THE MINERALOGICAL RECORD

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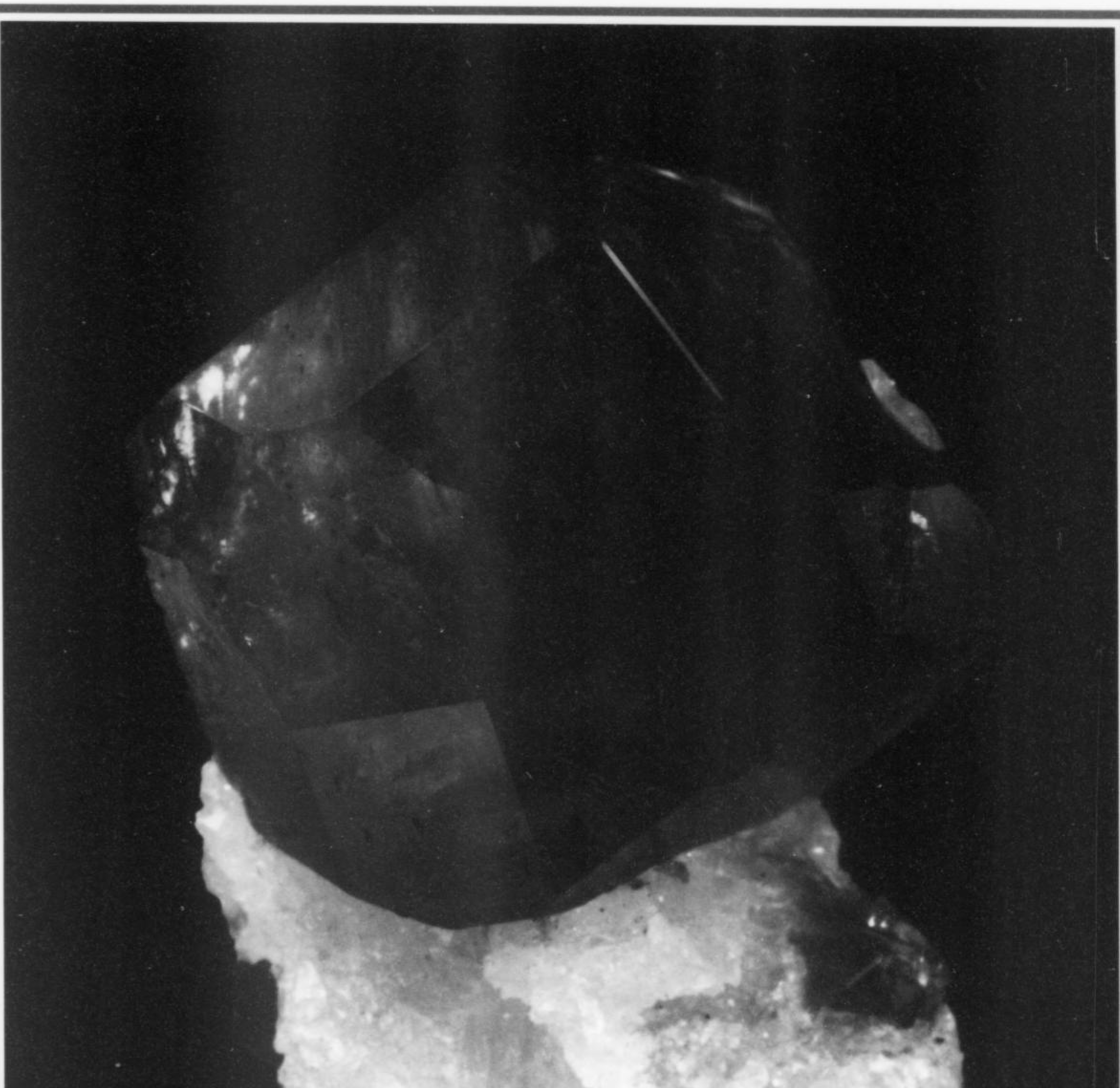


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The

Mineralogical Record

The International Magazine for Mineral Collectors

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Editing & Advertising
4631 Paseo Tubutama
Tucson, AZ 85750
Tel.: 520-299-5274
minrec@earthlink.net
minrecord@comcast.net

Subscriptions & Book Orders
P.O. Box 35565
Tucson, AZ 85740
Tel.: 520-297-6709
minrec@aol.com

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Sodalite crystal, 2.6 cm, from the Kokcha Valley, Badakhshan, Afghanistan. Herbert Obodda collection; Jeff Scovil photo.

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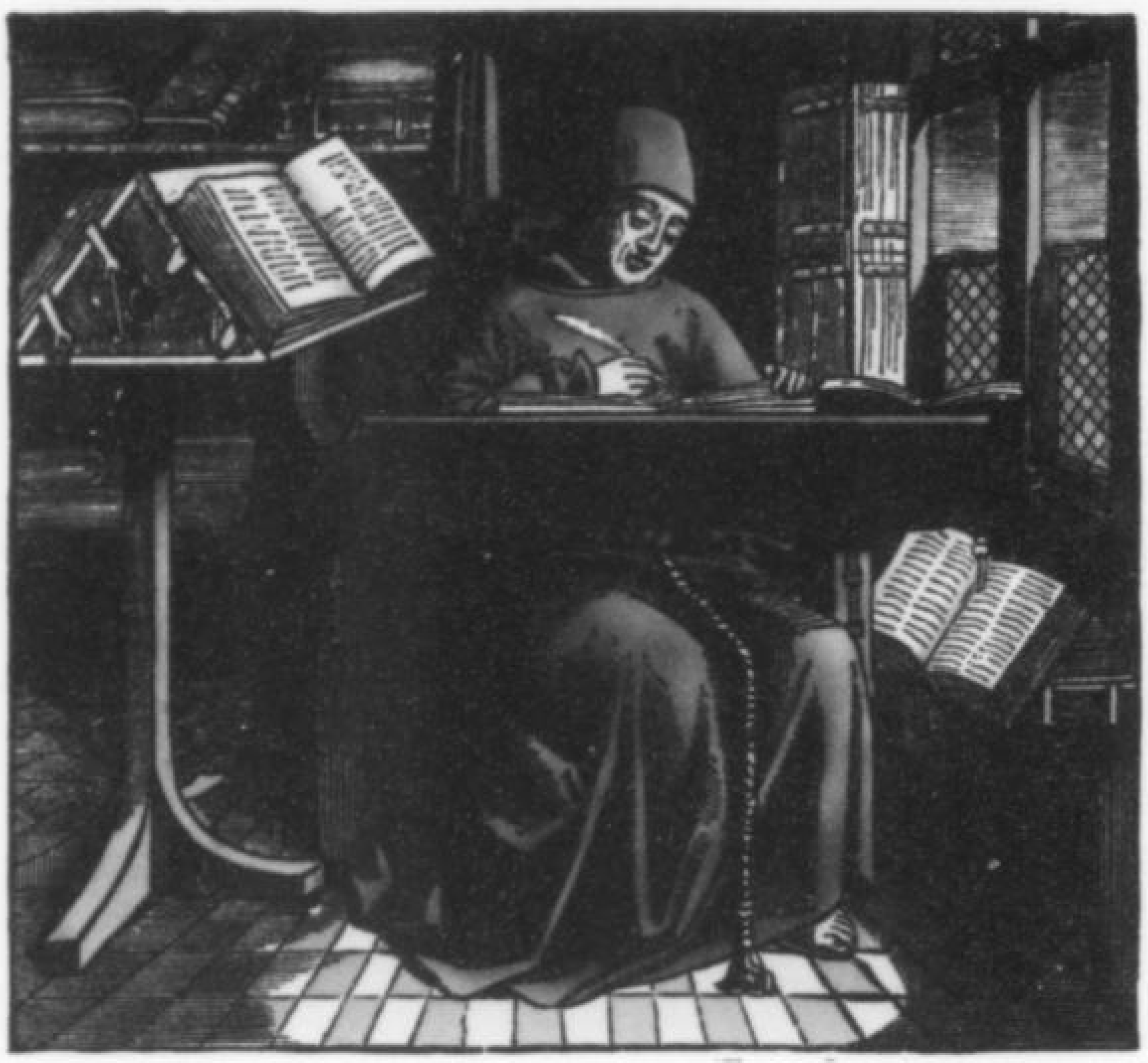


Notes from the Editors

Benefactors & Fellows

Back in 1926, Washington Augustus Roebling (1837–1926), one of the leading mineral collectors of his day, donated $45,000 (the equivalent of several million dollars today, depending on how you calculate inflation) to form an endowment to help publish the *American Mineralogist*. That endowment fund has grown substantially since then, and is still providing critical financial support for the journal. Likewise the Helen Dwight Reid Educational Foundation was established in 1956 to support worthy publications, and for many years has provided the financial and business support necessary for the continued publication of *Rocks & Minerals*. The *Mineralogical Record* has never enjoyed the luxury of an endowment or a supporting foundation to assure its continued survival, but it has received financial support from a number of individuals.

Readers will have noticed already our redesigned title page, and the box at upper left recognizing some very important people. The **"Benefactors"** are those individuals who each have donated major cash support (well into six figures) to the *Mineralogical Record* over the years. Without the support of these great gentlemen, the *Mineralogical Record* would not exist as you see it today, and perhaps not at all. We can never thank them enough, but from now on, at least, they will be permanently recognized on our title page.

Some of our supporters have contributed smaller amounts, and we are very grateful to them as well. Beginning this year, we will recognize donors of $1,000 or more on our title page as **"Fellows"** of the Mineralogical Record, for one year (six issues). Should they choose to donate again the following year, their name will be retained on the masthead for another six issues, and the years will be noted in parentheses. There may be other benefits for Fellows established in the future—stay tuned.

Some of the donated funds (depending on the wishes of the donor) will be added to our fledgeling endowment fund, the interest from which will help to support the magazine in perpetuity. This is an important cause—imagine what the mineral world would be like without the *Mineralogical Record*! We invite all of our readers to consider joining this esteemed group in assuring the future of our favorite publication. The Mineralogical Record, Inc. is an official non-profit scientific-educational organization under IRS code 501c(3), and donations are fully tax deductible.

Japanese Mineral Cabinet

We always like to direct our readers' attention to small cabinets that can be adapted for storing mineral specimens. The elegant chest shown here is advertised as a "Japanese Artisan's Chest," or *ko-cho-tansu*. Its clean lines are said to embody the Zen principles of simple beauty (*shibui*), subtlety and harmony. The four-drawer cabinet is made of kiri wood with a cherry finish, and measures 13 inches wide, 15 inches tall and 12 inches deep. The individual drawers look to be about 2¾ inches deep, so the chest can store specimens up to miniature size as well as some small-cabinet-size specimens. It can be ordered online from the Acorn Company in West Chester, Ohio; www.AcornOnline.com, item # 13783, $110.

Giant Diamond Discovered

Travis Metcalfe of the Harvard-Smithsonian Center for Astrophysics leads a team of researchers who have discovered an enormous diamond in space, measuring 4,000 km in diameter and weighing in at ten billion trillion trillion carats. The space diamond is located at a distance of 50 light years from Earth, in the Constellation Centaurus. Astronomers have dubbed it "Lucy" in a tribute to the Beatles song "Lucy In The Sky With Diamonds." Lucy, also known as BPM 37093, is actually a crystallized white dwarf. A white dwarf is the hot core of a star, left over after the star uses up its nuclear fuel and dies. It is made mostly of carbon and is coated by a thin layer of hydrogen and helium gases.

The white dwarf diamond is not only radiant but also harmonious. It rings like a gigantic gong, undergoing constant pulsations. "By measuring those pulsations, we were able to study the hidden interior of the white dwarf, in the same way that seismographic measurements of earthquakes allow geologists to study the interior of the Earth. We figured out that the carbon interior of this white dwarf has solidified to form the galaxy's largest diamond," Metcalfe said.

First Edition of *A. M. T.* Print Sold Out

As readers will recall, a complementary framing print by Wendell Wilson is being sent out with every copy of the *American Mineral Treasures* book purchased through the Mineralogical Record. These prints are available in no other way, and are exclusive to the sale of the book. The first print, entitled "The Mine with the Iron Door," depicts a fantasy underground collecting scene at the famous lost gold mine in the Catalina Mountains above Tucson. The print was produced in a signed and numbered edition of 300 copies, printed on 100% cotton paper. We recently sold our 300th copy of the book, and consequently the supply of the prints is now exhausted.

However, the offer of a framing print is still open. Wendell has reproduced a new painting, depicting a fantasy underground collecting scene at the Old Yuma mine near Tucson (appropriate, inasmuch as he wrote the Old Yuma mine chapter in the book). This one also has been prepared in a signed and numbered edition of 300, available only to purchasers of the book from the Mineralogical Record. Orders can be placed through the "Bookstore" section at www.MineralogicalRecord.com, or through the Circulation Manager at minrec@aol.com.

New Mineral Museum

It is always a pleasure to hear of the opening of a new mineral museum! Most recently the Vermont Museum of Mining and Minerals opened in Grafton, Vermont, in a small cottage at 55 Pleasant Street. Displays include the minerals of Vermont (naturally), the history of mining in Vermont, special guest exhibits by members of the Brattleboro Mineralogical Society, specimens from the collection of the late Ernie Schlichter (1929–2007), a hands-on fluorescent minerals exhibit, uncut gem crystals, special children's exhibits, and fossils. The museum will be open weekends and major holidays from 10 a.m. to 4 p.m. (except for the lunch hour, noon to 1 p.m.), from May 30 through October and at other times by appointment. For information or an appointment contact Sue Haddon (author of the "Eden Mills, Vermont" chapter in the *American Mineral Treasures* book) at 802-875-3562 or at 802-843-2300.

How to Avoid Embarrassment After You're Dead

Sadly, we all get old and die. So far, no approach for avoiding this has worked, not even Woody Allen's idea ("I was hoping not to be there at the time"). When it happens, we may very well publish an obituary notice for you, accompanied by a photo. Where will this photo come from? Will it be flattering? How do you wish to be remembered as looking?

There is no need to leave this to chance. Simply send us a good photo print of yourself now, one you really like, taken at any time in your life, and we will add it to our extensive portrait achive for possible future use some day. You might as well make your own choice now, while the opportunity is available. Send it to the editors at 4631 Paseo Tubutama, Tucson, AZ 85750.

2,675 Biographies!

The **Biographical Archive** on our website currently contains 1,127 biographical entries, and Curtis Schuh's recently posted **Bio-bibliography** of mineralogy and crystallography contains another 1,548 entries. That's a grand total, so far, of 2,675 biographies! Although no more will be added to Curtis's work, the Biographical Archive is constantly growing. If readers should come across labels or information, or should they need information on someone in particular, please contact the editor and we will research it for you. We have many historical research tools and resources at hand.

The Bad Old Days

In 1946 an early California mineral dealer, Albert Everitt (1881–1950), wrote as follows in a grateful letter to Peter Zodac, who had founded *Rocks & Minerals* magazine 20 years before:

> A few of us remember away back when there wasn't as much as a pamphlet published, or any information obtainable, regarding mineral collecting. The present-day collector will never know what efforts we put into getting together those early collections. The few dealers were of little help in giving away any information; their lists of customers were locked in the strongbox and exchanges were practically unknown. Today members of the various mineral societies are scattered throughout the length and breadth of the United States—thanks to the untiring efforts of Peter Zodac.

Died, George S. Switzer, 92

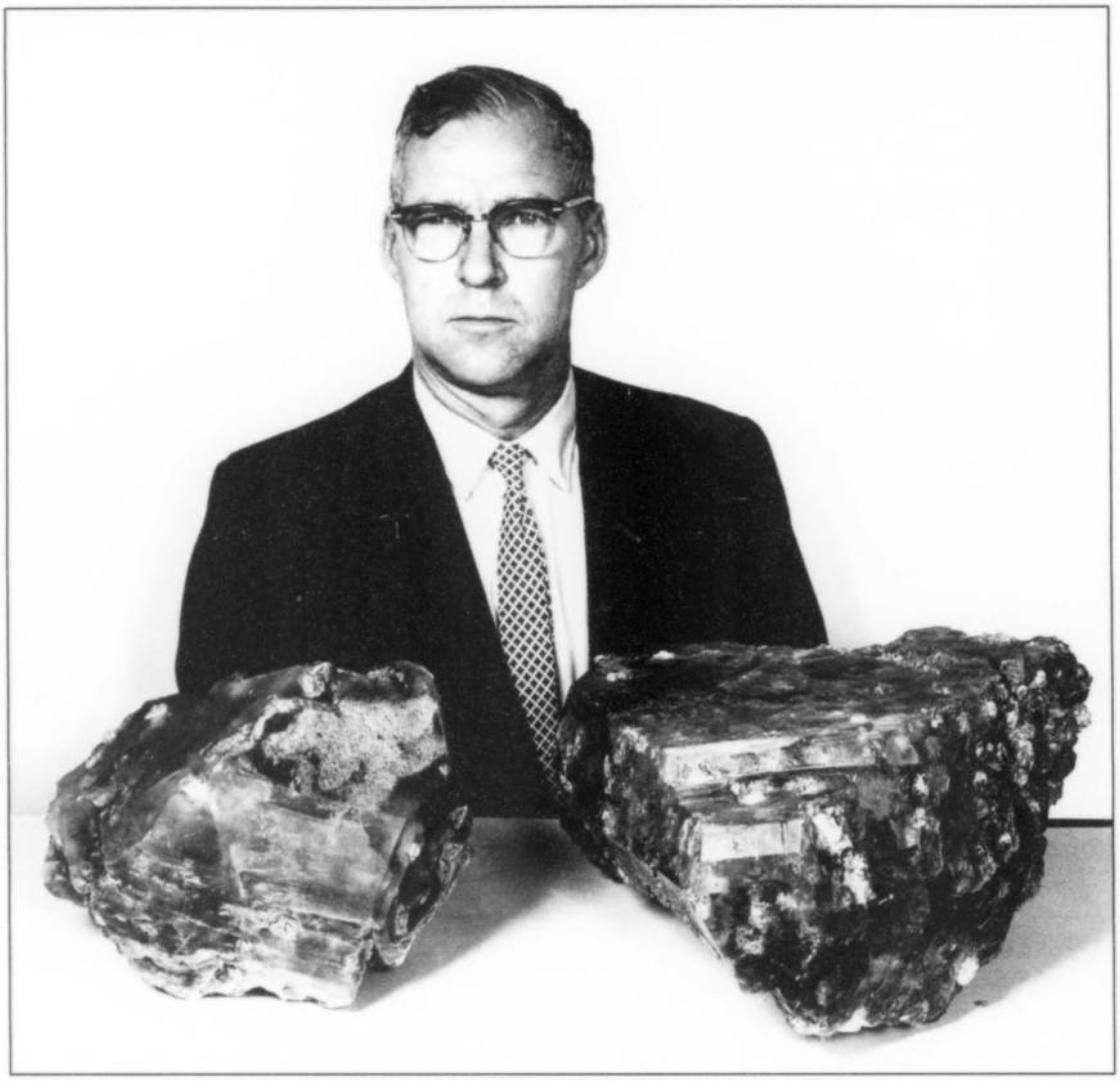
George Shirley Switzer, former Smithsonian Curator of Minerals, was born in Petaluma, California on June 11, 1915, the son of Charlotte Elizabeth Ryan and Albert "Bud" James Switzer, a mechanic. He graduated from Santa Rosa Junior College in 1935, received his B.A. from the University of California Berkeley in 1937, his M.A. from Harvard in 1939, and his Ph.D. from Harvard in 1942.

Dr. Switzer was an instructor at Stanford University in 1939–1940 and at Harvard University in 1940–1945. He worked as a crystallographer for the Majestic Radio and TV Corporation in 1945–1946, then served as director of research for the Gemological Institute of America in 1946–1947. He joined the US Geological Survey as a mineralogist in 1947–1948, after which he took a position as associate curator in the Division of Mineralogy and Petrology at the National Museum of Natural History, Smithsonian Institution, where he served for 16 years (1948–1964), including a stint as Chairman of the Department of Mineral Sciences (1964–1969). He stayed on as Curator Emeritus from 1969 until his retirement from the Smithsonian in 1975.

Switzer was elected a Fellow of the Geological Society of America and the Mineralogical Society of America, and served as Secretary of the Geological Society of America (1960–1966). He was a member of the American Gem Society and past Secretary of the Examinations Board for the Gemological Institute of America. He was also the author of three articles for the *National Geographic Magazine*, (in November 1951, April 1958 and December 1968), of entries for the *Encyclopedia Britannica* and of the book *Diamonds in Pictures* (1967), and he co-authored *Gemology* (1979) with Cornelius S. Hurlbut, Jr. Additionally, Switzer taught undergraduate evening classes at American University for many years.

Switzer was involved in the description and naming of five new mineral species during his career: veatchite (1950), ordoñezite (1955), paradamite (1956), paratellurite (1960) and galeite (1963). In 1967, John S. White and Peter B. Leavens described and named the new mineral ***switzerite***, $Mn_3(PO_4)_2 \cdot 4H_2O$, in his honor. In 1986, Pier F. Zanazzi redefined switzerite as $Mn_3(PO_4)_2 \cdot 7H_2O$ and renamed the original type material as ***metaswitzerite*** $Mn_3(PO_4)_2 \cdot 4H_2O$.

During 1972 and 1973, Switzer, his staff and colleagues at the Smithsonian Institution worked on lunar samples from the Apollo 15 and Apollo 16 missions.



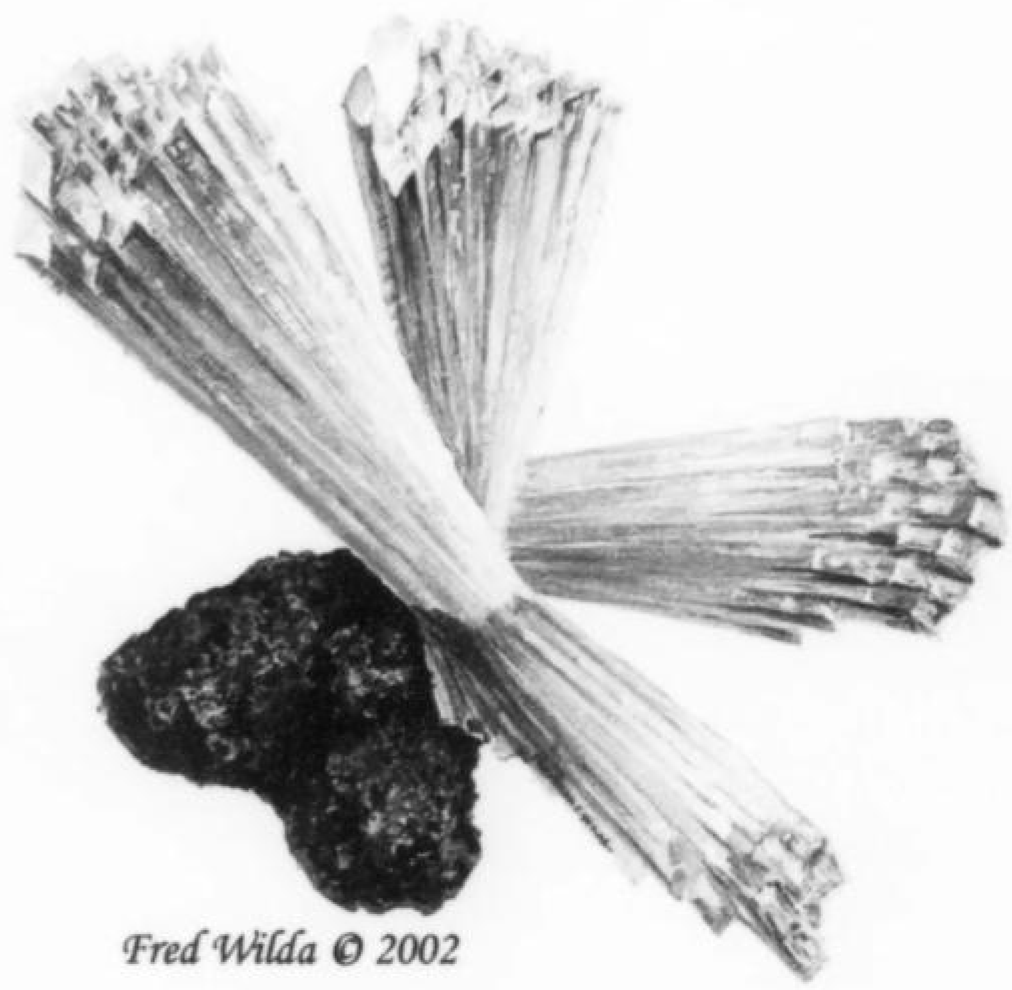
George S. Switzer (1915–2008), shown here in the 1950s with two large crystals of kurnakovite.

In 1958, Switzer's ongoing efforts to develop a major national gem collection were rewarded with the gift of the Hope Diamond by the famed New York jeweler Harry Winston. The Hope Diamond is the single most popular item in the entire Smithsonian Institution. On April 27, 1962, Switzer, unarmed and traveling alone, hand-carried the Hope Diamond to Paris for a special exhibition, "Ten Centuries of French Jewelry." As with all stories about the Hope Diamond and its purported curse, things soon started going wrong. Pan Am flight 116 departed Friendship Airport on time but on its first scheduled stop at Philadelphia a bad landing damaged the plane and caused the remainder of the flight to be cancelled. Forced to maintain secrecy and improvise, Switzer caught a flight to New York and then Pan Am flight 72 to Frankfurt, Germany. He cabled his French contacts of the situation and worried about the German customs officials. Would he be guilty of smuggling? Fortunately, he was able to remain in the transit lounge and wait for his Air Maroc flight to Paris which arrived nine hours behind his original schedule. Greeted by two frantic Louvre museum staff, he was whisked away by car. Just a block from his destination the car was involved in a minor auto accident.

Retiring from the Smithsonian Institution in 1975 to pursue his decades-long hobby of Azalea propagation, he enjoyed 30+ years of active and productive retirement, including the describing and naming of a new Azalea cultivar, *Nannie Angell,* in 1992. In 1999, he received a Certificate of Recognition for his years of service as a Director of the Azalea Society of America and as the Assistant Editor of the *Azalean*, as well as his Charter Membership and many years service as President of the Ben Morrison Chapter of the Azalea Society of America.

George Switzer died on March 23, 2008. He is survived by his wife of 68 years, Sue Joan Bowden Switzer, sons James R. Switzer and J. Mark Switzer, eight grandchildren and 12 great-grandchildren. He was preceded in death by his sister Dorothy N. Parr and daughter Patricia Sue Sengstack. He was a Charter Member of the American Chestnut Land Trust, and gifts in lieu of flowers can be sent to ACLT, P.O. Box 2363, Prince Frederick, MD 20678.

Note: Email address for Wendell Wilson is now minrecord@comcast.net



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Paleontologist on the Point of a Discovery

Wendell E. Wilson © 1992

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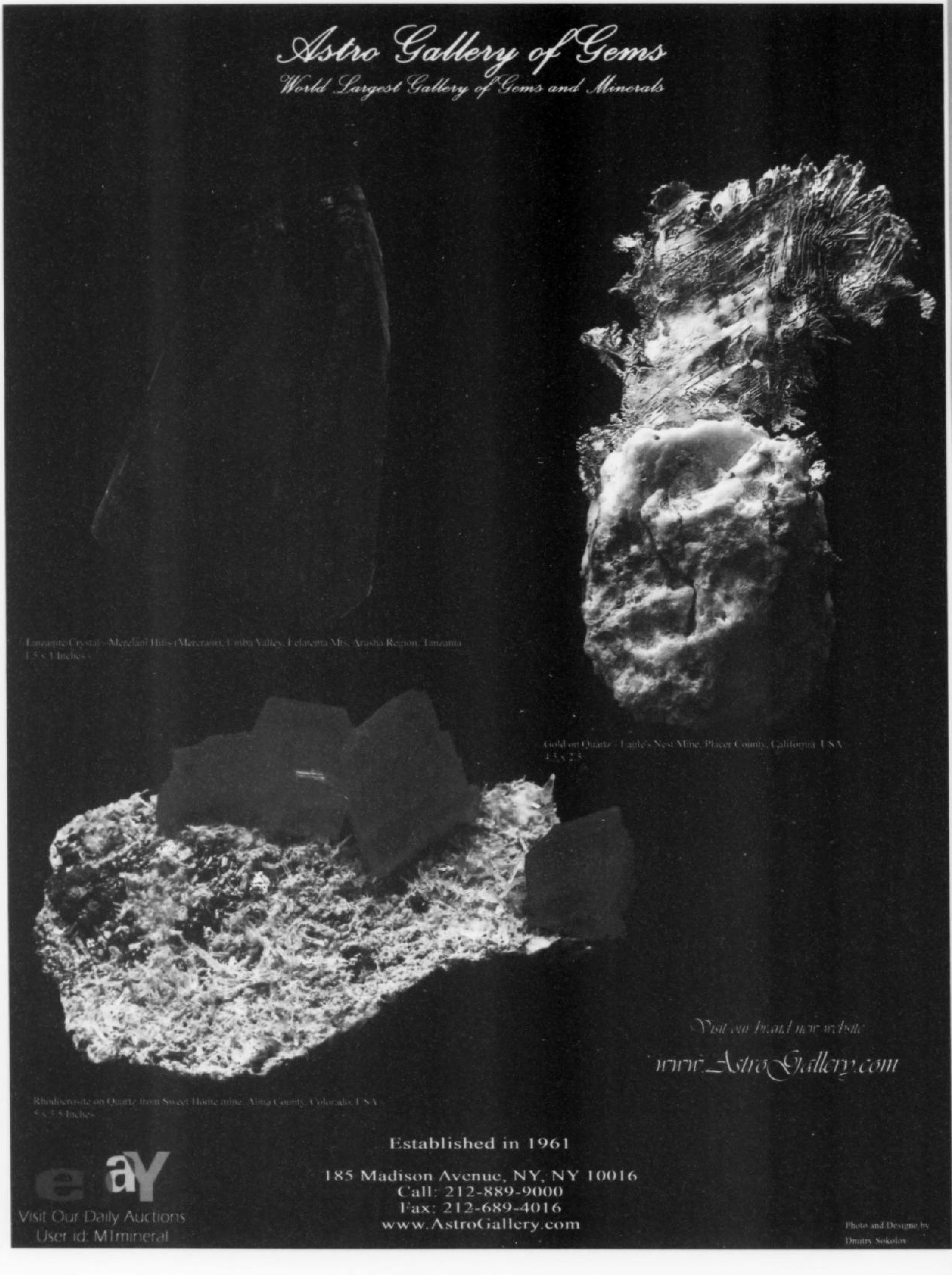

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Green Apophyllite *from* Bidkin, Aurangabad, India

Sami Makki
Muhammad F. Makki
Matrix India
B-36 Abhimanshree Society
Pashan Road, Pune, 411008 India

In late 2006 an extraordinary cavern complex lined with green apophyllite crystals was discovered at the bottom of a well near the small town of Bidkin, about 25 km from the old city of Aurangabad in Maharashtra Province, India. Several tonnes of fine specimens were collected there during the summer of 2007.

INTRODUCTION

The first spotty information about a new find of green apophyllite in India reached Europe in the fall of 2006. At this time it was not yet possible to comprehend the full extent of the find, although a few beautiful specimens were on display for a short time at the Munich Show. In the beginning of May 2007, just before the onset of the monsoon, the occurrence was pinpointed to a well which can only be entered during the dry season. The photos shown here were taken during the mining of specimens that followed (Makki and Makki, 2007).

Maharashtra's extraordinary richness in zeolites is a perpetual source of mineralogical surprises. The most recent discoveries to gain great fame took place in 2001 and 2004 near the village of Mominakhada, close to Rahuri in the Ahmednagar district of Maharashtra (Makki, 2002). Afterwards there came a "breather," with no more spectacular finds—if one doesn't count the continuing and routine market offerings of zeolites and associated minerals from the quarries around Mumbai, Nasik, Pune, Ahmednagar, Jalgaon, etc.

Formerly, most zeolite specimens were collected from basalt quarries in operation near these cities, but about 20 years ago the dealers and runners[1] discovered that zeolites could also be found in the many wells which had been dug in these areas over the preceding 50 years. When the water level in the old wells falls during the dry season, irrigation needs become threatened; thus, to improve the reliability of the water supply, old wells are now being deepened, and cavities with zeolite mineralization are being found from time to time in the course of the work.

THE BIDKIN WELL DISCOVERY

In June 2006 some honey-gatherers were passing by an old well when they noticed many zeolite specimens lying about on the trash dumps. This well is in the village of Bidkin, about 25 km from the old city of Aurangabad. The nearby town of Ajanta is famous for its 1000-year-old Buddhist frescoes and temple carvings. Runners from Ajanta soon learned of the discovery and visited the well; a

[1] A "runner" is someone who "runs" with minerals from the mine or other exposure to dealers, to sell specimens to them. Many runners buy specimens on the spot on their own accounts, with their own money; other runners work for the dealers for some sort of salary, eventually receiving bonuses if the dealers can sell the specimens to interested parties. Zeolite occurrences like the one described here are not at all common, but rather are rare—however, when one is found, very many specimens can result. It is exactly for this reason that "runners" in India serve as middlemen and/or agents.

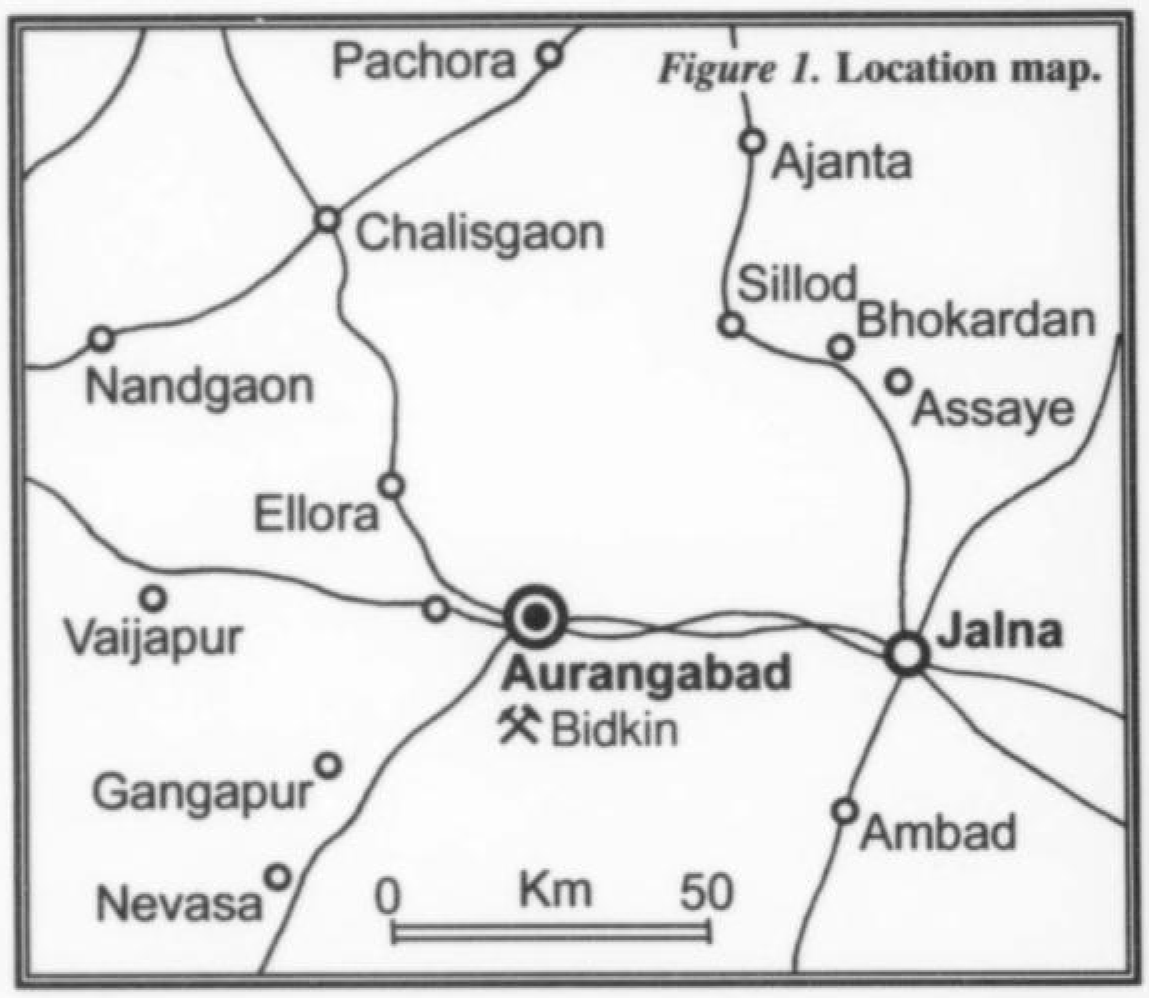


Figure 1. **Location map.**

Figure 2. **The hoisting engine for lowering people and supplies down into the well, and raising specimens out.**

Figure 3. **The Bidkin well.**

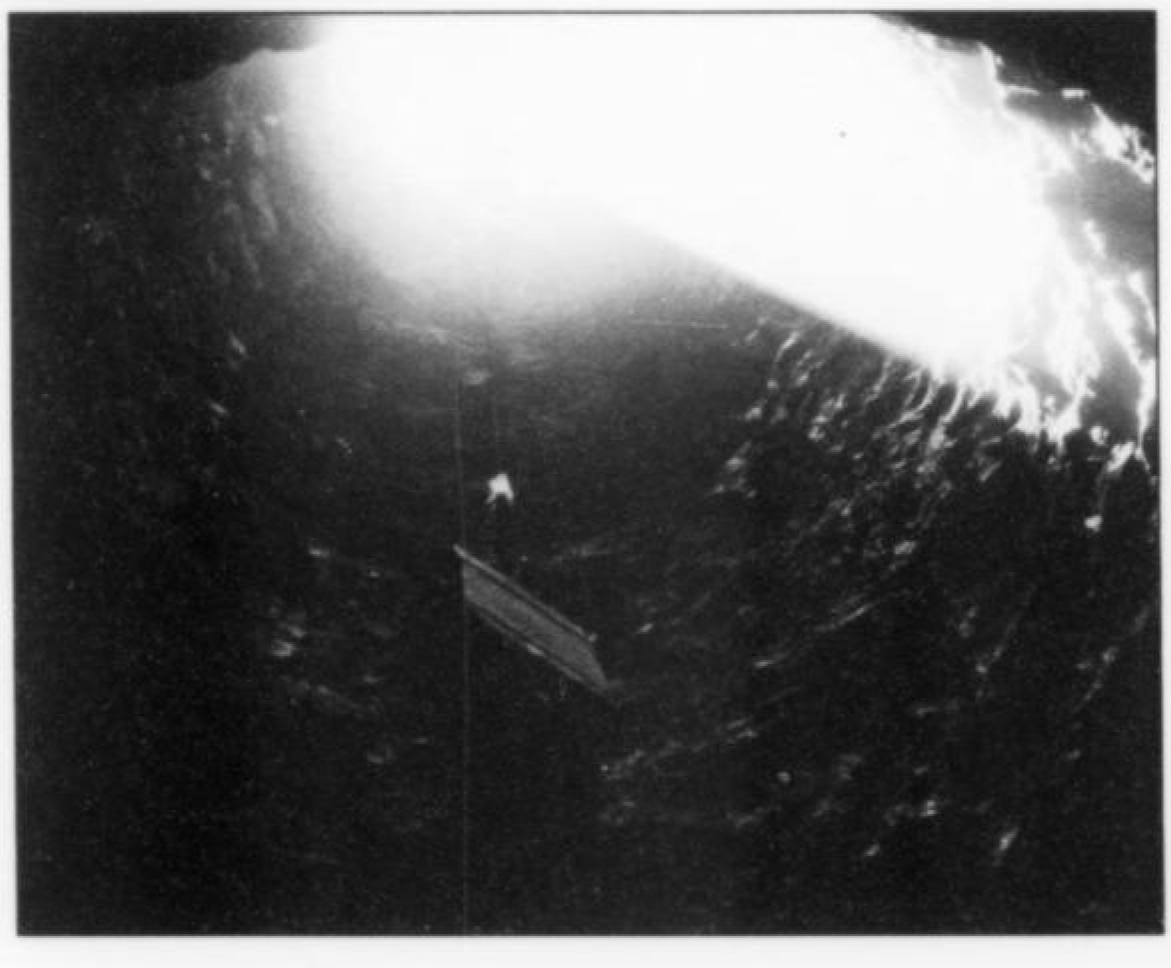


Figure 4. **A crate of supplies being lowered down into the well.**

few especially adventurous runners tried to descend into the well to check out the source of the zeolites.

At a depth of about 25 meters they came upon a zone of spectacular cavities lined with green apophyllite crystals. With the help of torches and candles to pierce the gloom, they were able to liberate a few specimens from the rock. Initially, of course, they were not equipped with the necessary tools or lights, and were thus unable to effectively mine cavities of such size at such a depth.

While the runners were squabbling over the first finds and their distribution, the monsoon rains set in. In a very short time the well was filled to its brim with water. The next chance to work the cavities came the following summer, several months later.

In March 2007, the runners from Ajanta organized themselves into small groups for collecting green apophyllite from the well in Bidkin. But bitter contention soon arose among the runners over control of the well, and heated arguments broke out. Most of the 100 or so runners from the village of Ajanta were connected by family or some other sort of relationship, and these men formed a large clan. The village elders finally had to intervene to stop the

Figure 5. **At the bottom of the well it intersected the central portion of a cavern system in the basalt; the openings extend in both directions as seen here.**

Figure 6. **A little drilling and blasting was required to loosen blocks of basalt and gain access to the deeper crystal-lined fissures.**

Figure 7. **A toad on apophyllite.**

Figure 8. **One of many bats inhabiting the well.**

quarrels. Disputes about particular issues persisted, but all of the parties involved were united by the fact that the cavities had to be worked and the minerals had to be taken out before the onset of the next monsoon.

The issue of who would be permitted to work the cavities was of greatest concern, and led to renewed disunity and contention. After many long conferences and arguments, all finally came to agree that the best solution would be to have an outsider conduct the work, receiving an appropriate compensation; this would make it possible to avoid further strife, and all would share in the profits.

