wonders of Agate" and "The Bavarian Ice Age," it was one of the show's three thematic presentations. Over the Ice Age site proudly loomed the show's biggest (no contest) landmark, a great mastodon skeleton that showed the way to the conscientious layouts of Ice Age maps, enlarged photos of Pleistocene digs, critter bones—and even the nearly complete skull of a Neanderthaler from Nördlingen.

Wunder von Achat was clearly the first-among-equals of the three theme displays, the one on which Herr Keilmann had lavished the most love and funding. Besides the myriad rows of backlit agate slabs from worldwide localities, which were of course colorful and fancifully variegated as agate will be, there was much educational material. Its centerpiece was an almost life-size reconstructed room in an old Idar-Oberstein-style agate-cutting shop. Here, machines whirred and hummed in the gentle, make-believe, cog-and-lever manner of such reconstructions; piles of agate nodules gathered make-believe coatings of grit; and one human mannikin stolidly lay prone, draped over a board at the midriff, head nearly touching the great rotating polishing wheel to which his hand offered the stone.

But for obvious reasons I'd rather get down to particulars about the display devoted to Siegerland minerals, organized by the same dedicated and friendly Herr Günter Grundmann of the *Technische Universitäts München* who did a similar job for the Freiberg exhibits last year. The centuries-old Siegerland mining district, now quite extinct both orewise and specimenwise, is likely to be much less well known to U.S. collectors than, say, the Harz or Erzgebirge districts. We may think vaguely of the gorgeous orange rhodochrosite from the Wolf mine at Herdorf, but still pull a blank on the more general term "Siegerland." Well, the region is very near the center of modern West Germany, straddling the meeting-place of the three modern *Bundeslände* (roughly, "states") of Hessen, Nordrhein-Westphalia, and Rheinland-Pfalz. Its largest town is Siegen, about 100 km north-northwest of Frankfurt. Classic specimens include magnificent bournonites and tetrahedrites (Horhausen), millerites (Wissen), and chalcopyrites (Daaden); the usual ranges of secondary copper and lead minerals, in fair to very good specimens; and such rarities as ullmannite (Eiserfeld) and linnaeite (Müsen) in well-developed crystals. King among the Siegerland pieces in this display was a flat 70 x 70-cm siderite matrix from the Georg mine across which are scattered about a dozen clusters of 3-cm elbow twins of brilliantly lustrous bournonite: the best bournonite specimen I have ever seen, barring the Cornwall ones in the British Museum. Also from the Georg were a few huge chalcopyrite matrix pieces of the same general style and almost equal impressiveness. From the Neue Hoffnung mine there were many fine galenas in a variety of oddly complex habits, and a 10 x 10-cm, shining brown pyromorphite equal to the best from Ems. From the Wolf and Luise mines there were eccentric pincushion-clusters of orange rhodochrosite needles; and from the Friedrich mine at Wissen, there was a 20 x 20-cm mass almost entirely composed of dull yellow millerite prisms thick enough to show terminal faces. On the bottom shelves of most of the plain glass cases, old-fashioned wooden compartmented drawers full of miniatures from the private collection of G. Schweisfurth of Siegen gave a sense of the district's profusion of species: native copper, pyrolusite, hausmannite, malachite, cerussite, anglesite, ullmannite, and lots more. Together with the show booklet's thorough chapter on the Siegerland (decorated with good color specimen photos and with cute pictures of cute turn-of-the-century German postcards welcoming visitors to the cuckoo-clock-cute villages nestling in folds of hills—end of overlong cute parenthesis), this display taught a full and convincing lesson in what this venerable, underrated locality has had to say for itself. So interesting were the minerals that, I confess, I hardly looked at the cases full of miners' paraphernalia, topographic and geologic maps, documents, photographs, etc.—though honorable mention goes to a large case housing a mean pair of steel swords, one a turn-of-the-century Prussian officer's saber, the other a huge stout beast that once belonged (the sign said) to a warrior of the seventeenth century, one Clemens Wopper.

But now to the dealers' offerings—beginning with some newly mined specimens of *orange* sturmanite from the N'Chwaning mine, Black Rock District, South Africa, these being shown by Desmond Sacco at the stand of Paul Balayer (P.O. Box 978, South Africa Randfontain 1760). I have enthused before in this space about sturmanite—for how many new and rare species, after all, come in spectacular groups of large crystals?—but must enthuse again now about these translucent beauties, the color of good orpiment, from a single pocket which according to Sacco was hit just two months ago. The crystal habit is the same as for the familiar lemon-yellow sturmanites: stout hexagonal prisms, most in floater groups or as singles but a few in large (though most of these slightly damaged) clusters on matrix. When I reached Sacco early in the afternoon he had already sold

almost half the supply he had brought to Munich, and about 30 pieces remained, of thumbnail to large cabinet size, priced at only $30 for a very good thumbnail and up to $1800 for the largest remaining matrix group. Moving briskly, too, at the same stand were some fine old (upper level) Tsumeb pieces, e.g. an exquisite cerussite thumbnail (now mine!) priced at only $50, and some excellent malachite-azurite pseudomorph groups.

There were some interesting gem-pegmatite minerals from the St. Anne's mine in Zimbabwe to be seen at the stand of Rüdiger Hesse (Beethovenstr. 41, D-7921 Heidenheim). One knows of St. Anne's blue topaz, but not necessarily of such things as the fat, lustrous black, mostly doubly terminated prism of uvite, either as floaters or lying flat on matrix, at $12–18 for a fine thumbnail; and one is even less likely to know the capacity of this mine to produce quite spectacular emerald crystals. The best of these is a beautifully sharp hexagonal tablet about 1.5 cm across, of the deepest green one could wish, and partially gemmy, for an amazingly low $45. There were also about

Figure 1. **Malachite crystals to 4 mm, with cerussite, from the Friedrich mine at Niederhövels, Siegerland, West Germany. Photo by Werner Lieber.**

30 very dark green-black elbaites in loose terminated crystals and, yes, some rather poor blue topaz.

While visiting mineralogical Africa I must report too on some fine, transparent deep red and gemmy, octahedral cuprites, some associated with green tufts of malachite, from the Mupine mine in Katanga, Zaire. Their French handler, Christian Gobin (4 Rue Point de Pre Coste, F-13770 Venelles) said that some very limited specimen prospecting is continuing at this small copper mine, no longer commercially worked. Unfortunately the cuprite crystals prefer to hide too shyly, i.e., quite deeply embedded, in small vugs in mostly over-large matrixes, but their color and gemminess are outstanding, and what faces *have* developed have done so sharply and mirror-smoothly. The thumbnails are the most impressive, but specimen sizes range up to an 8 x 8-cm matrix with two 2-cm cuprites in a single vug, and prices ranged reasonably from $60–300.