OUR MINING OPERATION

The general opinion was that the only people with the necessary expertise and experience to successfully clean out cavities of such

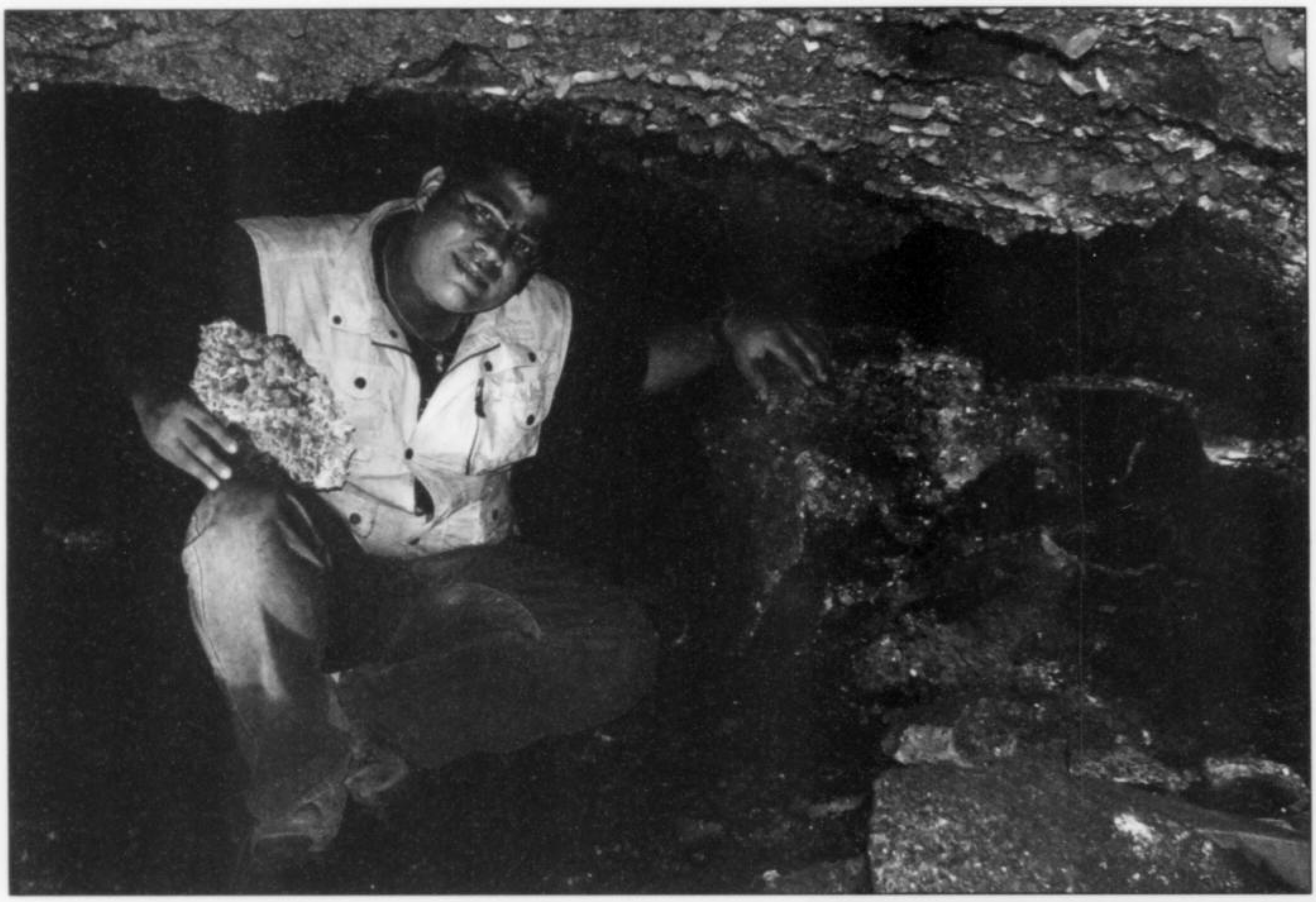
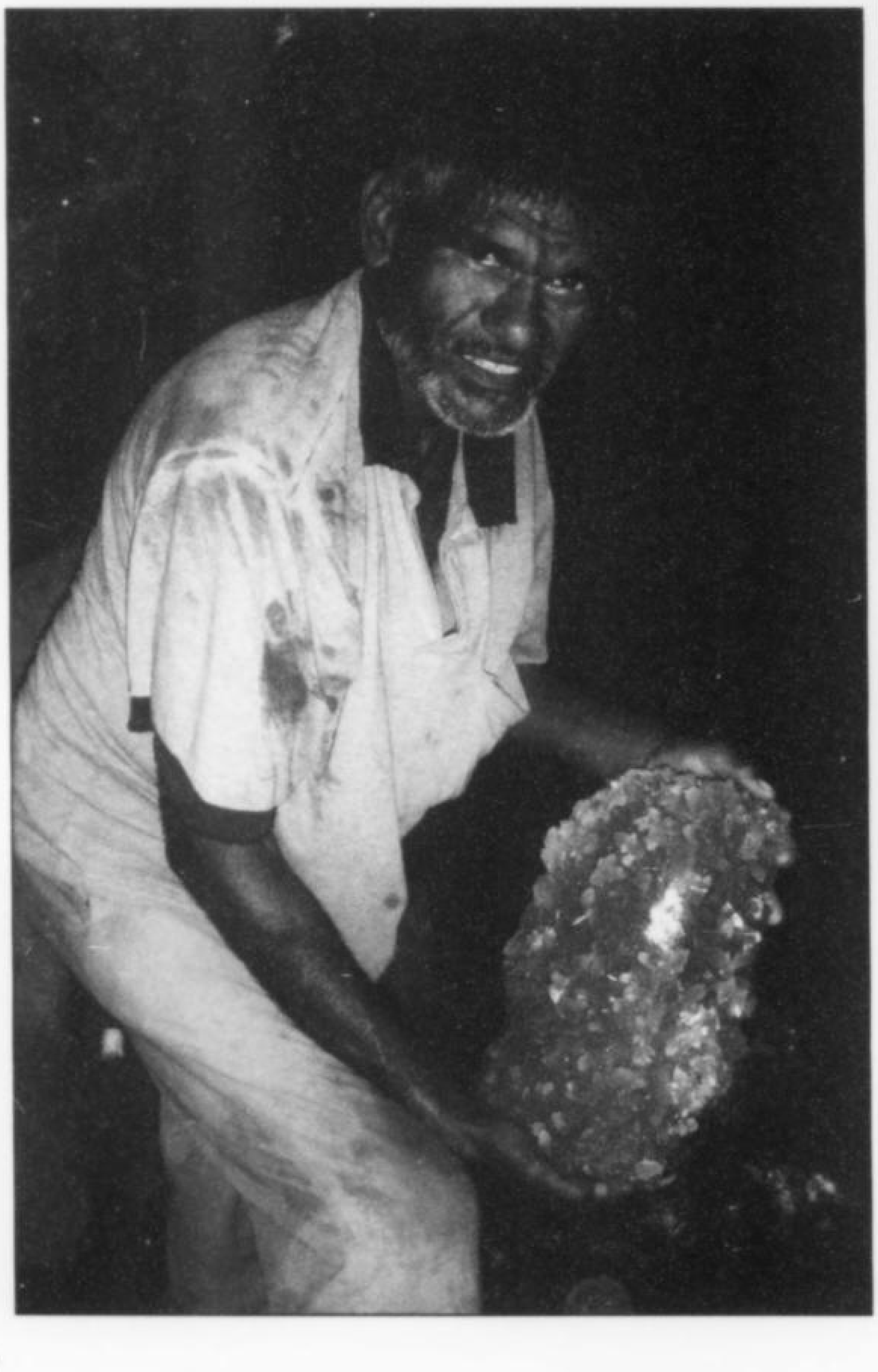
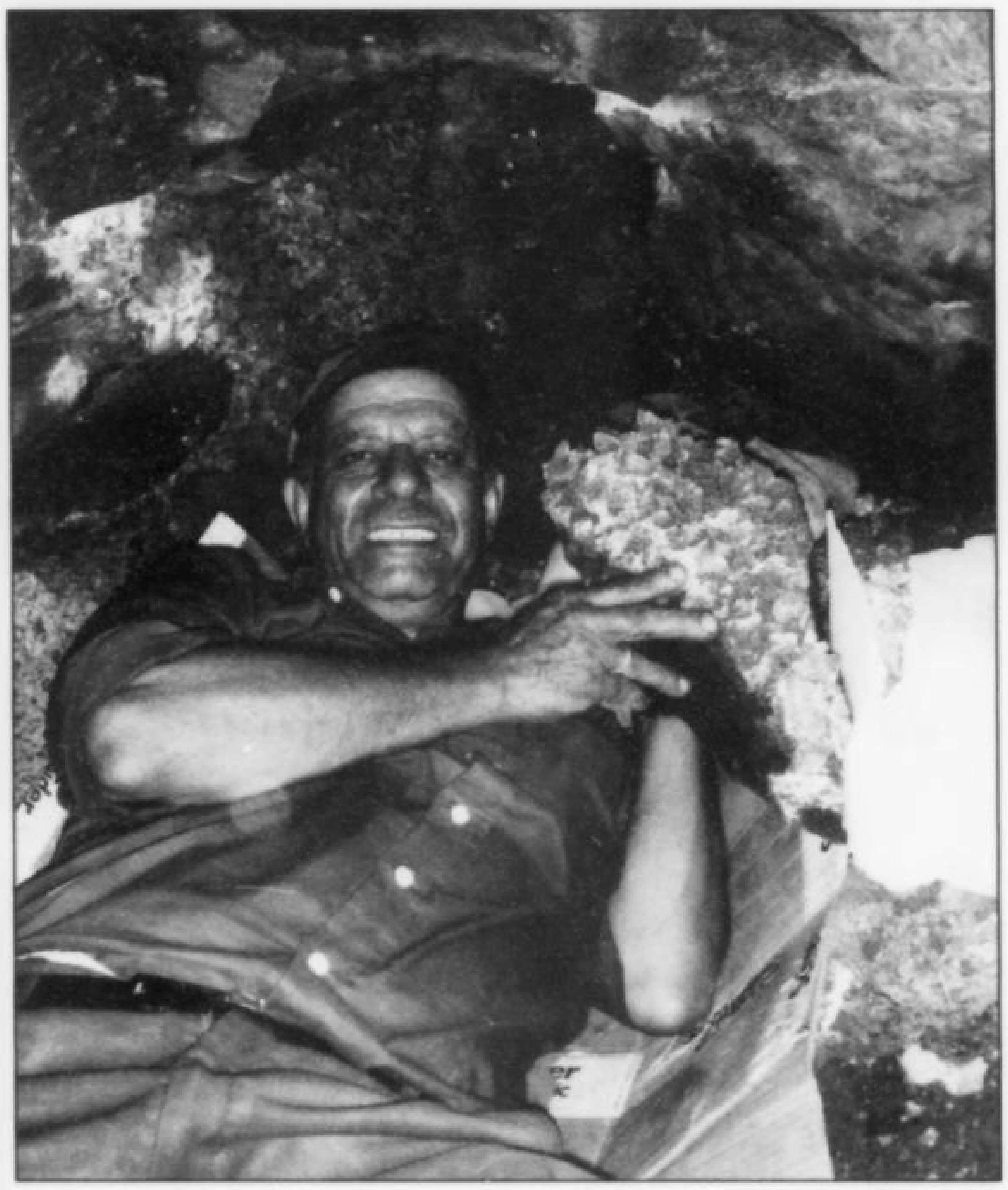


Figure 9. **Sami Makki beside apophyllite-coated basalt blocks and fissures.**

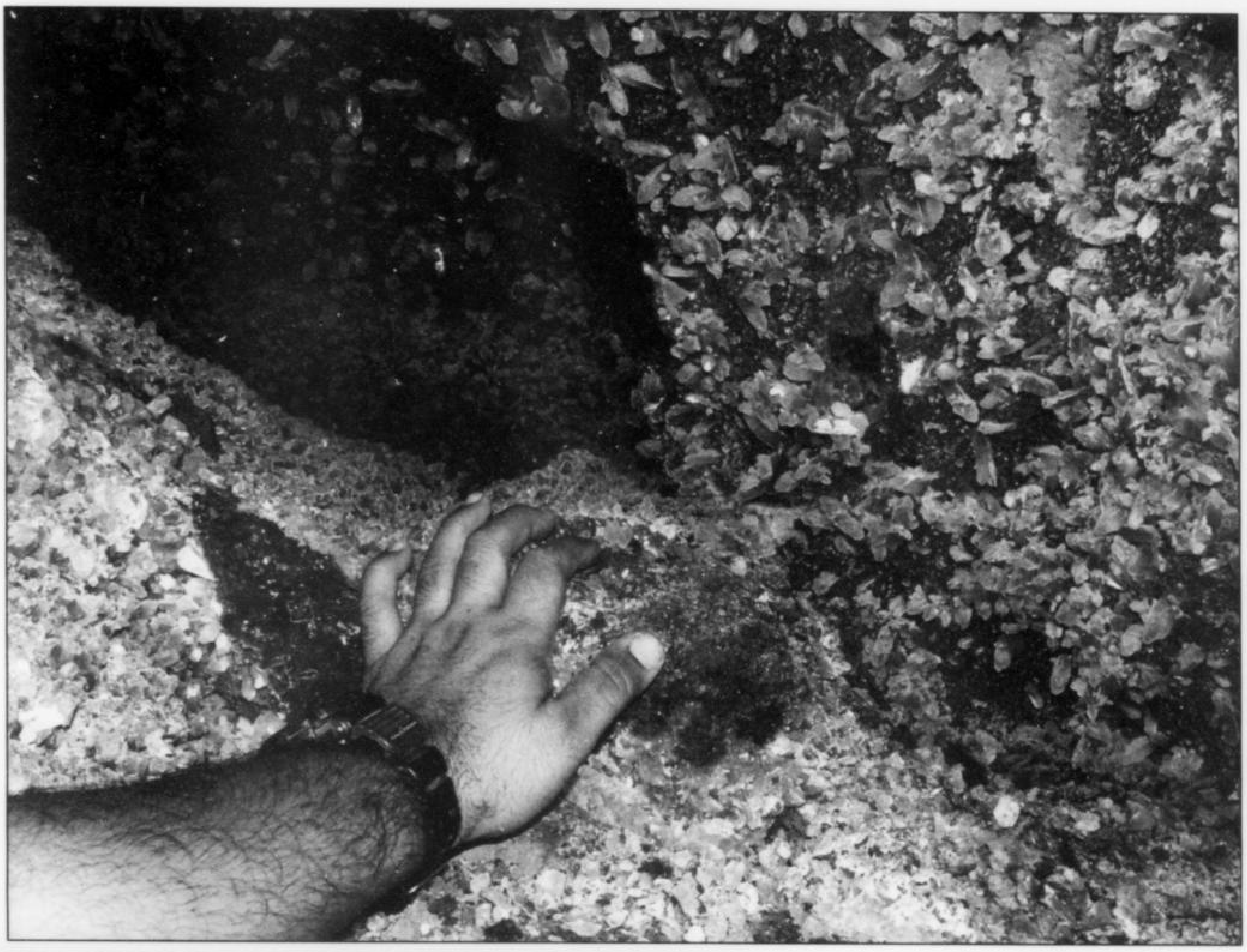
Figure 11. **M. Makki withdrawing apophyllite specimens from a high cavity.**

Figure 10. **An apophyllite specimen freshly removed by one of the miners.**





size, and at such a depth, were the authors. So the village elders contacted us and offered us the chance to work at the site. Soon we were making the necessary arrangements for workers, equipment and other indispensable things. After preparations were complete, we began work in the middle of April. The temperature at that time was 42° C (108° F). Although we had built small, flexible sheds out of matted bamboo, we all slept in the open field directly adjacent to the well. Unfortunately the freshly cultivated soil in the fields was black; it got very hot during the day and remained hot until after sunset. The environment at the bottom of the well, however,



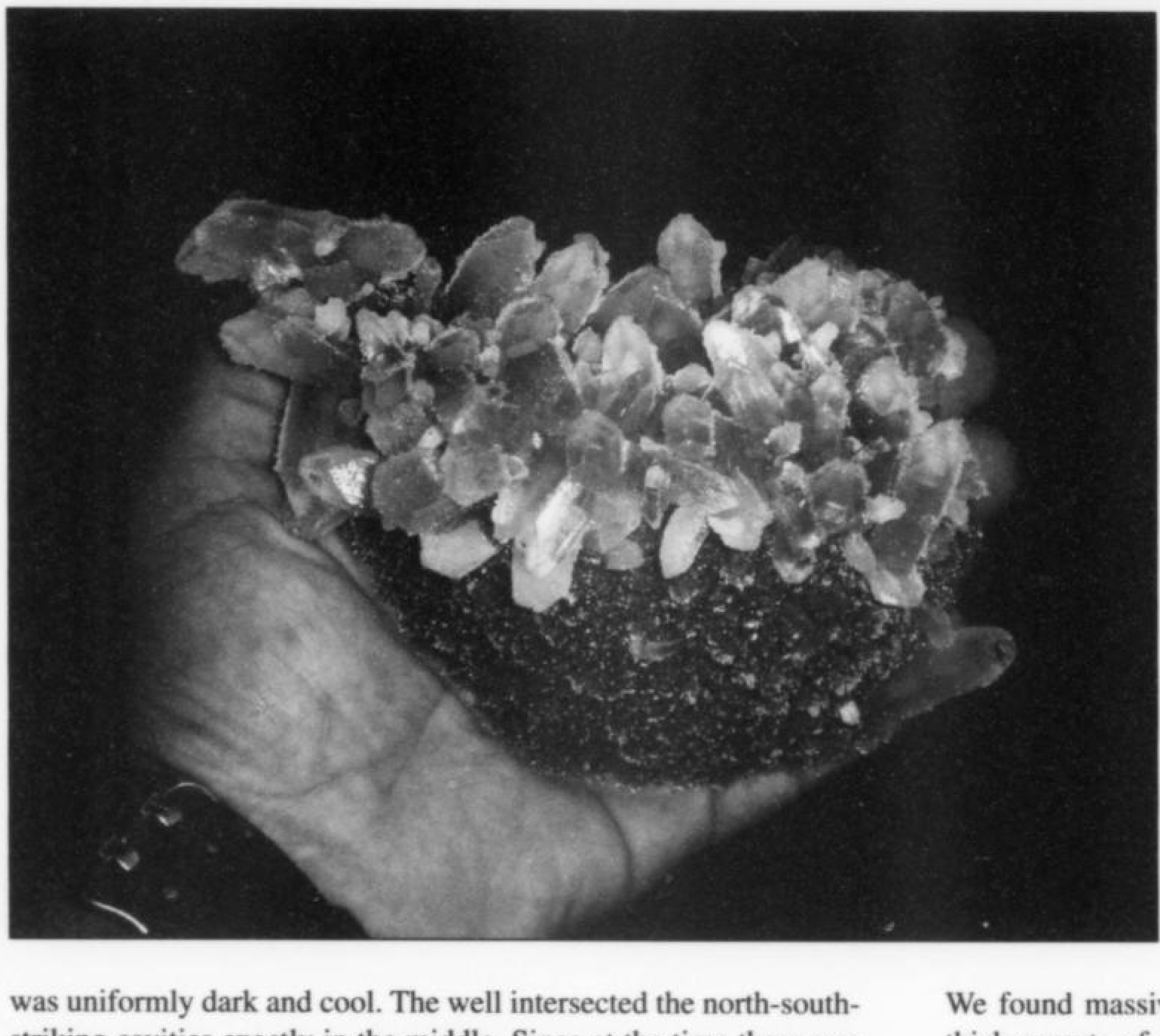


Figure 12. **Apophyllite-coated cavern walls.**

Figure 13. **A freshly collected apophyllite specimen.**

was uniformly dark and cool. The well intersected the north-south-striking cavities exactly in the middle. Since at the time there was hardly any water in the well, the cavities were inhabited by bats and toads. We prayed that no snakes had taken up residence.

It became clear that green apophyllite crystals occurred as thick overgrowths on the ceilings of cavities, where they rested on a substrate of tiny, leafy crystals of pink stilbite. The growths of green apophyllite on the floors of the cavities resembled thick carpets of grass; a few of the crystals have tiny sugarlike encrustations. We found massive slabs and huge boulders of basalt covered by thick carpets of green apophyllite crystals. The cavities extended for as far as the eye could see, flexing and twisting laterally into dark niches.

Bats fluttered constantly around our heads and faces, and flew constantly into and out of the well and the crystal-lined cavities, protesting with constant chirping our invasion of their cool refuge. The toads sat in water puddles below, in the refuse heaps, and began croaking in unison at each onset of darkness. Regrettably the bats

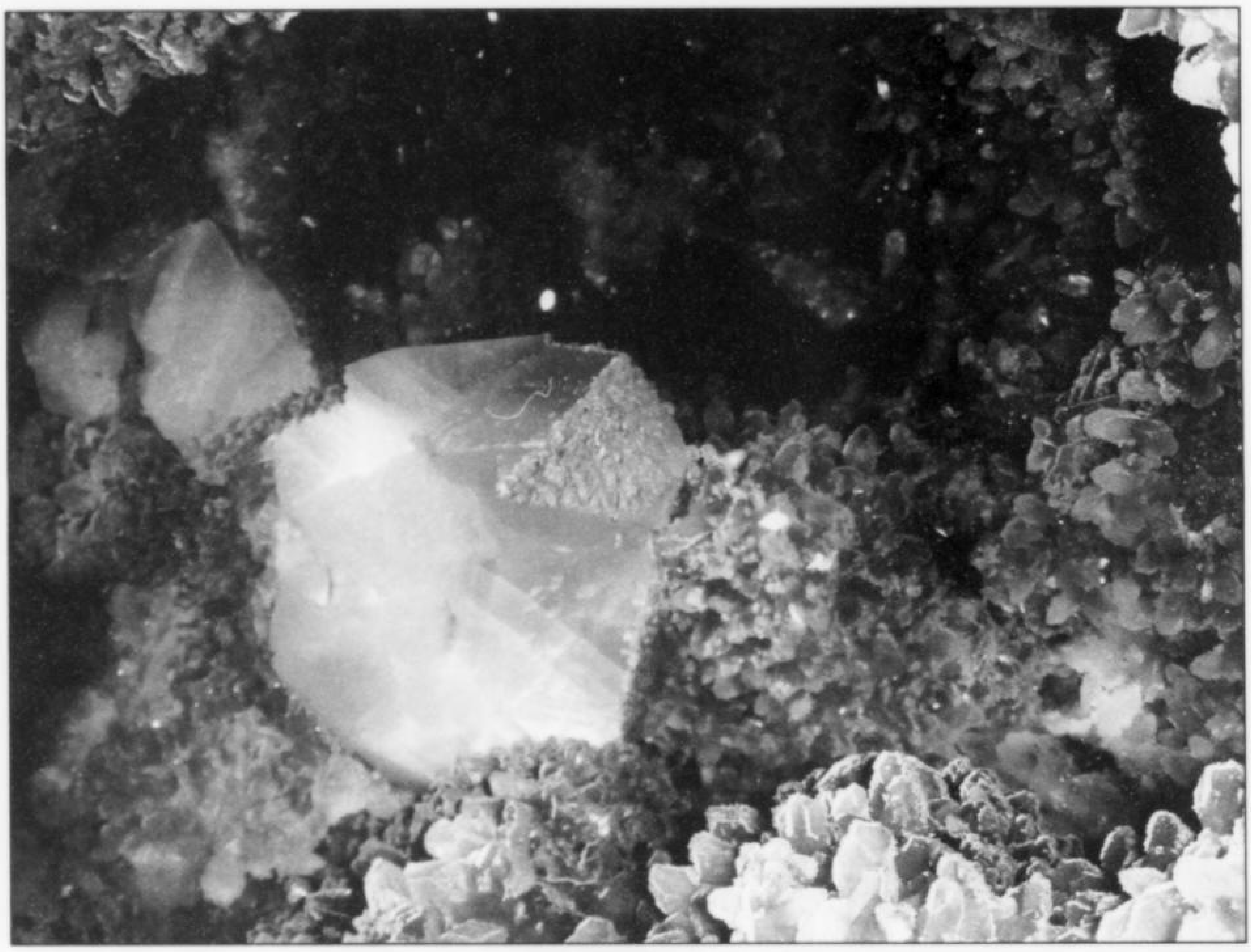


Figure 14. **Large calcite crystals on apophyllite in a cavity.**

Figure 15. **Apophyllite-lined surfaces extending back into the dark reaches of the cavern.**

and toads grew scarcer as our work went on. In the vegetation all around the well there were great numbers of snakes, and thus also mongooses.

When collecting the specimens from the ceilings and floors of the cavities we moved horizontally, and we were able to see on the floors many large, deep holes, pits and fissures which reached down vertically as much as 3 meters. These too were all sprinkled or carpeted with green apophyllite crystals. On the side walls of the cavities were deep horizontal openings reaching from 1.5 to 2 meters into the country rock, and in these openings we found another type of crystallization: isolated, diverging apophyllite crystals on pink matrix, with no encrustations at all. At these sites there were also a few rhombohedral calcite crystals.

The basalt in the well showed former gas pockets and small vesicles to 1 cm diameter, lined by velvety coatings composed of countless hemispheres, to 1 mm, of a material which has yet to be tested.

Figure 16. **Apophyllite and white heulandite crystals lining a thin fissure in the ceiling of the cavern.**

We had to work hectically in order to finish collecting the apophyllite before the monsoons began again, and so we took out 3 or 4 tonnes of specimens which we offered for sale at mineral shows. After our labors were finished we were very satisfied, and we felt very grateful for the help and co-operation of all who took part. It does not often happen that one can work in such huge cavities and take out such great numbers of fine specimens.

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The Barite Roses of Oklahoma

David London
ConocoPhillips School of Geology and Geophysics
University of Oklahoma
100 East Boyd Street, Room 810 Sarkeys Energy Center
Norman, Oklahoma 73019

Oklahoma's centennial anniversary in 2007 marked an appropriate milestone to reconsider what is known about the geology and origins of the well-known "barite rose" crystal clusters. Few mineral specimens are as distinctly recognizable and traceable to source as the Oklahoma barite roses, also known as "rose rocks" and "barite-sand rosettes."

INTRODUCTION

In private and public collections around the world, the barite roses with sand inclusions from Oklahoma are cataloged and displayed as minerals (along with barite from other localities), not as rocks. This classification is correct—barite roses are mineral specimens, not rocks, because the shapes of rocks are indeterminate, whereas the shapes of minerals are determined by a combination of forms and habits derived from the interplay of crystal structure and environment of growth. Unfortunately, the barite rose became the official state ***rock*** of Oklahoma when Oklahoma House Bill 1277 was signed into law in 1968. Noble, Oklahoma was made the official rose rock capital (of Oklahoma, and by default, the world) via an "emergency" act of the Oklahoma House of Representatives in 1983. Oklahoma now has an official state crystal (the hour-glass sand gypsum crystals from the Salt Plains Wildlife Refuge near Jet, Oklahoma) as decreed by Oklahoma House Bill 4, signed into law in 2005, but no state mineral. The barite rose would have been a fitting candidate for that distinction.

BARITE ROSE LORE

The resemblance between barite roses and flowers or other common objects other than rock has evoked some colorful legends and myths about their origins. The most commonly cited legend has it that when the Cherokees were marched into Oklahoma on the Trail of Tears, the blood of Cherokee men and the tears of Cherokee women that fell in drops to the ground turned to stone roses, to remind the Cherokees of their real flower, the Cherokee rose, state flower of Georgia (Stine and Stine, 1993). No such myth appears in authoritative compendia of Cherokee legends (e.g., Underwood, 1956), and a consensus within the Cherokee Nation today is that the myth was fabricated by Anglo-Americans to sell barite roses. The Cherokees point out that barite roses do not occur on any of the lands granted to them.

In his study of the barite roses east of Salina, Kansas, Knerr (1898) uncovered an intriguing legend, which he offered to the Kansas Academy of Science as homespun, popular science. Knerr (1898) states:

> The explanation is that at one time there was located in this valley an Indian storehouse of goods, and a large portion of the stock on hand consisted of balls of rawhide. A tornado came along and destroyed the lodge containing the goods, burying its contents in the mud where the balls of rawhide thongs became petrified in the course of time. No mystery of natural formation in Kansas can be so deep but that it may be thoroughly cleared up, it seems, by the aid of the Indians and a cyclone.

COLLECTING: PAST AND PRESENT

If there was a heyday for barite roses, it was in the 1940s–1960s, when Frank Shobert (deceased) produced large quantities of fine barite roses from his farm in Slaughterville, Oklahoma (location 4, Fig. 11a). Today, like all other private locations, the Shobert farm is closed to collecting, and the Shobert descendants do not sell roses, either. I visited the locality on a sweltering summer day in 1995 with the current landowner, Randy Shobert. Under a stifling canopy of

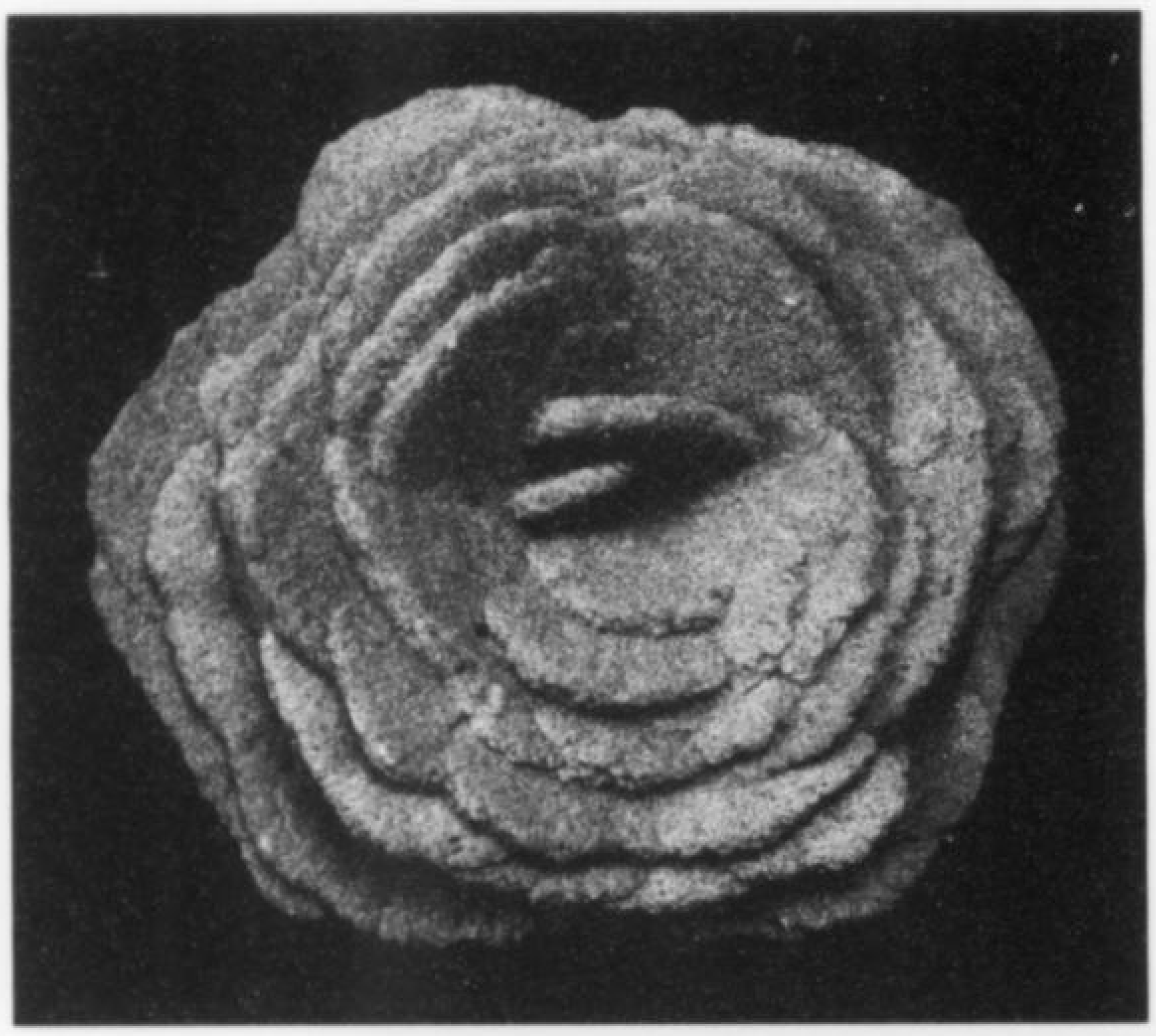
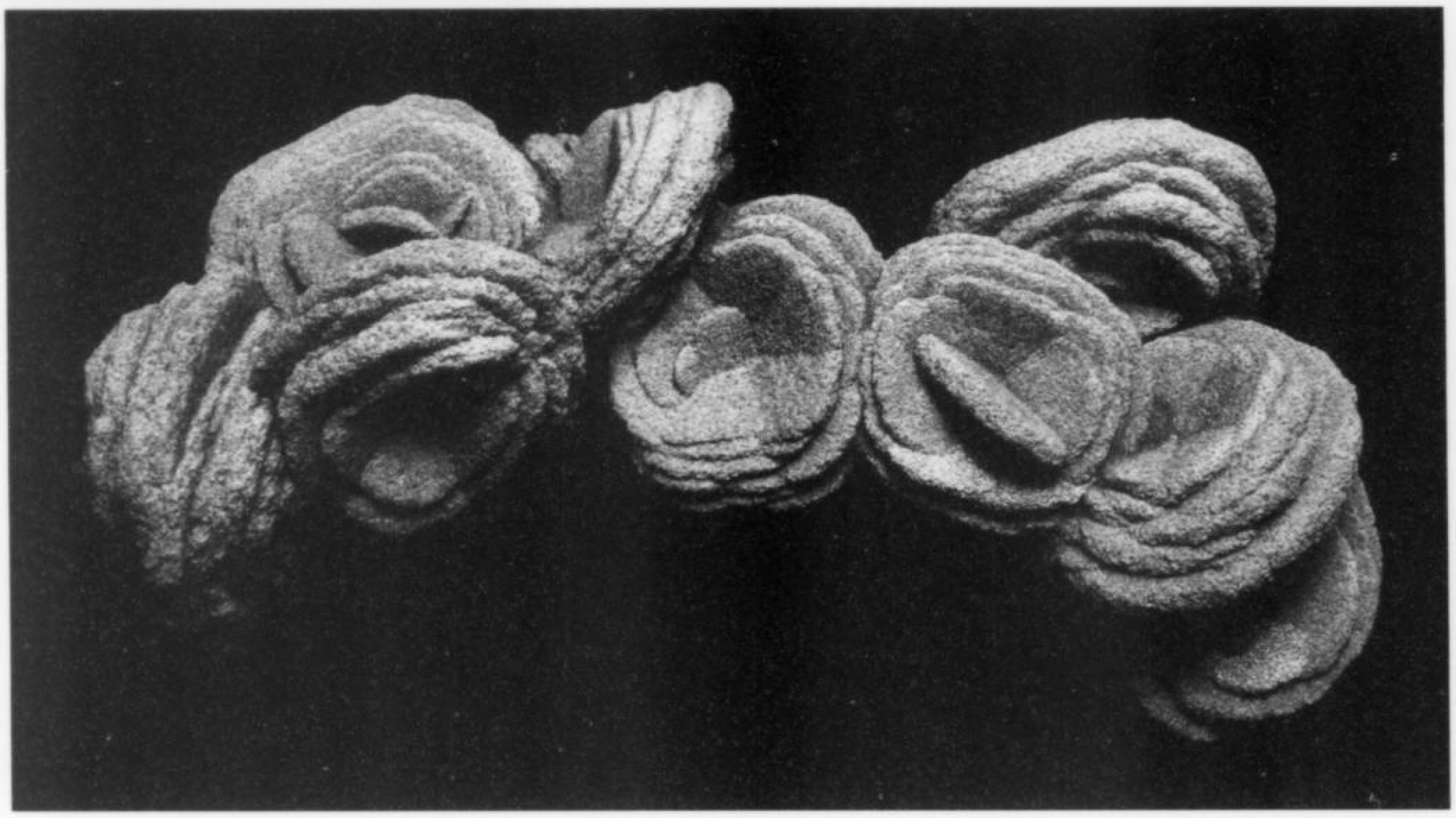


Figure. 1. **A good example of a well-formed barite rose (8 cm, Hailey locality) showing uniformly round and symmetrical development of thin barite crystals with high luster, from the Hailey locality (see locations in Figure 11a). All photographs by the author, and all specimens from the author's collection unless specified otherwise.**

Figure. 2. **A cluster of barite roses (17 cm) from the Hailey locality. Note that the shapes of individual roses are less round, more tabular, as they have adopted more of the orthorhombic morphology that barite crystals normally exhibit.**



oaks, on ground thickly covered with poison ivy, and in the presence of an irascible black snake, I could determine that the locality still contains plentiful barite roses. A continuous barite rose cluster (~3 meters in length) was exposed in an outcrop following an east-west strike; efforts to dislodge the cluster with a large bulldozer had failed. Based on popular accounts, this would be the largest known cluster of barite roses. A stucco of barite roses on the old Shobert homestead stands as a roadside symbol of this once great locality (Fig. 12).

Tom Blair's "Oklahoma Rose Rock Farm" (location 3, Fig. 11a) gave the impression of a real farm thanks to the simple fact that Mr. Blair (deceased) produced barite roses only from the soil horizon; he harvested crop after crop for decades, and the roses were of remarkably uniform size and crudely shaped like potatoes. Blair also sold them at the price of potatoes (Fig. 13). Blair's plentiful and cheap barite roses must have served as a disincentive for neighbors to market their own. At the time I saw the locality, it appeared as mounds of hand-dug muck, with no signs of a working face or machinery-driven excavation.

Though his digging site was not far from Blair's Rose Rock Farm, Pete Peters (deceased) produced barite rose columns that were altogether different from Blair's single roses (location 2, Fig. 11a). Peters' specimens were barite-cemented pipes that contained tiny barite roses decorating the sides of the pipes (similar to Fig. 9). The most intriguing feature of the pipes was that the low-angle cross-bedding within the host Garber Sandstone was also preserved (discussed further below).

J. C. Hailey (deceased) sold roses that he picked up off the ground surface. When I met Mr. Hailey in 1994, he granted me permission to dig the locality in his back yard (location 5, Fig. 11a). From the start, the Hailey location produced abundant and well-formed barite roses, including clusters weighing approximately 320 kg (Fig. 14). I dug the location by hand continuously between 1994 and 2006. Much of the geology presented here was gleaned from this steady history of digging. Today, the locality is nearly mined out, and is closed to collecting.

Other than a few Internet auctioneers, only Joe and Nancy Stine continue to market barite roses for the public from their Timberlake Rose Rock Museum in Noble, Oklahoma (location 1, Fig. 11a). The Stines are known for their metal sculptures that employ barite roses as the base and as flowers at the tops of stems. Otherwise,

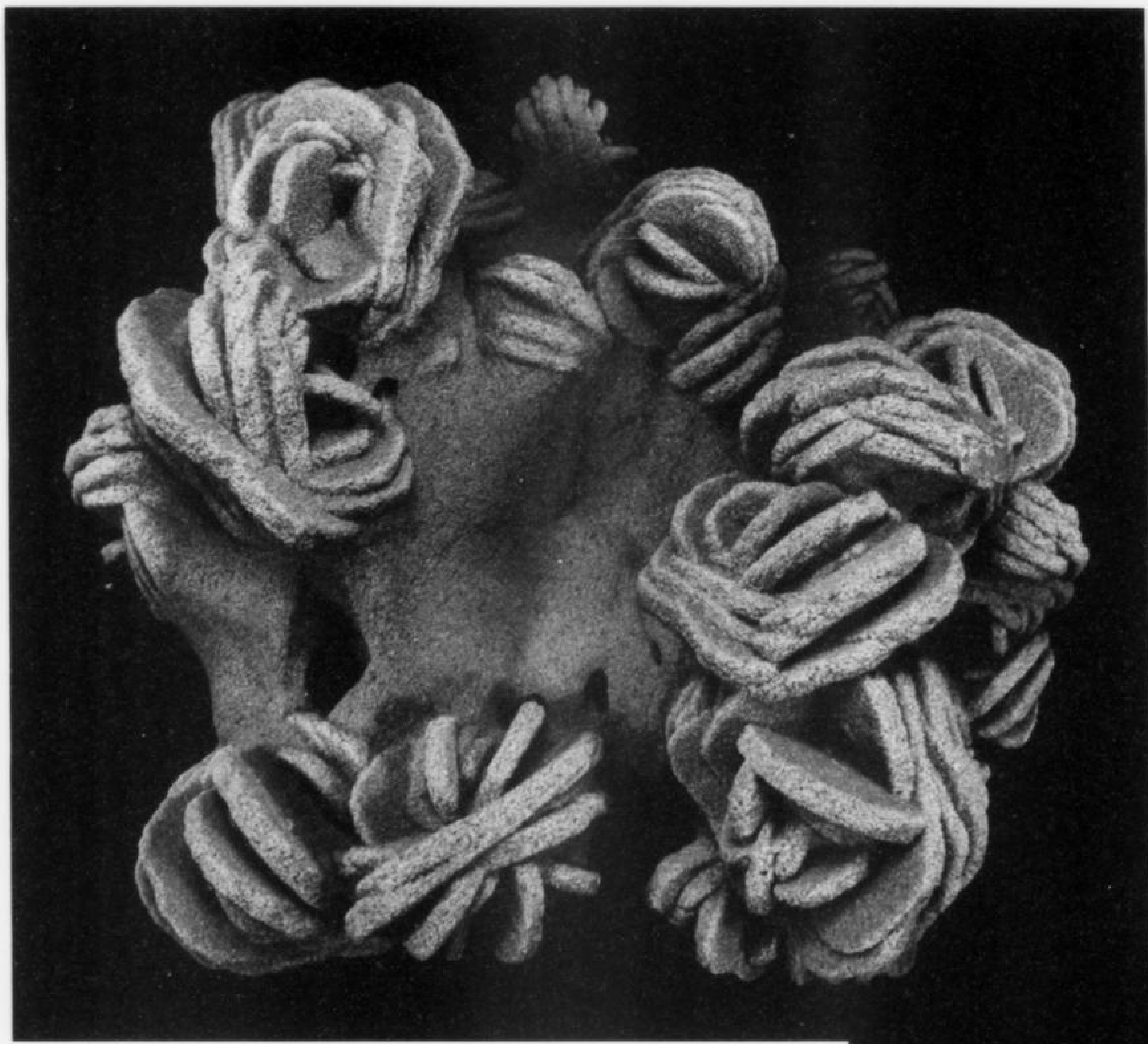


Figure. 3. **A cluster of barite roses (18 cm, Hailey locality) in which the enclosing Garber Sandstone has been only partially removed.**

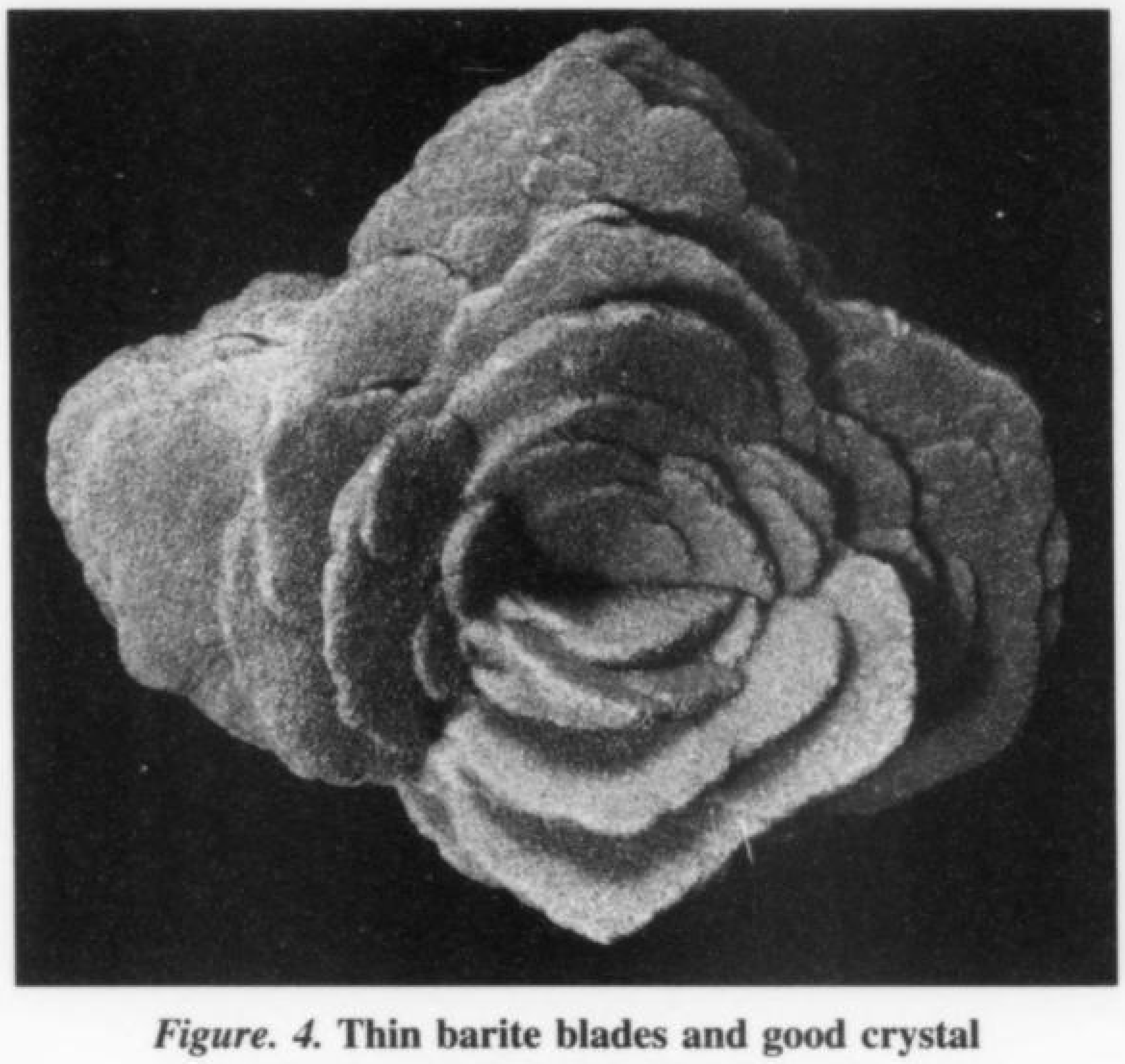


Figure. 4. **Thin barite blades and good crystal separation impart high definition to barite roses (11 cm) from the Shobert locality (Fig. 11a). Individual barite crystals tend to be elongate (pointed) along the [100] direction, however, which makes them look less like flowers.**

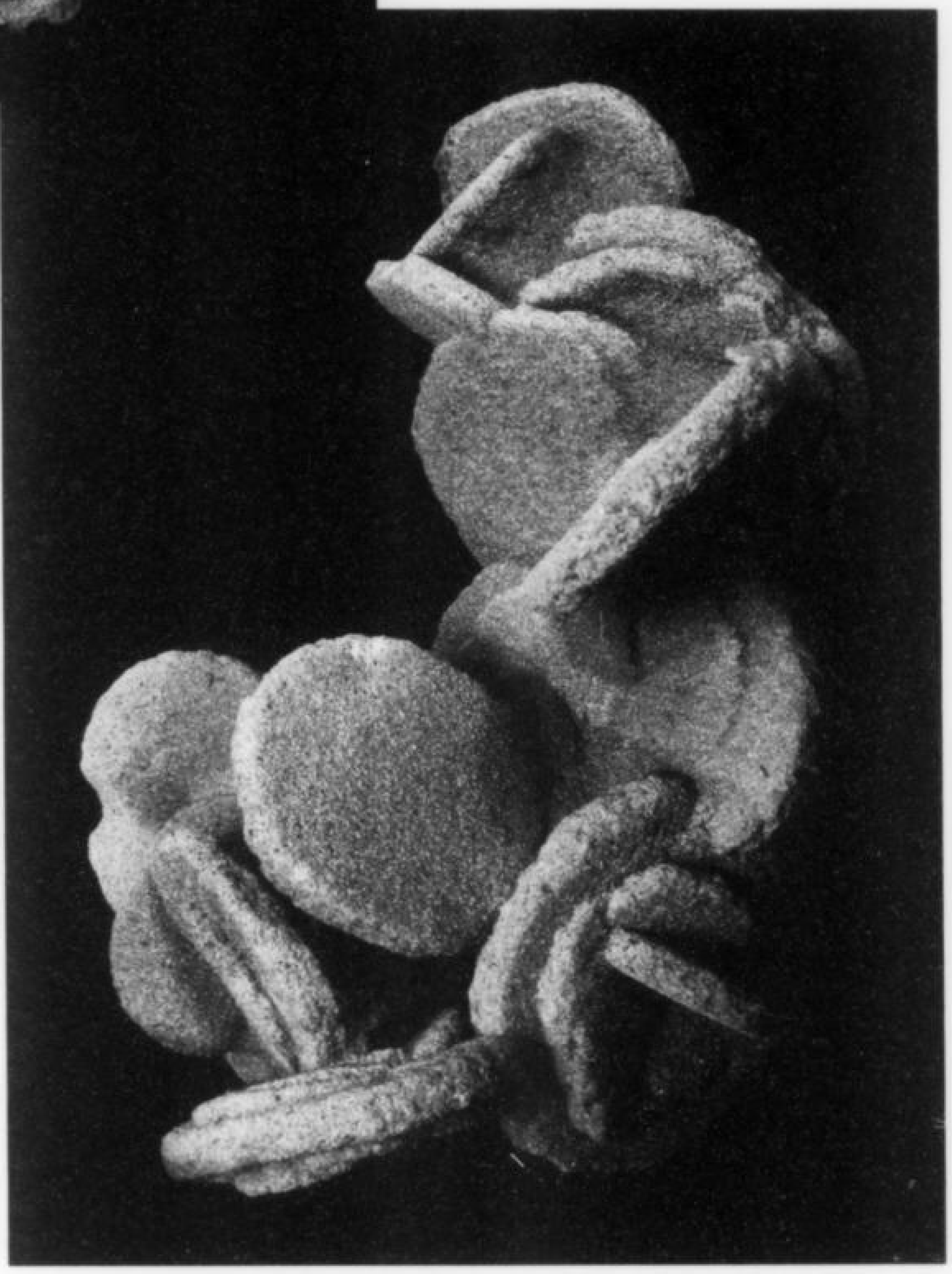


Figure. 5 **A specimen (12 cm, Hailey locality) containing roses plus several single, round disks of barite. The round barite disk, referred to in the text as the medial disk, commonly occurs by itself, without the development of attached barite crystals that create the rose shape.**

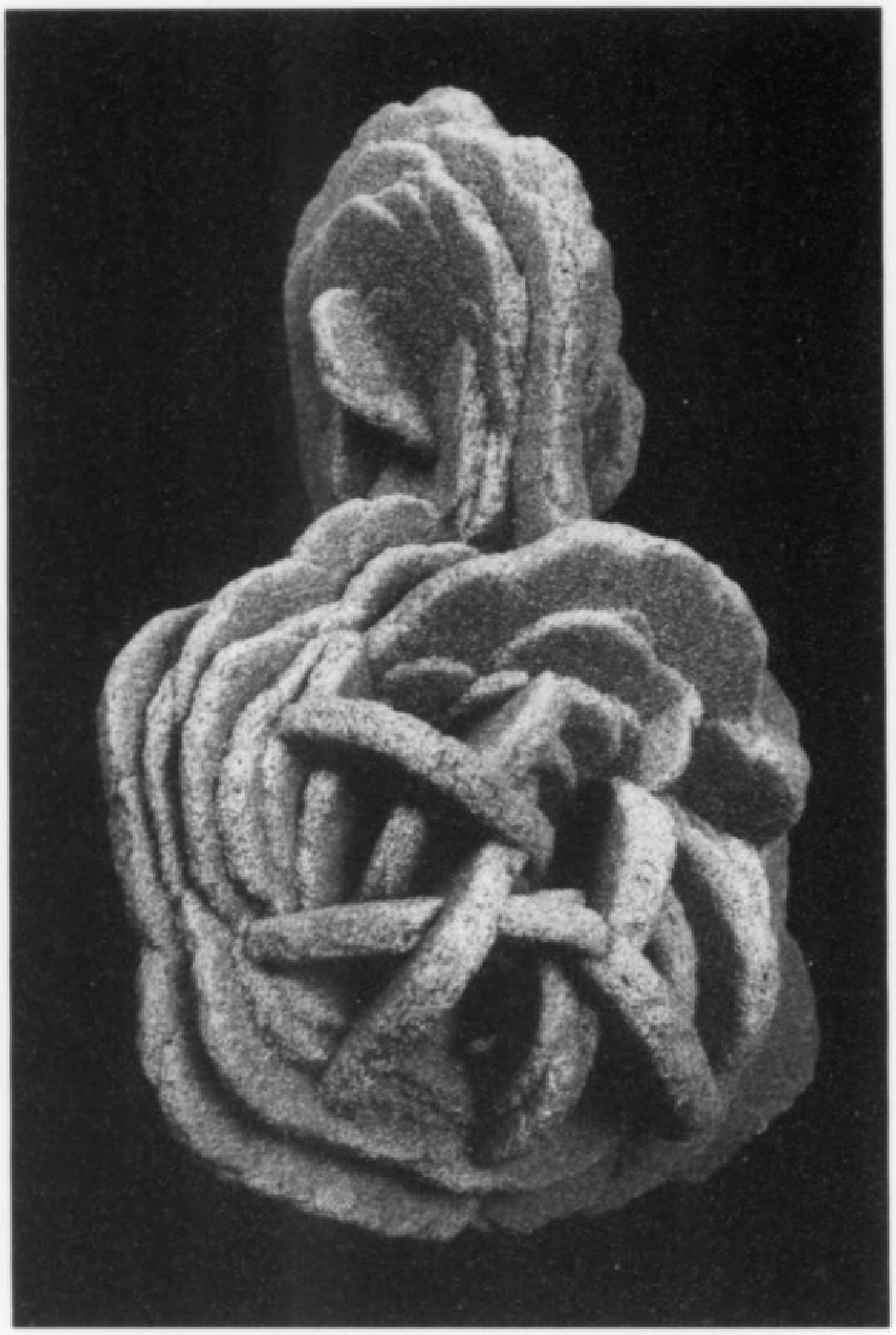


Figure. 6. **The crossing patterns of barite crystals on this specimen (15 cm, Hailey locality) may contribute to make the "fourling" pattern when two sets of crosses are intergrown but separated by 90 degrees of rotation.**

Figure. 7. **Resembling a military aviation medal, this barite rose cluster (9 cm, Hailey locality) grew in a vertical orientation. The central medial disk of the barite rose was aligned along a vertical fracture. The wing-like rose at the top was created as barite-depositing solutions moved out laterally along a more permeable layer in the host Garber Sandstone, approximately at right angles to the fracture surface.**

barite rose digging and marketing are in Oklahoma's past, with all of the important producers now deceased, and with no further production permitted from any of the historic sources. Locations where barite roses still occur in large abundance, however, are too numerous to count.

Barite rose-bearing horizons are exposed around the shorelines of two public lakes in the region: Lake Thunderbird and Stanley Draper Lake. Digging is not allowed at either location, but the exposures (during low stands of lake level) on the west and south sides of Stanley Draper Lake are both instructive and impressive (Figs. 11b, 15a,b). The Oklahoma City Police Department, which patrols Stanley Draper Lake, permits individuals to collect a few roses for personal use from the surface exposures.

MINERALOGY

The barite roses consist of multiple barite ($BaSO_4$) crystals arranged in a radial or rosette pattern (e.g., Fig. 1). They contain roughly equal proportions of barite and quartz sand, the latter representing grains of the Permian Garber Sandstone that were included when the barite crystals grew through the pore spaces in the rock (Fig. 16). The roses contain trace amounts of hematite (α-Fe_2O_3), enough to give them a pale red hue, but there is far less hematite in the roses than in the enclosing deep-maroon Garber Sandstone. Clay minerals that are abundant in the Garber also are present at trace levels in the roses. Otherwise, the barite roses are non-porous and lack fluid inclusions. Barite crystals have effectively occluded all of the original void space in the original Garber Sandstone.

Most individual barite roses range in size from ~1 cm to 10 cm in diameter. The largest single rosette known to date has dimensions of 51 × 56 × 53 cm and weighs 135 kg (Fig. 17).

The Garber Sandstone contains well-sorted but highly angular medium quartz sand that constitutes ~70–80 volume percent of the rock (Fig. 16). The remainder is mostly pore space (~15–20 volume percent), a few percent of hematite cement and clay minerals, and trace amounts of feldspars and other detrital minerals.

Barite roses are mostly confined to the strike of the Garber outcrop in central Oklahoma from northeast of Oklahoma City south to Lexington. Nodules of spherically radial barite crystals without sand are known from outcrops near Paoli and Lawton. Outside of Oklahoma, white barite-sand roses come from east of Salina, Kansas (Knerr, 1898), where they occur in Cretaceous sandstones (Fig. 18). Barite-sand rosettes are also reported from Permian red sandstones in southeastern Australia (Prof. Alan J. R. White, University of Melbourne, personal communication, 2001), and recently at Bou Lalou, Morocco (Sean Falkner, University of Massachussetts, personal communication, 2008). The few other reported locations for sand-filled barite roses (in Egypt and California) are more dubious because the barite roses are often referred to as "desert roses," which are the much more common gypsum rosettes that form true "desert roses" by near-surface evaporation of ground water.

The barite roses are found almost entirely within soils developed

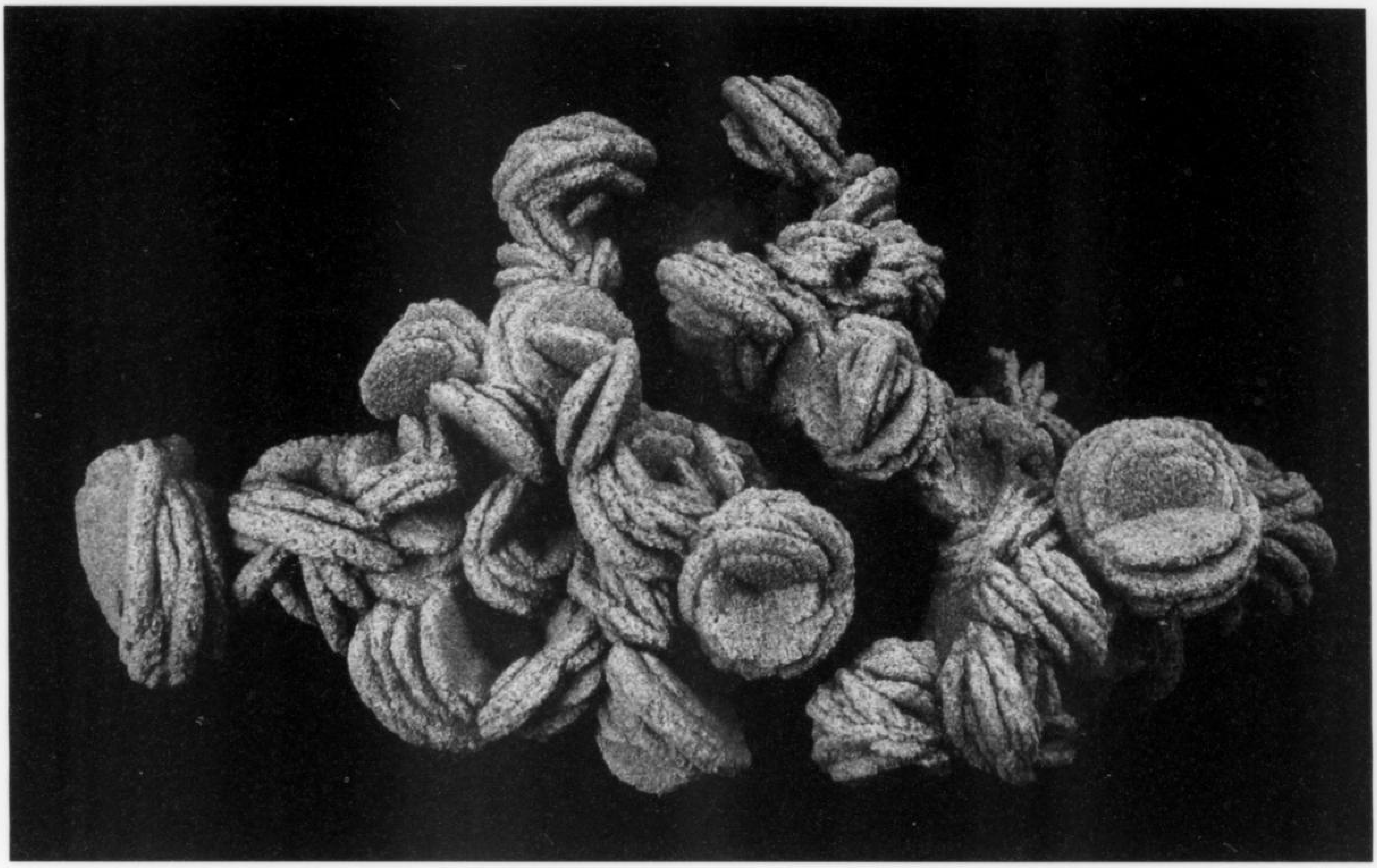


Figure. 8. **Barite roses in miniature, delicate clusters like this one (12 cm, Hailey locality) and others shown in this article come only from outcrops within the Garber Sandstone. Such delicate clusters are crushed by overburden in erosional lag deposits. The two portions of this sample are bridged by greenish brown masses of limonite that are thought to be the oxidized remnants of framboidal pyrite or other iron sulfide.**

on the Garber. Occurrences of barite roses in rock outcrop (as at the Shobert and Hailey localities) are very rare, and of the thousands of water wells drilled into the Garber Sandstone, only one known well has reliably encountered barite roses at depth. In a detailed Master's thesis study of the Garber Sandstone in central Oklahoma, Baker (1951) found no barite cement in any of the scores of Garber outcrops sampled. Apparently, barite occurs only as discrete roses in the Garber Sandstone.

GEOLOGY

In the only published work on Oklahoma's barite deposits, Ham and Merritt (1944) proposed that the roses formed during the deposition of the Garber Sandstone in Permian time (~250 Ma), in an environment interpreted as a complex of arid fluvial fans, deltas, and restricted lagoonal deposits draining westward toward an open marine environment. Ham and Merritt (1944) envisioned that the barite roses formed by a "sabkah" process, wherein the percolation of hypersaline surface brines downward through a permeable sand body results in mineral-forming reactions between the surface brine and either fresh water or seawater that fills the pore spaces in the subsurface.

Geologic investigations by the author conducted mostly at the Hailey locality have revealed that where the barite roses crop out, they tend to be related to joints or fracture sets that strike approximately north-south and east-west and dip subvertically. At the Hailey locality, the east-west fracture sets are the most extensively and reliably mineralized, in zones of brecciated rock approximately 20–40 cm wide (Fig. 19). Hence, the barite roses postdate the deposition and lithification of the Garber Sandstone, though the ages of the geologic structures with which the barite roses are most closely associated are still unknown.

The barite roses are concentrated where the two joint sets meet, and these regions of intersecting fractures may be so permeated with barite roses that they form cylindrical cemented barite pipes (Figs. 9, 15a, 20a). In some locations, the pipes consist of massive hematite (a.k.a. ferricrete) with barite roses, or else of hematite only.

Away from the barite pipes, the roses are further concentrated along the strike of the east-west fracture surfaces (Fig. 20b). In this association, the barite roses contain a single, dominant barite crystal disk that is aligned parallel to the fracture surface (Fig. 20c). The radial barite crystals grow off this medial disk, and the rose structure tends to be predominant on one side of the disk (Fig. 20c). Internal cross-bedding within the Garber is often preserved in these roses, but some roses lack any indications of inherited bedding.

In horizons that are parallel to the bedding surfaces in the Garber, barite roses form lateral concentrations that are thickest and densest close to the vertical fracture surfaces and die out laterally away from them. Economic geologists refer to strata-bound mineral deposits formed by lateral flow of fluid away from fractures or pipes as "mantos" (Figs. 15b, 19a, 20d), and we can adopt the term here. The barite-cemented pipes form large clusters of roses, and similarly large clusters occur in the mantos. In the mantos, typically, a cluster has formed where a particularly permeable surface within the Garber became completely impregnated with interdigitating roses or massive seams of barite which represent the original fracture surface for the laterally migrating fluid (e.g., Fig. 10).

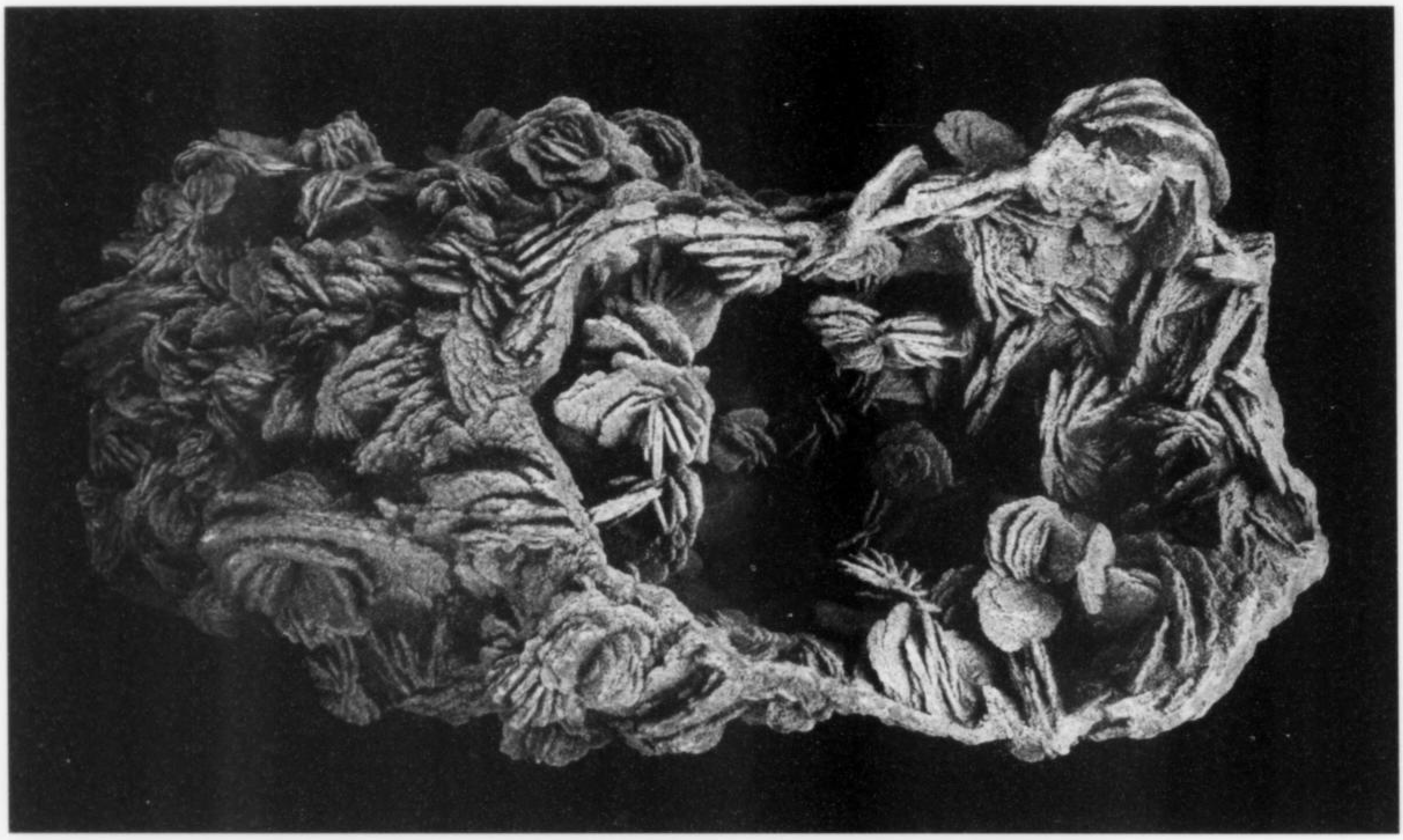


Figure. 9. **A barite rose pipe (32 cm, Shobert locality) shows the solid, cylindrical barite seam that becomes the pipe casing off which barite roses grew.**

Figure. 10. **A cluster of barite roses (31 cm, Hailey locality) from a horizontal manto. Larger clusters like this one formed tongue-shaped masses that generally contained a proliferation of smaller clusters and single roses that diminish in abundance away from the tip of the cluster. Barite roses commonly occur only on one side (top or bottom) of the horizontal bed or bedding surface that promoted the lateral flow of barite-mineralizing ground water.**

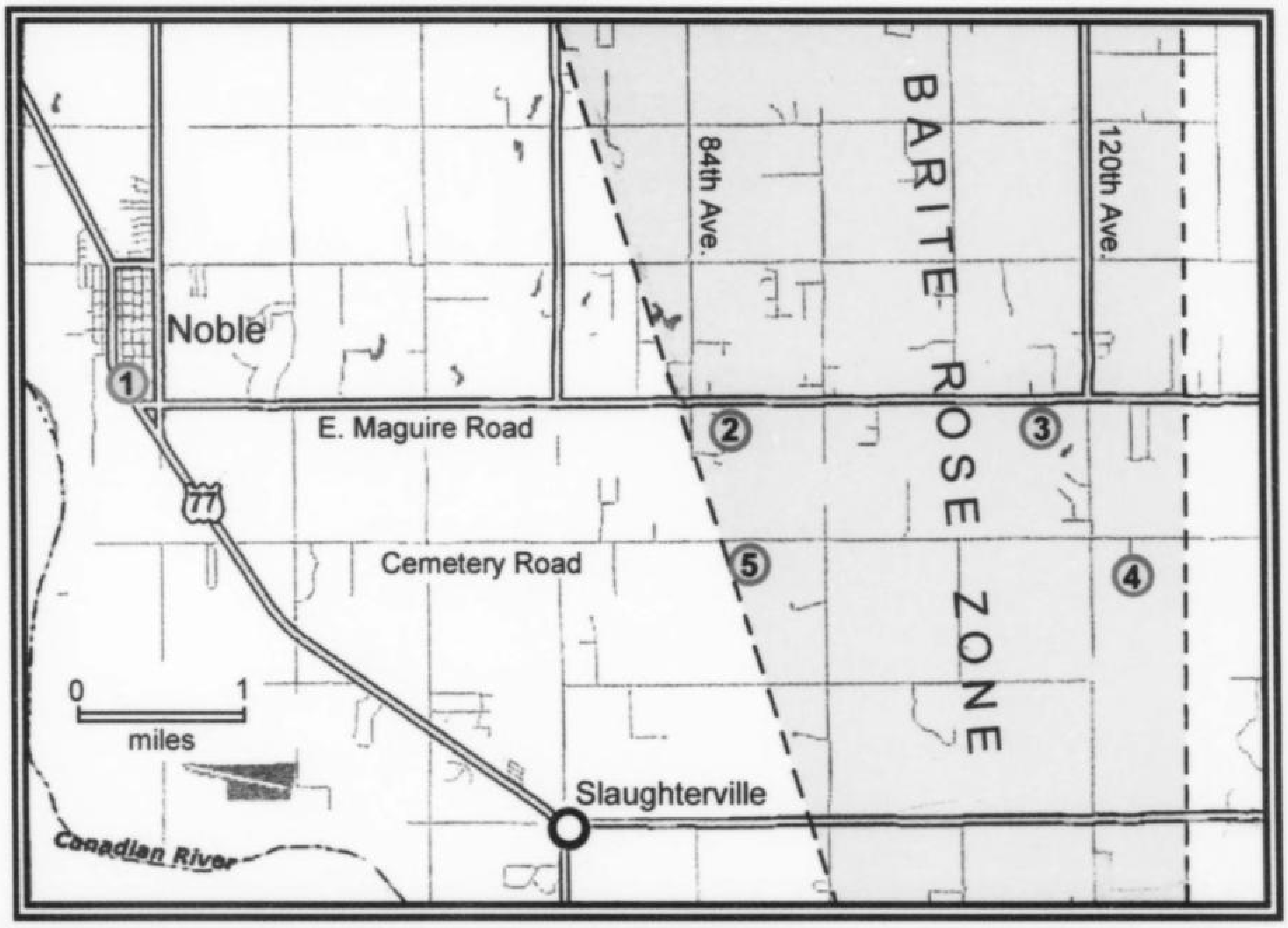


Figure. 11-a. **The historic "Rose Rock Trail," beginning near the junction of US 77 and East Maguire Road, where the Timberlake Rose Rock Museum (1) is the last remaining purveyor of barite roses in Noble, Oklahoma; (2) is the former Pete Peters locality; (3) is the former Tom Blair locality; (4) is the former Frank Shobert locality; and (5) is the former J. C. Hailey locality.**

Figure 11-b. **When the shoreline is exposed by lowered water levels, barite roses can still be found today at the two locations shown at Stanley Draper Lake in the southeastern Oklahoma City area.**

GEOLOGIC PECULIARITIES

Numerous basic questions surround Oklahoma's barite roses. Most of the questions lack definitive answers, and some are without answers of any kind.

(1) Why are the barite roses found only (with trivial exceptions) in Oklahoma?

Red sandstones of Permian age are widespread throughout the world. These sandstones have a common geological environment of formation, one that is semi-arid at the surface but near a large marine body and periodically inundated by marine brines. With the possible exception of an occurrence in Australia (cited above), these sandstones lack barite roses.

The barite roses apparently do not owe their origins to any process specifically related to the environment of deposition of the (now) red sandstones. If correct, this conclusion signifies that some other feature of the deep subsurface of Oklahoma distinguishes these

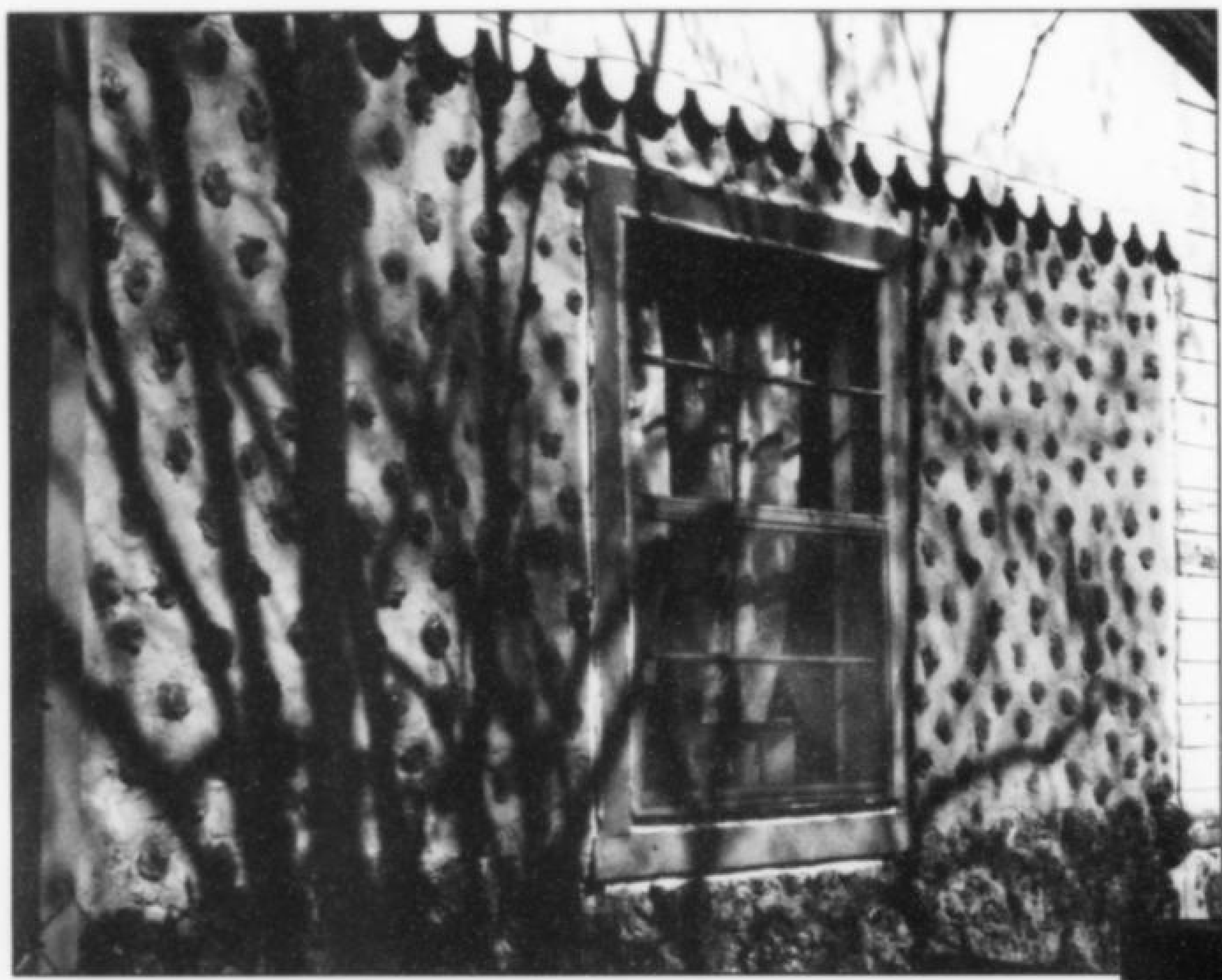


Figure. 12. **Frank Shobert homesite, containing individual barite roses and clusters in stucco.**

Figure. 13. **Tom Blair barite roses for sale. A typical fist-sized rose cost 25¢ to 50¢ in 1996.**

Figure. 14. **J. C. Hailey and a recently dug cluster of barite roses (now at the Goddard Youth Camp, Davis, OK) from his back yard, 1994.**

Permian red sandstones from others around the globe, or that a subsequent and significant geologic event that occurred in Oklahoma did not happen elsewhere.

The basement rocks in Oklahoma are granites and gabbros, which are common throughout the North American craton. One less common feature of Oklahoma's subsurface is the occurrence of deep basinal brines of the type that are associated with large oil fields. Those brines are somewhat exotic. In Oklahoma, the oil field brines contain abundant iodine, for example, which makes Oklahoma the only domestic producer of commercial iodine.

(2) How old are the barite roses?

In the model of Ham and Merritt (1944), the barite roses are the same age as the Garber Sandstone, ~250 Ma, i.e. Permian, and throughout the Midcontinent region of the U.S., mineralization events that formed the Viburnum Trend, the Tri-State lead-zinc

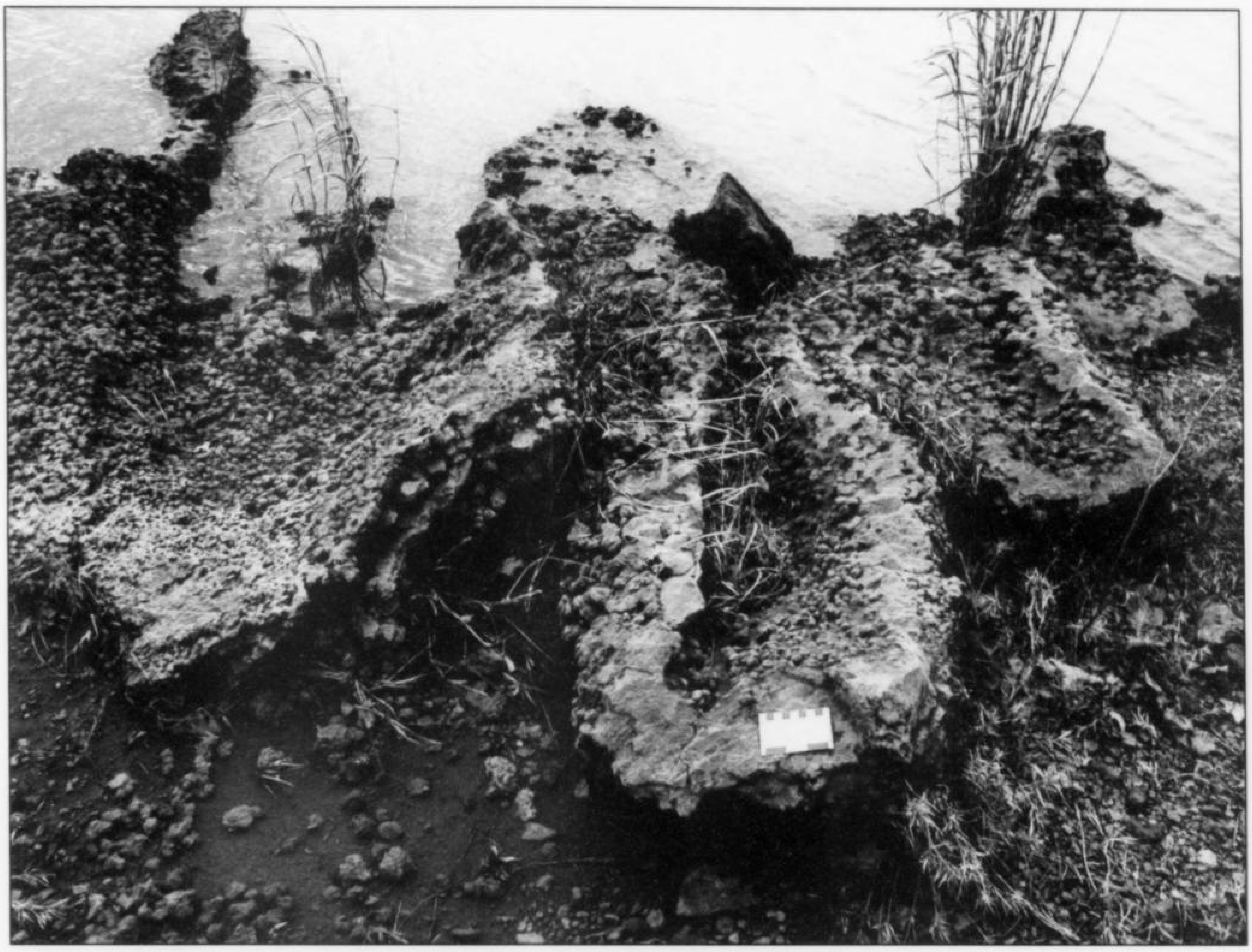


Figure. 15. (top) **Barite-cemented pipes and *(bottom)* strata-bound barite manto at Lake Stanley Draper; see Fig. 11b for locations.**

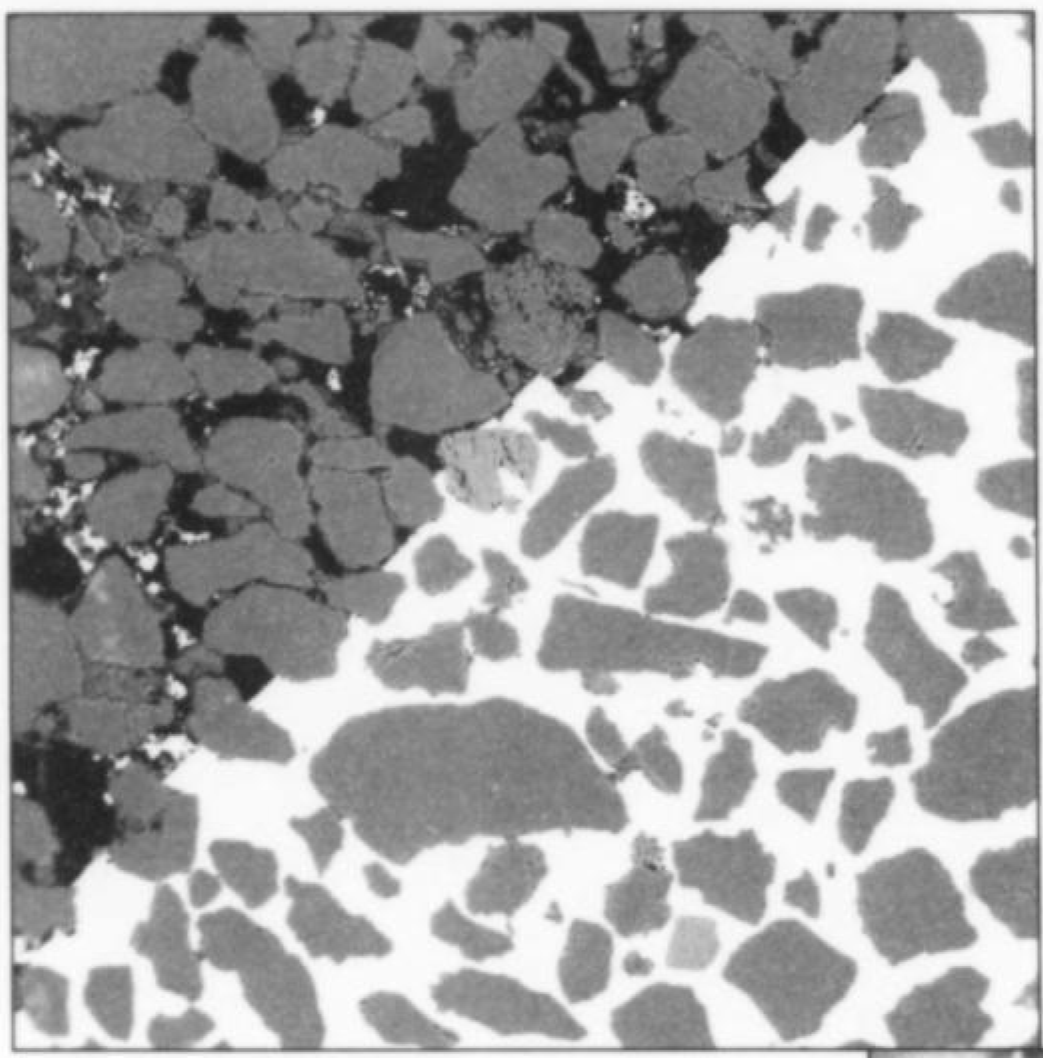
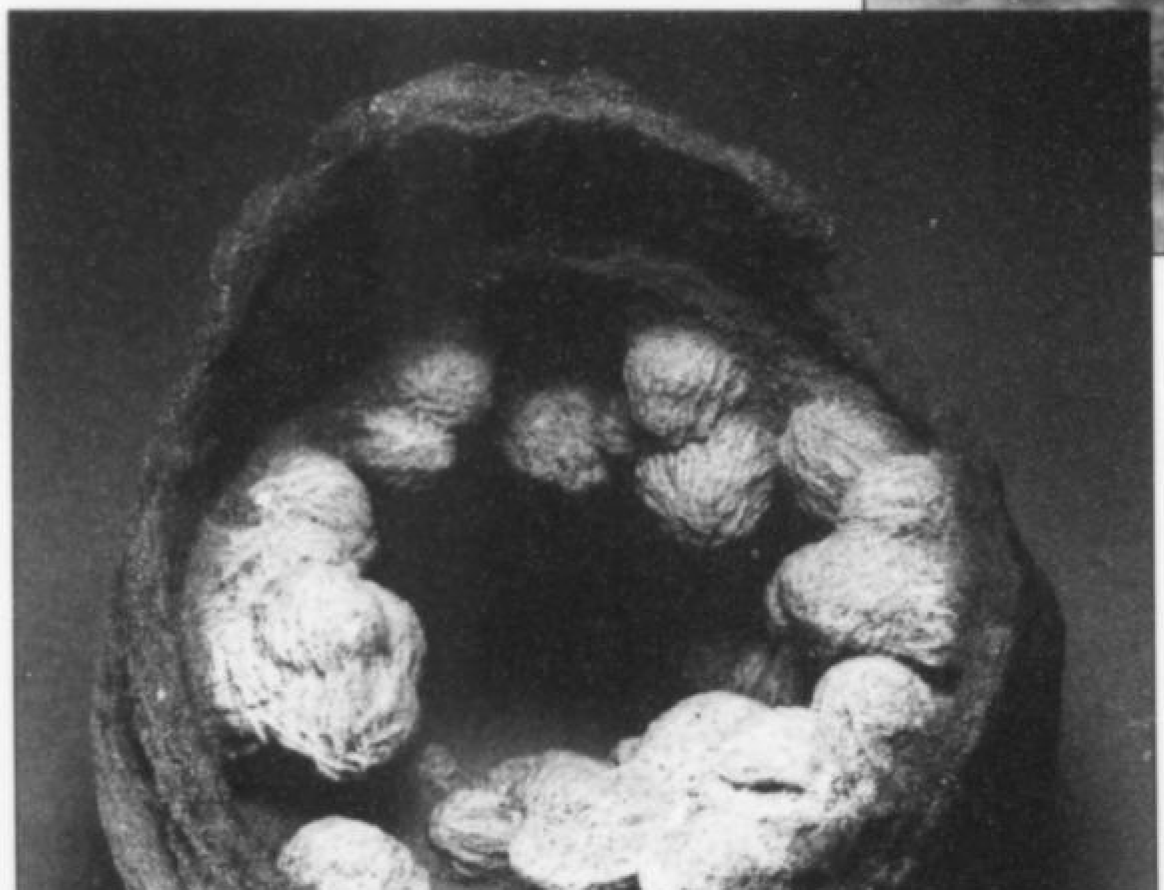


Figure. 16. **Back-scattered electron image of an interface between a barite rose crystal and the surrounding Garber Sandstone. The image contains a single crystalline blade of barite (bright white) defined by a sharp crystal boundary, angular quartz grains (gray), pores (void space) in the Garber Sandstone (black), which contain flecks of hematite (bright white) and traces of clay (fine-grained gray aggregates). Notice that quartz sand is in grain contact in the sandstone, but not in the barite crystal, signifying that the growth of the barite crystal either dissolved or shouldered aside some of the sand grains. The field of view is 1.5 × 1.5 mm.**

Figure. 17. **The largest single barite rosette known to date (56 cm, 135 kg).**

Figure. 18. **Heavily hematite-cemented sandstone (ferricrete) pipe, 20 cm across, lined with barite-sand roses. Collected east of Salina, Kansas, by Marie McDaniel Kennedy; now in the collection of the School of Geology & Geophysics, University of Oklahoma. Based on the trace of faint cross-bedding along the sides of the specimen, this pipe was originally formed as viewed, in a vertical orientation.**



deposits, the Southern Illinois fluorspar deposits, and the Pine Point district are strongly correlated with this time period.