We move now to the minerals of Czechoslovakia (lots of them: it's astonishing that such a small, landlocked country shaped like a guppy has produced so many mineralogical marvels over the centuries)—and to the stand of a German dealer I've mentioned in an earlier Note, Erich Schmidt (Friedhofstr. 3, D-8591 Tröstau). This time out, Schmidt had about a dozen large miniature to cabinet-sized specimens of very good, very bright, twinned cassiterite from Schlaggenwald (or Slavkov) in the Bohemian Erzgebirge; shining maroon kermesite needle-sprays on miniature-sized matrixes from Pezinok, Slovakia; blocky fair-quality green apatites in solid groups to 4 cm from a pegmatite at Dolny-Bory; a few pieces showing 4-cm radial sprays of the very rare stromeyerite, from Pribram, Bohemia; and, most glamorously, a single marvelous proustite from the Medenek mine at Joachimstal (or Jachymov), a 6-cm cluster of bright red crystals on a 9-cm matrix.

Arguably the show's most intriguing new find appeared as a small smattering of mostly small specimens dispersed among several dealers: metallic gray, semi-arborescent groups of crude spiky crystals of dyscrasite from Pribram. In none of my references (not even in the *Record*'s article on Pribram, vol. 12, no. 3) is this rare species mentioned as occurring at Pribram; in fact, dyscrasite in visible crystals has been described only, as far as I can tell, from the renowned Samson mine at St. Andreasberg in the Harz, and these (I've seen them) are dull grayish rounded growths no more than a centimeter or so across, and hardly dazzling. The Pribram pieces are far better crystallized, and in their way quite attractive; they closely resemble some Pribram silvers I've seen, although the latter are slightly more, well, silvery-colored, the dyscrasites being grayer with a faint tinge of bronze. One dealer opined that a continuous series may exist between the native element and the antimonide (dyscrasite is Ag_3Sb) at this occurrence. In any case, some old shaft at Pribram seems to be cooking up some late surprises: let's hope for more of what must qualify as the most attractive (i.e., the only attractive) crystallized dyscrasite yet found anywhere.

It appears that collecting in Spain is flourishing nicely these days. One German dealer, Manfred Grimmel (Gewerbeschulstr. 36, D-5600 Wuppertal 2) had more and better of the Almaden mine cinnabar crystals that I mentioned last year; one rhomb on its black matrix measures 2 cm across, and on other specimens many good singles and twins almost as large rest on white calcite vein fillings that in themselves contrast nicely with that black shaly matrix. Prices on these ranged from $45–300. On a smaller number of specimens, all thumbnails and miniatures, liberal sprinklings of native mercury droplets up to 5 mm across upstage the micro-sized cinnabars. Also at Grimmel's were some huge, gemmy (though subhedral) crystal masses of sphalerite from Picos de Europea, and some fair examples of a new green octahedral fluorite from Papiol. The newly discovered fishtail gypsums from Zaragoza that have lately been appearing were well represented here as well, with some twins to 5 cm long standing up at diverse high angles from the creamy yellowish-white alabaster matrixes; a 20 x 20-cm piece, with a dozen large, absolutely transparent gypsums, an awesome-looking thing really, sold for $185.

Bailey Minerales (Paseo Castellana 171, E-28046 Madrid) offered hundreds of miniatures and small cabinet-sized pieces from a new pyromorphite occurrence in Spain—given only as Cordoba—some with fine barrels to 1.5 cm; the loose clusters and those on a delicate boxworked limonite-quartz matrix somewhat resembled the Bunker Hill, Idaho, pyromorphites in color, being of almost the same prima-donna-bright yellowish green. The Bailey people also had about twenty enormous cabinet groups, to 50 cm across, of excellent dolomite rhombs from the famous occurrence (the world's best for this species) at Engui, Navarre. The prettiest of the rhombs are transparent, others were bluish-gray and translucent, and I saw one individual 5 cm on

(continued overleaf)

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edge; prices for these brutes were a surprisingly moderate $125–300.

Recent collecting at Koutalas on the Greek island of Seriphos has been yielding many pretty yellow-brown melanite garnet groups, fine ilvaites, and a fetching opaque green quartz that's being loosely called "prase"—these last either as single, sharply terminated, fattened prisms up to 8 cm long, or parallel groups of two to five such prisms; at Munich the best of the quartzes were to be had for about $130 from N. Albantakis (Iros Konstantopoulou 112, GT-16346 Athens). The same dealer had, from the same locality, something I hadn't seen before: epidote in good miniatures and two or three excellent thumbnails, the best piece here a 6 x 6-cm cluster with fine though rather dull-lustered prismatic crystals, overpriced at $400.

The wonderful Stari Trg mine, Trepča, Yugoslavia, vivianites that suddenly have again become moderately plentiful on the market were liberally represented at Munich, but Azizaj Afordita (Röthelteich 44, D-5828 Ennepetal) had the best. One miniature for $1500 (yes, a fair price) with beautiful thick sea-green crystals on a bed of needlish quartz crystals deserves special mention, though others displayed with it were almost as impressive; there were also a few Trepča rarities like ludlamite and bournonite, and of course large spectacular cabinet groups of black sphalerite, many individuals garlanded by milky white calcite crystal crusts.

And then there was the small handful (this metaphorically speaking: they averaged 15 cm high) of flattened fans of pale blue anhydrite crystals from Sauvillo, Mexico. The surfaces of the blades are dusted with sparkling quartz; all specimens are very beautiful, and could be had for $175–500 from Francisco Conesa (Nuestra Sen. Valvanera 115, E-28000 Madrid).

Brief mention must be made, finally, of the topnotch Chinese cinnabars now very plentiful in the smaller sizes and thus coming down (though still quite high, naturally) in price; of the many Bolivian vivianites as choice as or choicer than the Trepča ones; of the hundreds of good Pakistani Afghan topazes and aquamarines and elbaites and hessonites; of the numerous promising small specimens (so far no superpieces) of the Untersulzbachtal, Austria, epidote now again becoming available thanks to the efforts of the Vienna Natural History Museum collecting staff; of the whole spread of excellent and (in contrast to earlier years) really inexpensive bournonite thumbnails from Quiruvilca that one Peruvian dealer was offering (though only offering, unfortunately, in Spanish; the English to which he asked me to switch from my slow-learner German made no more impression on him than the German had).