The uplift associated with the Appalachian-Ozark-Ouachita-Arbuckle orogens was an important geologic event in Oklahoma and elsewhere in the Midcontinent of the U.S. That mountain-building event sent deep basinal fluids migrating north and west, and these migrating fluids are thought to be responsible for the galena, sphalerite, barite, and fluorite orebodies known throughout the region (including Oklahoma) as Mississippi-Valley-Type deposits. The mountain-building event that caused Mississippi-Valley-Type mineralization in the Midcontinent region began in Pennsylvanian time (~300 Ma) and may have continued into the Permian; however, the deposition of the Garber Sandstone and the Mississippi-Valley-Type mineralization cited above occurred as a consequence of, and hence after, these orogenies. Throughout the Midcontinent region, mineralization associated with the Mississippi-Valley-Type deposits, with

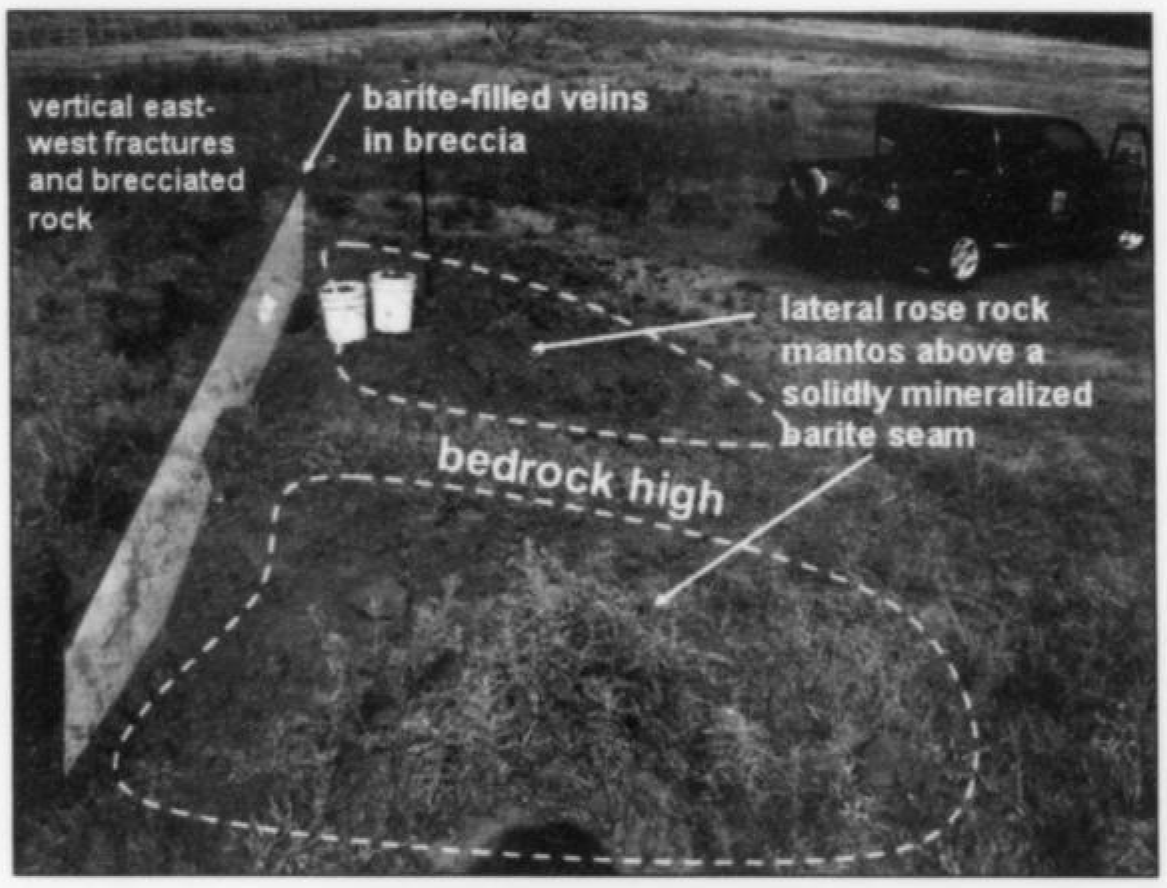
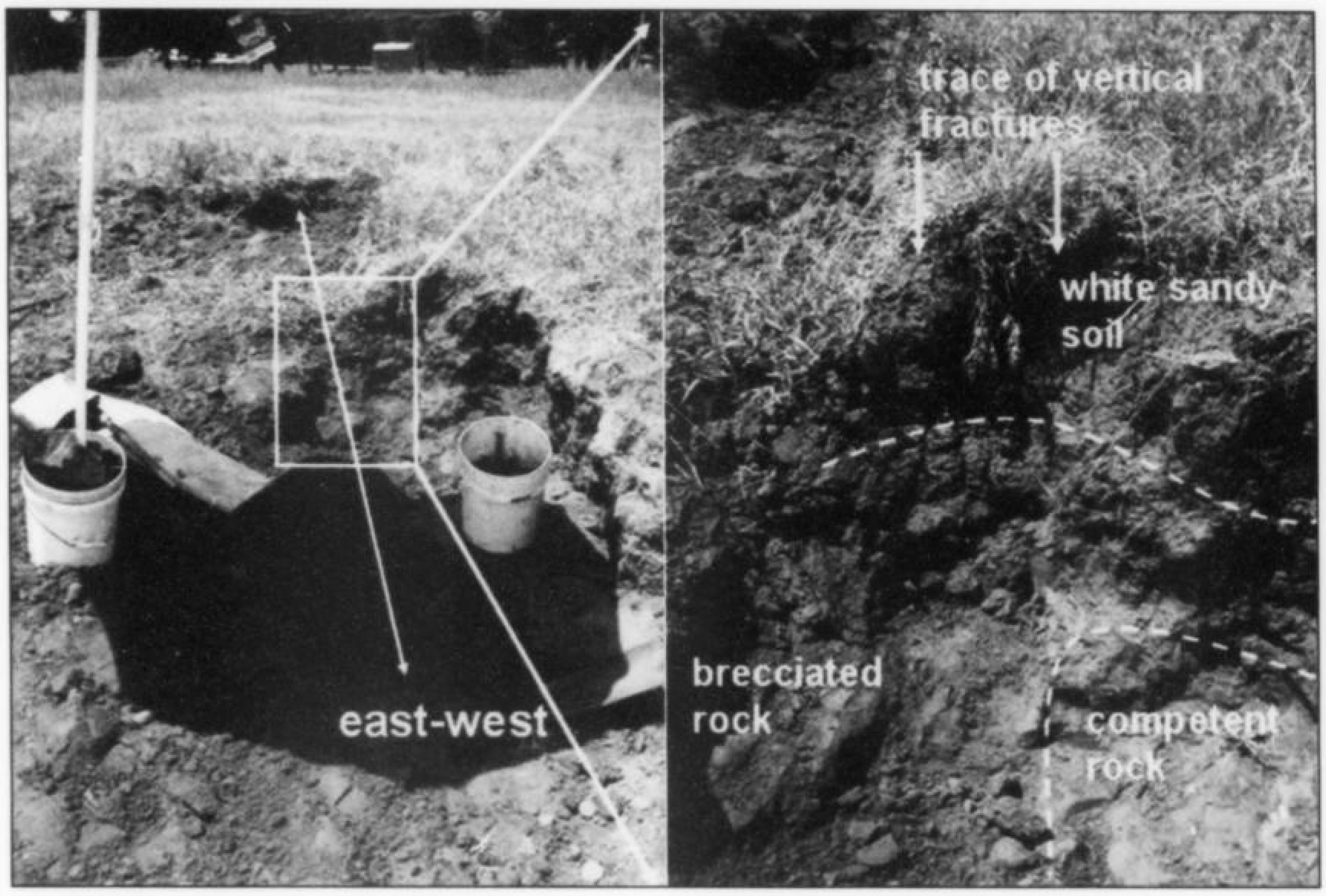


Figure. 19. **(a) A field exposure at the J. C. Hailey locality (2003) showing the shape of a lateral barite "manto" in relation to a pervasively mineralized vertical east-west fracture. (b) The vertical trace of the east-west fracture set is evident in weathered rock *and* in the overlying soil.**



roll-front copper deposits and with oil and basinal brine migration, all carry a mid-Permian to late-Permian age (e.g., 250–200 Ma). Surprisingly, although some Mississippi-Valley-Type deposits are as old as 215 Ma, other periods of Mississippi-Valley-Type mineral formation occurred sporadically over the ensuing 200 million years to a most recent event at 39 Ma (Coveney *et al.*, 1999). There are no known geologic events (i.e., uplift that would cause the migration of basinal fluids) associated with these younger mineralizations. Thus, lacking other controls, the barite roses could have formed in a single event, episodically, or continuously since the end of the Permian, and they may still be forming today.

(3)Why are the barite roses found mostly in soils, and why do they disappear in the Garber Sandstone below the soil horizon?

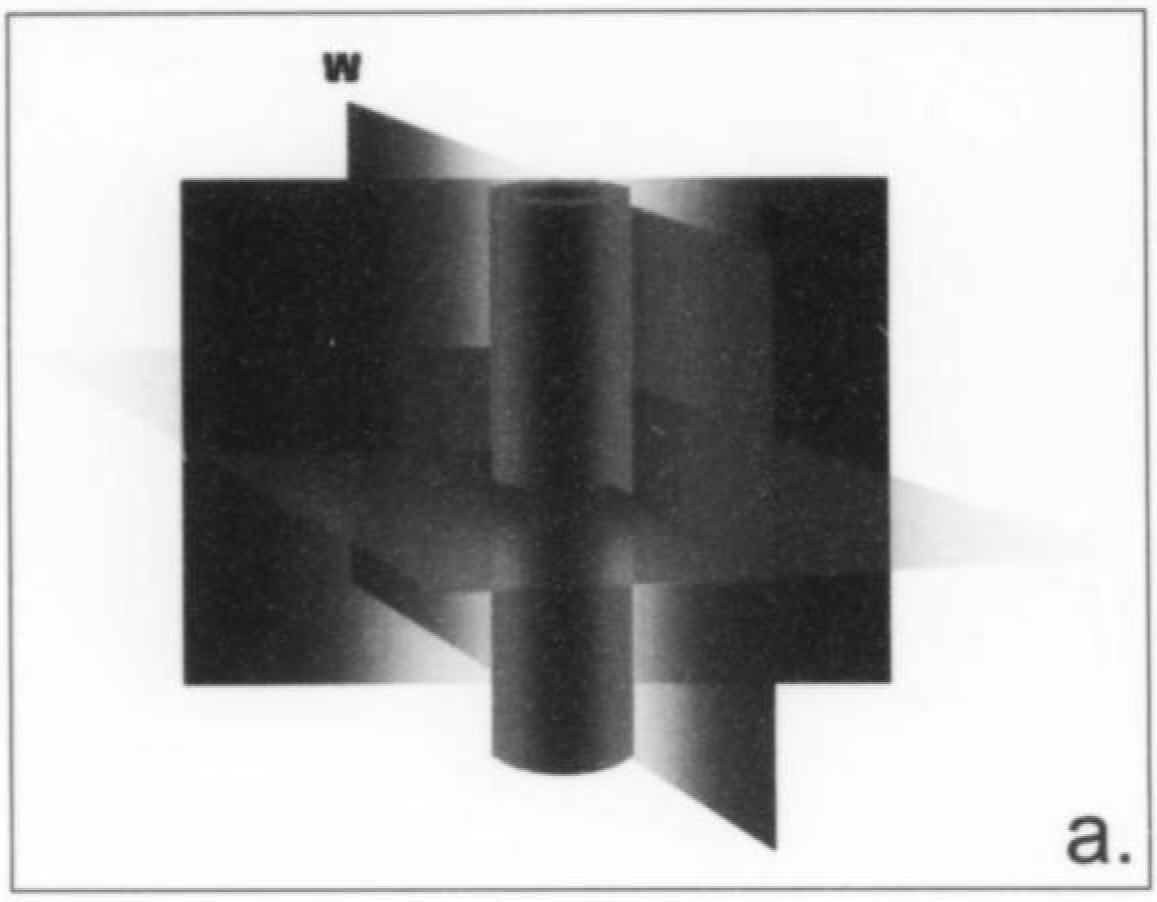
The barite roses formed in the Garber Sandstone. They are not a mineral product of modern soils. The reason that they are abundant in the modern soil zone, but generally absent in the underlying rock, is that they represent an accumulation of erosional remnants. Sedimentary geologists refer to this as a lag deposit or eluvial deposit. The high density and very low solubility of the barite leads the roses to accumulate in soils during the weathering of their host rock, and to remain behind when erosion removes most of the smaller and easily transported weathering products of the sandstone.

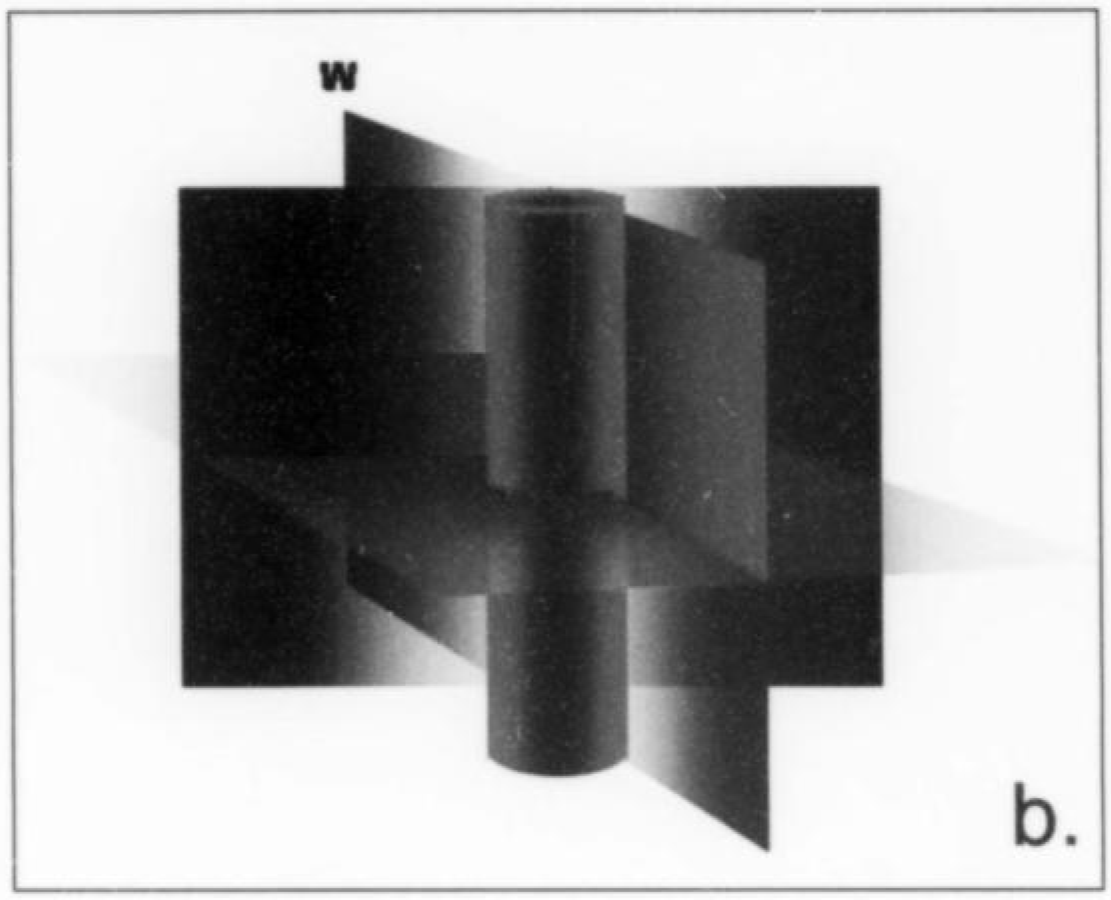
Pete Peters, a former vendor of barite roses in Noble, Oklahoma, reports that when he found barite-cemented pipes in soil, they were lying horizontally. The traces of sedimentary bedding that they contain, however, dictate that their original orientation was vertical. Thus, they have fallen over as they accumulated at the soil surface. Peters was mining an erosional lag deposit.

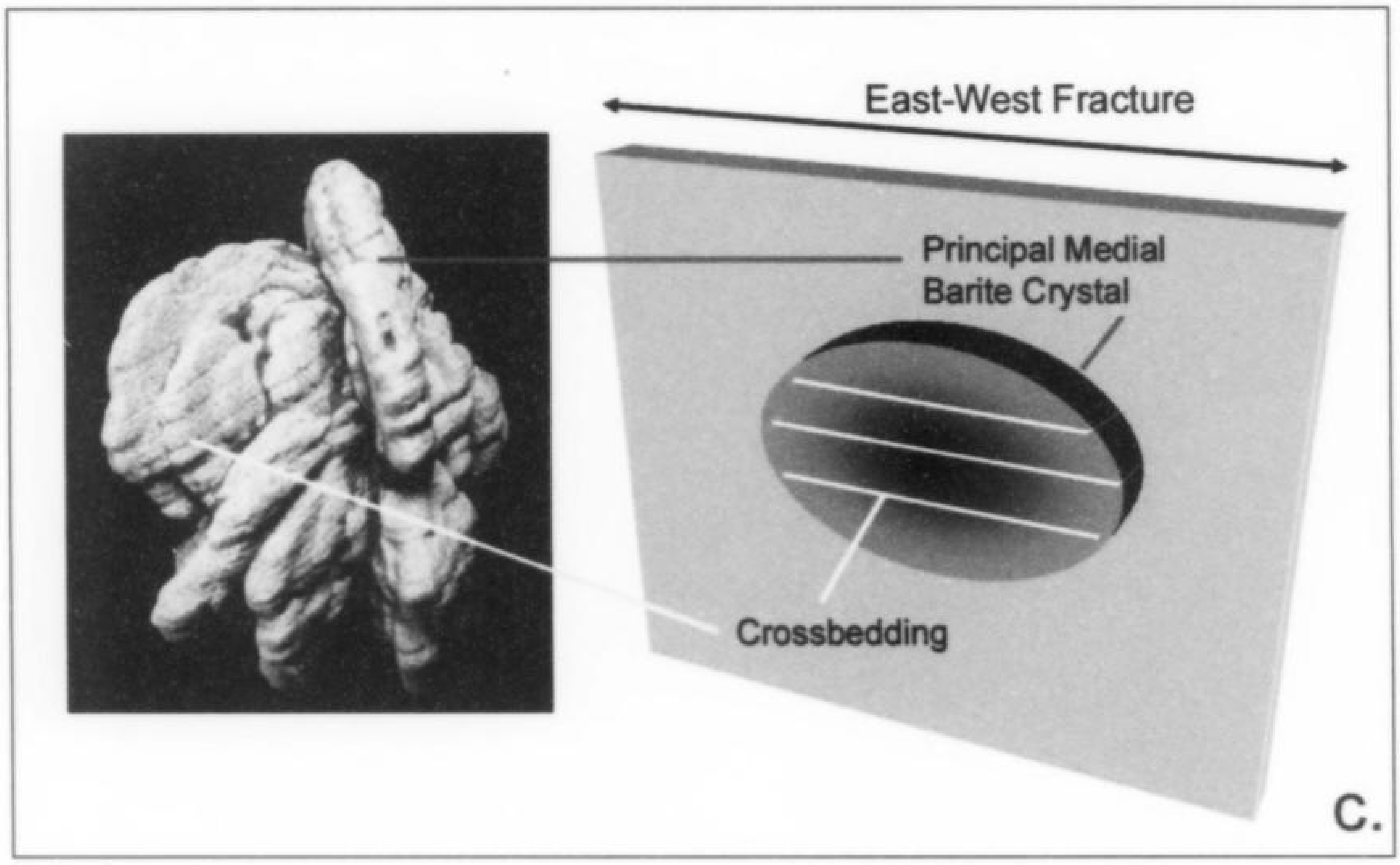
The barite roses are found near the lower (eastern) contact between the west-dipping Garber Sandstone and the Wellington Formation below. Because they are mostly erosional remnants, however, they actually came from the portions of the Garber Sandstone higher in the stratigraphic section, which are now eroded, but would extend toward the west in the subsurface. Exploration for barite roses *in situ* within the Garber, therefore, should be directed toward the west from the current accumulations in modern soils.

(4) How do the barite roses get their shapes?

Radial and rosette habits of crystals are common to many mineral species. The radial habit of growth in three dimensions (e.g., the spherical habit of adamite, rosasite, natrolite, etc.) or in two dimensions (e.g., pyrite "dollars" in shale) entails the nucleation of many crystals at a point source, and growth away from that source in the direction in which each crystal can remain in contact with the solution that nourishes its growth. Radial crystal growth







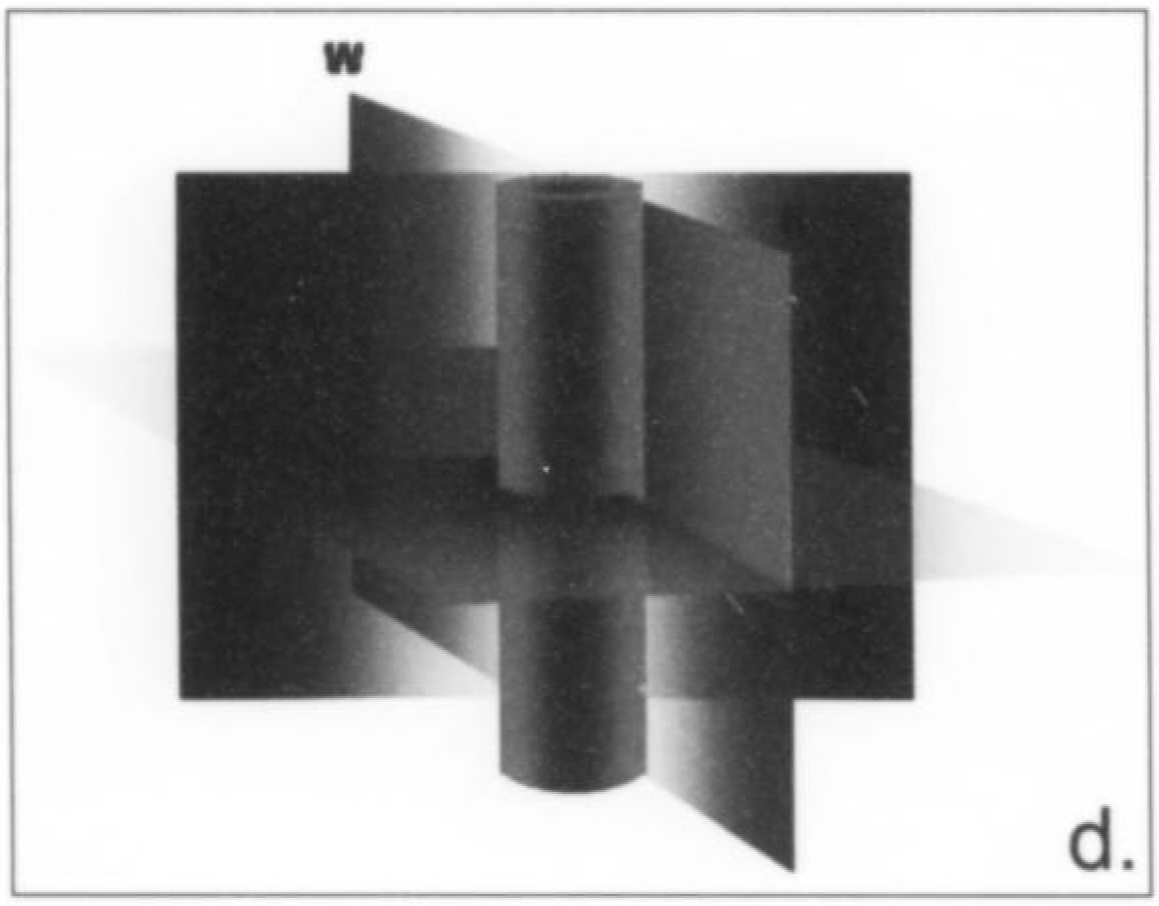


Figure. 20. **Relations of barite roses to bedding and structure within the Garber Sandstone. (a) The intersection of subvertical east-west and north-south fractures creates a highly permeable zone that becomes cemented with barite (± hematite) pipes. (b) The east-west joints are the main structures that host barite mineralization. (c) In most instances, the large, medial disk of barite that is present in the roses grew along the vertical trace of the east-west fractures. When the medial disk is so oriented, then the angle of cross-bedding in the roses matches that found today in the flat-lying portions of the Garber Sandstone. (d) Mantos of barite formed by the lateral migration of groundwater along exceptionally permeable bedding surfaces in the Garber Sandstone.**

is essentially linear, and not necessarily in the direction of elongation that may be prevalent in euhedral crystals. Corners are the fast-growth directions in any crystals, and when corners grow out, they form lines in space (i.e., linear crystals). Rosettes are similar to radial habits in that a large number of crystals nucleate at a point and grow radially outward, but the crystals develop a tabular habit, which means that they grow along edges rather than just along corners. Linear crystals in radial habits and tabular crystals in rosette habits both reflect conditions of rapid crystal growth from highly supersaturated solutions.

Most barite roses form radial and rosette clusters of crystals. In the radial habit, individual crystals of barite diverge from around a

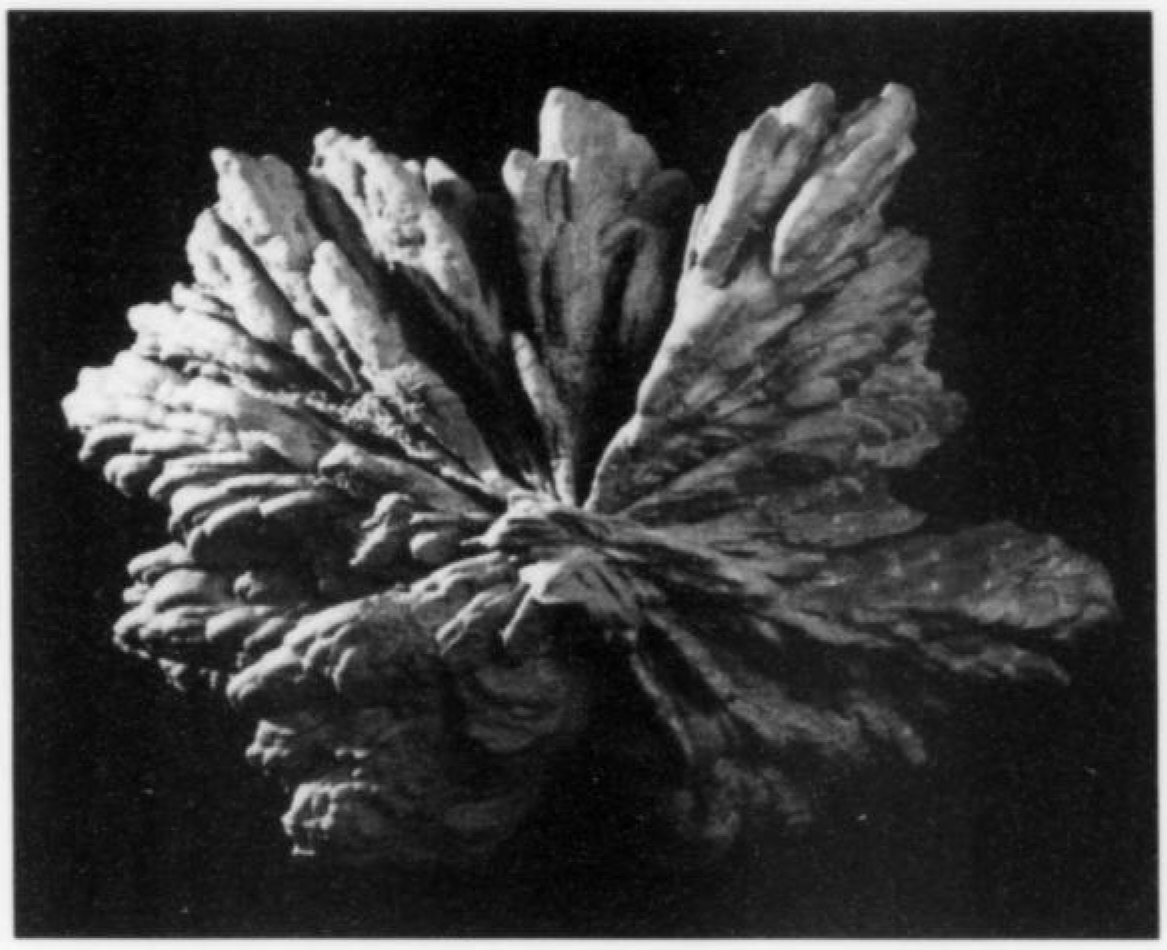


Figure. 21. **A barite rose (51 cm, Cleveland County, Oklahoma) showing radial growth of barite blades off a central axis. On the reverse side, a crudely defined barite rose is evident along the axis of the cluster.**

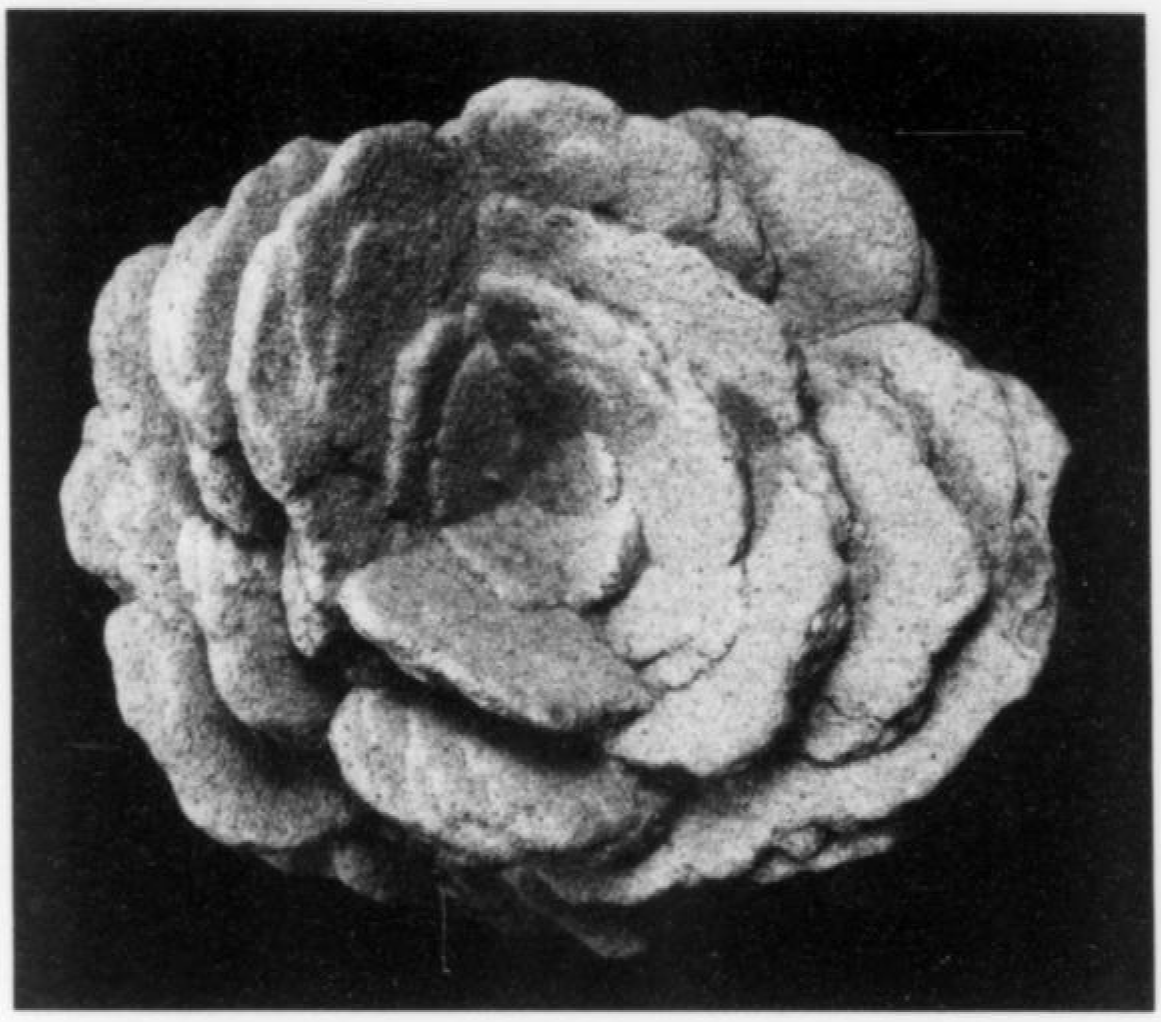


Figure. 22. **A barite rose (12 cm) from the Lexington Game Preserve, northeast of Lexington, Oklahoma, shows the "fourling" pattern of crystal growth around the axial center of the rose.**

central axis, much like blades around the shaft of a fan (Fig. 21). The rosettes possess the more flower-like habit of crystals (Figs. 1 and 5). Most contain the medial barite disk (parallel to the fracture surface) described above. In some cases, only the central disk develops, and the result is a single, round crystal of barite (Fig. 4). The centers of many roses consist of a conical arrangement of four barite crystals (or four sectors of composite crystals at right angles to one another) that form a square pyramid whose apex is the nucleation center for the rosette at the center of the medial disk (Fig. 22). Barite is not known to twin, and what might be construed as "fourling twins" could be a manifestation of organized habit in an environment that required rapid crystal growth. The "fourling" relationship, however, is prevalent in many barite roses. Where crystallographic directions can be ascertained, the barite crystals that comprise the central "fourling" pattern grew away from the center along the [100] zone (e.g., Fig. 5).

The one peculiarity of Oklahoma's barite roses that makes them most resemble flowers is this: the "petals" of the rose, which consist of individual barite crystals, grew as round disks rather than adopting the tabular orthorhombic crystal forms that are normally present in barite (Fig. 4). In most environments of rapid crystal growth, the corners and edges of crystals grow out in advance of the faces, creating skeletal crystals. For barite, which normally develops a prominently tabular combination of orthorhombic and other forms, fast growth at the corners would yield an "X" or "butterfly" shape, exactly as was produced by Prieto *et al.* (1992) through rapid growth at high supersaturation in silica gel. In the case of the barite roses, growth at the corners of the orthorhombic barite crystals was stunted, which is just the opposite of the normal fast-growth situation.

When growth surfaces or directions are stunted, crystal chemists usually look for an agent, called a "poison," that adheres to the surface of crystals and keeps them from growing by accretion. The probable cause of stunted growth at the corners of the barite roses is poisoning by organic compounds.

I have grown barite crystals at 25°C, 1 atm, via diffusion in an organic gel made from ordinary, sugar-free culinary gelatin. The organic composition of culinary gelatin is not specified, but it is high in water-soluble protein and free of organic fats or carbohydrates. The barium source was $BaCl_2$ solution, and the sulfate source was $MgSO_4$ solution, with three different concentrations used (25 wt%, 12.5 wt%, and 6.25 wt% each of $BaCl_2$ and $MgSO_4$ in aqueous solution). Barite grew in the zone of solution mixing within the gel (Fig. 23). Crystals on the barium-rich side of the mixing zone tended to be round in habit (Figs. 23a–c), whereas those on the sulfate-rich side developed more of the tabular orthorhombic forms that barite normally adopts (Figs. 23d,e). At the highest solute concentration, the rose-like rounded shapes of barite changed to those of the "X" or "butterfly" skeletal habit, though with unusual reentrants and rounded growth steps.

The barite crystals formed in this organic gel produced crystal habits and radial aggregates that are highly rounded. Some individuals formed radial and rosette clusters that grew off one side of a starting basal crystal (same as the "medial" crystal of the roses). It is evident that barite growth in an organic hydrogel produces crystal habits and aggregates that bear a striking resemblance to the barite roses, and these are wholly unlike the barite crystal morphologies observed when organics are removed from the gel or growth medium (Prieto *et al.*, 1992).

(5) How did the barite roses form?

Barite roses grew in the subsurface along fractures and permeable bedding directions away from those fractures in the Garber Sandstone. Though the barite must have been precipitated from an aqueous solution, water-soluble organic components are specifically implicated in the development of the rounded shapes of the crystals.

In this low-temperature environment, barite is one of the most insoluble minerals known (Putnis *et al.*, 1995). The vanishingly low solubility of barite explains why the roses can survive deep weathering of the Garber Sandstone, and why the roses can persist for possibly geologic-scale time durations in the modern-day soils. The low solubility of barite, however, poses problems for producing large concentrations of barite in a narrowly defined zone of fluid flow in the Garber.

In many geologic settings, high concentrations of normally insoluble minerals arise from mixing between solutions from dif-

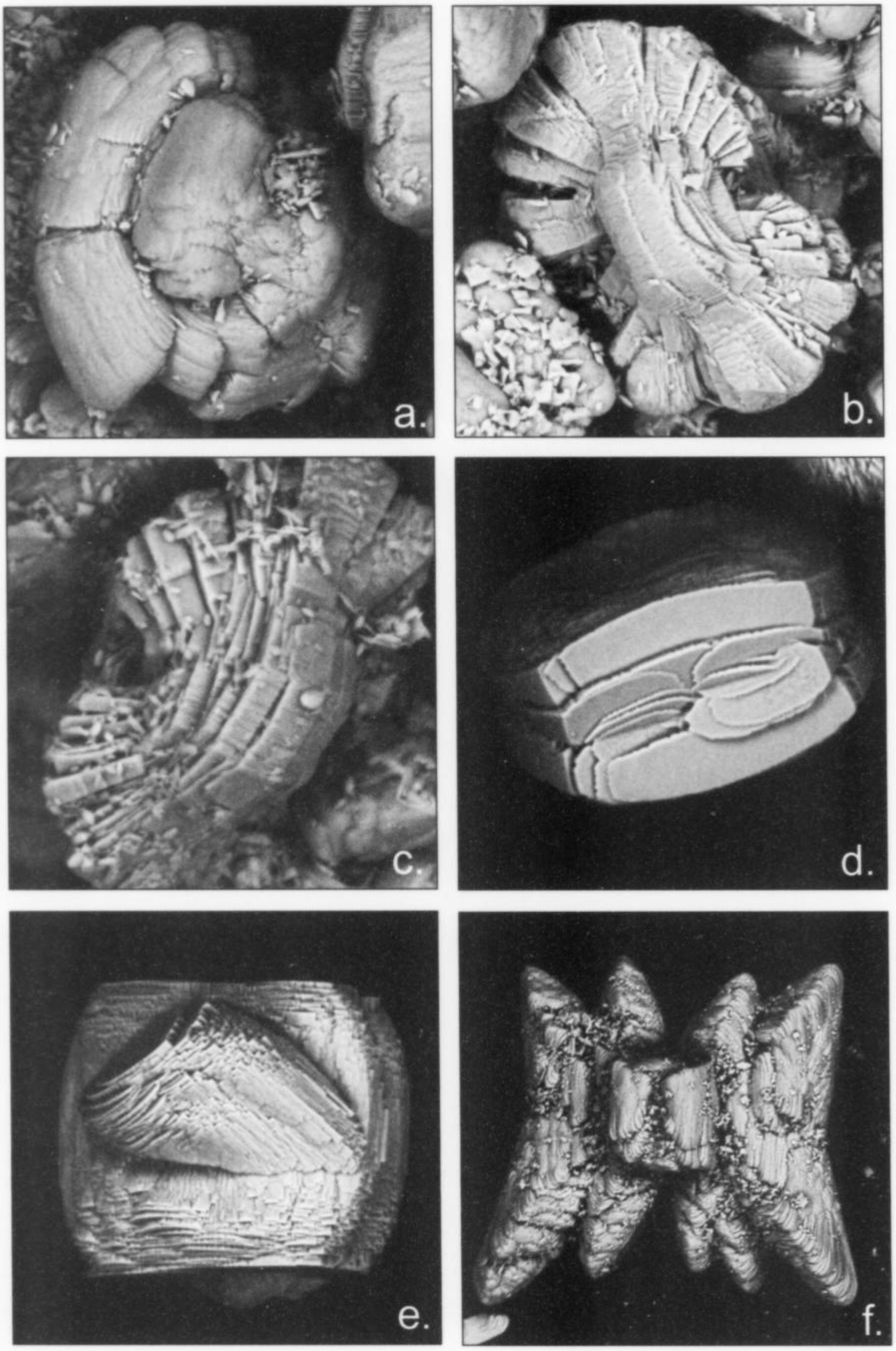


Figure. 23. **Backscattered electron images of synthetic barite crystals and rosettes grown by diffusion in organic gels. (a) The rounded habit of a single barite crystal. (b) A radial array of rounded crystals about a central core. (c) A rosette formed by a concentric array of barite crystals off a central medial crystal. (d) A high degree of curvature is evident in the stepped growth of this barite crystal; except for a few platelets at the end, this appears to represent a single crystal. (e) Overall rounding of individual crystals occurs because of the decreasing radius of growth steps in the [100] direction of barite growth. Interpenetrating crystals like these two are common in the experiments, but the angular relationship between the main crystal and its epitactic intergrowth are not the same as in the barite roses. (f) A single, stepped barite crystal exhibits the "butterfly" habit of accentuated growth along the [110] directions through the crystal; this is the habit anticipated by rapid growth along the corners of the crystal. Other reentrants into the crystal are unexpected consequences of rapid growth in the organic gel.**

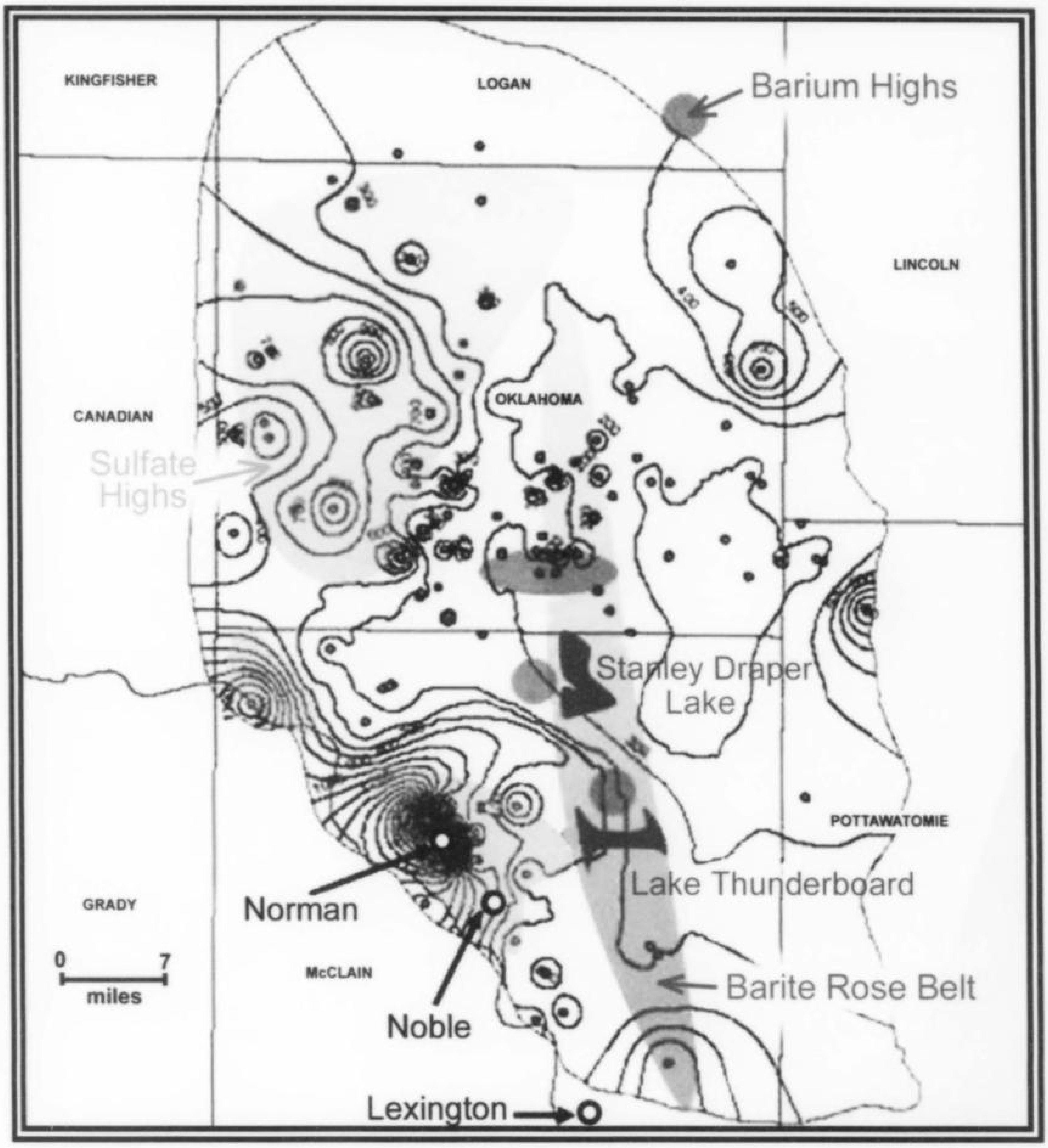


Figure. 24. **A map of total dissolved solids in subsurface wells of the Central Oklahoma Aquifer, also known as the Garber-Wellington Aquifer (Oklahoma Department of Environmental Quality). Superimposed on the map are regions of sulfate (green) and barium (red) highs from Parkhurst *et al.* (1994), as explained in the text, and the trace of the barite rose belt, in which the color saturation correlates with barite rose abundance.**

ferent sources, each carrying some but not all of the constituents needed to precipitate the insoluble mineral. In this case, the Garber Sandstone, which is a highly porous and permeable aquifer in central Oklahoma, could have carried solutions from different sources—one rich in barium and the other rich in sulfate—that mixed within fractures and precipitated barite. Within the modern Central Oklahoma Aquifer (Fig. 24), a broadly north-south band of sulfate-rich groundwater is distinct from but adjacent to a narrower band that contains anomalously high Ba (>1 ppm) in well water. Whether or not barite is precipitating today along the flow boundary between these two regions, the existence of spatially separate highs for Ba and for sulfate make the mixing model a viable one and hence a potential answer.