Although the Munich Show has gained elbow room it has also lost—and this permanently, and by the considered design of chief organizer Johannes Keilmann—the *Sonderausstellung* case of earlier years, where specimens individually entered by participants competed for the Viktor Goldschmidt best-specimen-in-show award. Herr Keilmann wants, he told me, to de-emphasize any and all elements of "competition," while even further emphasizing that of public education—fair enough, though I'd editorialize here that at these German shows I do miss the American-show-style displays of private collections, "competitive" or not. What, then, is to be the chief educational theme for next year, the Munich Show's 25th anniversary year? Admirably perverse, Herr Keilmann avows that, no, it will *not* be silver, there will be no spectacular roomfull of Silver Anniversary wires and ferns, this being a much too predictable, vulgarly uncreative, idea. Rather—he lowers his voice and smiles—the nature of next year's showmanship is to be kept a *secret*; the lips of the hundreds of people required to coordinate the display are to be, so far as humanly possible, sealed. We shall have simply to wait for whatever surprise lurks inside the main entrance for us—not that any such trick of suspense will be needed to get *me* there.

For instance, I seem to need to such thing to be making my plans to hit the big show at Hamburg next weekend—from whence next Note.

NUREMBERG SHOW 1987

[I was unable to attend the Nuremberg Show this year, but Dr. Jan Stobbe was kind enough to supply the following report.]

I try to visit the annual Nuremberg Show each year because it always offers some interesting features. The city of Nuremberg, second in Bavaria only to Munich, is well worth seeing. The Old Town area, with many late medieval and renaissance buildings, is surrounded by a massive, restored wall. Walking along the wall it is not difficult to imagine lively street scenes from the 1500's, here where the famous Renaissance painter Albrecht Dürer was born (his birthplace is now a museum).

The show itself is relatively large, with over 140 dealers, about 20% of which are actually just local collectors. And there is always an abundance of minerals from old and famous Bavarian localities such as Hagendorf, the Fichtel Mountains, Wölsendorf and Rabenstein which are difficult to find for sale elsewhere.

Among the classic items offered were some very large quartz crystals from the Bayerland mine (closed in 1971), and steatite pseudomorphs from Johanneszeche. Topaz crystals to 1 cm, from the Fuchsbau quarry, could be had for $5–6, and smoky quartz from the famous 1960 find for $6–10. Wölsendorf barites and fluorites were abundant but the quality was generally poor.

There were some new and quite interesting offerings as well. The enlargement of Lake Fichtel (Fichtelsee) allowed the recovery of large, gemmy, smoky quartz crystals, and also some attractive, gemmy phenkite micromounts ($6–9). Road work near Kirchenlamitz intersected a pocket containing psilomelane-coated quartz crystals to several centimeters, which are actually rather aesthetic.

Good specimens from the classic Bohemian localities were also available from several dealers, although at steep prices. Excellent micromounts from Hagendorf, Bavaria, were abundant and inexpensive.

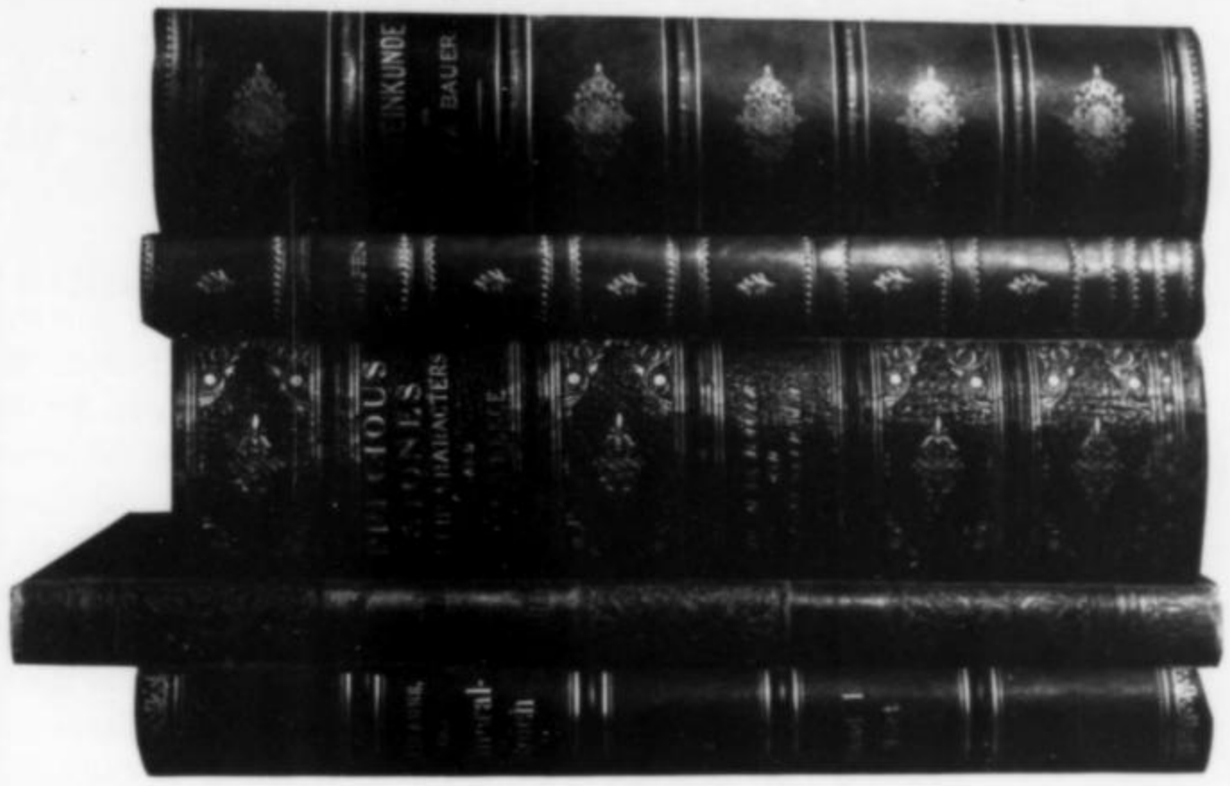
A Romanian dealer was offering large, high-quality groups of quartz and calcite in very aesthetic specimens, some of them museum-size. Prices were very reasonable, e.g. $80 for a 20-cm specimen. The same dealer had specimens of what must be the world's largest semseyite crystals, individuals up to 2.2 cm grouped like roses. They sold quickly.

Old Russian specimens were available from a few dealers, but the quality was generally mediocre. A 2.5-cm alexandrite (chrysoberyl) crystal on matrix was priced at $425, rather high considering the quality. Rüdiger Hesse, a Heidelberg dealer, had a variety of Zimbabwe specimens including nice blue euclase crystals from near Harare.