Barium and sulfur could have been carried together by groundwater in which the sulfur was reduced to sulfide. Deep oilfield brines in Oklahoma contain appreciable quantities of reduced sulfide as H_2S. The brines are acidic, which causes H_2S to dissociate to reactive HS^-. If deep oilfield brines containing heavy salt components (e.g., Ba, Br and I) and reduced sulfur (as HS^-) rise along fractures toward the surface, they will eventually encounter the vadose zone of oxygenated surface water. Upon oxidation of sulfide to sulfate, barite would precipitate immediately. High concentrations of barite could form at that interface between reduced and oxidized groundwater. The deep oilfield brines also contain water-soluble organic compounds, such as acetates and oxylates. I hypothesize that these have acted as organic poisons on selective barite growth surfaces (most notably, the {110} faces), leading to the formation of round crystals.

(6) Are the barite roses still growing?

We now know that the barite roses are younger than the depositional event that produced the Garber Sandstone. We do not know when (or precisely how) the quartz grains of the Garber became so angular, nor when the modern east-west and north-south fracture sets developed in the rock. Growth of the barite roses, however, postdates both of these events. The vast majority of the barite roses are not modern, either. They have been present in the soils of this region since they were eroded from the Garber Sandstone.

Modern groundwater in Oklahoma and Cleveland Counties is sulfate-rich (Fig. 24), with marked highs at locations beneath Norman, and Noble (Parkhurst *et al.*, 1994). Areas where barium anomalies exceed 1 mg/L of Ba (>1 ppm Ba) lie just to the east of the sulfate highs, and these few locations where Ba exceeds 1 ppm coincide with the trace of the rose rock belt. The highs in the sulfate map are likely to represent upwelling of deep, sulfur-rich water along highly channelized fracture zones. The high sulfate content (>250 ppm dissolved SO_4^{2-} in the green areas of Fig. 24) is sufficient to precipitate barite and hence keep the Ba concentrations below 1 ppm (cf. Putnis *et al.*, 1995). Therefore, barite could be precipitating as sulfide-rich waters rise into the aerated vadose zone near the surface, or else at the boundary of mixing between sulfate-rich and Ba-rich groundwaters. At least to a small degree, barite roses could be growing today.

At Zodeltone Mountain in southwestern Oklahoma, artesian springs are depositing barite at the surface today. This is one of only four springs known to be precipitating barite at the surface anywhere in the world (Sanders, 1998). The chemistry of water samples from the spring contains a component of Oklahoma's deep oilfield brines (Sanders, 1998), which are rich in Ba (~600 ppm), and are highly reduced, with 99.99% of total dissolved sulfur as reduced HS^- rather than as oxidized SO_4^{2-} (Collins, 1975). Zodeltone is a likely modern analog to the organic-rich springs that have fed (and may still feed) barium and reduced sulfide into the subsurface rocks in central Oklahoma. At present, this model is the most likely scenario for the formation of the barite roses.

CONCLUDING REMARKS

Barite roses are so plentiful in the soils from eastern Oklahoma County to the southern tip of Cleveland County that their supply should be regarded as limitless. In almost all instances, however, they occur on privately-owned land that is not in production and that is closed to collecting. The current owners of the historic localities cited above are adamant in their refusal to accept or even consider requests for digging. One problem with the market for barite roses is that the vast majority of them are small and rather poorly formed, and hence they have little value except in bulk quantities. Another problem is that most land owners are unaware of potential markets for selling barite roses outside of their own immediate locations. If all of your neighbors have barite roses, then you have no local market, and this fact and the historically low prices for barite roses conspire to deter digging and selling.

When they are good, however, the barite roses can form particularly aesthetic sculptural clusters and groups. Whether as individual rosettes, pairs, or an endless diversity of arrangement in clusters, the best of the barite roses are distinctly beautiful, and distinctively Oklahoman.

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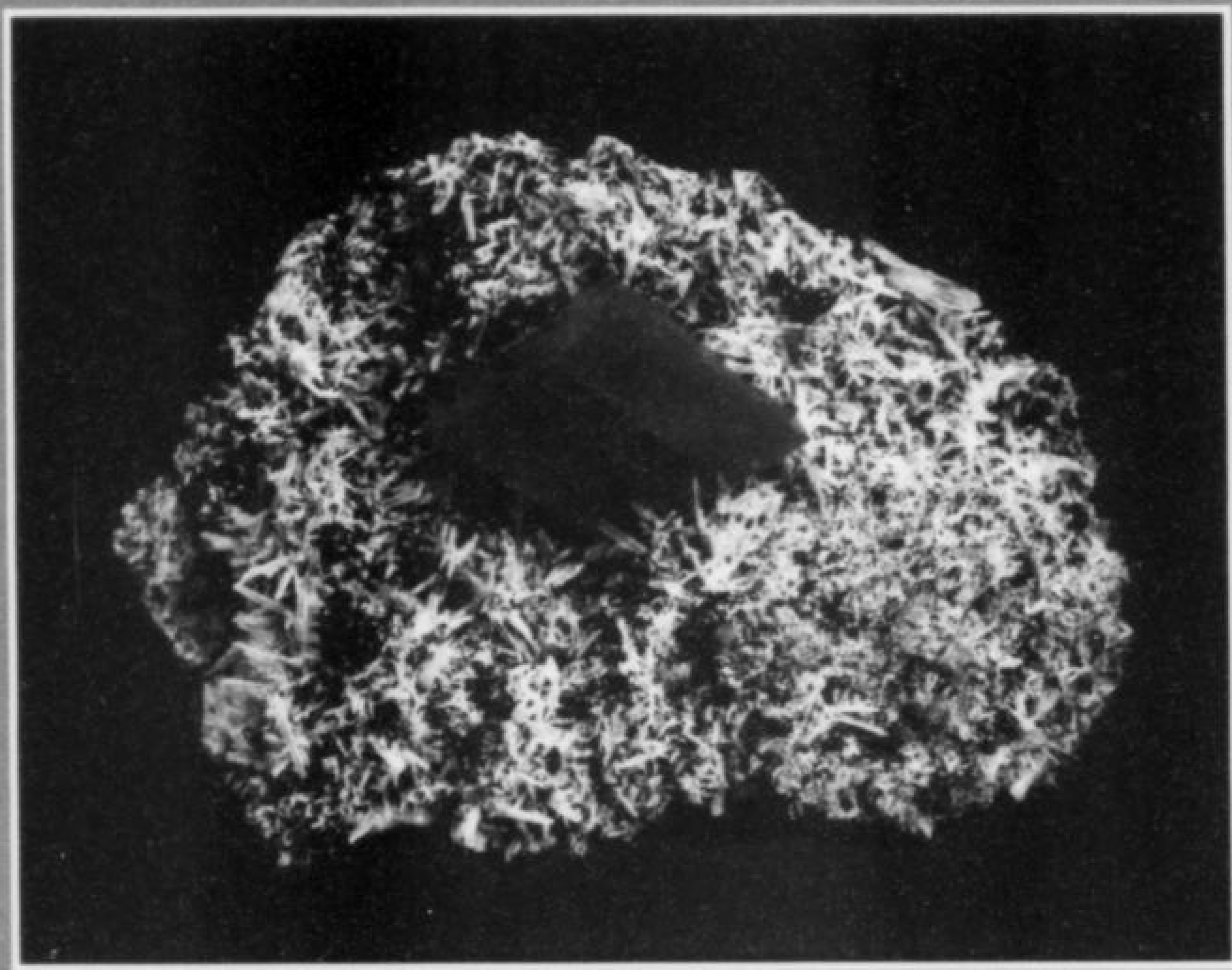

RHODOCHROSITE on Quartz, 18.2 cm,
from the Sweet Home mine, Park County, Colorado.
Marc P. Weill collection; Jeff Scovil photo.

GOLD, 22.8 CM, from the
Red Ledge mine, Nevada County,
California. Marc P. Weill collection;
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METATORBERNITE, 5.9 cm,
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The Emperor Mine, Vatukoula, Viti Levu, Fiji

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The Emperor gold mine, perched on the side of a caldera on the island of Viti Levu in the Pacific Ocean, has been known as a source of native gold and telluride minerals since 1868. It has yielded interesting specimens of crystalline gold, sylvanite, krennerite and native tellurium.

INTRODUCTION

This article was inspired by a specimen the senior authors acquired at the 2007 Tucson Gem and Mineral Show; it was labeled "Sylvanite, Vatukoula, Viti Levu, Fiji." Dave Bunk observed the crystal's apparent trigonal symmetry and suggested that it might instead be a tellurium crystal. This alternative identification was consistent with tellurium's point group 32, as opposed to sylvanite's 2/m. At his suggestion we took the specimen to Gary L. Zito, Laboratory Manager of the Electron Microscopy Laboratory of the Metallurgical and Materials Engineering Department at the Colorado School of Mines, and he confirmed the identity as native tellurium.

HISTORY

The Republic of Fiji, in the southwestern Pacific Ocean, is a volcanic archipelago consisting of 322 islands, the economy of which is dominated by the sugar cane industry.

The Emperor (or Vatukoula) mine is located at the northern tip of the main island of Viti Levu, in the Nakauvadra Mountains about 100 km northwest of Suva and 8 km inland from the coast. It has been historically the most productive of Fiji's precious metal mines, and Fiji's orebodies have the distinction of being the World's farthest from any continental land mass. Placer gold was discovered there in 1868, and commercial mining commenced in 1932 on Viti Levu's sister island, Vanua Levu. The Mt. Kasi mine there operated until 1946, producing 1800 kg of gold; it was reopened in 1996.

In 1933, a year after the Mt. Kasi discovery, the epithermal veins next to the Tavua collapsed caldera were brought into production. These mines, of which the Emperor is by far the most important, produced ten million ounces of gold from 1935 to 2005 (Rogers, 2005), and they continue in operation today. Since 1993 the operations there have shifted from the lower grade open-pit ore to higher grade ores exploited by underground workings (Mining Journal, 1998). The Emperor mine currently produces about 120,000 ounces of gold per year (Rogers, 2005). The Emperor Mines, Ltd. (and its predecessors) built the town of Vatukoula (meaning "Rock of Gold" in the local language) to accommodate the many mine employees who were brought in; the town has about 5,000 residents.

GEOLOGY

Compared to the continents, Fiji is very young, dating only from the Eocene (see Denholm, 1967; Ibbotson, 1962). The primary rocks are either extrusive, or intrusive bodies related to the extrusions. Sedimentary cover is limited, and consists largely of early reef and platform limestones. Between about 35 and 12 million years ago, in the middle Miocene, the Pacific plate was subducted under the Tonga Ridge, producing an extensive volcanic suite. In the middle Miocene subduction was reversed; during this time, low-potassium tholeiitic gabbros and tonalites were emplaced. Intense folding and faulting, produced by rifting, began in the late Miocene; this

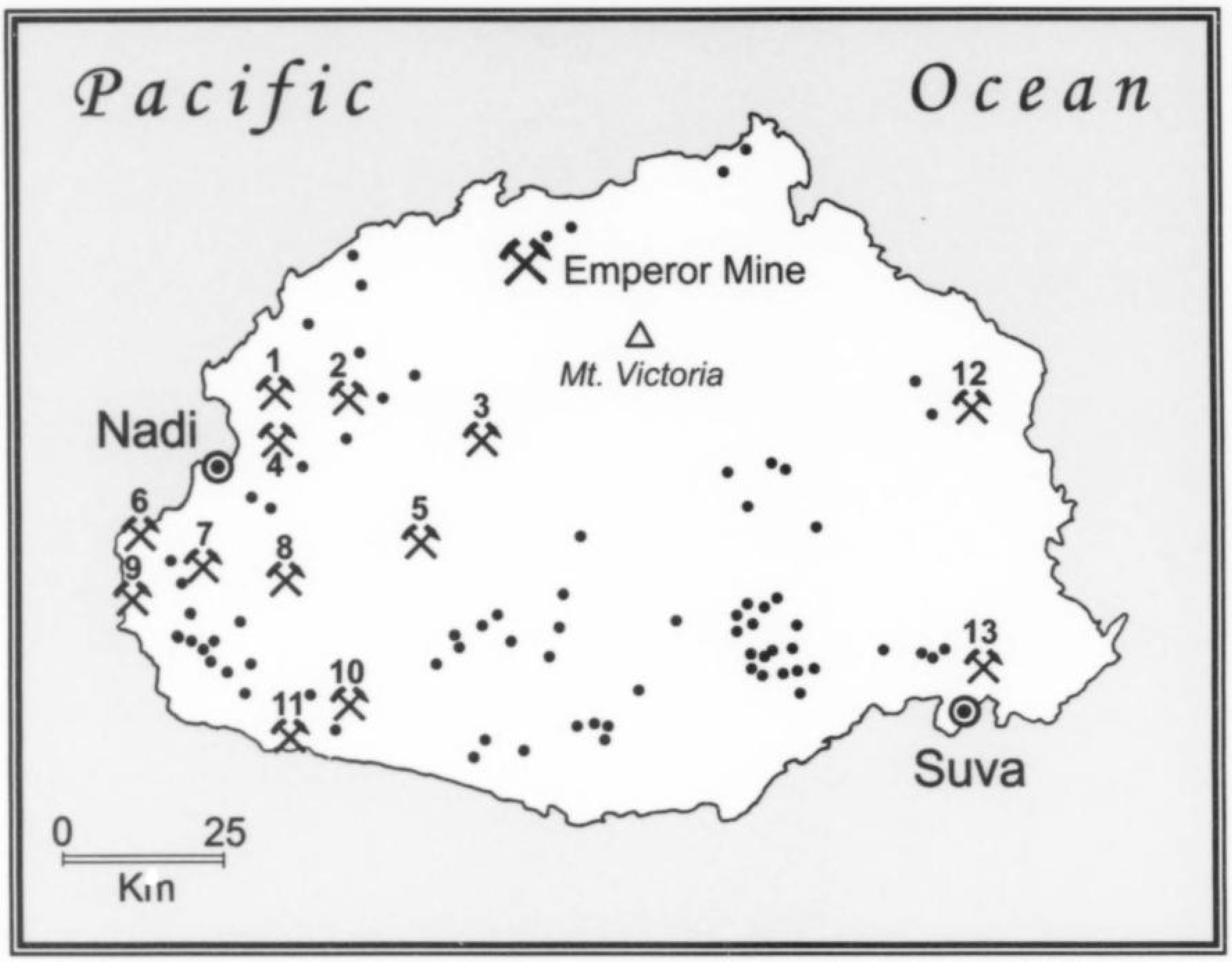

Figure 1. **Mines (⚒) and prospects (•) on Viti Levu Island, Fiji: Emperor mine (Au, Ag). *1.* Vuda mine (Au, Cu). *2.* Kingston mine (Cu, Au). *3.* Tabuquto mine (Mn). *4.* Votualevu mine (Mn). *5.* Nasaukoko mine (Mn). *6.* Mistry mine (Au, Ag). *7.* Nabu mine (Mn). *8.* Vunamoli mine (Mn). *9.* Koroviko mine (Mn, Fe). *10.* Baravi mine (Mn). *11.* Sigatoka Dunes mine (Fe, Ti). *12.* Wainivesi mine (Zn, Cu). *13.* Kalabo mine (Mn). Data from Fiji Mineral Resources Department, Ministry of Lands and Mineral Resources.**

activity led to intense volcanism, and also emplaced a number of plutonic bodies.

The Emperor mine straddles the western border of the Tavua collapsed caldera, which forms a basin about 4.5 × 5 km in area. The parent volcano underwent five intrusive stages, at least two of which were followed by collapses; the volcanic activity spanned the Pliocene, and was followed by shearing and gold mineralization, so the mineralization is quite young.

The classic epithermal ore deposits occur in steep shear zones in shattered country rock, and in nearly horizontal structures known locally as "flatmakes." The ore occurs in crustified quartz veins and pods.

MINERALS

Mindat.org lists 48 minerals from the Tavua Gold Field. These include 15 minerals containing gold and/or silver and 14 tellurides, among which are the lead telluride *altaite*, the mercury telluride *coloradoite*, and the nickel telluride *melonite*. Other unusual minerals of note in those orebodies are the relatively rare vanadium oxides *karelianite, nolanite*, and *schreyerite*, as well as the vanadium mica *roscoelite*.

The volcanic origin of the Tavua orebodies is analogous to that of the Cripple Creek district but, curiously, Tavua's list of 48 minerals does not include fluorite, which is pervasive at Cripple Creek.

Lawrence *et al.* (2001) described the various minerals found at the Emperor mine (most of which are not of collector quality, though some have micromount potential); their work is the principal source for the data that follows:

Arsenopyrite FeAsS

Arsenopyrite was found mainly in the Dolphin East lode, as tiny prismatic crystals on pyrite. The crystals contain sub-microscopic amounts of gold.

Barite $BaSO_4$

Barite is found in clusters of tiny white grains and in colorless, rhomb-shaped euhedral crystals commonly found attached to the termination faces of quartz crystals.

Calcite $CaCO_3$

Calcite occurs at the Emperor mine in much smaller amounts than quartz, and is only rarely observed as colorless, poorly formed crystals of the "nail-head" habit. Ore minerals are never present as inclusions, indicating that calcite crystallized after the ore-forming phase.

Chalcopyrite $CuFeS_2$

Late-stage chalcopyrite in sphenoidal microcrystals and reniform blebs lining cavities in telluride ore has been found on the 12th level of the Emperor mine.

Coloradoite HgTe

Coloradoite has been identified in polished sections from the Cardigan West shaft, in grains to 1 mm along quartz boundaries and as inclusions in krennerite (?) and calaverite (?).

Empressite AgTe

The rare silver telluride empressite has been reported as a minor component of Emperor mine ore.

Gold Au

Although gold is present in smaller amounts than the tellurides, some surprisingly attractive specimens have been recovered. Small, elongated crystals of gold to more than 1 cm occur on drusy quartz at

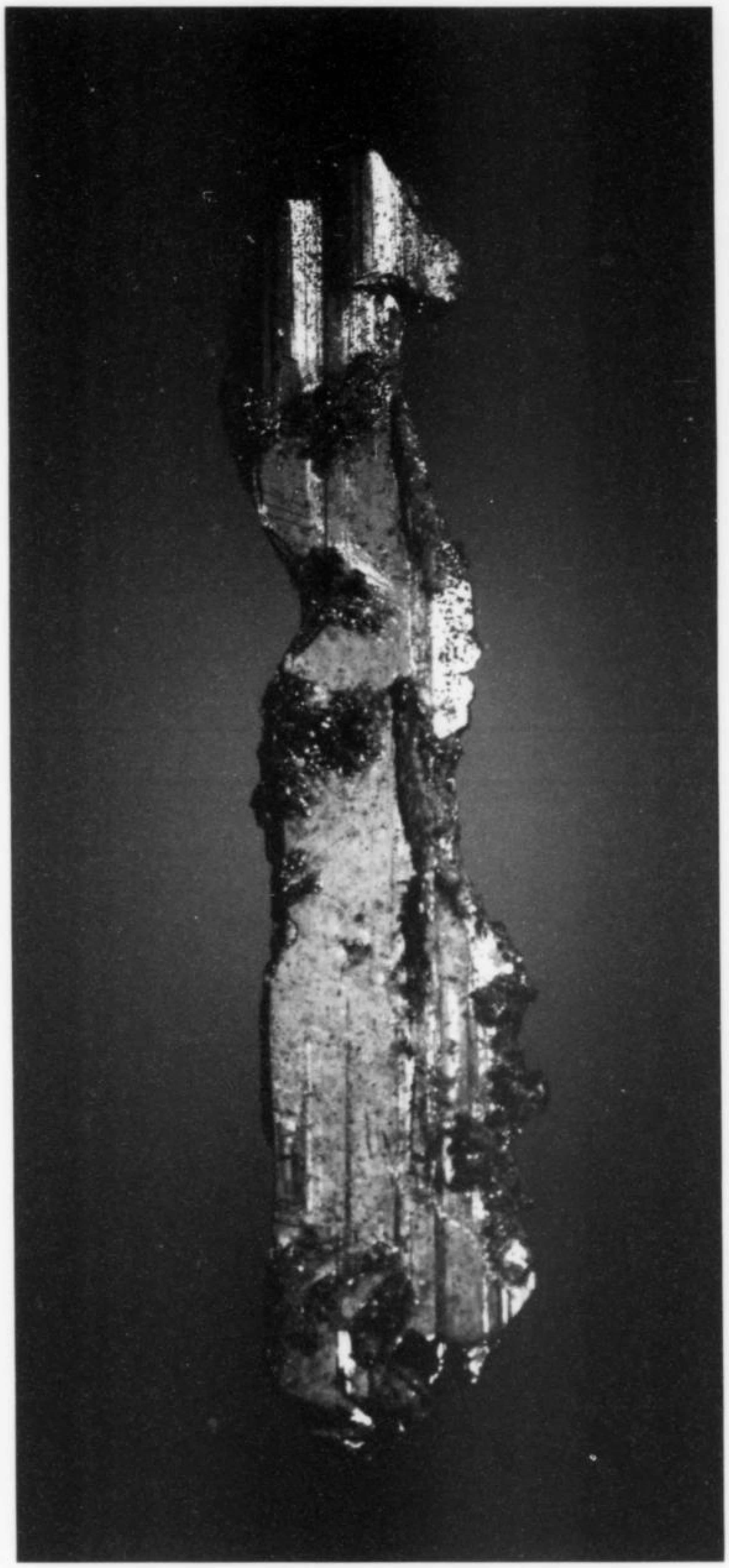

Figure 2. **Krennerite crystal, 2.7 cm, from the Emperor mine. Natural History Museum of Los Angeles County collection, donated by Kay Robertson; Anthony R. Kampf photo.**

the Emperor mine, and are found intergrown with sylvanite and pyrite in the Loloma mine (adjacent to the Emperor mine). The crystals are square in cross-section, and finely striated by alternating octahedron faces perpendicular to the axis of elongation. Equant crystals to about 1 mm are also known, in some cases covering several square centimeters of vein surface. Thin filaments (in sub-parallel nests like a bristle brush) and thin wires twisted and intertwined with quartz have been found; these wires can be up to 3 cm long. Earthy, brownish yellow "mustard gold" occurs lining near-surface joints as a result of the oxidation of other gold-containing minerals.

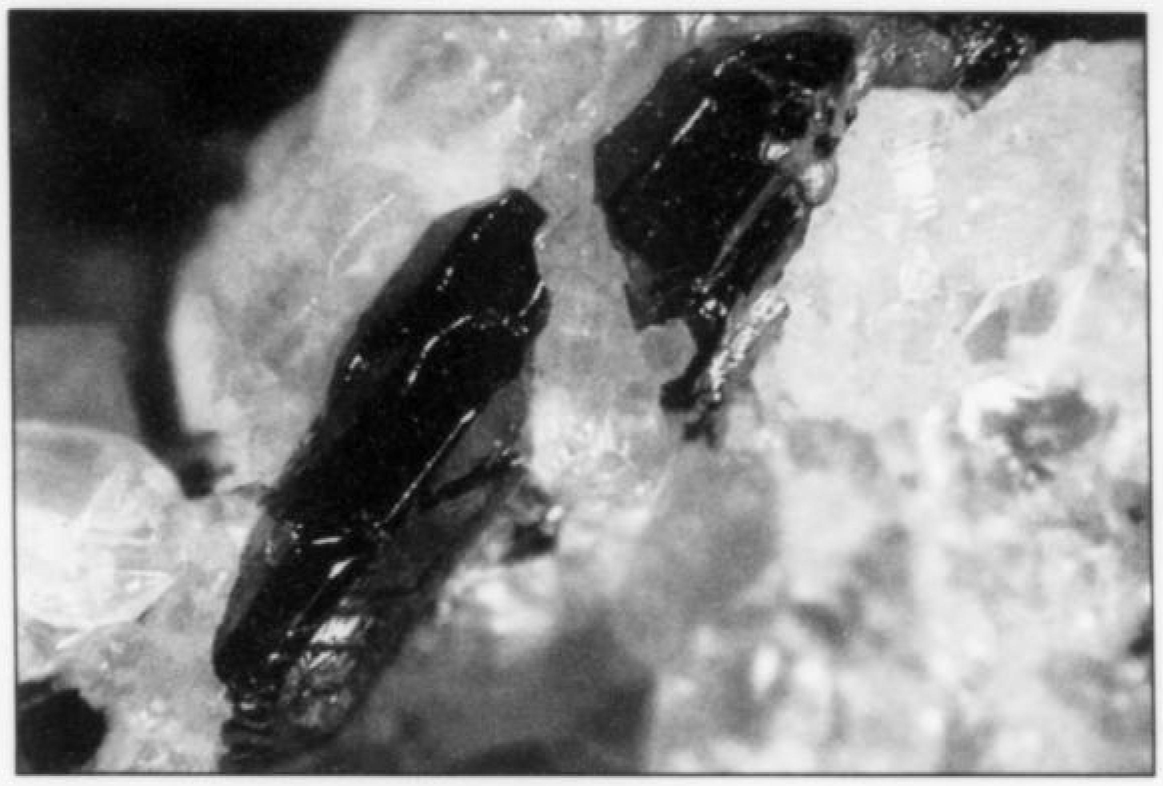

Figure 3. **Krennerite crystals to 2 mm, from the Emperor mine. Lou Perloff collection and photo.**

Hessite Ag_2Te

Hessite crystallizes in cubic symmetry above 149° C. but is monoclinic below that temperature. Emperor mine hessite formed above the inversion temperature. It was found more commonly in the 1940's, associated with sylvanite and gold. The rare macroscopic crystals are small and of a dark lead-gray color, usually surrounding sylvanite crystals.

Krennerite $(Au,Ag)Te_2$

Krennerite is known from the Emperor mine as a 3 × 4-cm specimen that used to be on display in the mine office of the former Mine Manager, P. Schmidt. The specimen consists of cleaved, silvery masses showing patches of violet iridescence.

Rock Currier visited the Emperor mine some years ago, and reports that, "They had a watch glass full of krennerite (?) crystals up to about an inch long. Thin, striated, silvery crystals, slightly rough but apparently terminated."

Melonite $NiTe_2$

Melonite has been found in polished-section studies of massive ore, in rare particles up to 20 microns across associated with chalcopyrite, sylvanite and hessite, and as inclusions in sylvanite and tellurium.

Nagyagite $Pb_5Au(Sb,Bi)Te_2S_6$

Nagyagite from the Emperor mine has been known since the 1944 edition of *Dana's System of Mineralogy*, but has not been reported since then.

Orthoclase $KAlSi_3O_8$

Diamond-shaped low-temperature crystals of orthoclase have been reported in mineralized vugs, but require confirmation.

Pyrite and Marcasite FeS_2

Pyrite, the most abundant of the Emperor mine metallic minerals, occurs as minute grains and disseminations, as microcrystals in vein-like aggregates, and as small crystals and clusters in the interstices between bladed sylvanite crystals. The cube and pyritohedron are the dominant forms. Late-stage marcasite blades have also been found associated with pyrite.

Pyrolusite $Mn^{4+}O_2$

Some of the mineralized vein quartz (carrying gold, stibnite or hessite) in the Emperor mine is colored dark gray to black by inclusions of pyrolusite.

Pyrrhotite $Fe_{1-x}S$

A few small grains of pyrrhotite have been seen in polished sections of telluride ore.

Quartz SiO_2

Quartz typically encrusts the walls of fractures, fissures and vugs at the Emperor mine, generally as drusy layers of transparent and colorless to white crystals up to around 4 mm.In some areas it is tinted greenish, presumably by chloritic inclusions.

Roscoelite $KV_2\square AlSi_3O_{10}(OH)_2$

Roscoelite, a rare vanadium-mica, is found as tiny flakes up to 0.5 mm in size, in wallrock close to quartz veins. Interestingly, roscoelite also occurs in association with telluride minerals at Cripple Creek, Colorado.

Siderite $FeCO_3$

Siderite occurs in the Emperor mine as the bright brownish red, tellurium-rich variety coating fracture surfaces in basalt near sylvanite-hessite veins, and as tiny salmon-pink globules with tellurides in quartz cavities.

Stibnite Sb_2S_3

Stibnite has been found occasionally; the best crystals (stellate groups of radiating prisms to 6 mm) have come from the 6th level of the Emperor mine.

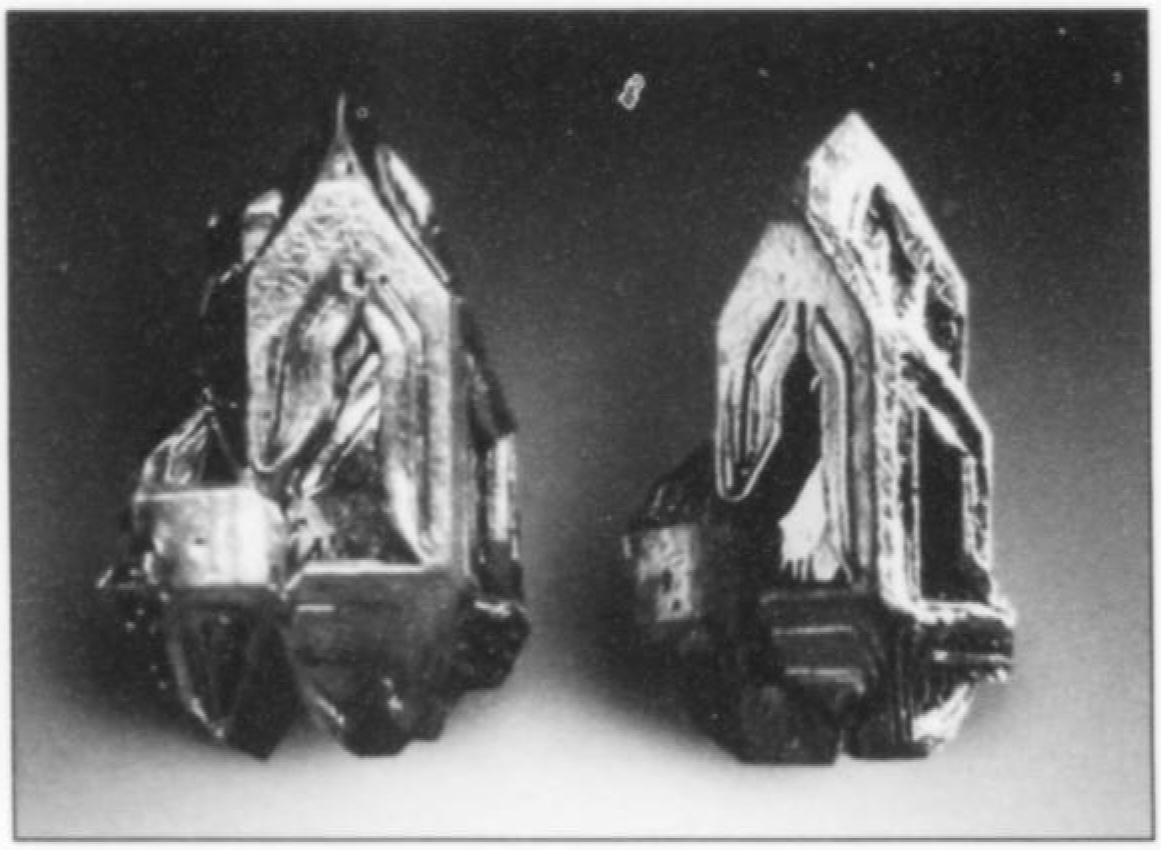

Figure 4. **Sylvanite crystal (two views), 6 mm, from the Emperor mine. Jason McEvoy photo.**

Sylvanite $(Au,Ag)_2Te_4$

Sylvanite is the principal telluride mineral at the Emperor mine, and occurs in a range of associations, intergrown on a fine scale with pyrite, tetrahedrite, arsenopyrite, hessite, native tellurium and occasionally gold. Habits include (1) elongated, striated prisms on drusy quartz, (2) lustrous, well-formed prisms stacked in parallel orientation in and on blackish quartz , and (3) as prismatic crystals to 2 cm in vugs lined with drusy quartz and ultra-fine-grained masses of tellurides and sulfides that sometimes encase sylvanite crystals. Numerous specimens of this type were collected in the 1970s.

Tellurium Te

Tellurium in bright, silvery crystals is common in small vugs lined with tiny quartz crystals. As a component of massive ore it occurs intimately mixed with sulfides, tellurides and gold. Single crystals and crystal clusters of tellurium rank with native gold as some of the finest specimens from the Emperor mine.

Slender, terminated, trigonal prisms to 4 cm have been reported in quartz cavities. The crystals are usually striated, occasional bent,

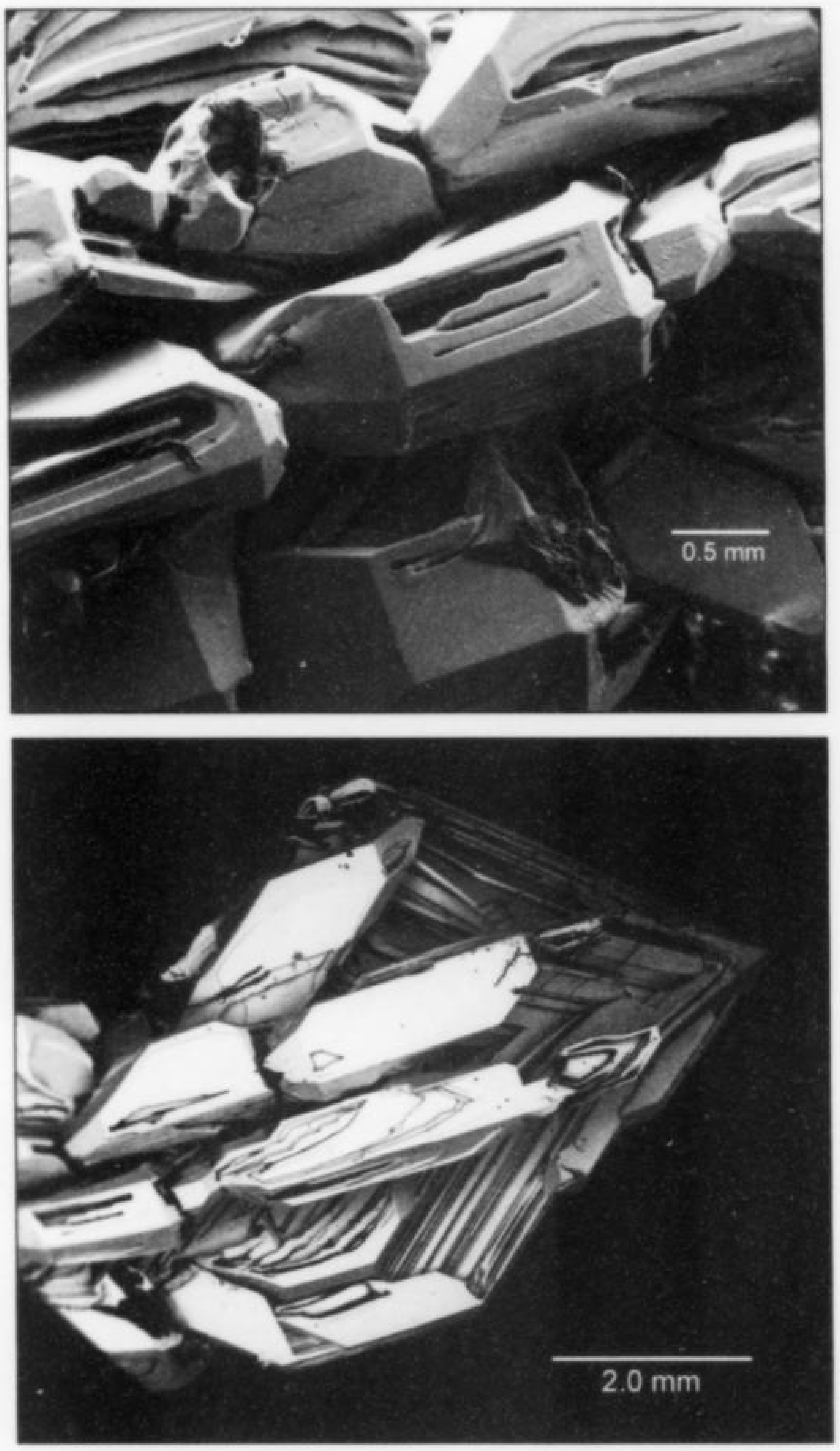

Figure 5. **Tellurium crystals, Emperor mine. Bill and Carol Smith collection; SEM photos by Gary L. Zito.**

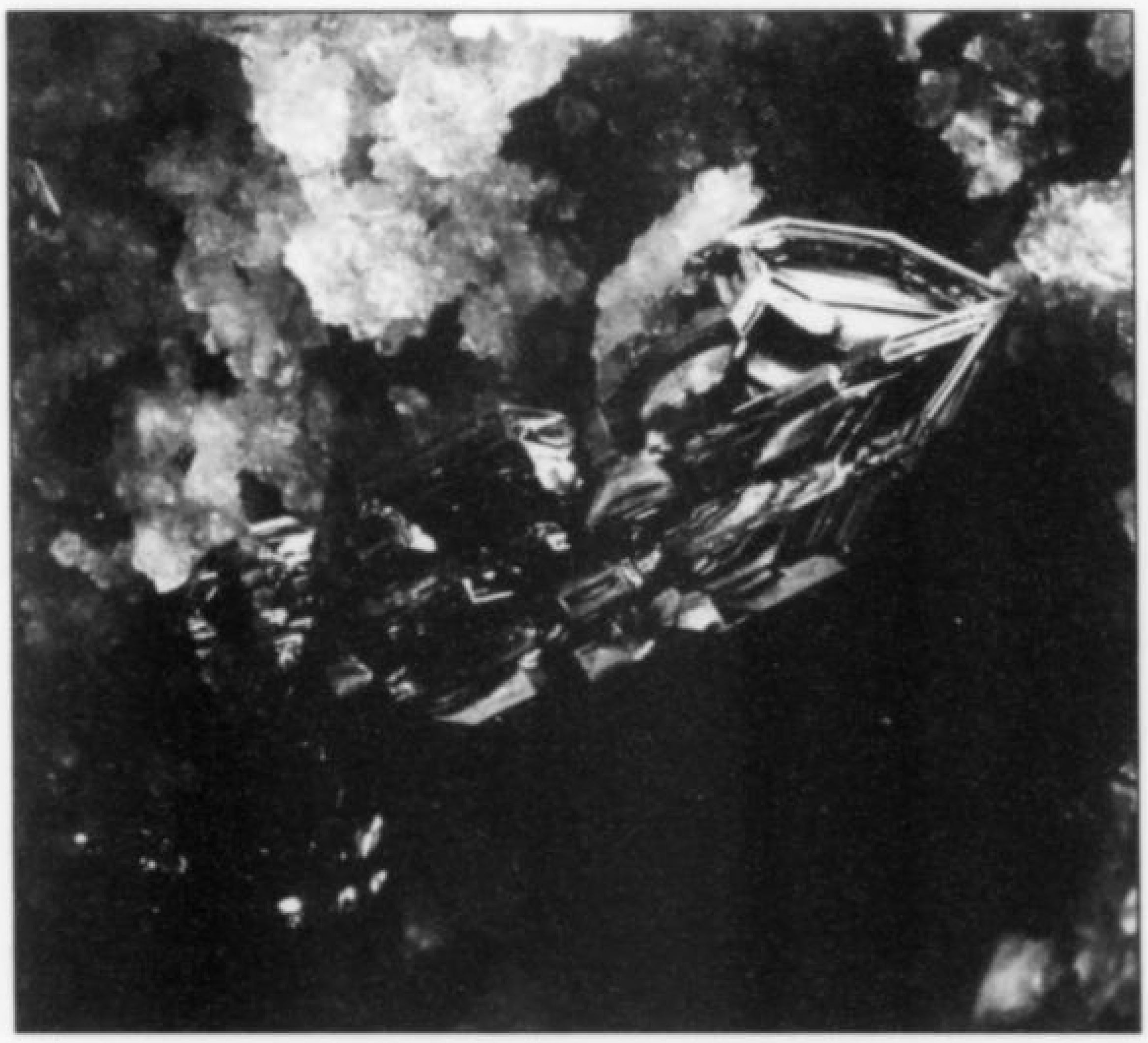

Figure 6. **Standard illumination photo of the specimen shown above in Figure 5. Bill and Carol Smith collection; Jeff Scovil photo.**

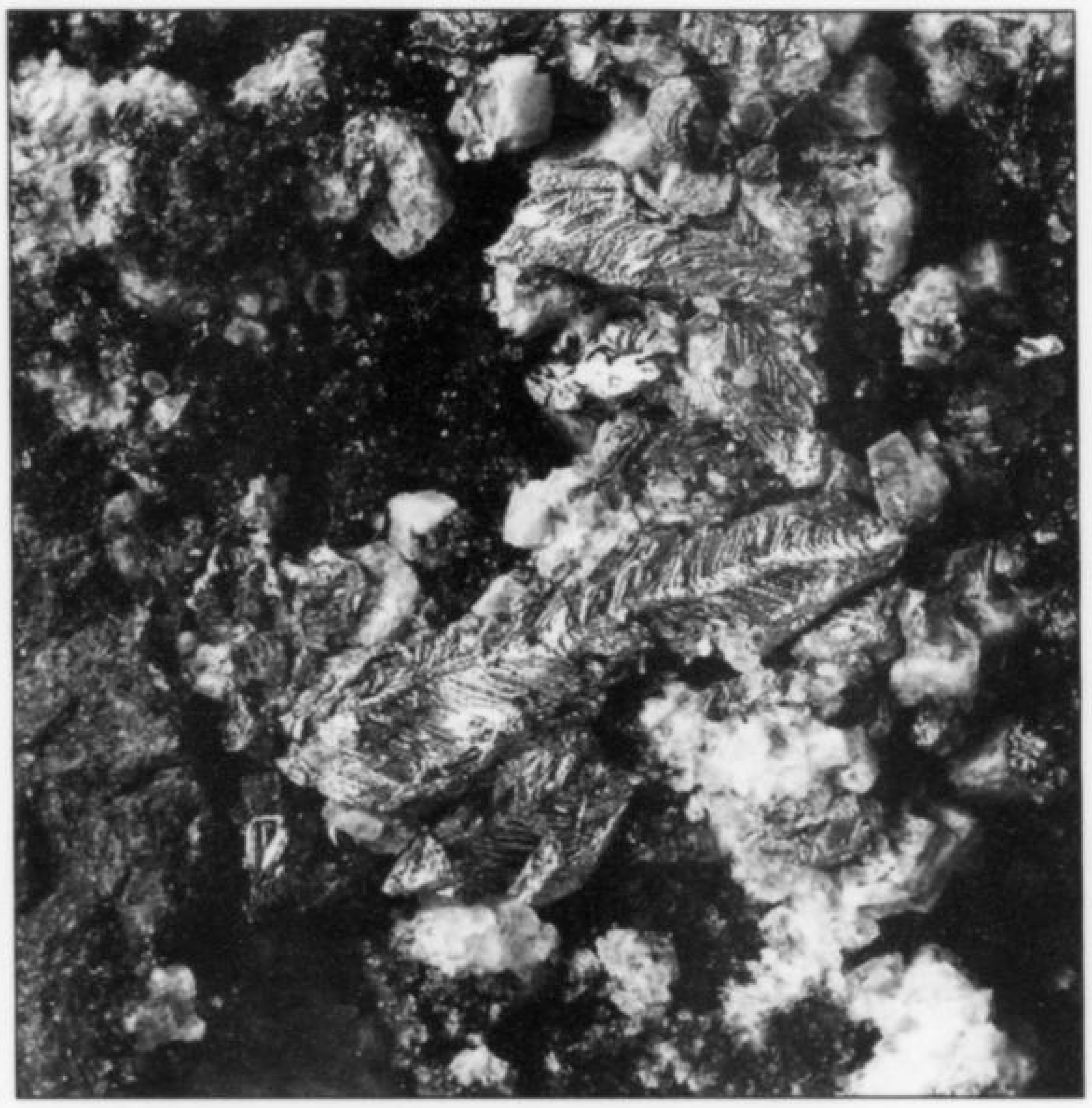

Figure 7. **Tellurium crystals to 1.4 cm, from the Emperor mine. Jordi Fabre specimen and photo.**

and may show a colorful iridescent luster. It is only rarely associated with other metallic minerals.

Our specimen was analysed using an electron microscope (a Quanta 600 FEI), and the EDX analyzer (a PGT-Prism 2000). Imaging was performed in the backscatter mode at 20Kv. The EDX spectra was collected at 20Kv and 40mA. This remarkable system can handle macro targets (our specimen is 6 × 6 cm) with a resolution down to 100 nanometers, and demands no special preparation (e.g. carbon coating).

Tetrahedrite $(Cu,Fe,Ag,Zn)_{12}Sb_4S_{13}$

Tetrahedrite in sharp, lustrous, modified tetrahedral crystals to 8 mm has been found rarely on drusy quartz vein linings. The crystals often have the points of smaller crystals protruding from their faces, suggestive of penetration twinning.

Other Minerals

Polished section studies have also noted the presence of galena, sphalerite, bornite, covellite and chalcocite. The Crown Crescent lode in the Emperor mine has yielded very minor amounts of bournonite, pyrargyrite, proustite and polybasite. Calaverite was tentatively reported but has not been confirmed. Dolomite and ankerite have also been reported.

Oxidation products of the primary minerals (usually as thin veneers) have also been reported from the upper levels of the mine. These include apple-green emmonsite, and a vanadium-rich variety of the rare scandium phosphate kolbeckite in tiny lime-green crystals associated with sylvanite.

ACKNOWLEDGMENTS

Our thanks to Dave Bunk and Gary Zito for positive identification of the tellurium specimen. We thank Ed Raines for providing most of the geologic literature. And we thank Jeff Scovil for his photography.

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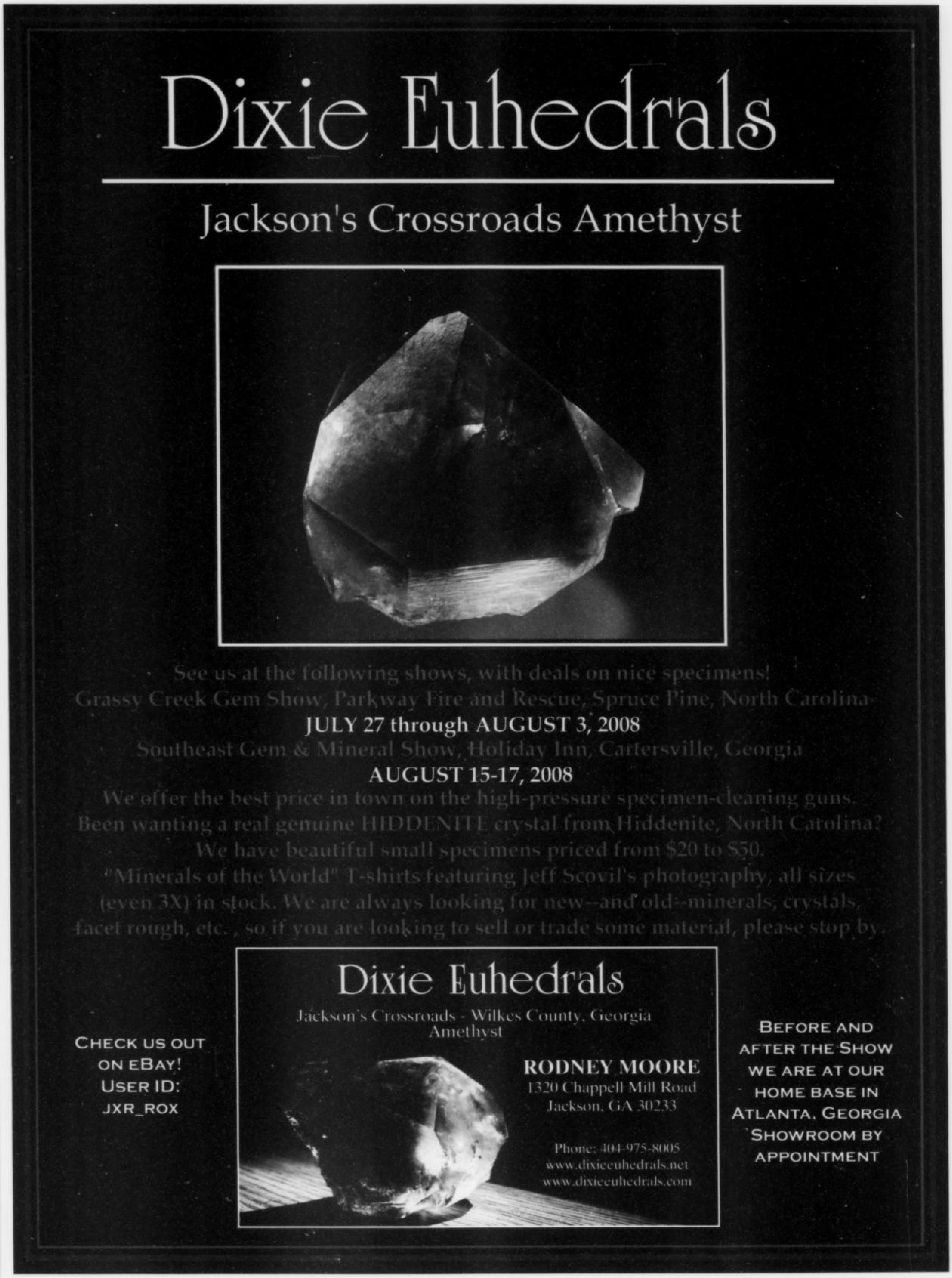
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About Mineral Collecting

Part 1 of 5

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Some personal observations, ruminations, reflections, reminiscences, ramblings, digressions, grumblings, approbations, wisdom and advice gleaned from 50 years of collecting and dealing in minerals

Our Growth as Collectors

As we grow as collectors we become "partialized" to particular mineral species or localities. Perhaps early in our lives we worked at a borax mine that produced fine specimens of borate minerals, and we came to love them. Or perhaps we attended a mineral show and became hypnotized by an exhibit case full of fabulous silver specimens displayed by an old collector. Or we were out field collecting with a friend and discovered a superlative pocket of meyerhofferite pseudomorphs after inyoite. These and other life experiences partialize us, often without our realizing it, to certain kinds of minerals, and we will always have a soft spot in our hearts for them.

If you become a mineral dealer, you will need to learn that the partialities you developed during your early years are, in many instances, not reflected by similar ones in your clients. In learning this lesson your first reaction may be irritation that others, because of their ignorance, do not appreciate the same kinds of specimens that you do. You think that if you can just educate them sufficiently, they will come to adopt your preferences as their own. These are rocky fields to till, and eventually you come to accept, at least to some degree, that the world is as it is, and not as you want it to be. After many years you look back at some of your early attitudes and wonder where in the world they came from. And at last you find that your personal tastes have indeed been shaped by the marketplace after all. However, as Mark Twain remarked, "It is better to be a young June bug than an old bird of paradise."

Over the years your value system will change. Every collector has had the experience of visiting a collection and being highly impressed, then in ten or 15 years going back to look at it again and wondering what happened to all the good specimens. In most cases the specimens did not change, only your perception of them. This sort of phenomenon strikes particularly hard at field collectors. When you break into a good pocket of crystals and collect them, they look like the finest things in the world. Usually, however, when you get them home, unwrap them, clean, trim and label them they look smaller and not nearly as good as they did when you took them out of the ground. Then after you take them to a mineral show, where they have to compete with all the other specimens offered for sale, they look even less remarkable.

Here is an example: One summer my best buddy said to me: "Come on! Let's go to Colorado and collect some amazonite. I have some claims near Crystal Peak in Teller County, Colorado that look good. You pay for the bulldozer and we will split 50/50."

That sounded great to me, so off we went. It was a glorious summer spent camping among the pines and aspen trees and collecting amazonite. I learned to drive a bulldozer and swat flies at the same

A gentleman collector
(1825)

From Gottlieb Tobias Wilhelm's (1825) *Unterhaltung aus der Naturgeschichte; Des Mineralreichs* (published by Anton Pichler, Vienna, plate 1). Although his attire is more elegant than is typical of field collectors today, he still carries his magnifier to examine small crystals, his rock hammer, his field notebook and a broad-brimmed hat for sun protection.

time. We got about 1,000 pounds of amazonite crystals. We found many different pockets of amazonite and one of them, let's call it pocket #17, produced some particularly fine specimens. One of them was a stacked cluster of fabulous dark blue amazonites about a foot high. We thought it looked like the Empire State Building! We carefully packed it away in a box and marked it so it would not get lost among all the other boxes.

A few months later we got around to cleaning up that particular batch of specimens and unwrapped the specimens from pocket 17. We were both shocked! The specimen had vanished. We scrabbled in vain among the packing materials, thinking we had not unwrapped everything, but the specimen simply was not there. We even considered the possibility that someone had gotten into the box and stolen it. Eventually I pointed to a small specimen and said, "You know, it was sort of like that one, but much larger." We both examined the specimen and put it back down on the table and stared at it in silence. At the same moment we looked at each other and came to the sinking realization that this small, modest specimen was in fact our cherished Empire State Building specimen that we remembered so vividly. It had shrunk to the size of a small cabinet specimen. We just broke up laughing about it.

I don't think anyone is immune to such "shrinkage." Dick Bideaux, one of the authors of the multi-volume *Handbook of Mineralogy*, and a stickler for accuracy, carried a small plastic ruler in his wallet to measure crystals so he could record their dimensions rather than have to rely on memory, which he knew was not very reliable.

Not all collectors will continue to collect all their lives. Sometimes it is a passing fancy. Life is continually changing and it takes us in many directions. Young collectors who get married may find that a wife and children cause an interest in minerals to become dormant for many years, only to flower again later in life.

Also, fashions in minerals change. For a few years thumbnail-size specimens might be all the rage, but then some years later fewer people seem to be collecting them. A few collectors (fortunately only a few) come to feel that they have been led down the garden path by dealers who loaded them up with overpriced specimens, and consequently they drop out of the hobby in disgust and disillusionment.

Most of what I have written below is directed not at transient collectors but rather at those who will most likely become collectors for life. There is much literature out there for novice collectors that I never found very useful, informative or "real-world," so I decided to write this for dealers, curators and advanced collectors who should, if I have done my work successfully, experience some cognitive resonance when reading my remarks.

How much can you know?

No matter how much you have done, read or observed, you are never going to know it all. The best you can hope for is to learn more than anyone else. If you think you know a lot about minerals, consider this example: tell me all about the minerals and specimens from Cerro Rico. What? You have barely heard of the place? Well, it has been continuously mined for the last 450+ years and is considered by many to be the richest silver deposit ever found. The city of Potosí in Bolivia sits at the foot of Cerro Rico ("Rich Mountain"), and during its heyday it was the largest city in the western hemisphere, with an opera house and riding academies. Potosí is probably best known to collectors for the world's best phosphophyllite crystals, but, considering its long and illustrious history, how could you not know about all the *other* specimens produced at this locality? Some people do possess bits of information (perhaps recalled from the *Mineralogical Record* article on the locality in 1999), but we can be sure that no one can know more than a tiny percentage of the truth about this place. In fact, we can also be certain that *no one at all* has ever known about or seen many of the best specimens, which have ended up pulverized and smelted into silver coins produced by the Casa de la Moneda (minting house) established there by the Spanish. The best azurite specimen that was ever found is probably now in the form of a copper pipe somewhere under New York City.

Where can I find out about fine mineral specimens and what they are worth?

There is much more to a well-rounded mineral maven than just knowing about specimens. Much of our civilization is built from the raw materials produced from the mines and quarries that produce the specimens we crave. The history of humanity is entwined with these localities, and wars have been fought over them. All of our lives as specimen-collecting nut cases we spend learning about why some specimens are better than others, their current availability, and how much they are worth. Collectors are always gossiping about such things, but the discussion of collecting's financial aspects in print seems to be largely avoided.

For one thing, financial evaluations are a matter of opinion, always changing, sometimes according to fashion or from one encounter to another, and are not easily pinned down with any precision.

Another concern for magazine editors may be that someone's opinion about the quality or value of a specimen will offend some of their readers, or worse yet, step on the sensitive financial toes of the dealers who advertise in the magazine. Heaping praise on a specimen, or specimens from a particular locality, presents no problem, but saying or implying that some are not worth as much as others is "taboo." There is little financial upside in making such value judgments in print, only a down side.

If a dealer has what he thinks is the best of a particular mineral species in the world, he will proclaim it to the heavens. If, however, he does not, which is almost always the case, he is not anxious to compare his goods with the best. The reason is simple and obvious. If comparisons were made, the specimens offered for sale would appear less appetizing and be more difficult to sell. Even if we don't have the best specimens, we are usually able to exaggerate the quality of our wares enough to make a profit on them. We get away with it most of the time because we usually know more than the person buying the specimen. Need I point out that this "evil" behavior is not limited to mineral dealers and used car salesmen, but is common in most areas of human commerce? *Caveat Emptor.*

As collectors, when we are looking at a display case of mineral specimens, especially fine ones, we often play the game "What is the best specimen here?" or "Which one would I like to have?" It is a way to hone our ability to discriminate between the best and near-best. Often, when buying an expensive specimen, even collectors will ask the dealer, "How good is this specimen?" This same question is asked in many different ways: "Is it worth the money?" "How many better ones have you seen?" "Is the mine still producing specimens?" Of course any answer(s) from the person selling it should be taken with a grain of salt. If you put these questions to another dealer, keep in mind that he may be reluctant to praise a competitor's merchandise because he would rather sell you something from his own inventory. In such cases his praise of the specimen might be less fulsome than true objectivity might call for. Depending on whom you are dealing with, the amount of waffling about the desirability of a particular specimen may be in direct proportion to its price.

Here is a tip that all collectors should take to heart. If you borrow a specimen from one dealer to show to another, show it in private and in circumstances that preclude the possibility of the owner knowing who you are showing it to. Even if you follow this rule, many dealers and collectors are reluctant to comment honestly on the value and quality of a specimen because they have found out that such opinions will more often than not cause them problems with other dealers and collectors.

When all is said and done, we are often still not sure of how valuable a specimen is. I told a dealer friend of mine after the Freilich auction (see below) "You know, sometimes I think I don't have any idea of what's going on in the mineral business anymore!" He answered, "Well, I do . . . one or two days out of the week."

Collection of Eugene Patrin

(1742–1815)

Copper

Touria mines, Ural Mountains, Siberia, Russia

From Eugène-Melchior-Louis Patrin's (1801) *Histoire Naturelle des Minéraux* (vol. 5, page 104; published in Paris by Chez Deterville). In the text he comments that a discovery in the Touria mines in Siberia yielded incomparably beautiful arborescent groups of cubic and octahedral copper crystals having a brilliant gold color as shown. The mine manager, a Mr. Pokhodiachinn, presented him with many specimens of that rare variety.

Eight things you can do to learn about mineral specimens

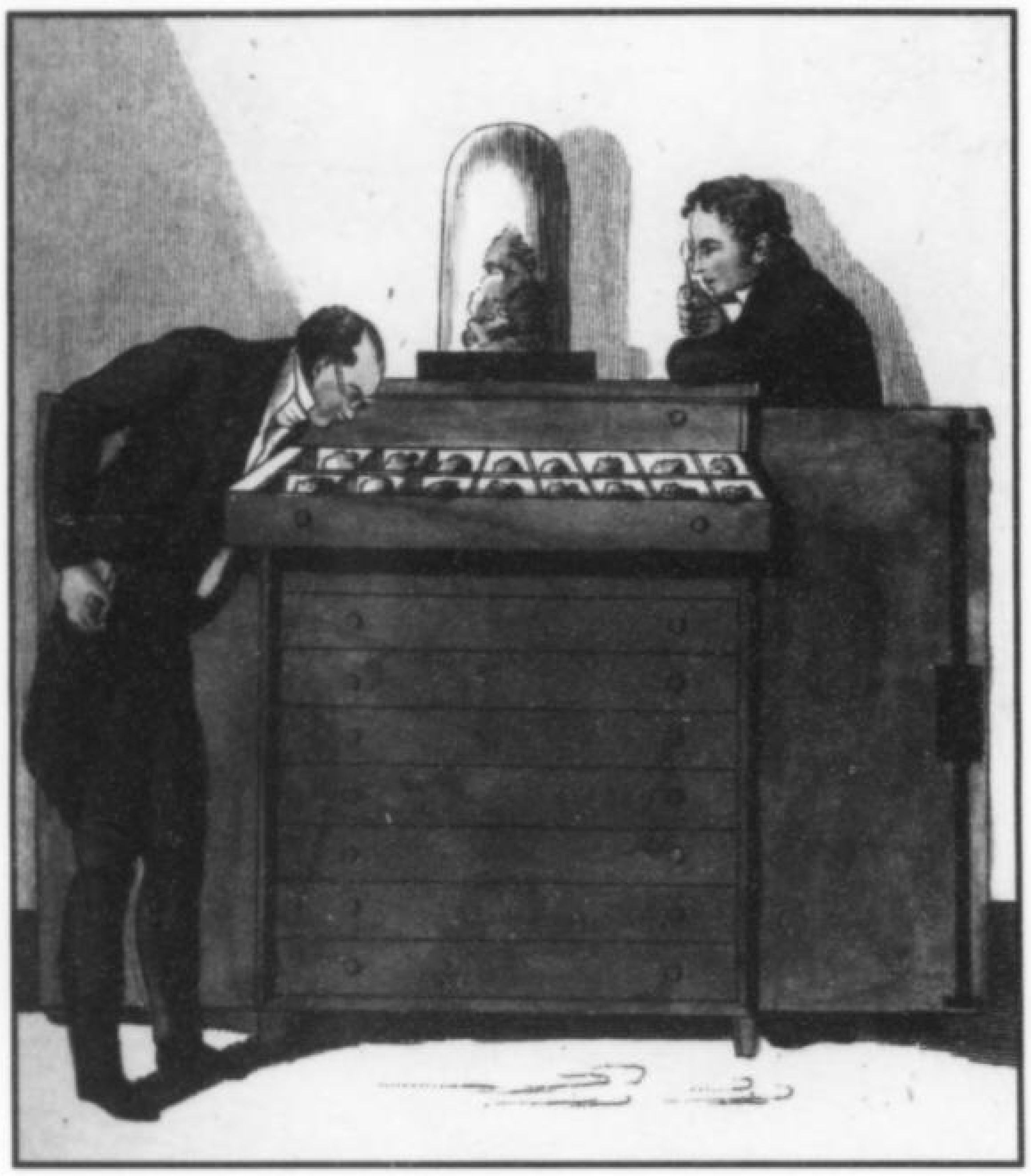
To learn about minerals and mineral specimens you must see them and handle them. It is very important to handle them. A picture can be very good and can teach you a lot, but it provides only a limited one-dimensional view of a specimen. It will not teach you the feel, heft, smell and taste of a mineral or allow you rotate it in three dimensions and look at it from all angles. Doing so allows you to more easily comprehend surface textures, weight and the three-dimensional nature of different kinds of crystals.

To really learn about minerals it is essential to go to where the specimens are, and see them in person. (1) Visit museums and schools that have mineral collections, (2) ask to see private collections, (3) attend meetings of gem and mineral societies, (4) visit gem and mineral shows, and (5) collect your own specimens as a learning exercise. You also need to study *about* them; (6) read mineral magazines and mineral books, (7) take classes, attend study sessions and (8) surf the Internet. Here are some suggestions about each of these approaches:

Some great institutional mineral collections to visit

The great public mineral collections include, but are by no means limited to, the following institutions, not all of which have their collections on display:

Harvard Mineralogical Museum, Cambridge, Massachusetts
Yale University, New Haven, Connecticut



Collectors studying a collection
(1825)

From Gottlieb Tobias Wilhelm's (1825) *Unterhaltungen aus der Naturgeschichte; Des Mineralreichs* (published by Anton Pichler in Vienna, plate 2). In a scene that is regularly duplicated precisely by collectors today, two visitors examine a friend's mineral collection in its cabinet of drawers.

American Museum of Natural History, New York
Academy of Sciences, Philadelphia
Bryn Mawr College, Bryn Mawr, Pennsylvania
U.S. National Museum of Natural History (Smithsonian Institution), Washington, D.C.
Seaman Mineral Museum, Houghton, Michigan
Carnegie Museum of Natural History, Pittsburgh, Pennsylvania
Houston Museum of Natural Science
Denver Museum of Natural Science
Natural History Museum of Los Angeles County, Los Angeles
Canadian National Museum, Ottawa, Canada
Royal Ontario Museum, Toronto, Canada
Natural History Museum, London
École des Mines, Paris
Sorbonne University, Paris

I chose to mention these few either because I have spent a lot of time studying the specimens in those institutions or because the curators granted me extraordinary privileges in handling and photographing their treasures. For a more complete listing and description of many mineral museums, see the 25-year index to the *Mineralogical Record* and look under "Museums and Private Collections" in the General Index (available online at www.mineralogicalrecord.com). Also see the book *World Directory of Mineral Collections* (1994) by the International Mineralogical Association.

Good private collections

See as many of these as you can. Donated private collections are the foundation upon which great institutional collections are built. Most collectors love to show off their collections. If you meet someone who has a good collection, introduce yourself and say "I've heard that you have a wonderful mineral collection; may I come and see it?" Most collectors will be delighted by your interest, and only very rarely will you be turned down. Even in the reluctant cases, a little perseverance will usually gain you access. Among your fellow collectors resides much of the knowledge that you are seeking. Convince the collector or curator that you are interested and knowledgeable, and the doors will swing wide, granting you access to their specimens, their knowledge and their help.

If you are allowed to examine a mineral collection, observe good collector etiquette: do not pick up any of the specimens unless you understand the correct protocol (which I will outline below).

Books & Magazines

You should invest in some of these. Much of what you need to know as a collector is scattered through the mineralogical and geological literature, but some sources are much richer than others in information about what constitutes good specimens.

I have always had a pet peeve about the descriptions of minerals in books. Many books will give lists of minerals found in various geological environments or found at various localities, but say precious little about the quality of those specimens, nor will they present a photo to see. My main gripe has always been "Where's the beef?" When pictures of the described specimens are not present, which is usually the case, consider what kind of knowledge about specimens the author is likely to have. He may have profound knowledge of what fine specimens are, or he may be a geologist or a mining engineer with a very limited knowledge. In the latter case, the author may wax enthusiastic about a mine that has 3-foot green fluorite "crystals," but fail to mention that they are only massive, highly fractured blobs of fluorite, barely distinguishable from the country rock and of interest only to people who want to make fluoridated toothpaste.

Many years ago when I was doing a lot of field collecting I called up Dr. Richard Jahns, an expert on pegmatites, at Stanford University. I asked him for advice about where to go in the Petaca mining district in New Mexico, since he had written the USGS Professional paper on the district. He enthusiastically told me about a fabulous mine there that had 3-foot fluorite crystals and sprays of columbite and tantalite in the walls of the mine. But he cautioned me not to tell anyone else! We found the fluorites to be as described (strictly speaking). The most memorable things about the mine were some amazing, round, white hemispheres of slime mold, some almost a foot across, that we found growing on old, wet mine timbers near the water level in the incline.

Here are some books I have found particularly useful and instructive: in other words, those which have the most "beef" in them for specimen lovers.

Das Mineral Reich (1903) by Reinhard Brauns

This book was also issued in an English translation, *The Mineral Kingdom,* in 1912. It contains colored plates which show what fine mineral specimens were considered to look like in the late 19th and early 20th centuries. The specimens were taken mostly from German collections and mineral museums. For many years it was perhaps the best book to consult when you wanted to determine where one of your specimens stood in the hierarchy of mineral quality. Although the image quality in the book was good for its day, one wishes that it could be republished today using modern photographic and printing technologies. Still, it is plain that the best specimens of 100 years ago are still fine specimens today.

***Dana's System of Mineralogy*; 6th & 7th editions, and *Dana's Textbook of Mineralogy*, 4th edition**

James D. Dana is generally considered to be the Father of American Mineralogy, and the various editions of his *System of Mineralogy* have long been cherished by American mineralogists and collectors. The 7th edition lacks descriptions of silicate minerals but has good crystal drawings. Pictures of fine specimens are lacking. However, for each species, in the "Observed" section, there are mentioned many localities that have produced specimens. I can't think of how many times I have consulted these weighty tomes for correct locality information. But I should also pass on a word of caution about these localities. Many have been carried forward from earlier editions and references. Sometimes the authors had never even seen a specimen from the locality they were citing. When the earlier source reference was published, the specimens from those localities were frequently the best ones available. Quality standards have escalated, and many of those old specimens would hardly be given a second glance by today's collector. But if these localities were referenced by the illustrious Dana, the specimens must be worthy of being included in new books—right? Well, sometimes, quite often in fact—but not invariably.

***Handbuch der Mineralogie* (1897–1975) by Carl Hintze**

Publication of this work began at the end of the 19th century and continued intermittently for decades thereafter. Although this work is in German, any serious mineralogist or mineral collector should at least be familiar with it. The complete work consists of 247 volumes of mineralogical information. Well, OK, it isn't 247 volumes, it just seems that way. The work is so large and detailed that it is at first intimidating. Some Americans just throw up their hands, saying "Only the Germans would do something like this." But the Hintze volumes are to European mineralogists what Dana's *System* has been to Americans. It sort of reminds one of the *Encyclopedia Britannica* or the full, unabridged *Oxford English Dictionary*. Its sheer bulk makes Dana's *System* seem rather anemic in comparison. But you will need to understand some German to make much use of it.

***Mineralogy for Amateurs* (1964) by John Sinkankas**

This is a deceptively simple-looking book, but one that embodies a wealth of mineralogical knowledge and wisdom. It has many photos of good specimens and tells you about others. Get a copy and use it; you will find it rewarding. This is the one mineralogy book that we carry in our wholesale warehouse. Depressingly, we find that it is difficult to sell, and it is in fact outsold (by a factor of 100+ to 1) by books on the metaphysical attributes of minerals. I become depressed when I consider what this implies about the reason-based society that, I think, most of us would like to live in.

***Handbook of Mineralogy* by Bideaux, Anthony, Bladh & Nichols**

At six hefty volumes, it sure doesn't fit in a hand. The work is arranged alphabetically by mineral species, and each volume deals with chemically related groups of minerals like silicates, phosphates, etc. This will certainly be rated, in time, as one of the great mineralogies. The most common complaint about the work is that it allows only one page to describe each mineral, whether it be an extremely rare one-locality mineral or a common mineral such as quartz or calcite. At the top of each page is a brief discussion of "Crystal Data." For the collector, perhaps the most interesting feature of this section is mention of the largest known crystal of that mineral. It often will not tell you what locality that largest crystal might be from or much about what it looks like, but you will at least know how big the crystals of this species get. I do not know how much work each of the authors did in writing this book, but Dick Bideaux was a real stickler for accuracy, and considering that he personally financed the publication of the handbook I believe the accuracy of the data in this mineralogy may surpass that of all others. Dick offered a five-dollar reward to anyone who could spot an error in the text and, if I recall correctly, up to the time of his death he had paid out less than $100.

The Scholar

(1500s)

Just as in the 16th century, there is no substitute today for studying books to learn about your favorite subject. Of course, today, some of those "books" are actually on the Internet, but a personal library is still a valuable resource for any collector.

***Popular Guide to Minerals* (1912) by Louis Pope Gratacap**

Written by a former curator of the American Museum of Natural History, this book includes a description and some photos of specimens in the Clarence Bement collection, which in its time was considered the greatest private mineral collection in the world. Its gift to the American Museum, thanks to the generosity of J. P. Morgan, instantly catapulted the museum to the top ranks of great mineral museums. It was reported that at the time the museum had not a single specimen that was not bettered by a similar specimen in the Bement collection. Over the years, after the departure of longtime curator Fred Pough, this magnificent patrimony was frittered away by inept curators and misguided museum policy. Although today the curation again appears to be in competent hands, the specimens remaining in the museum from this great collection cast but a faint shadow of its former greatness.

Gratacap infused his work with mineralogical wisdom for the collector, most of which is as true today as when he wrote it early in the 20th century. Examples: "A delicate regard for one's pocket

Collection of Casimir Schmiedel
(1718–1792)
Cinnabar
Velker-Grunde, Carpathian Mtns., Hungary

From Casimir Christof Schmiedel's (1753) *Erz Stuffen und Berg Arten* (published by Johann Michael Seligmann in Nuremberg, plate 13). We take well-illustrated mineralogy books for granted today, but Schmiedel's work was the first important book with good color pictures of mineral specimens to aid in field identification.

book will not enhance the distinction of one's cabinet." Speaking about bournonites: "Many fine, but one recalls with regret those in the British Museum." Speaking about cuprites from Bisbee, Arizona: "They allow a patriot a pardonable thrill of pride in their flattering comparisons to their British counterparts."

***En Visitant Les Grandes Collections Mineralogiques Mondiales* (1964, 1972) by Claude Guillemin**

The author visited many museums and private collections and made lists and a few line drawings of the specimens he thought were the best, then published them in two paperback volumes. Had he sufficient resources to publish these with good color photos instead of line drawings, these books would be much better known to collectors than they are. Even so, these are good books to have if you are interested in fine minerals.

***The World's Finest Minerals & Crystals* (1973) by Peter Bancroft**

This is surely one of the best efforts to the date showing what the best specimens in the world look like. It is somewhat limited in the variety of mineral species depicted, and many specimens have since been bettered by recent discoveries, but the book was a benchmark for its time.

***Gem & Crystal Treasures* (1984) by Peter Bancroft**

This book is a wonderful collection of photographs and descriptions of classic mineral localities with descriptive text by a prominent collector of considerable knowledge. It also has some good pictures of fine mineral specimens from those localities. You should have this book and read it if you want to be a well-rounded collector. Unfortunately it is rather scarce on the used book market, but a new, updated edition is said to be in preparation.

***The F. John Barlow Mineral Collection* (1996) by F. John Barlow, Robert W. Jones & Gene L. LaBerge**

Barlow's lavish personal collection catalog contains many good color photos of fine specimens from John's collection and many interesting "war stories" about the acquisition of his specimens. It is nice because the photos are scattered throughout the book with the relevant text adjacent rather than being all bunched together to save money. Much of John Barlow's former collection is now in the Houston Museum of Natural Science. If you need to buy one book that will show you what fine specimens are (even if not always the *very* finest), this is the one you should get. As in all books, there are some errors; for instance, the stannite pictured in the book is really a sphalerite.

***The Desmond Sacco Collection* (1999) by Bruce Cairncross**

This book describes the specimens in Desmond Sacco's collection and shows predominantly specimens from South Africa and Namibia. Many of the specimens pictured are very fine and they will give a collector a good perspective of what fine specimens look like from those localities. One young man I know considers this to be the "Bible" of fine minerals. You will need to make up your own mind.

***The Magnificent Mineral Collection of Joseph A. Freilich*; a Sotheby's of New York auction catalogue, January 11 & 12, 2001 (Sale 7586)**

The specimens pictured in this auction catalog are all from the Joseph A. Freilich collection, and many very good ones are included. Calling the collection "magnificent" may be an exaggeration if one knows about some of history's other great private collections, but I suppose the hype is understandable, considering the commercial aspect of the auction. And unlike many historical collections, this one was assembled in only about two years, so it constitutes a time capsule of what was best on the market during that brief period. Many of the great color photos were taken by premiere mineral photographers Harold and Erica Van Pelt (although Sotheby's neglected to give them credit for their photos in the catalog).

This catalog and the separate list of hammer prices from the auction are important to collectors because this was the first time in at least 100 years that there has been a major auction of fine mineral specimens. The hammer prices at the auction were all over the map, from modest to silly, but they provided a concrete benchmark of how much people are really willing to pay for fine specimens.

Don't go bothering Sotheby's for copies of the catalog because they were all sold out shortly after the auction. If you want one you will have to get it from dealers in out-of-print mineral books. However, the *Mineralogical Record*'s special issue (January–February 2000) on the Freilich collection, depicting over 100 of Freilich's best specimens, is still available from the publisher.

The reserve prices on the Freilich specimens were known only to the auctioneer and one or two other individuals. Almost 40% of the specimens failed to reach their reserve prices and were withdrawn. Of the specimens that were sold, 60% went for less than the minimum estimate. Many of the specimens were sold for about 70% of the low estimate, which was about as low as the auctioneer seemed willing to accept.

A number of specimens in the Freilich collection were not in the auction because Freilich had not yet paid for them himself, and so they were returned to the dealers who had supplied them. Some of the specimens that had not been paid for were purchased by Sotheby's because they thought the auction would not be successful without them. One very knowledgeable dealer was shocked when a pyrite specimen from Peru sold for $75,000; well, to be honest, we all were. Yet a wonderful crystallized gold called "The Eagle" only brought $69,750. Dealers bought more than just a few of the specimens. One dealer bought back a specimen that he had sold Mr. Freilich because he was able to buy it for about half of what Freilich had paid him for it. The "companion sale," so to speak, to the mineral auction was the auction of the much more valuable collection of mineral books owned by Mr. Freilich. Conventional wisdom has it that Sotheby's really wanted the books, but to get them they also had to take the minerals; the books, unlike the minerals, sold briskly for high prices.

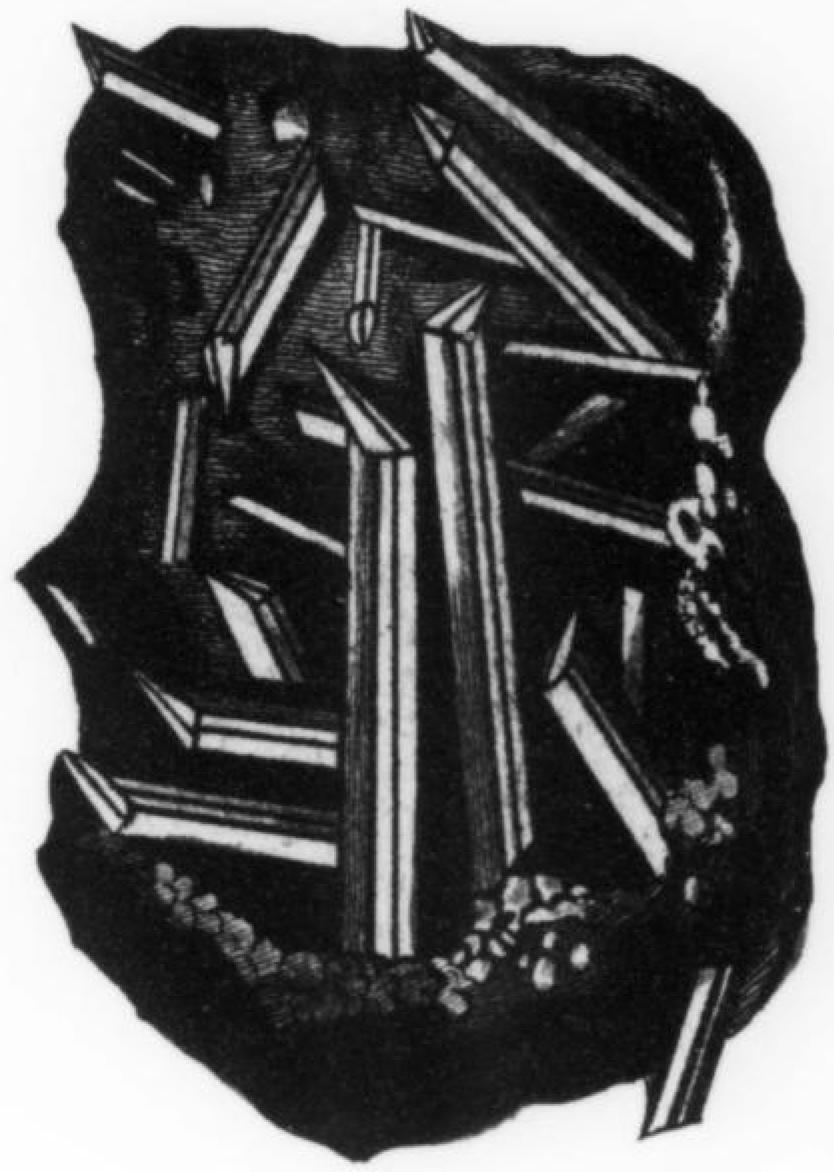
***Tsumeb* (1999) by Georg Gebhard**

Tsumeb, Namibia (formerly South West Africa) is a classic locality known to all collectors. This locality was mined for more than a hundred years, and almost all but the most specialized collections have specimens from it. You can't be a mineral collector and not be familiar with the wonderful specimens Tsumeb has produced. This book provides the collector with pictures of fine specimens from Tsumeb, wonderful pictures of the locality, and a good historical perspective.

Mineral magazines

Probably the most influential of the mineral magazines today is the *Mineralogical Record,* which has been published without interruption since 1970. The full run of this periodical is certainly the single greatest repository of information about fine specimens. Its articles and photographs will help you learn more about fine mineral specimens than any other single source. Its editor-in-chief, Wendell Wilson, produces a magazine that is a tough act to follow. He is, however, more shy about putting controversial items into the magazine than are the editors of some of the foreign magazines. This may be more due to the litigious nature of the American culture than to a fear of controversy. Another good magazine is *Rocks & Minerals*, which has been in existence much longer (since 1926), although it has not always focused exclusively on fine minerals. Among the good foreign publications, some that come immediately to mind are two German magazines, *Lapis* (a tough competitor for the *Mineralogical Record*) and *Mineralien Welt*; the Italian magazine *Rivista Mineralogical Italiana*; the French magazine *Le Règne Minéral*; the Spanish magazine *Bocamina*; and the British *U.K. Journal of Mines and Minerals*.

Another word of caution. Some articles are written with the purpose of publicizing a particular find that is currently on the market, or promoting the commercial desirability of the specimens described. Commercial motivations are usually obvious enough, and may nevertheless result in good information being shared. Other articles are written by authors who love the specimens of a particular area and hope to infect others with their enthusiasm. Most of the time the authors just want to pass on knowledge they have accumulated, enjoy seeing their name in print, want to add another title to their personal bibliography and make a name for themselves, or all of the above.



Collection of Joseph von Baumeister

(1750–1819)

Gypsum

Dürrenberg (?), Germany

From Joseph Edlem von Baumeister's (1791) *Die Welt in Bildern* (printed on Baumeister's own press in Vienna, plate 3, Figure 1). His book was aimed at young students, but contained a wide range of attractive specimens and was not limited to ores as was the Schmiedel book.

Gem and mineral shows and dealers

A great part, perhaps the greatest part, of mineral collecting is your interaction with other mineral collectors, dealers and curators.

The Tucson Gem and Mineral show is arguably the best place for you to interact with peers, and offers the most intense learning experience that a collector can have. Every February for more than fifty years mineral collectors, curators and earth science professionals from across the U.S. and around the world have been converging on the desert community of Tucson, Arizona. Here they interact with each other, listen to or give lectures, buy, sell and display mineral specimens, books, gems, jewelry and vast amounts of any imaginable related material. It is the ultimate bazaar of our hobby. This is the "Mecca" of the mineralogical world and you owe it to yourself as a mineral person to make the pilgrimage at least once in your life. More on this show later.

Many other gem and mineral shows are also worthwhile. The big European show in Munich in early November is exceptional, and the shows in Denver in September and Sainte-Marie-aux-Mines, France, in June are good. It is at these shows that you will be able to meet and get to know mineral dealers and learn about the prices of minerals.

In addition to attending shows, you should visit individual mineral dealers at their homes and shops whenever you can. Unless you become strictly a field collector, dealers will provide you with most of your specimens.

Field collecting

If you learn to collect your own specimens in the field, it will add a substantial dimension to your appreciation of minerals. Climb down 600 feet of wooden ladders of questionable integrity into an

Collection of Franz von Wulfen
(1728–1805)
Wulfenite
Old St. Matthäus mine, Bleiberg, Austria

From Franz Xavier von Wulfen's famous (1785) *Abhandlung von Kärnthnerischen Bleyspate* (published by Johann Paul Krauss in Vienna, Plate 7, Figure 16). Wulfen's remarkable book on wulfenite and associated lead minerals from the Bleiberg area, Carinthia, Austria highlighted what was to become one of the most popular and sought after mineral species among collectors.

abandoned mine, camp underground in the darkness for a day or two, exhaust yourself breaking and moving rock, collect a pocket of good specimens, carry them back up the ladders on your back and you will come away a different person. Try it, and you will remember it for the rest of your life. And, strangely enough, if you are young, you will want to do it again. It is an unforgettable experience to break into a pocket of fine minerals that has been there for millions of years, and then to collect them.

The problem is that it is not easy to do, and it is more difficult yet to make a living by doing it. Even the most successful field collectors do not live high on the hog. Why more collectors are not killed in abandoned mines is a mystery to me. I have done more than a little of this kind of collecting and have had a couple of close calls from falling rocks that could have killed me. All field collectors worth their salt have harrowing stories about how they nearly met their ends in quarries and abandoned mines. But when you are young you feel immortal, so you don't worry about it.

If you want to learn how to field collect successfully, you should locate an experienced field collector through gem and mineral societies or internet chat rooms and see if he will agree to take you under his wing and show you the ropes. Carry his rock hammers, pay for the gas and all the food, laugh at his jokes and tell him how handsome and intelligent he is. Whatever it takes, it will be worth it. It is not that you can't do it on your own, but with an experienced field collector as your guide you can learn essential safety procedures, save yourself years of effort, and make your collecting more productive and enjoyable by an order of magnitude. With a good collecting buddy you will find that you will egg each other on and find more good rocks.

Gem and Mineral Societies

Many gem and mineral societies for amateurs exist all over the United States and sparingly in other countries. Most of them are oriented toward gems and jewelry-making, even though they usually have a few lonesome souls whose main interest is mineral specimens. A few societies are mostly mineral-oriented, and you will need to find one of those to join. Here you will meet your soul mates. If you have no idea how to connect with one of these clubs, do a Google search on the phrase "mineral club" and your state name. At my last look, Google gave me over 50,000 hits when no particular state was specified.

Also the Internet has various chat groups devoted to gems and minerals. Www.mindat.org hosts a number of chat groups specializing in various aspects of mineral collecting. Here you can ask for information about groups or people in your area. You will find many people willing to help you. If you live in a country where there are no listings, professors at your local university should be able to put you in touch with kindred souls.

In the United States, perhaps the most influential institution which has shaped the perception of what quality specimens are has been the American Federation of Gem and Mineral Societies and its regional affiliates. The Federation has developed a set of rules governing competitive gem and mineral exhibits, and these rules are still in use. If you decide to enter these competitions you do so at your own risk. In addition to the rules, you will learn that the decisions of some judges can be arbitrary, and that some of the judges don't know all that much about minerals anyway. The Federation rules spell out the different categories in which you can compete, the things the judges look for, and how many points can be won or lost for different aspects of the exhibit. These include perfection (freedom from damage), rarity, labeling, and quality of presentation (are there wrinkles in the fabric lining the exhibit, or is there lint on the liners?).