Dr. Harry Wilke showed some large and exquisite specimens from various American localities. Good specimens of recently collected epidote from Knappenwand, Austria, were offered at high prices by an Austrian dealer. A German dealer had two magnificent cassiterite specimens from Bain Mod, near Tshenhermandal, province of Hentiy, Outer Mongolia. I bought the largest of the crystals: reddish brown, opaque to translucent and idiomorphic in form, measuring 6.5 cm (large for a cassiterite crystal!).

A large old-time collection containing some very good and reasonably priced items was also for sale. Nice old-timers include Freiberg argentite crystals to 1 cm in a 5 x 7-cm group ($85), colorless beryl thumbnails from the Ural Mountains ($40), and Japanese topaz thumbnails ($20–40). The large and fine Norwegian zircons were also available at relatively low prices.

Thomas Moore
Karlstalstrasse 9
D-6751 Schopp
West Germany



Book Reviews

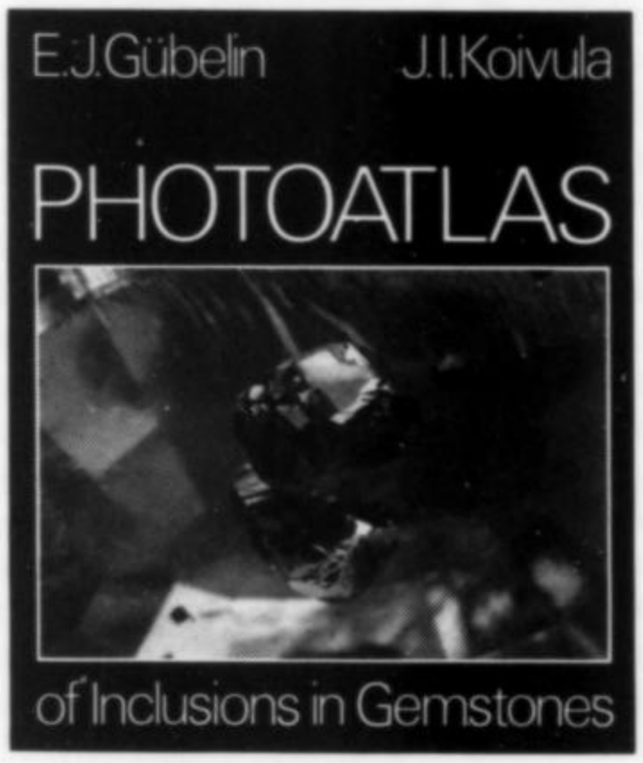


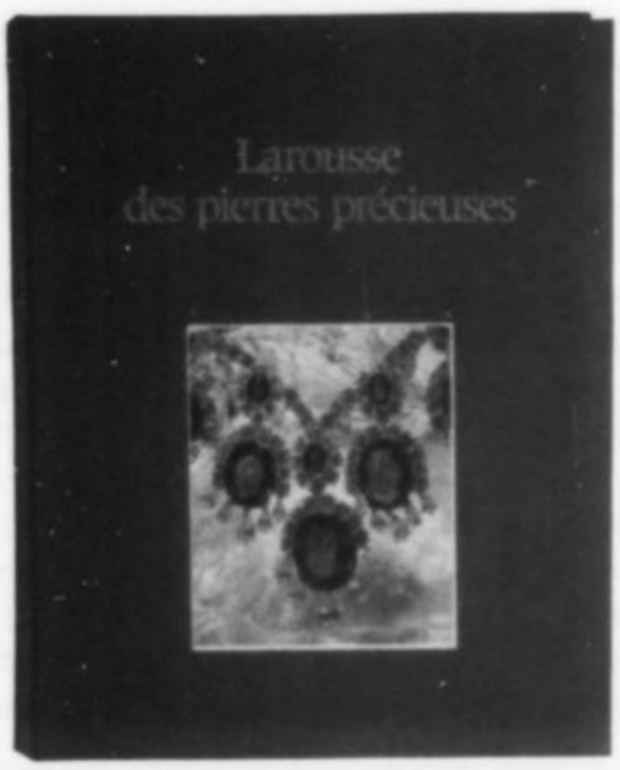
Photo Atlas of Inclusions in Gemstones

by E. J. Gubelin and J. I. Koivula (1986). Published by ABC Edition, Zurich; available in the U.S. from the Mineralogical Record Bookstore, 1601 Fairview Dr., Suite C, Carson City, NV 89701; hardcover, 22 x 25 cm, 532 pages, $175 plus $3.50 postage and handling.

Gemologists have their own approach to mineralogy. Because the natural external morphology of crystals is sacrificed to the faceter's wheel, that leaves only the transparent interiors for study. To a great degree the internal aspect is sadly overlooked by most mineralogists who are more interested in determining Miller Indices, *d*-spacings, trace elements and so on.

This exceptionally handsome volume, filled with an incredible 1400 full-color photographs of crystal interiors, was compiled by the world's leading authority on inclusions, Dr. Edward Gubelin, in association with G.I.A.'s Senior Gemologist John Koivula. A finer treatment of the subject is hard to imagine.

Mineral collectors who long to see actual crystal forms will not be disappointed; many inclusions are themselves fine microcrystals, particularly the exquisite pyrite crystal group in quartz which was chosen for the cover photograph. And not just the typical gem species but a wide range of host and inclusion minerals are covered. Introductory text is clear and figure captions are detailed and thorough. This is fascinating reading for anyone interested in mineralogy.



Larousse de Pierres Precieuses; Fines, Ornementales, organiques,

by Pierre Bariand and Jean-Paul Poirot, in collaboration with Michel Duchamp, with photography by Nelly Bariand. Published (1985) by Librairie Larousse, 17, Rue du Montparnasse, 75298 Paris Cedex 06, France. Hardcover, 22 x 27 cm, 264 pages.

Parlez vous français? Well, even if you don't speak much French, this beautifully illustrated encyclopedia of gemology is great fun to browse through. Hundreds of color photos show natural crystal specimens, cut stones, fine jewelry and historical scenes. Figure captions giving species, size, locality and owner of specimens are easy to read without any knowledge of French, and a surprising amount of text is too. The text is not as detailed and technical as Webster and Anderson's 1000-page, poorly illustrated *Gems, Their Sources, Descriptions and Identifications* (fourth edition published by Butterworths, Boston, 1983), and the photographic emphasis is much heavier on uncut well-formed crystals and elaborate jewelry items than Joel Arem's recent *Color Encyclopedia of Gemstones* (second edition, 1987), which pictures mainly cut stones and crude rough. The Larousse encyclopedia makes a nice complement to these two, an attractive "coffee table" book and a nice gift item.