In the mineral specimen competition there are different size categories in which you can compete: micromount, thumbnail, miniature, cabinet, etc. Federation rules specify that specimens competing in the thumbnail category must fit within a 1-inch cube as displayed, and miniature-size specimens must fit within a 2-inch cube as displayed. The "as displayed" means that when sitting in the display case, you must be able to set a 1-inch or 2-inch cube straight down over the specimen.

There are categories for different kinds of specimens: self-collected, minerals containing some element like copper, educational displays, pseudomorphs, etc. The rules specify that you can get up to a maximum number of points if all your labels are correct, if your display is perfect, etc.

Most of the time, competition hinges mainly on the quality of the specimens and their freedom from damage. When a collector loses a competition because some of his specimens have some slight damage, you can imagine how closely he will inspect future specimens before he buys. I have heard dealers complain that some collectors go over prospective purchases with a magnifying glass. A collector who became a dealer, David Wilber, was notorious for his insistence on perfection, and even the tiniest, barely visible chip became known as a "wilber." The European collecting community, which does not have a similar competitive environment, does not have the mania for perfection that we do in America. The influence of the federations has been declining for a number of years, but the emphasis on perfection persists.

Take Classes

If there is a junior college, college, or university near you that has a geology department, go over and get to know the mineralogist on the faculty. He can be of great help, and may allow you to officially audit (take without being graded) or unofficially sit in on his mineralogy lectures.

Local mineralogists sometimes become involved with gem and mineral clubs and will hold regular study meetings and lectures for club members interested in learning more about mineralogy. Find out what your local club has to offer in this area, and if they don't offer anything, talk to other members and round up enough interested people to form a study group. Show a sincere interest in learning, and there will almost always be someone with training who is willing to step up and teach your group.

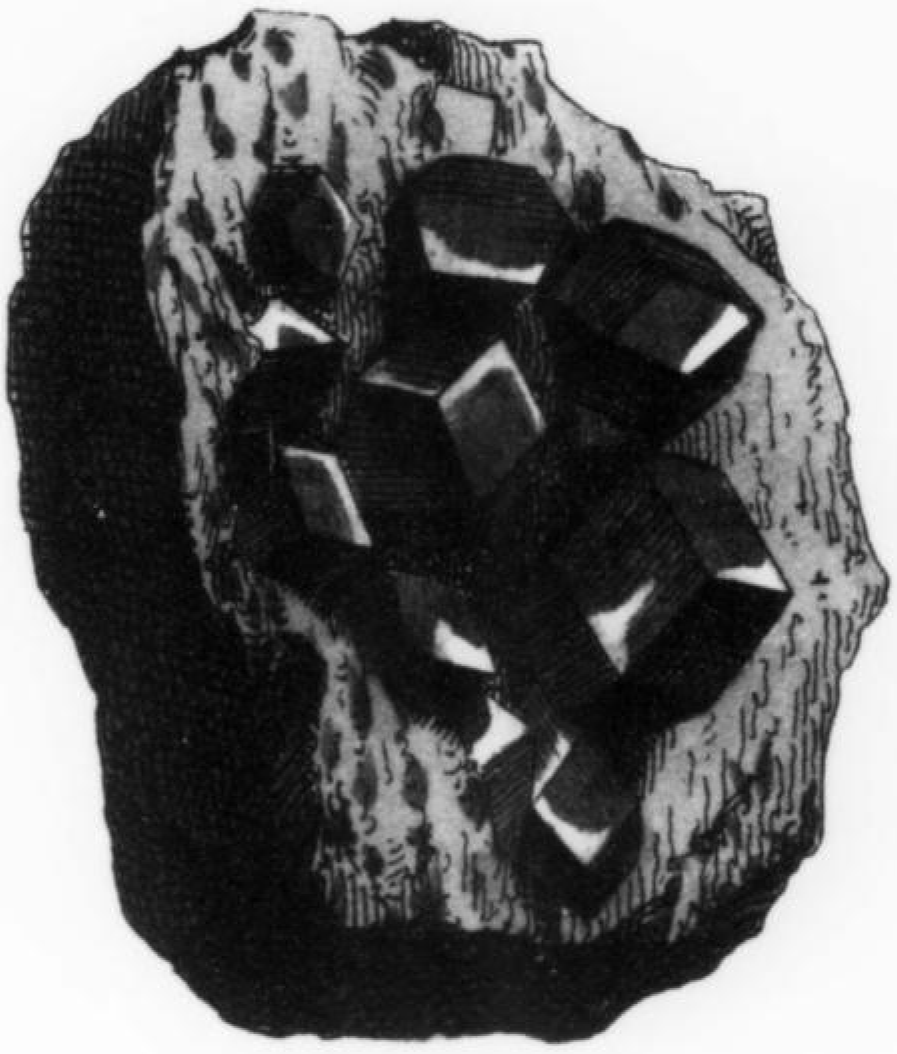
Surfing the Internet

Increasingly, the Internet and the information posted on it has become an important tool for learning about minerals. For some people it has largely replaced the traditional sources of information represented by books, magazines, gem and mineral societies, and gem and mineral shows. Dr. George Rossman of the California Institute of Technology told me that almost all of the references cited in his students' papers were Internet references.

The Internet allows you to interact with people of similar interests in chat groups, and you can learn about the technical side of mineralogy from publications available online. If you are interested in building a collection, the Internet is full of hundreds of web sites created by people who would love to sell you specimens and have posted more pictures than you could ever look at. Many are for sale at fixed prices and others are for sale at auction on sites like eBay. Visiting the auction sites and the dealer websites is a good way to learn about specimen pricing. There are dealers who specialize in high-end specimens, rubbish specimens, and all intermediate qualities. I would caution you to pay close attention to the size of the specimens, because you will usually find when the specimens arrive that they look smaller than you imagined them to be. Also keep in mind that the people who take pictures to post on the Internet often know how to take really *good* pictures under highly idealized lighting conditions, and that when the specimen(s) actually arrive they will frequently look inferior to the pictures you saw on the net. A woman photographed by a master photographer in his studio always looks better than she did before she got there.

An increasingly important website for collectors and even professional mineralogists is www.mindat.org. Here you can find much mineral information included in standard mineralogy texts plus much of interest to collectors. This site contains a searchable database listing thousands of localities and pictures of thousands of mineral specimens from these localities. The chat groups on this site are frequented by the most knowledgeable and sophisticated mineral people in the world. There is also an extensive list of links to other websites. You can learn a great deal here and can share your knowledge with others.

Huzzah! Now that you have finished reading about the eight things to do in your quest to reach mineral collecting Nirvana, perhaps you will read further. What follows in the next installment are some observations about the various kinds of mineral collectors. You may be one or more of them and, if not, you will probably *become* one in due course.



Collection of Johann Von Kurr

(1798–1870)

Uvarovite

Mt. Tarnowitz near Bissersk, Siberia, Russia

From Johann Gottlob von Kurr's highly popular (1859) Das Mineralreich in Bildern (first published by Schreiber and Schill in Stuttgart and Esslingen, Plate 2, Figure 12). Kurr's book was so popular among collectors that it went through several editions, in German, English and French, and was continued after his death by Adolf Kenngott.

Editor's Note: The engraving shown in the heading of this article is part of the title page engraving in Ignaz von Born's personal collection catalog, *Lithophylacium Bornianum* (1772), volume 1. The cameo-style vignette depicts the ancient Greek philosopher and naturalist Theophrastus (371-287 B.C.). His *Peri lithon* ("About Stones") is a work of special interest in the history of mineralogy, and is the most significant document on minerals to survive from Classical times. It is unique among ancient and Medieval writings in its relative freedom from mythological and magical components, and remained for 1800 years one of the most authoritative treatises on minerals.

HERBERT P. OBODDA

Dealer, Gentleman, and Collector Extraordinaire

John S. White
P.O. Box 332
Stewartstown, Pennsylvania 17363
john@jwkustos.com

This past year Herb Obodda celebrated his 50th year as a mineral dealer, an occasion observed by displays at the 2007 Munich Show. The show theme was the minerals of the mountains, particularly Pakistan—an appropriate connection because Herb Obodda played such a key role in opening up the extraordinary mineral wealth of that country, a fact that few people today fully appreciate. Nor do many realize the extraordinary breadth of his personal collecting activities.

INTRODUCTION

Many years be competitors in the mineral business began their incursions into this wild and often forbiddingly mountainous country, Herb was making regular visits there and establishing contacts with potential suppliers of specimens. Before venturing into Pakistan, Herb had already been chasing minerals in neighboring Afghanistan with his then partner Frederick (Rick) L. Smith, a fellow New Jersey mineral lover, and it was there that he learned of the wonderful mineral potential in Pakistan's rugged peaks. When in 1973 he was prevented from exporting from Afghanistan, Herb went to Pakistan for the first time, though only because he was able to have his minerals delivered there and could then easily take them out of that country. In the 34 years since, Herb has been back to Pakistan more than 100 times. His success is grandly apparent in his mineral show display cases.fore the parade of

EARLY LIFE

But first, some history. Herbert Paul Obodda was born in Brooklyn, New York to Catholic German-speaking parents, Heribert and Elsa Obodda. German was the only language in which he claimed fluency when he entered grade school. His grandfather and great-grandfather had been the owners of a hotel/restaurant in Gemlitz (near Danzig, modern-day Gdansk, but in those days it was part of German-speaking Prussia); it was called "Gasthaus Paul Obodda." There in Gemlitz his father Heribert was born and educated. He worked for a while as a teacher, then in 1919 he hired on as a waiter on a steamship in order to visit America. Once in New York he worked variously as a waiter, chauffeur, butler and bartender. In 1929 he met Elsa, a milliner from the Freiburg area who had recently immigrated; they worked together for an affluent family, she as cook and he as butler and chauffeur. Soon they were married, and their son Herb was born on September 24, 1942.

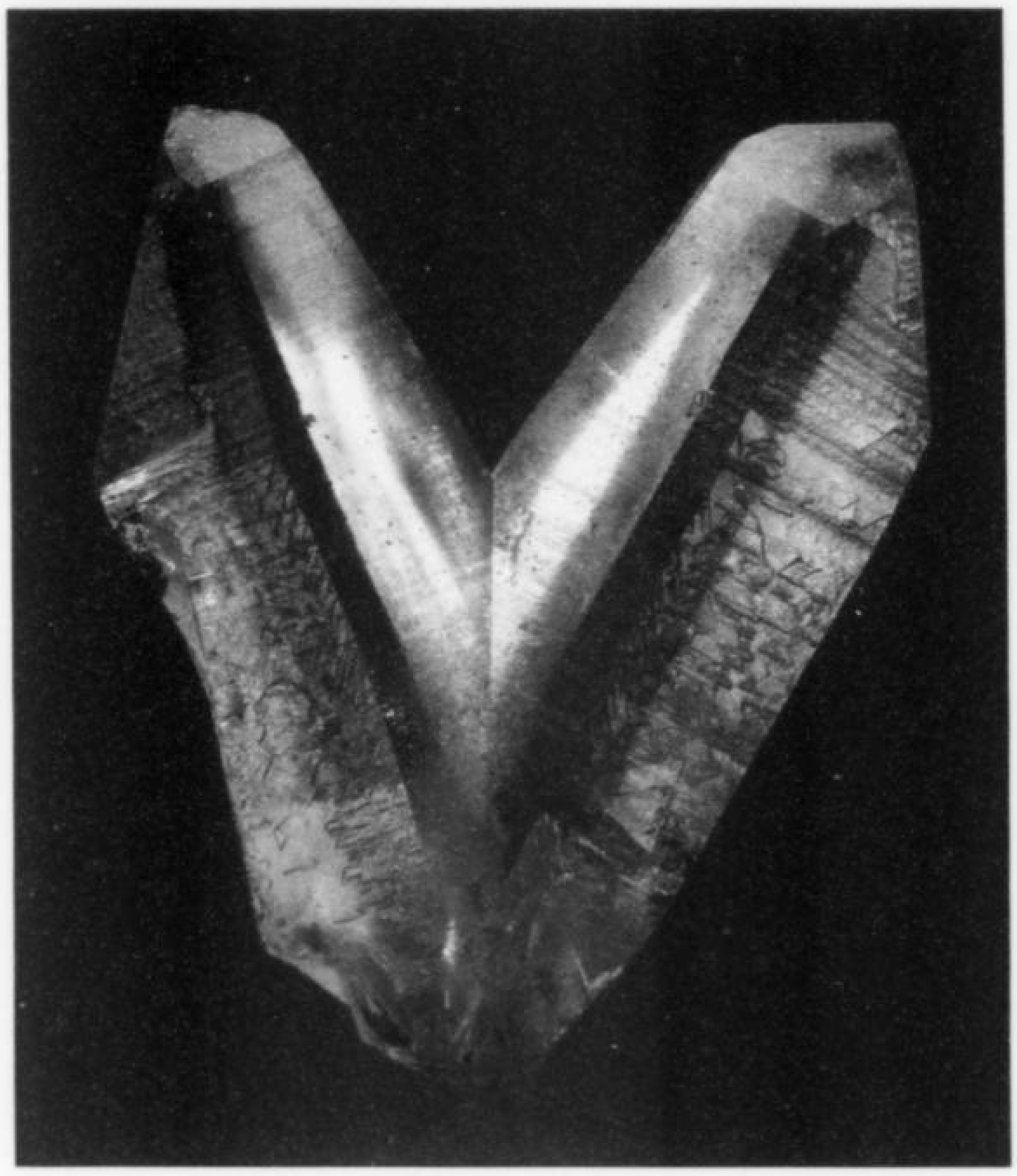
The Nazi invasion had forced the rest of his family to flee Prussia and give up their Gasthaus, but after the war it was possible to visit Germany again. Herb remembers discovering the fascination of collecting minerals during a family visit to Germany in 1949, as he was collecting pebbles from his grandmother's driveway.

Back in the U.S., driving to a country home his family owned in nearby northeastern Pennsylvania, they passed the Buckwheat dump in the town of Franklin, New Jersey. Herb was "bewildered to see people bent over piles of rocks, swinging away with sledgehammers." Curious, he subsequently visited the American Museum of Natural History and saw his first Franklin mineral, a "huge, perfect franklinite crystal perched on white calcite with a wide band of rich, deep-red zincite across the front." He was hooked. "Wow, now I knew why those people were on their hands and knees digging. They were finding these things."

He pleaded with his parents until they finally agreed to take him to the Buckwheat dump to do his first real collecting. Contacts with

***Figure 1.* Herb and Moni Obodda at the Spruce Pine, North Carolina Show in 1972.**

***Figure 2.* Quartz twin (an unusual twin law), 8.2 cm, from Lavra Ariranha, Municipio de Pavão, Teofilo Otoni district, Minas Gerais, Brazil. Obodda collection, ex Richard V. Gaines collection; Jeff Scovil photo.**



other collectors there led to discovering the mineral wonders of the zeolite-rich trap rock quarries so prevalent in the West Paterson region of New Jersey.

MINERAL DEALING

As a teenager in 1957, Herb obtained part-time employment at Ronald (Ron) C. Romanella's mineral and gem shop in New York City. (Romanella would also greatly influence the career paths of other mineral and gem dealers, including Lawrence H. Conklin, Narinder Malhotra, Eric A. Engel and David P. Wilber.) At the time, there were actually three or four mineral dealers in the city, among them Harry Bookstone. Having read a note in *Rocks & Minerals* about Bookstone's recent trip to Brazil, and an ad describing the fantastic aquamarine, tourmaline, green spodumene and other crystals he had obtained there, Herb got on the subway and made the easy trip to see him at his 12th floor shop at 22 West 48th Street. Harry failed to recognize the potential standing before him and said, "Look, kid, I don't have any time for you. You want minerals, you go downstairs with that Romanella"—whose shop was indeed one floor down in the same building. This Herb did, and it turned out to be one of the most serendipitous things Herb could have done in a life that was to be filled with serendipity.

First, he and Ron really hit it off. Second, Ron happened to need someone to replace Larry Conklin, who had left to go into the mineral business on his own. After Herb had admired the wonderful crystals in the showcases and they had been chatting a while, Ron said, "Hey kid, do you want to work for me?" It was easy for Herb to say yes. He got out of school around mid-day and could take the subway into Rockefeller Center and work the afternoons until about five or six. Ron was also a good mentor. He taught Herb how to sell minerals, what made them desirable, how to interact with customers, and many of the other basics of dealing in stones.

About six or eight months later, when Herb had pretty much learned how to run the business, Ron announced that he was leaving for Wyoming to see about another business he owned—and put the 15-year-old Herb in charge! "You can take care of everything; put the money in the bank," Ron said, and he just left. So Herb ran the shop, only hearing from Ron about once a month (long distance calls were very expensive in those days) with questions like "How're things going? Is there enough money in the bank?" That was about all the support he got.

This continued for about two years, at which point Herb decided he wanted to go to college. Infatuated with the minerals of Butte, Montana, particularly the sulfides and sulfosalts, he enrolled at the Montana School of Mines, but soon realized that he'd been making more money working for Romanella than a graduate mining engineer would make. He was also disillusioned to learn that he knew more about minerals than his professor. After about six

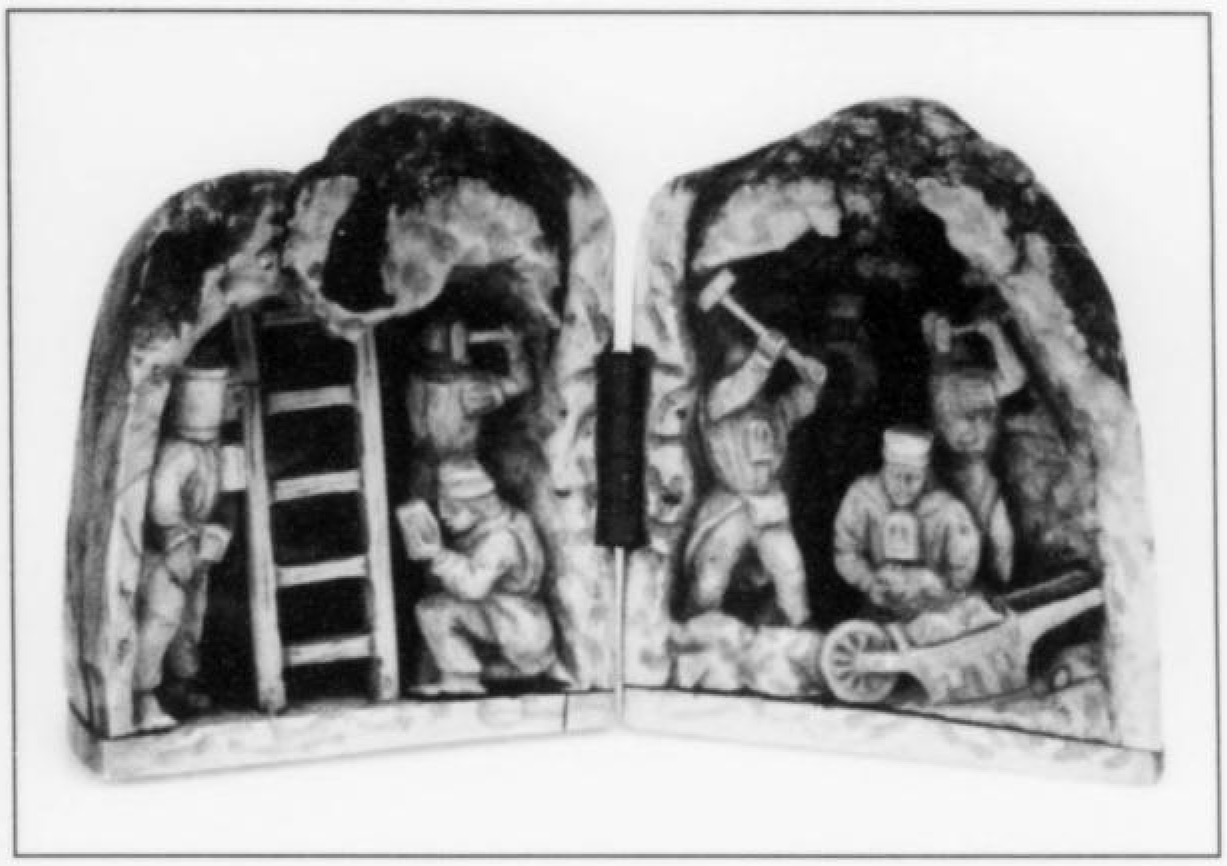


Figure 3. **A hinged ivory tusk with carved miners inside. The miners are carrying lamps called *Freiberger Blende*, indicating that the carving was made in Saxony, ca. 1880. Obodda collection and photo.**

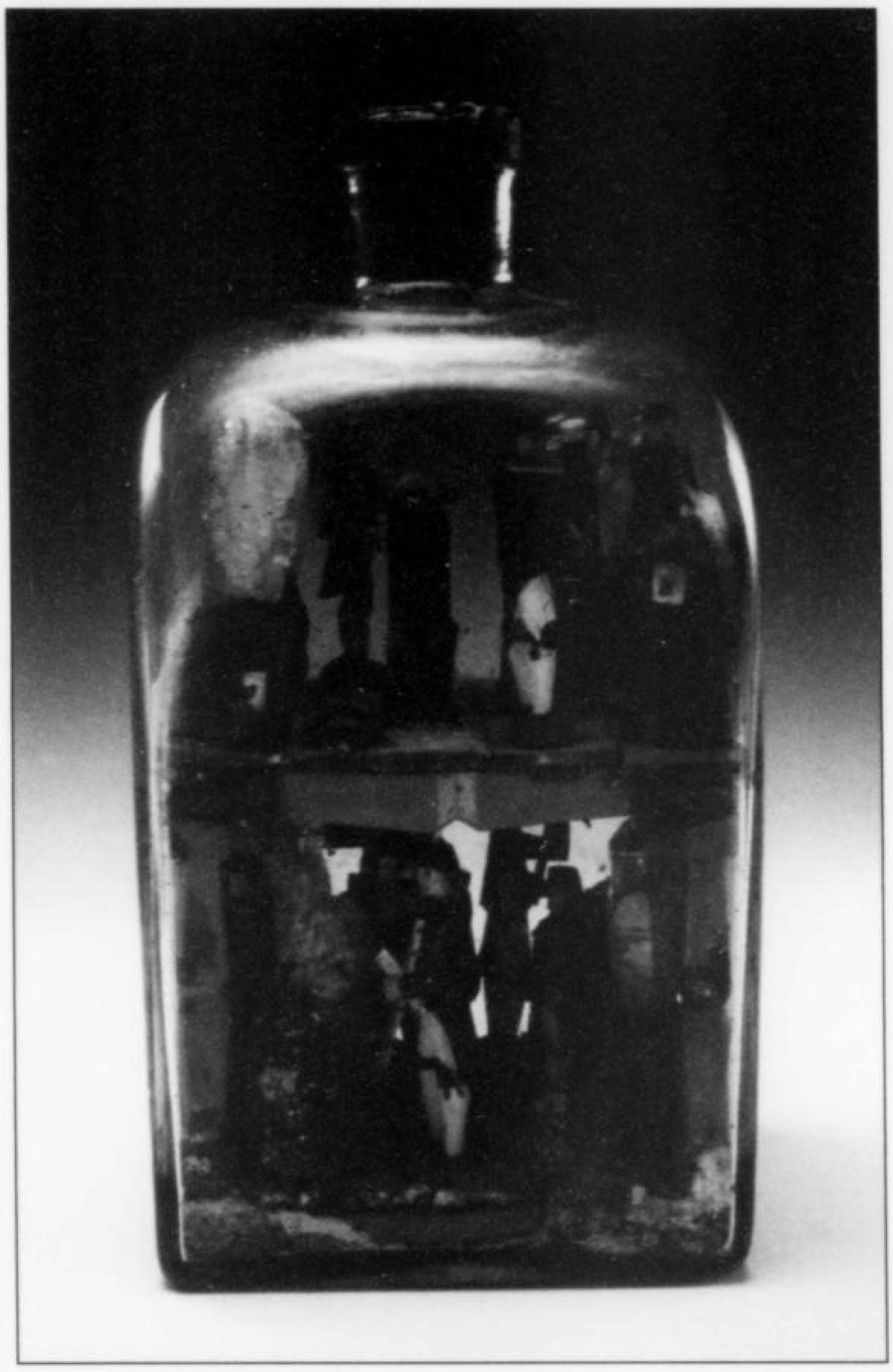


Figure 4. **Miners in a bottle (a *Geduldsflashe*), 19.8 cm, made in Schemnitz, Hungary ca. 1750s. Obodda collection; Jeff Scovil photo.**

Figure 5. **Mining memorabilia from Butte, Montana: a mother-of-pearl shell with silver adornments and engraved view of the Anaconda mine at Butte; a copper-washed inkwell in an ore barrel with miner holding a pickax and a shield depicting the Anaconda mine; a Calumet and Hecla mine tumbler; and three silver souvenir spoons from Butte. Obodda collection and photo.**

months, he dropped out and went back to work for Romanella, joining Narinder Malhotra, who had been hired to replace him when he left for school. Herb mostly handled the minerals and Narinder was responsible for the gems.

In 1964, Herb decided to enlist in the U. S. Army "to see the world." The army offered him his choice of jobs and stations, which meant he could go to Germany, so he ended up in an artillery division there. Volunteering to join the army would not seem to be the smartest thing to do, and yet it had its own serendipitous quality. "Romanella fought like crazy to keep me from enlisting in the army," Herb says, "but it may have saved my life because it kept me from having to go to Viet Nam. I got out of the army in 1965, and by 1967 things were really beginning to heat up in Viet Nam. In fact, some of the people I was in the army with died over there."

By the time he enlisted, Herb had been going to Europe privately just about every year, and was also doing some mineral shows in the U.S. for Romanella. At one of them, Herb bought for himself a small packet of gemmy pollucite from Maine. When Ron found out, the two got into a serious fight. Ron felt the stones should be his; Herb argued that he was in the business because he loved minerals, and there wouldn't be much point in his working for the business if

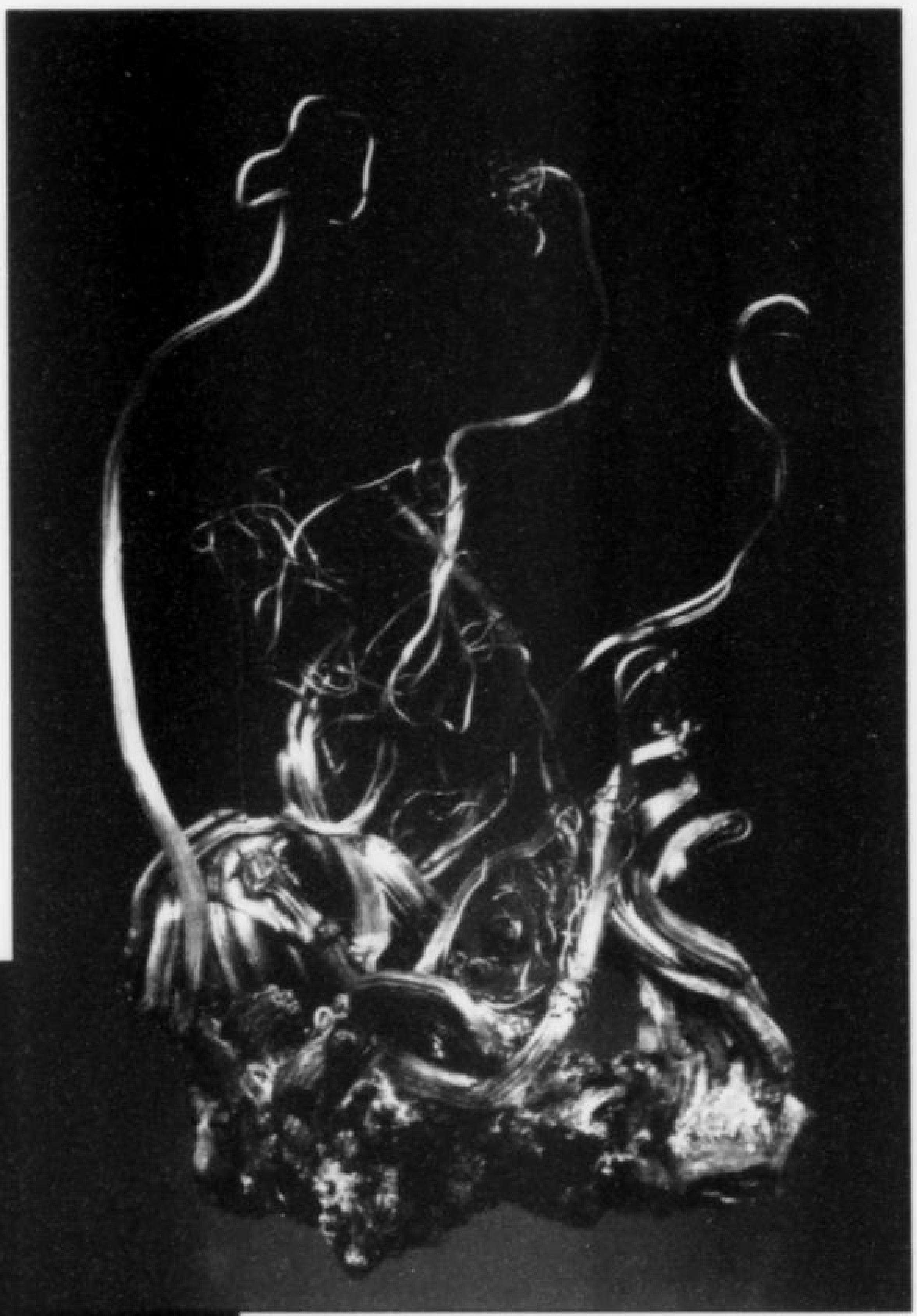


Figure 6. **Wire silver, 12 cm, from Freiberg, Saxony. Obodda collection; Jeff Scovil photo.**

Figure 7. **Carved ivory miner's "frog" lamp, 20.4 cm, depicting a musician miner playing a flute; French, ca. 1870. The inscription reads "La Lumière du Monde de c'est l'Amour." Obodda collection; Jeff Scovil photo.**

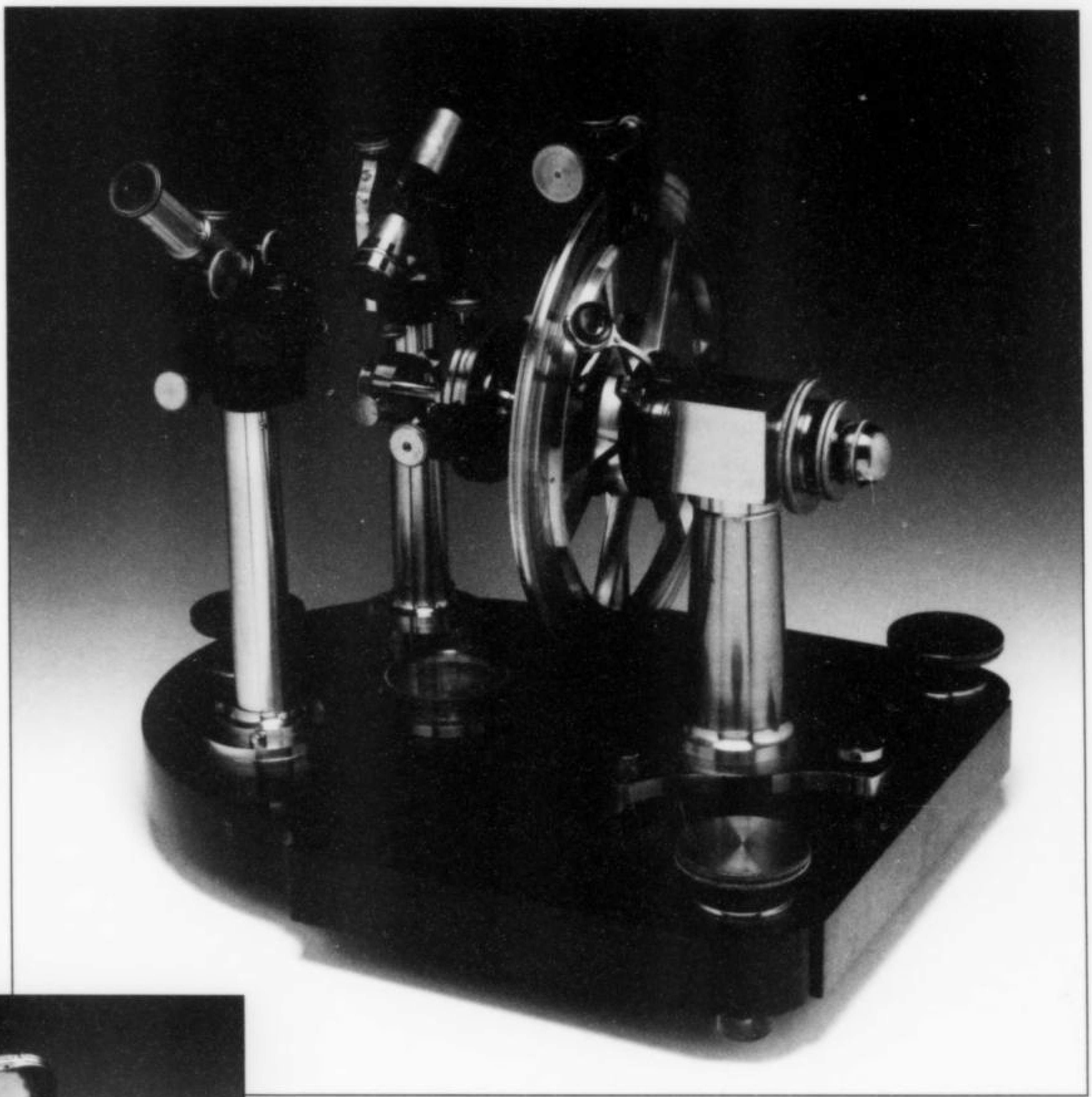


Figure 8. **Mitcherlich-type goniometer made by Breithaupt and Sons in Kassel, Germany, dated 1885. Obodda collection; Jeff Scovil photo.**

Figure 9. **Meissen porcelain box with seven mining scenes painted by B. G. Hauer ca. 1740. Obodda collection.**

he couldn't have his own specimens. Ron wouldn't agree, so Herb quit; but about two weeks later Ron called and said he'd better come back to work, and agreed that Herb could keep anything he bought with his own money. Herb began amassing specimens.

By the time he left Romanella for good in 1969, he had a very substantial inventory and many good U.S. and European contacts. It was while working for Romanella that Herb first met Rick Smith and Charles Key, who were at that time partners in the mineral business. Victor Yount came in at the age of about 13 or 14 with his mother, who admonished Herb not to take advantage of her son. Mary Murphy was a regular customer at 13 and would routinely spend about $100 or $200 a visit, which really impressed Herb, as he was making only about $100 a week.

Among his earliest gem and mineral contacts in Germany's Idar-Oberstein gem district was Gerhard Becker, an excellent cutter of rare and unusual gem materials, such as fluorite. Herb had him cut much of the rough he'd been stockpiling, enabling him to offer rare stones that made his inventory stand out from those of most other gem dealers.

Another Idar friend was Rudolph (Rudi) Cullmann, a gem dealer about four years younger than Herb, who was the son of Karl August Cullman, one of Romanella's suppliers. Ron had invited Rudi to work for him in New York, more or less as an apprentice and, while there, he and Herb had become close friends. Herb invited Rudi to stay at his home where he lived with his invalid mother, which Rudi did for about six or seven months, after which he returned to Idar-Oberstein before moving to Canada. While they were together, the two seemed to have been as much focused on partying as on minerals and gems. The association also gave Herb the opportunity to become acquainted with Rudi's then- girlfriend Monika ("Moni") Zaumseil of Dusseldorf, who was working at the time as an apprentice goldsmith in Idar. On October 10, 1970, Herb proposed marriage to Monika, figuring it was cheaper to get married than make all those long distance phone calls and fly back and forth to Germany from New York for the purpose of dating. Herb and Moni were married April 30, 1971, a fact for which all of us who love this wonderful couple will forever be thankful.

Back in the states, Herb and Moni began doing mineral shows

Figure 10. **Herb Obodda and friends enjoying a barbecue in the tribal area near the Khyber Pass (ca. 1976).**

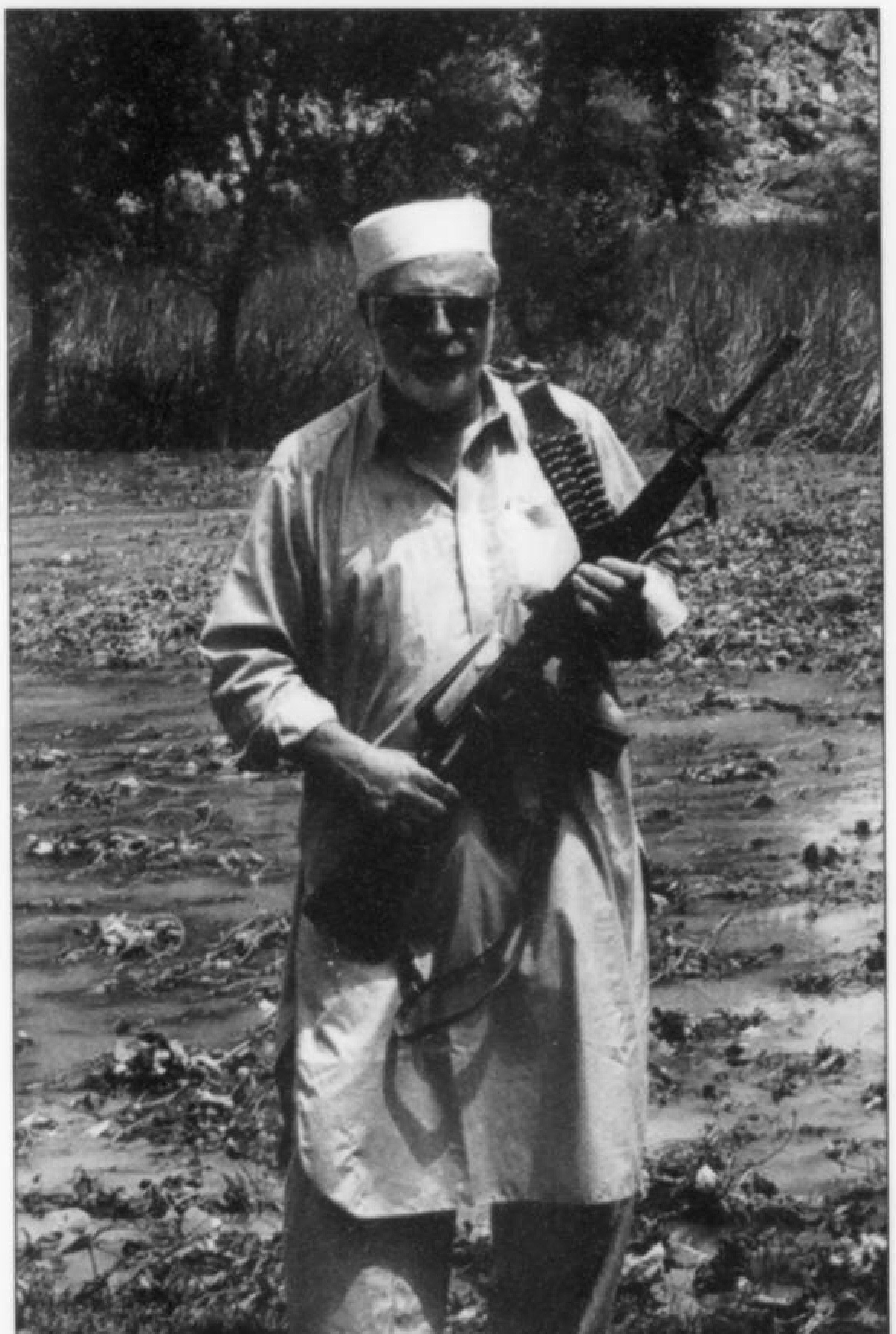


Figure 11. **Herb Obodda in traditional Pakistani garb, on the way to visit the Zagi Mountain deposit in Pakistan. Note the loaner Kalashnikov thoughtfully provided by his guides.**

in a big way, some ten to twelve a year. He never had a shop but did invite customers for private showings.

Herb has been a regular presence at the Tucson shows since 1968, when he and David Wilber together managed a booth for Romanella. Looking back on his nearly 40 years of Tucson participation, Herb reflects on how the mineral business has changed. In the earlier days, it seemed that everybody (in the U.S. and Canada, at least) knew everybody else. Dealers, collectors, curators—we all worked together and played together. At the Desert Inn in Tucson, late-night (or early-morning) poker games were a fixture for many of the dealers, including Herb. There was serious social drinking, and rooms tended to stay open late into the evening. One could wander down the halls and pop into any number of rooms where there would always be a lively discussion taking place.

The pressure on the dealers was less severe than it has since become, and prices for minerals had not yet reached the stratospheric levels we see today. Herb loves to tell the story about the time Romanella sold a 54-kg Brazilian topaz—which Herb and another employee had to drive to Florida to deliver—for less than $1,000, delivery included. In short, mineral shows were far more fun in the 1960's and 1970's than they are today and Herb and Moni were a major part of that fun. Even in Munich, which at that time was the only European show that was heavily attended by Americans, the fun continued as many of us (mostly Americans) gathered in the evenings at the Hackerkeller next to the show for some major beer drinking, something that Herb enthusiastically participated in.

HERB AND PAKISTAN

Herb's first buying trip on his own was to Morocco. Since then, although amazingly he has never been to Brazil, his buying trips have taken him to Chile, Peru, Nigeria, Russia, Poland, the Congo,

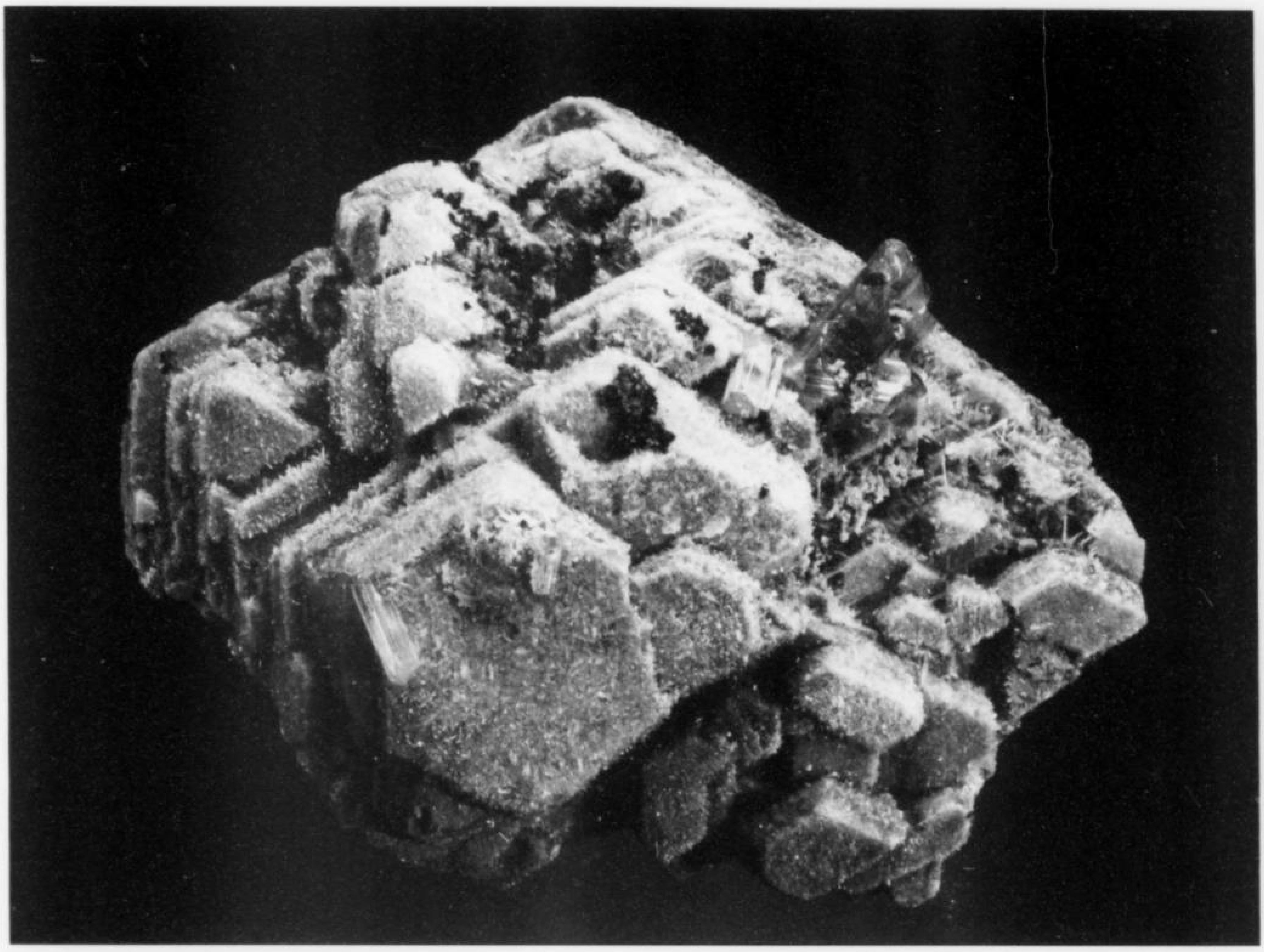


Figure 12. **Leadhillite crystal, 10.6 cm, from the Tsumeb mine, Namibia. Obodda collection; Jeff Scovil photo.**

Figure 13. **Gold, 6.5 cm, from Rosia Montana, (Verespatak), Romania. Obodda collection; Jeff Scovil photo.**

Tsumeb in Namibia, Romania and East Germany, mostly in association with Rick Smith. But he's made his reputation through his trips to Pakistan. In the mineral world, it's probably fair to say, Herb is "Mr. Pakistan."