W.E.W.

RECENT EUROPEAN PUBLICATIONS

by **Michael O'Donoghue**
Science Reference Library
The British Library
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London WC2B 4AT England

Die Entdeckung des Isomorphismus

by Hans-Werner Schütt (1984) (subtitle: Eine Fall studie zur Geschichte der Mineralogie und der Chemie); Gerstenberg Verlag, Hildesheim, West Germany, volume 9 of Arbor scientiarum, *Reihe A,* Abhandlungen; *324 p., DM68.*

The book opens with a discussion of what was known about crystal formation and structure at the end of the eighteenth century, and then proceeds to describe the impact of Haüy's work. His theories are outlined, and the minerals emerald (with the other beryl species), calcite, aragonite, diamond and graphite are considered in particular. The concepts of "masse chimique" and "melange chimique" are investigated before the book turns to the life and work of Mitscherlich and his papers from the early nineteenth century. The work of Berzelius is also discussed, and other theories on isomorphism up to the mid-nineteenth century are reviewed. The book is very well provided with references.

Natürliche und synthetische Rubine

by Karl Schmetzer (198?); Schweizerbart'sche Verlagsbuchhandlung, Stuttgart, West Germany; 131 p., color and black-and-white illustrations, DM38.

This is the first study of ruby to be presented in monograph form for many years and, while the emphasis is on the identification of gem quality specimens, there is also a good deal on the occurrence and crystallography of ruby. Methods of synthesis are described; there is a very extensive bibliography and very fine colored photographs of characteristic features which the gemologist can use to distinguish between natural and synthetic stones. Even these are thrown into the shade, however, by the magnificent inclusion photographs in black-and-white which continue the tradition established by Eppler. The mineralogist will find this book vital for its up-to-date studies of crystal form and chemical composition.

Der Mineralienführer Harz

by Frank Klose (1985); published by the author, Herderstrasse 1, D-3380 Goslar-Jerstedt, West Germany; 147 p., about DM30.

The Harz region is subdivided into several areas, each of which is described in detail with an accompanying map. Geology, mineralization patterns, and each of the major mineral species are described; an extensive bibliography is included. Visitors to the Harz Mountains should be able to pinpoint the famous localities quite easily using this book.

Der Schauinsland: Geschichte, Geologie, Mineralien

by B. Steiber (1986); Doris Bode Verlag, D-4358 Haltern 4, West Germany; 48 p., color and black-and-white illustrations, about DM25.

The Schauinsland lead-zinc district lies just east of Freiburg in the Black Forest of West Germany. Preliminary chapters cover the mining history of the area, following which the minerals are individually described and illustrated in color. As always with a Rainer Bode production (*Emser Hefte, Mineral Museums of Europe*), the specimen photographs are of very high quality. A list of references is included.

Klüfte und Kristalle

by P. Amacher, Strahler (1986?); published by Verlag Geo Uri, Amsteg, Switzerland; 139 p., color illustrations, about DM50.

The text by this well-known Swiss strahler (professional mineral collector) is accompanied by the excellent specimen photography of Eric Offermann. Most of the text deals with cleft occurrences in central Switzerland. The modes of formation for many of the pockets are minutely described.

Geologie der Eifel

by W. Meyer (1986); published by Schweizerbart'sche Verlagsbuchhandlung, Stuttgart, West Germany; 614 p., about DM80.

West Germany's Eifel region is of such importance to the mineralogist that a new and definitive review of the geology is long overdue. Well produced and with a superb bibliography.

Other Titles

Recently received have been further issues of *Inventaire minéralogique de la France.* They are nos. 8, 10, 11 and 13, dealing with the Départements of Haute-Garonne (no. 31), Tarn-et Garonne and Lot (82 and 46), Ariège (09) and Ille-et Vilaine (35). The numbers in brackets are those given to each Department. Each locality of mineralogical importance is identified by coordinates, the chief minerals and their mode of occurrence described and detailed descriptions of access given. Each volume has its own extensive bibliography and the minerals are listed in alphabetical order in a table, in which chemical composition and localities are also given. This valuable series, which is by no means expensive, can be obtained from the Bureau de Recherches Géologiques et Minières, BP 6009, 45060 Orléans Cédex, France.

V. Mattioli's *Minerali Ossolani* was published in 1979 by its author. It describes and lists the minerals to be found in the Ossolani area on the southern side of the European Alps. The area had provided 230 mineral species at the time of writing and they are arranged in the book in chemical order, each section having its own bibliography. Crystal diagrams are also provided.

Die Mineralien des Gotthardbahntunnels und des Gotthardstrassentunnels N2 was published in 1980, the authors being H. A. Stalder, V. Sicher and L. Lussmann. Probably the Naturhistorisches Museum in Bern would be the best place to approach for a copy; these European local mineral guides are hard to find and have short print runs. The importance of the Gotthard area is obvious to the mineralogist.

The Museum should also be approached for a copy of *Die Mineralien des Binntales,* by Stalder, P. Embrey, S. Graeser and W. Nowacki. This vital guide was published in 1978 by the Museum.

The Eifel region of West Germany is well covered by G. Hentschel's *Die Mineralien der Eifelvulkane.* This was published by the Munich firm of Christian Weise Verlag in 1983. It forms one of a projected series of monographs to accompany the journal *Lapis.* Geology of the area is described, and the minerals listed in chemical order with very good diagrams and color photographs. An extensive bibliography comes at the end.

Another useful guide to an important area of West Germany is Volker Kneidl's *Hunsrück und Nahe,* published by Kosmos Verlag of Stuttgart in 1984. The area of Idar-Oberstein lies in the Nahe valley and although a large part of this book is devoted to important locations for fossils, geology and mineralogy are well treated. In the same series, designed in general for travellers, is Wilhelm Meyer's *Geologischer Wanderführer: Eifel,* published in 1983.

The minerals of the Italian area of Liguria are described in *I nostri minerali: geologia e mineralogia in Liguria,* by M. Antonfilli, E. Borgo and A. Palenzona, published by SAGEP Editrice of Genova in 1983. Minerals, almost all of which are illustrated in color, are arranged in chemical order and their descriptions are prefaced by an essay on the local geology. The rather sketchy bibliography is offset by plentiful and well-reproduced maps and photographs of local features other than the minerals themselves.

Two French mineral books which may not have attained international circulation are D. and G. Mari's *Mines et minéraux des Alpes Maritimes,* published in 1982 by Editions Serre of Nice. This book contains a good deal of mining history as well as descriptions of the minerals. Locations are closely described; there is a comprehensive bibliography and an alphabetical list of minerals with their composition and localities.

The same publishers, in 1979, published G. Mari's *Mines et minéraux de la Provence cristalline.* This is arranged in much the same way as the above and the same sort of detail is provided.

M.O'D.

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Letters

GOLD CRYSTAL INCLUSION

The Microminerals column by Bill Henderson in the March-April 1987 issue was especially interesting. Quartz and its associations, in particular the many inclusions, pseudomorphs, etc., are a particularly fascinating subject. The article reminded me of an outstanding crystal I once held in my hand for at least 15 minutes. It was found in the early 50's at the Mariposa mine near Old Coso Village, southwest of Darwin, California, on the northern part of the Naval Weapons Center (then Naval Ordnance Test Station), China Lake. Centered in the termination of the crystal was the most perfect octahedron of gold I have ever seen. I can still visualize it, as it was so impressive. The perfectly clear and undamaged quartz was very close to 3.8 cm long and 1.3 cm thick, and the gold oriented on the *c* axis was at least 5 mm in each dimension. Also, being completely enclosed, no surface erosion of the gold was possible.

I was to facet a dark purple piece of sun colored old glass for the women who owned it in trade for the crystal. A week later I had it done, but in the meantime the woman's husband had been discharged and they had left the area. Talk about bad luck!

If you've read John Steinbeck's *Gods Little Acre*, that is what the mine resembled: trenches and pits along a shallow canyon for a distance of about 100 meters. I stomped over the area quite a few times and found a few quartz crystals but no Au.

I am certain some mineral collector has that crystal; he probably keeps it in a bank vault. I'd sure enjoy seeing it again, if you ever locate it, even if it's only a photo in the *Mineralogical Record*!

Royal Gould
Inyokern, California

Does anyone know the whereabouts of this specimen? We'll publish a photo of it if we can find one. It would make a nice companion piece to the quartz crystal with cinnabar crystal inclusion pictured in the Denver Show report elsewhere in this issue. Ed.

SWEDISH PHOSPHATE LOCALITY

In your September-October *What's New in Minerals?* column by George Robinson and Vandall King there is some confusion about the correct spelling of the name for the new phosphate locality here in Sweden. Their concluding suspicion is correct, "Svappavaara," and the specific locality is the Leveäniemi mine. This is an iron mine no longer in operation. The photo on page 367 shows pink strengite as indicated, but probably with beraunite on a matrix of hematite rather than rockbridgeite. Small amounts of rockbridgeite occur as a coating on spherical growths of beraunite.

I and a friend of mine have been working this locality since the first discovery of the phosphate occurrence in 1985. It has produced some really beautiful specimens along with many more ordinary specimens.

Analyses are still being performed in order to identify all of the species present. Phosphate minerals identified thus far include strengite, beraunite, fluellite, cacoxenite, kidwellite, variscite and rockbridgeite. All but rockbridgeite are well crystallized.

Unfortunately the area of phosphate mineralization was not very large, and so today it is difficult to find good specimens like the one you illustrated. Exquisite specimens like the ones we collected in 1985 can no longer be found at the mine.

I have about 100 Leveäniemi specimens in my collection, which I am happy to show to collectors who might be traveling through northern Sweden. These, along with my other display specimens (totalling about 1200), are, I think, worth a visit to see.

The Leveäniemi iron mine also produces some other very nicely crystallized minerals, the most beautiful of which are the zeolites and calcite. The most common zeolites are stilbite (crystals to 2 cm) and chabazite (crystals to 1.2 cm). Apatite crystals to 8 cm have been found, as well as nice microcline crystals to 4 cm, magnetite crystals to 8 mm, hematite crystals to 2.5 cm, and smaller crystals of prehnite, chalcopyrite, pyrite, epidote, quartz and others. Perhaps the most beautiful of the non-phosphates are the acicular crystals of natrolite to 2 cm.

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Hyggesvägen 7
95500 Råneå, Sweden

EVEN MORE ON USHKOVITE!

The recent discussion (vol. 18, p. 250–252) on ushkovite by P. J. Dunn closes with the statement that "all of the extant structural studies on laueite were performed on crystals not chemically analyzed in any other way."

Herewith I give a reprint of the short note on the discovery of laueite: →

The mentioned analysis was made with about one gram of idiomorphous laueite crystals from Hagendord-Süd, handpicked under binocular lenses and proved for homogeneity under the microscope. Two wet-chemical analyses gave unique results, as published in the cited short note. One of the crystals was used for the cell dimension determination, and some crystals were given to Plieth *et al*. for structure determination (manuscript arrived at the publisher on 12 February 1965!). The simultaneously published structure determination of P. B. Moore (arrived at the publisher on 3 February 1965) was made on a laueite crystal from Palermo mine. Both structures are in good agreement, both papers fully confirm the cell dimensions of 1954. There is no doubt the chemical composition of the laueites in all three publications is near the chemical analysis and formula published in 1954, near Moore's structural formula.

$Mn_{[6]}(H_2O)_4[Fe_2^{[6]}(OH)_2(H_2O)_2I(PO_4O_2]\cdot 2H_2O.$

Hugo Strunz
Technische Universitat Berlin

SONDERDRUCK AUS

DIE

NATURWISSENSCHAFTEN

SPRINGER-VERLAG / BERLIN · GOTTINGEN · HEIDELBERG

1954 HEFT 11, S. 256 41. JAHRGANG

Laueit, $MnFe_2^{III}[OH|PO_4]_2\cdot 8H_2O$, ein neues Mineral.

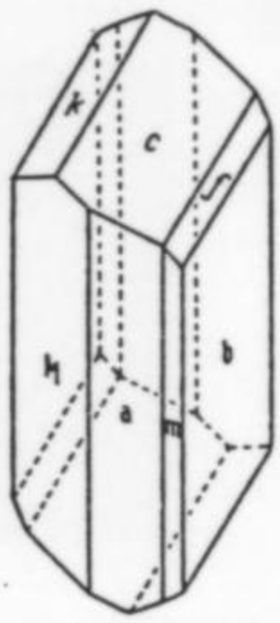

Fig. 1. Laueitkristall von HAGENDORF.

Bis 2 mm große honigbraune Kristalle von triklin-pinakoidaler Symmetrie. $a_0 = 5{,}28$, $b_0 = 10{,}66$, $c_0 = 7{,}14$ Å (metr. Å); $\alpha = 107° 55'$, $\beta = 110° 59'$, $\gamma = 71° 07'$; Raumgruppe $C_i^1 - P\bar{1}$; Analyse: CaO 0,23, MnO 11,06, FeO 1,34, MgO 0,52, Fe_2O_3 27,54, Al_2O_3 1,76, P_2O_5 26,47, H_2O 30,84 %. Vollkommene Spaltbarkeit nach {010}, sehr brüchig. Härte 3, Dichte 2,44—2,49; $Z = 1$. Häufigste Formen: $a\{100\}$, $b\{010\}$, $c\{001\}$, $m\{110\}$, $M\{1\bar{1}0\}$, $k\{0\bar{1}1\}$, $f\{011\}$. (Fig. 1.) Vorkommen im Feldspatpegmatit von Hagendorf-Süd in Ostbayern, und zwar auf Rockbridgeit.

Laueit ist isotyp mit Gordonit $MgAl_2[OH|PO_4]_2\cdot 8H_2O$ und Paravauxit $Fe^{II}Al_2[OH|PO_4]_2\cdot 8H_2O$. Benennung nach MAX VON LAUE.

Institut für Mineralogie (Kristall-, Mineral- und Gesteinskunde) der Technischen Universität Berlin-Charlottenburg und Hochschule Regensburg.

H. STRUNZ.

Eingegangen am 27. März 1954.

Author's response

It is kind of Dr. Strunz to inform us that the crystals studied by Pleith *et al*. were from the original analyzed lot; this fact was previously unknown. Inasmuch as I have not commented on the structure or cell of laueite, the rest of the letter is redundant. My concerns were with ushkovite.

Pete J. Dunn
Smithsonian Institution

STEREO PHOTOGRAPHY

I was surprised and delighted to see the article, and especially the illustrations in the article "Mineral Stereophotography" in the November-December issue of the *Record*. Too few people nowadays know the delights and the virtues of stereo photography.

Readers of the *Record* who might want to know more, and who may wish to learn still other ways of photographing their own collections in stereo, could contact the National Stereoscopic Association at P.O. Box 14801, Columbus, Ohio 43214 and/or the Stereoscopic Society, American Branch, c/o Cavender, 1677 Dorsey Ave., Suite G, East Point, Georgia 30344. The former publishes an excellent quarterly called *Stereo World*; the latter circulates folios of the work of its members. The memberships of both organizations include some of the finest (and most helpful) stereo photographers in the country, both professional and amateur.

E. Donald Kaye
Aurora, CO

HALE CREEK

Regarding the minerals occurring at the Hale Creek inesite locality (vol. 15, no. 5, p. 341), some specimens of mine were analyzed by Dr. Anthony Kampf at the Los Angeles County Museum of Natural History and he found four species not listed in the article: crystalline sulfur, covellite microcrystals coating wellsite, witherite crystals, and brochantite crystal sprays. He has also found what appears preliminarily to be a new species. I have specimens of several other as yet unidentified species from Hale Creek which appear not to be among those species listed in the article.

Garth Bricker
Fallbrook, CA

SNOWDRIFT MINE

I noticed in your May-June issue's Tucson Show report a photo of a cinnabar specimen collected by Bruce Bennett from the Snowdrift mine, Humboldt County, Nevada. I own the claims on the Snowdrift, and have been marketing specimens from this deposit for the last two years. The ground is *not* open to collecting; any persons found collecting on the ground will be charged with mineral trespass. People wishing to obtain specimens should contact Wayne and Dona Leicht (*Kristalle*).

Walt M. Martin
Fallon, NV

PAKISTAN GARNET COMPOSITIONS

Eighty-eight garnet specimens in the American Museum of Natural History collection have been analyzed using a fully automated 9-channel ARL-SEMQ electron microprobe analyzer as part of a comprehensive study of garnet compositions from worldwide occurrences. Natural almandine and grossular were used as standards for major elements, and the data were corrected for drift, dead time, background, mass absorption, secondary fluorescence, and atomic number using the procedures of Bence and Albee (1968). End-member mole fractions were calculated using the scheme of Rickwood (1968).

Included in our study were five garnets from the gem pegmatites of Pakistan (AMNH 92596, 92614, 48836, 97505, 98340), four of which had been previously semi-quantitatively analyzed by Kazmi *et al*. (1985) (vol. 16, no. 5, p. 393) using energy dispersive spectroscopy (EDS). The estimated Mn/Fe ratios for AMNH 92596, 96214, 48836, and 97505, as reported in Kazmi *et al*. (1985) are somewhat inaccu-

rate; more accurate estimates are given in Table 1.→

Based on several analyses of each specimen, all five Pakistani garnets appear homogeneous (compositional variation within each specimen less than 2 mole percent). Polished grain mounts, examined optically in reflected and transmitted light, showed no evidence of zonation.

Offered here, in abbreviated form, are the results of our analyses, which should be considered an addenda to Kazmi *et al.* (1985).

Ruth L. Lindsley
Consultant
Booz-Allen & Hamilton
Bethesda, Maryland

Joseph J. Peters
Sr. Scientific Asst.
Dept. of Mineral Sciences
American Museum of Natural History

Table 1. Microprobe analyses of garnets from Gilgit division of Pakistan (wt %)

	AMNH 92596	AMNH 96214	AMNH 48836	AMNH 97505	AMNH 98340
SiO_2	36.1	36.3	36.2	36.4	36.6
TiO_2	0.06	0.14	0.12	0.05	0.01
Cr_2O_3	0.00	0.00	0.00	0.02	0.00
Al_2O_3	21.0	20.9	21.0	20.9	20.8
FeO*	12.2	25.2	23.5	23.9	28.7
MnO	30.3	17.5	19.0	18.9	13.8
MgO	0.07	0.17	0.15	0.24	0.24
CaO	0.37	0.51	0.27	0.25	0.20
Na_2O	0.00	0.25	0.11	0.00	0.05
Total	100.1	101.0	100.3	100.7	100.4
Mn/Fe†	2.5/1	0.7/1	0.8/1	0.8/1	0.5/1
Mn/Fe‡	2/1	1/1	0.66/1	0.66/1	

AMNH 92596. **Spessartine (Alm28 Sp70 Pyr0).** Reddish brown, elongated crystal 3 cm high with core of gray quartz, from the Haramosh Mountains region, near Gilgit, Pakistan. See Kazmi, *et al.* (1985), p. 410, figure 31.

AMNH 96214. **Almandine (Alm67 Sp40 Pry1).** Reddish brown trapezohedron on matrix of white albite and colorless to gray quartz, from the Haramosh Mountains region, near Gilgit, Pakistan.

AMNH 48836. **Almandine (Alm55 Sp44 Pry1).** Small (largest crystal 1 cm), reddish brown trapezohedrons on a matrix of white albite, from near Gilgit, Pakistan.

AMNH 97505. **Almandine (Alm55 Sp44 Pry1).** Medium-sized (average 2 cm), reddish brown crystals associated with schorl and albite on a perthitic microcline matrix, from the Shingus pegmatites, Gilgit, Pakistan.

AMNH 98340. **Almandine (Alm66 Sp32 Pyr1).** Large (largest crystal 5 cm), striated, reddish brown crystals associated with white albite, silvery muscovite and gray quartz, from the Haramosh Mountains region, near Gilgit, Pakistan. Specimen was not analyzed by Kazmi *et al.* (1985).

*Total Fe reported as FeO. †Mn/Fe ratios present study.
‡Mn/Fe ratios from Kazmi *et al.* (1985).

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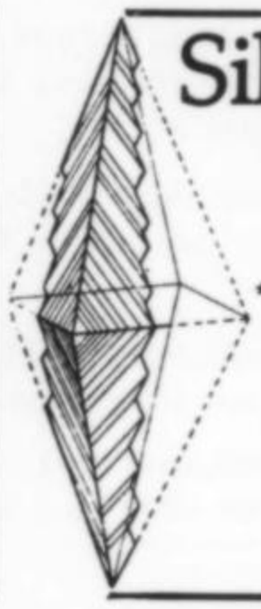

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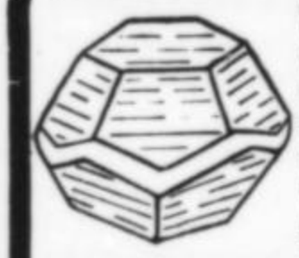

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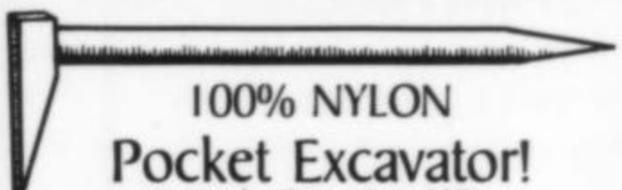

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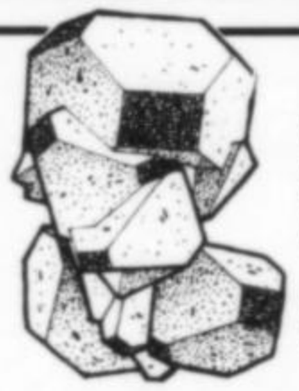

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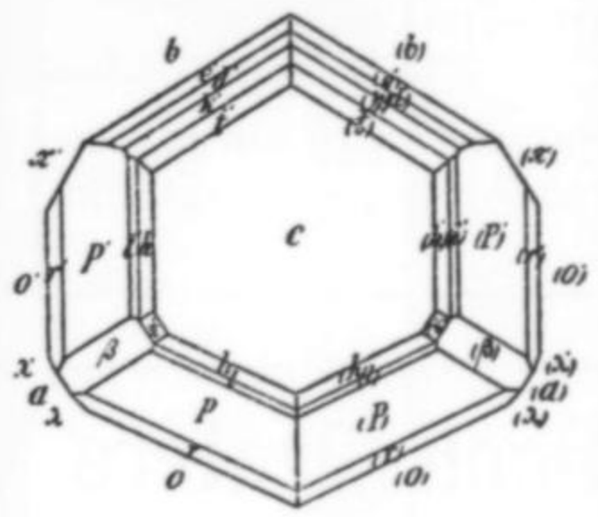

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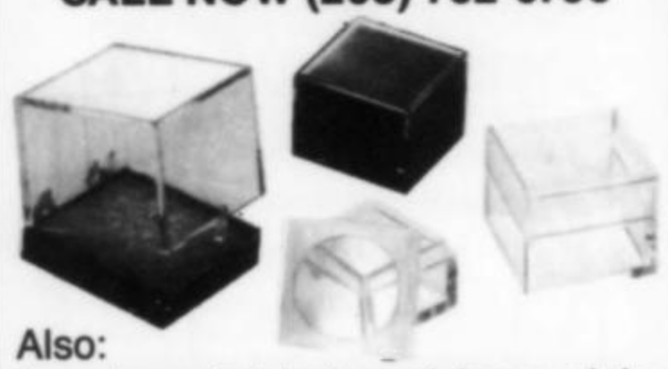

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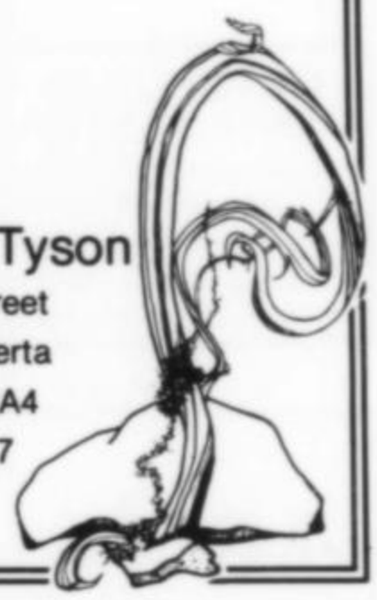

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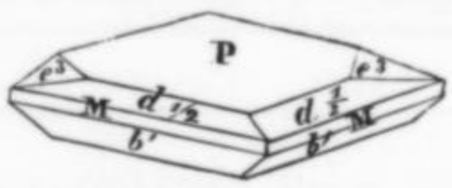

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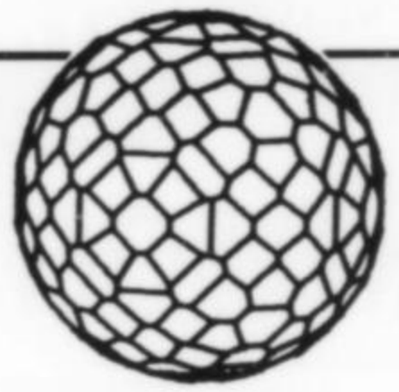

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Mar.	Cincinnati	Oct. 14-16	Pasadena
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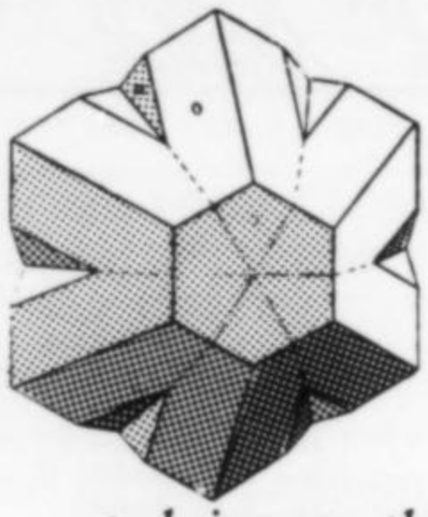

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