The route to that South Asian country was not direct, however. It came about, serendipitously as usual, through his business ventures with Rick Smith when the two began traveling to Afghanistan around 1972. Afghanistan was producing tourmalines and other exciting gem minerals long before Pakistan. At the time that Herb and Moni were dating in Idar, she was employed teaching German to an Afghani, Hussain Rezayee, who was living in Idar and Berlin. Once, while the three of them were having a beer together, Hussain casually pulled out a remarkable "pencil" of tourmaline. The crystal was about 15 cm long and 7 mm thick, gem clear, beautiful green—and Hussain had no idea what he had. "Do you know what this is?" he asked. "Does it have any value?" Sometime prior to this choice little exchange they had attended a Tucson talk by Pierre Bariand (then curator of the mineral collection at the Sorbonne in Paris) about collecting rubies and lapis crystals in Afghanistan. Herb and Rick decided they simply had to go there. They did, and encountered lots of great material that was incredibly cheap. They would have continued focusing on Afghanistan had it not been for that exporting problem mentioned above that drove them to export from Pakistan instead.

Herb was one of the first western dealers to go to Pakistan and ever since has returned about five times a year, estimating that

Figure 14. **Four colored-glass crystal models of gem minerals. These are part of a set of 70 such models, in a fitted, suede-lined locking case measuring 30.5 x 45.7 cm, made in Czechoslovakia before 1920. Obodda collection and photo.**

Figure 15. **Toad carved from ruby corundum and green zoisite from East Africa, 8 cm, by master carver Gerd Dreher of Idar-Oberstein, Germany.**

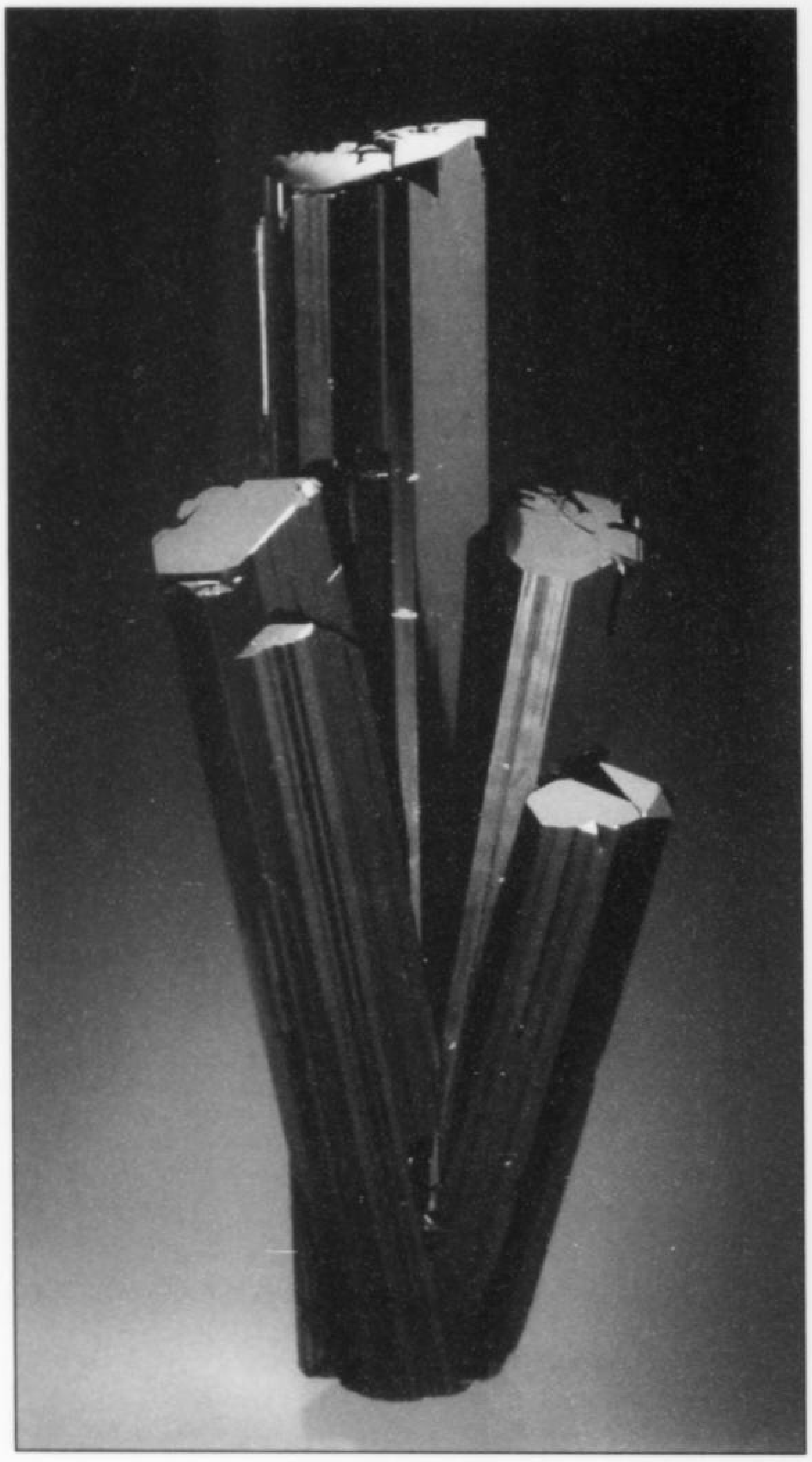
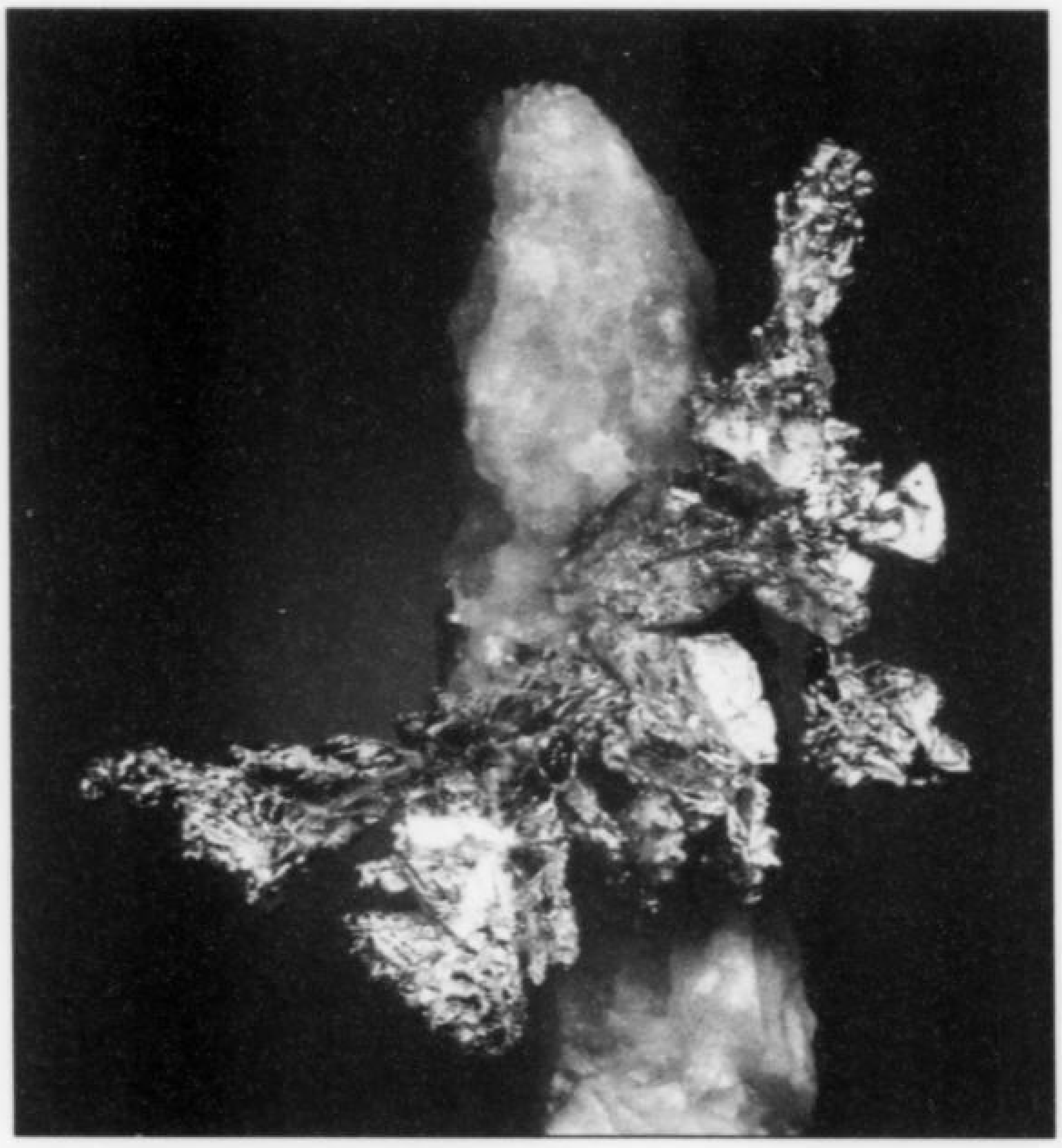


Figure 16. **Epidote, 7.6 cm, from Knappenwand, Untersulzbachtal, Austria. Obodda collection; Jeff Scovil photo.**

Figure 17. **Gold on quartz, 6.4 cm, from the Eagle's Nest mine, California. Obodda collection; Jeff Scovil photo.**



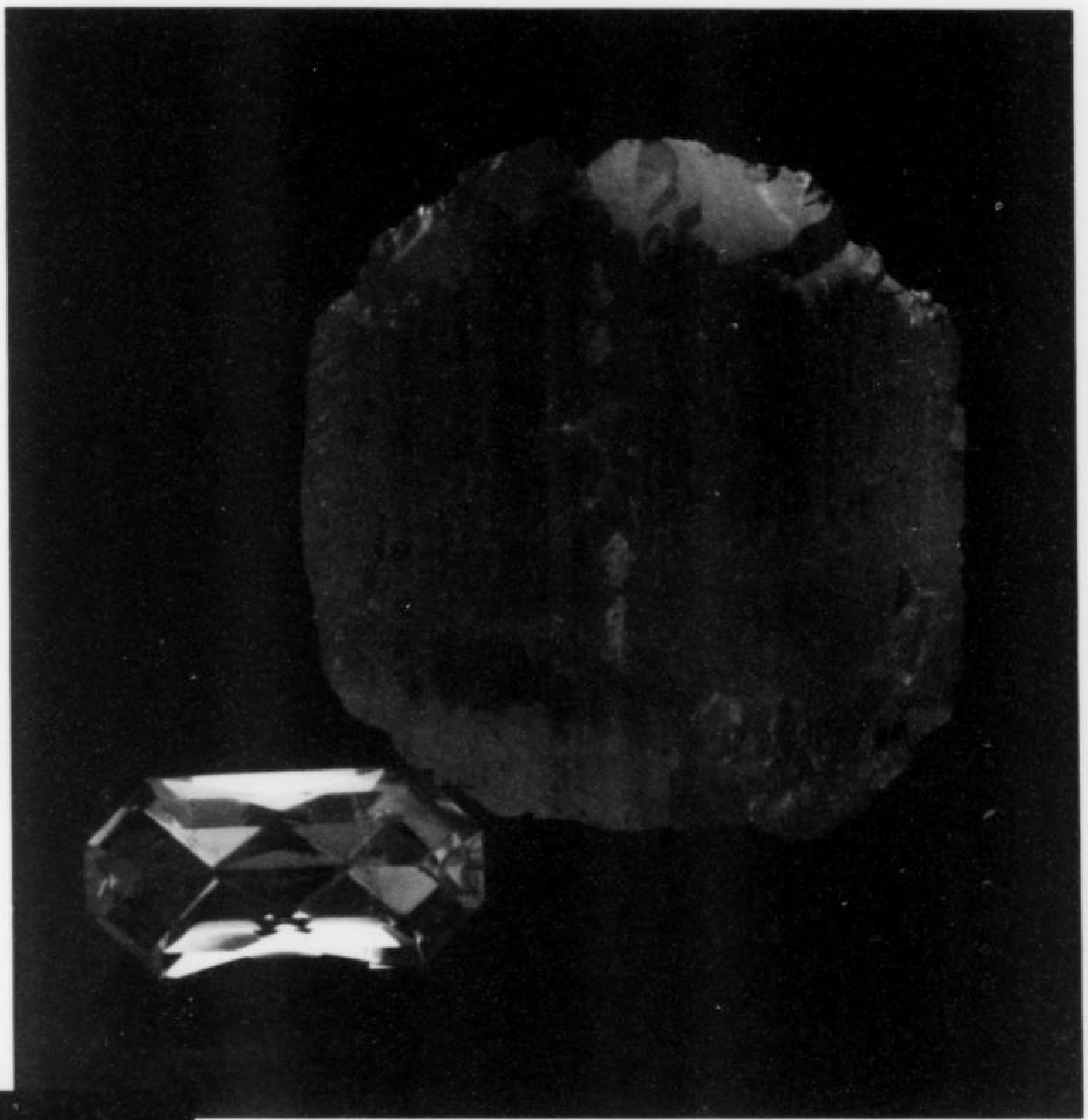
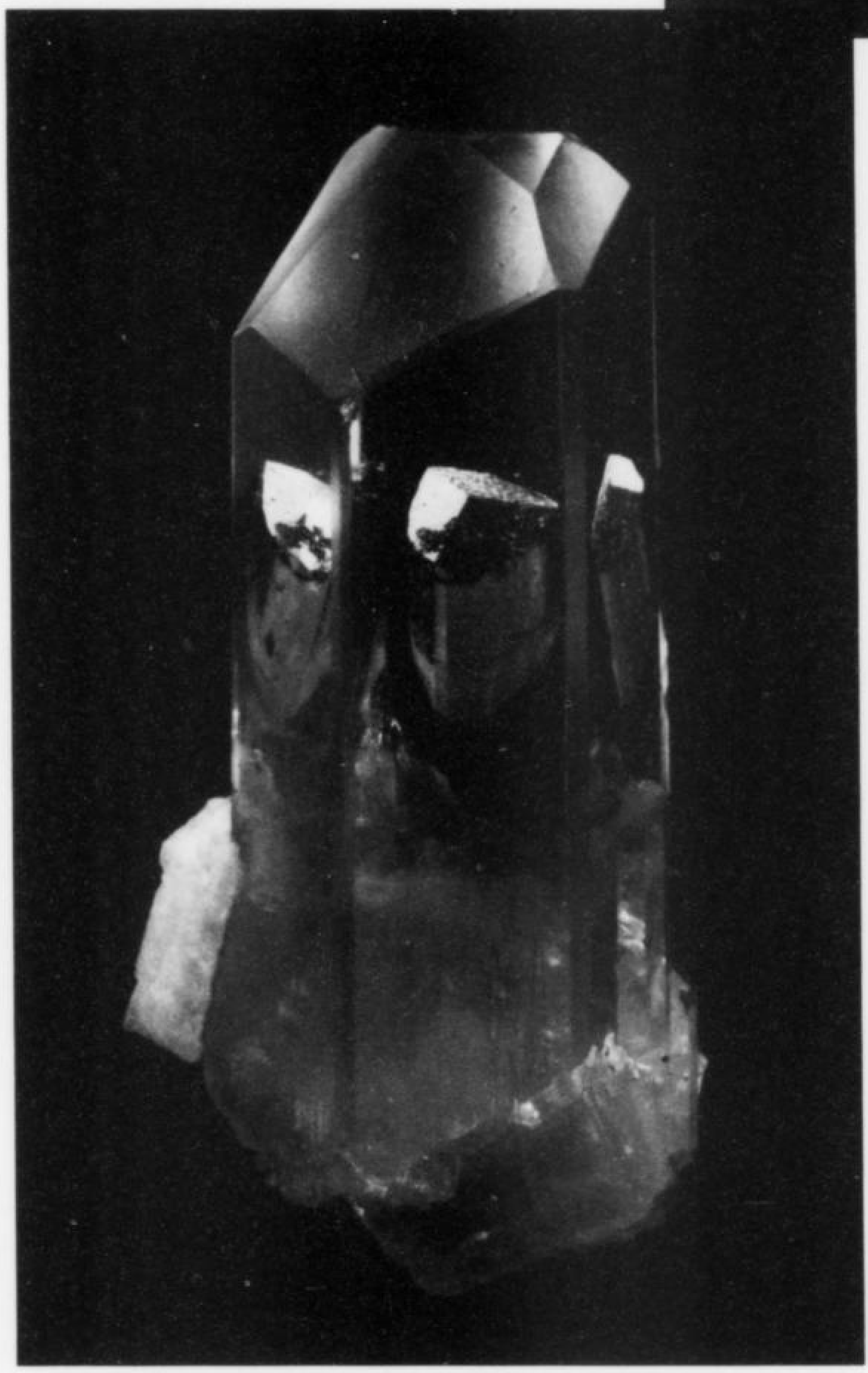


Figure 18. **Väyrynenite crystal, 1.7 cm, and cut stone, 0.55 cts., from near Shengus, Skardu area, Northern Areas, Pakistan. Obodda collection; Jeff Scovil photo.**

Figure 19. **Beryl (aquamarine) crystal with included schorl crystal, 6.5 cm, from Nyitbruk, Shigar Valley, Northern Areas, Pakistan. Obodda collection; Jeff Scovil photo.**



he has made over 100 trips into that country overall. Many visits yielded only disappointment, especially in the early years before he had established a solid relationship with a reliable "lead man." There were also great dangers. Treacherous roads with landslides were always a threat, and political unrest has been a running theme. On one 1982 trip with David Wilber to a small village (actually a refugee camp) near the border with Afghanistan, they could hear Russian artillery in the distance. When they arrived, they had to wait for hours to see the lot of "fabulous" kunzite crystals they'd come for. While they waited, the crystals were being retrieved from their underground hiding place as mortar rounds whistled overhead and exploded in the hills around the miners. When Herb and Dave were finally shown the crystals, they turned out to be of little value.

With the excellent relations Herb has since established with reliable suppliers, such fruitless excursions have occurred much less frequently now. In fact, Herb's taste in mineral specimens has become a Pakistani mineral standard of excellence: I've heard of dealers being told not to waste their time going to a specimen-producing area because there are no "Obodda specimens" to be had there.

COLLECTING

Circa 1962, Herb started buying highly collectible mineral specimens, forming the basis of his then-general mineral collection. One of his sources was the F. Krantz company in Bonn, where he liked to "cherry pick" the stock. There may have been 50 or so pieces of Knappenwand epidote, for example, in a drawer and Herb would take all of the decent ones, leaving scraps that were more or less unsaleable. This really annoyed Krantz's employees, so he was soon allowed to do this only while Krantz himself was present. Herb picked out whatever appealed to him, including fine phenakite crystals at a time when phenakite was considered a rare

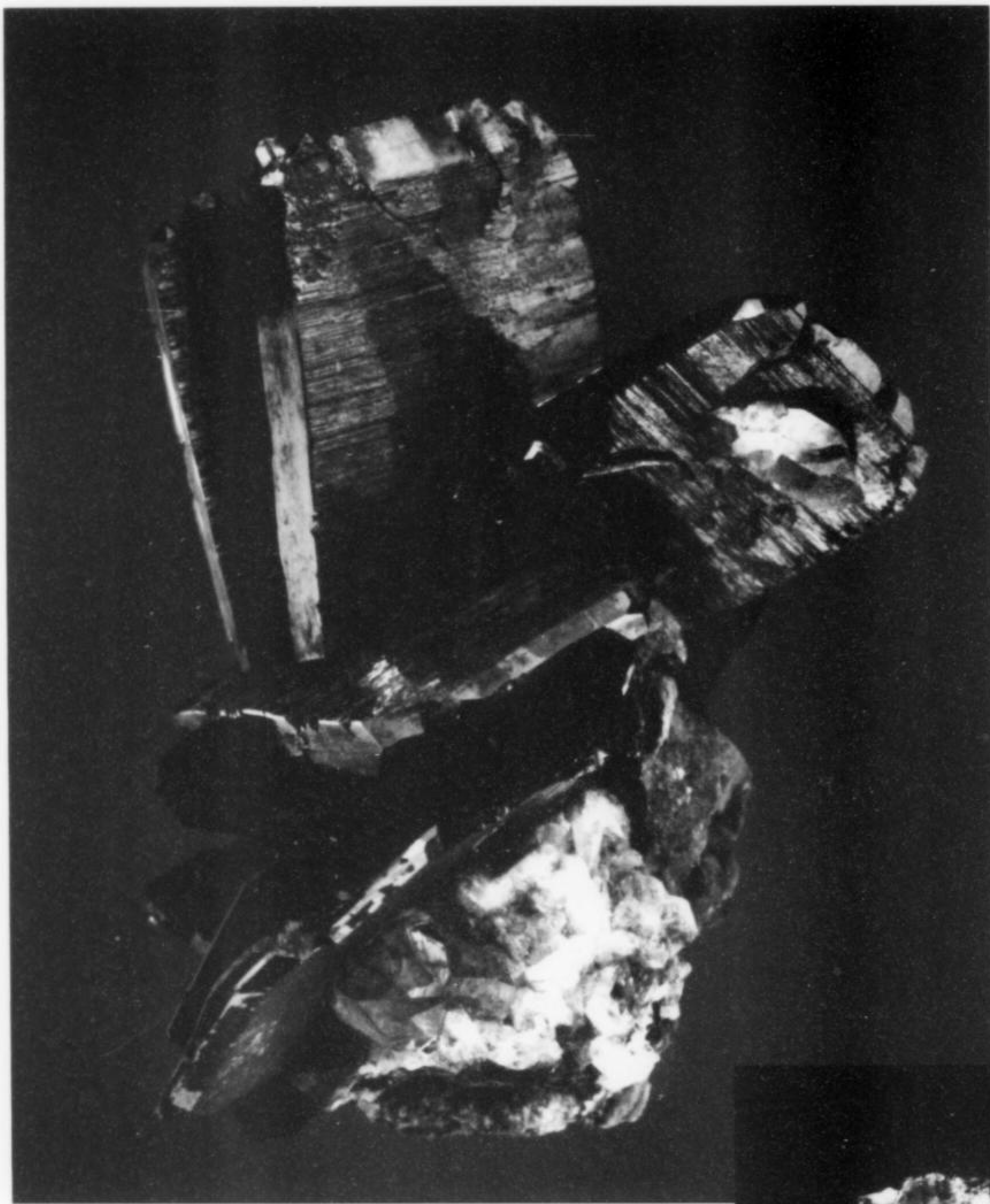


Figure 20. **Brookite crystal cluster, 5.5 cm, from Dalbandin, Baluchistan, Pakistan. Obodda collection; Jeff Scovil photo.**

Figure 21. **Beryl (emerald) crystals in matrix, 5.6 cm, from the Coscuez mine, Colombia. Obodda collection; Jeff Scovil photo.**

mineral; Krantz, however, had kilos of phenakite crystals from Brazil, virtually the world's supply. With his firm grasp of mineral aesthetics, Herb was able to pick out the best of the best and make great purchases. He bought from other suppliers in Europe as well, including Gregory, Bottley & Co. in London long before it became Gregory, Bottley & Lloyd, and Rayner, primarily a jeweler who also sold many minerals, especially fluorites from many localities in the U.K.

Herb's mineral collecting quickly expanded to include a variety of other things, all in one way or another connected to minerals. Those most directly related include a one-time collection of fluorites from worldwide localities, a collection of faceted rare stones in the 1-carat to 3-carat size numbering about 400, a faceted tourmaline collection of about 45 pieces ranging in size from 15 to 175 carats and representing all colors, a collection of the minerals of Pakistan with emphasis on gem minerals of the Northern Areas and rare-earth and associated minerals from the Zagi Mountain deposits in the North West Frontier Province, and choice minerals from worldwide classic localities, with specialties in silver minerals and gem minerals. The subcollections that are more peripherally related to minerals are so diverse and extensive that they defy adequate treatment in an article of this size, but I will list 14 of them here:

Figure 22. **Some thumbnail to miniature-size specimens in the Obodda collection; Obodda photo.**

(1) Herb's gemstone carvings are by master carver Gerd Dreher of Idar-Oberstein, considered by many experts to be the world's best gem carver. All of the carvings in the collection are one-piece artworks carved from a single piece of rough, such as ruby/zoisite, agate, morganite/aquamarine, amethyst, obsidian, and grossular/chromite, with only eyes made of other material. There are 22 carvings in Herb's collection, and he plans to add two to five pieces annually.

(2) A large collection of manuscript correspondence contains items mostly from and to George F. Kunz, but also from many other famous 18th and 19th century mineralogists and crystallographers. The collection includes over 400 letters to Edward Daniel Clarke, the first professor of mineralogy at Cambridge University. Many of these are from the most famous scientists of the time, such as Humphrey Davy, William H. Wollaston, Michael Faraday, Smithson Tennant, Henry Heuland, James Sowerby, and numerous others.

(3) A large collection of "mining art" consists of both exotic and everyday articles featuring depictions of miners, mining processes and scenes, minerals, etc. Included are cast-iron objects such as paperweights, inkwells, urns, candlesticks and more. Porcelain objects such as snuffboxes, pipe-heads, tea and coffee service pieces are included, with emphasis on those from Meissen (mid 18th century) and Furstenberg (19th and early 20th century).

(4) Art objects carved in elephant ivory date mostly from around 1880 and before.

(5) Herb has some extraordinary, historic "mining parades" (mining equivalents of "tin soldiers") in wood and pewter. There are three sets; two are of tin, one by Väterlein (a famous tin founder of Freiberg, Saxony) with about 65 pieces, made around 1880, and another with more than 75 pieces by R. Schumann of Dresden, also made about 1880. The third set of about 75 pieces is made of wood by Werner in Seiffen, Saxony.

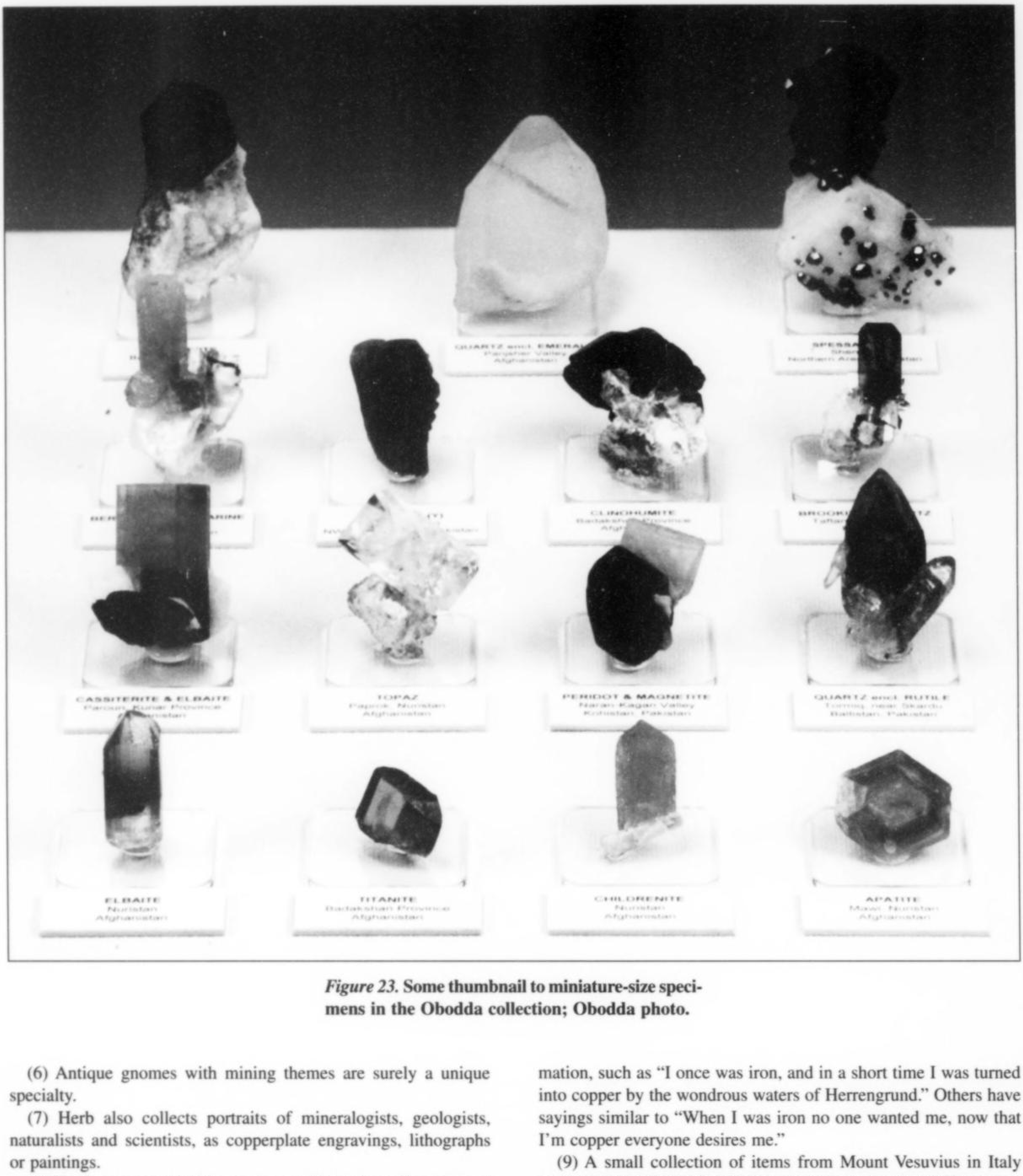


Figure 23. **Some thumbnail to miniature-size specimens in the Obodda collection; Obodda photo.**

(6) Antique gnomes with mining themes are surely a unique specialty.

(7) Herb also collects portraits of mineralogists, geologists, naturalists and scientists, as copperplate engravings, lithographs or paintings.

(8) He also owns mid-18th century art objects from Herrengrund (an historic mining town in Hungary). The various pieces, mostly cups, beakers, snuff boxes, small statues of miners, etc. were made from "cement copper" extracted from the "cement water" in the mine by precipitation using scrap iron. The pieces were made, in part, to commemorate the end of Turkish occupation. When the miners returned to the mines they had abandoned, they found the iron implements they had hidden in the mine waters (which were rich in copper sulfate) had been replaced completely, or in part, by much more precious copper. Most of the cups and beakers have sayings engraved upon them which allude to this "magic" transformation, such as "I once was iron, and in a short time I was turned into copper by the wondrous waters of Herrengrund." Others have sayings similar to "When I was iron no one wanted me, now that I'm copper everyone desires me."

(9) A small collection of items from Mount Vesuvius in Italy includes ashes from 13 different eruptions in April of 1906, pieces of lava embedded with coins, and special "medals" made by gathering small gobs of molten lava and forming them into flat shapes in waffle-iron presses engraved with the maker's name and date.

(10) He also has hundreds of silver, copper, and enameled spoons with mining motifs.

(11) And small, early 20th century copper souvenir items with emphasis on those from Butte, Montana.

(12) Herb's collection of antiquarian books dealing with mineralogy, mining, geology, gemology and crystallography is world-famous and numbers about 3500 cataloged items. The earliest book

in the collection was printed in 1491, and others date to as recently as 2006. The total shelf space required is about 137 meters (equal to about 1½ times the length of an American football field).

(13) Herb's collection of over 150 antique scientific instruments used in mineralogy and crystallography is especially attractive. Many examples are included of contact and optical goniometers, crystal models, refractometers, boxed mineral study collections, blowpipe and assay kits, microscopes and accessories. Seventy of these instruments were on long-term loan to the Houston Museum of Natural Science from 1991–2007, and some 40 of them were placed on public display while there.

(14) A more recent collection, started in 2005, consists of art objects from the baths of Karlsbad, Bohemia. Most of these sou-

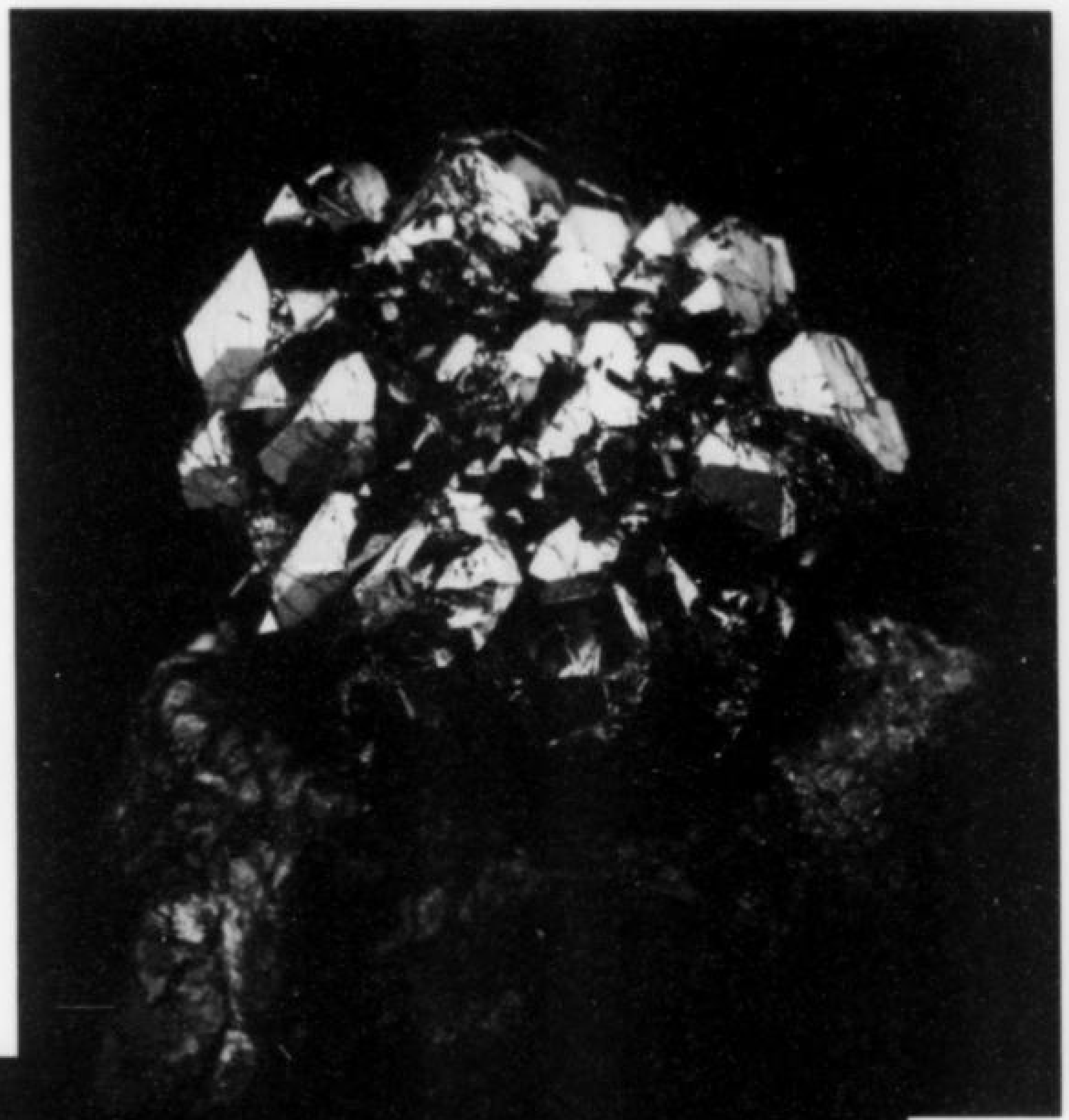


***Figure 24.* Sperrylite crystal in chalcopyrite, 3.8 cm, from the Oktyabrisky mine, Talnakh, Norilsk, Siberia, Russia. Obodda collection; Jeff Scovil photo.**

***Figure 25.* Some thumbnail to miniature-size specimens in the Obodda collection; Obodda photo.**

Figure 26. **Herb Obodda's home office and part of his library. Jeff Scovil photo.**

Figure 27. **G. E. Löhyneyss** ***Bericht vom Bergwerck*** **(1617), among the rarest of the early mining books, inscribed and signed by the author (the only known signed presentation copy). Obodda Library; Jeff Scovil photo.**

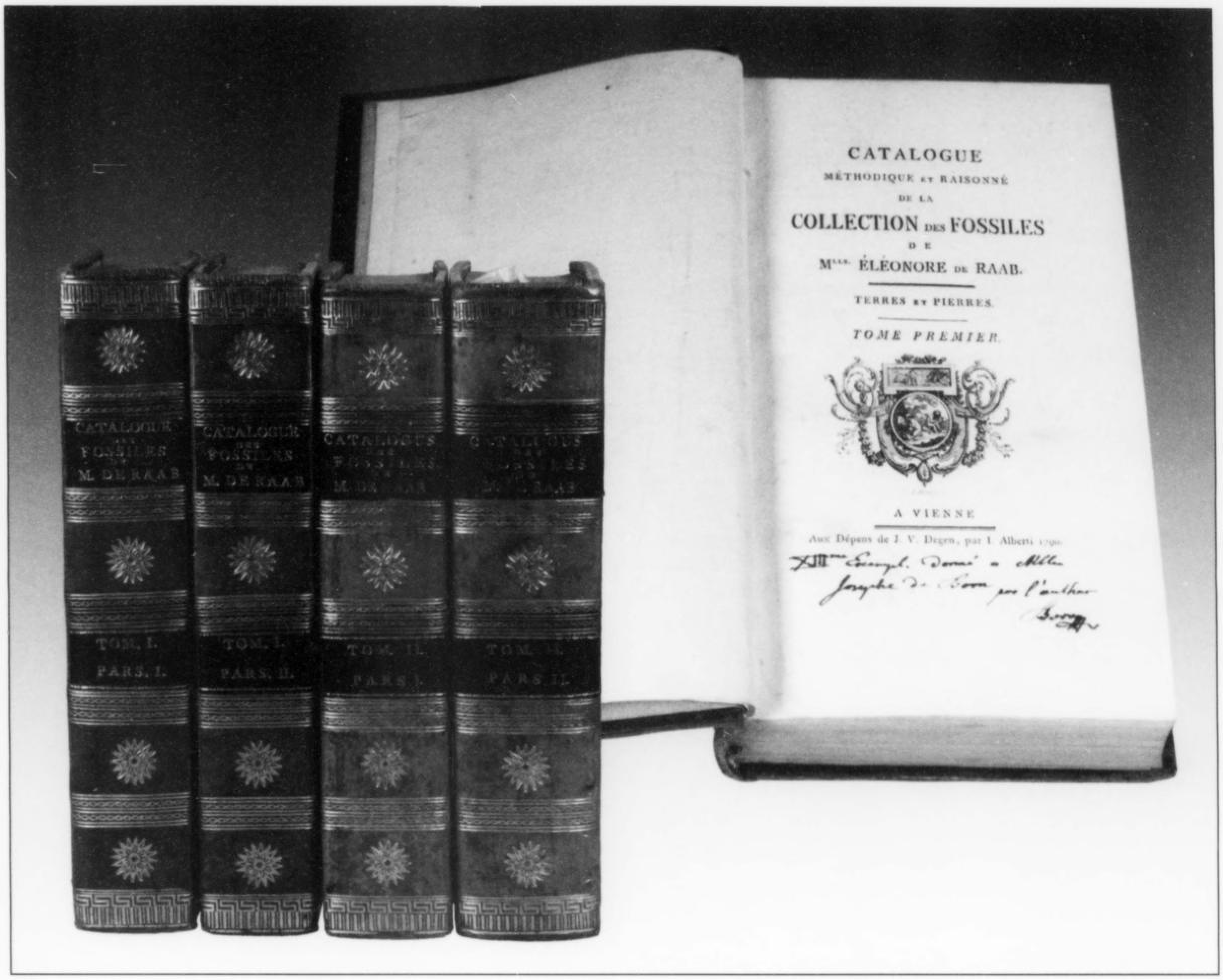


***Figure 28.* The catalog of the Éléonore de Raab collection (1790), by Ignaz von Born, inscribed and signed by the author. Obodda library; Jeff Scovil photo.**

venirs were made between 1880 and 1915. All contain detailed mosaics (*pietre dure*) made of multicolored aragonite "Kalk-Sinter," and take the form of boxes, desk utensils, eyeglass cases, money purses, smoking implements, gaming pieces and a myriad of other frivolous and useful objects. There are about 150 objects in this collection to date.

The *pietre dure* collection is a fine example of how important serendipity has been in the evolution of the Obodda collections. Herb had encountered a couple of examples of the above-mentioned mosaics from Carlsbad and was showing them to his friend Brian Lloyd, mineral dealer in London who is quite knowledgeable about antiques in general and also a collector of antique mineral craft items. Brian told him he was unlikely ever to find additional pieces, but within days Herb had walked into a shop that had an entire collection of them for sale—which, of course, he promptly bought.

I have to say that I have never in my life been as overwhelmed by the depth, strength, quality, diversity and general excellence of a private collection as I was by the Obodda Collection(s). The scientific instruments alone are breathtaking. Each is as fine an example of a craftsman's art as one could hope to find, all painstakingly restored to their initial pristine condition. Drawer after drawer is filled with crystal models, far more different sets by different makers than I knew existed. There are other smaller collections not mentioned above, each reflecting an intellectual curiosity on the part of this remarkable collector that is insatiable with respect to any object relating to minerals and mining.

Herb seems completely unaffected by what he has accomplished. He is as warm, engaging and friendly to everyone as he has always been. Because of the press of his intense collecting efforts, which include exhaustive cataloging incorporating digital images of nearly every object, he has recently retired from participating as a dealer in shows, but still plans to enjoy visiting the Tucson Show and others.

Herb can be maddeningly opaque when it comes to commenting on his competition or on controversial mineral collectors. He simply says nothing. His carefully honed approach to business has meant that he has avoided controversy, his reputation is impeccable, he is universally respected and (I suspect) envied, and his merchandise is always so exciting that most collectors and curators consider it a must-see at any show where he displays.

In spite of his reticence to indulge in criticism, it is easy to engage him in fascinating conversations on virtually any subject that is connected to his interests, which are so diverse that almost nothing is ruled out. He is one of the best *raconteurs* I have ever encountered, and he can remember in great detail every adventure or encounter he has ever had. As he gets into his stories, which are usually peppered with amusing anecdotes, he often chuckles with genuine delight as the tales unfold.

Herb Obodda is a gentleman in the best sense, a credit to the mineral trade, and truly a collector *extraordinaire*. At the end of our interview, I asked him what still drives him, at this point in his life, to continue dealing in minerals and making those exhausting and potentially hazardous trips to Pakistan some five times a year. It is, in fact, his insatiable need to collect. "I have to stay in business," he told me as I was leaving, "so I can afford to buy this stuff."

ACKNOWLEDGMENT

I am extremely grateful to my wife Merle and to Wendell Wilson for applying their impressive editing skills toward making this text more literate.

ADDITIONAL READING

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What's New

in Minerals

Dallas Show 2008 — by Thomas Moore

[May 1–4]

There is a new and potentially major American mineral show on the scene: the Dallas Fine Mineral Show at the Embassy Suites Hotel near the Galleria, 14021 Noel Rd., in Dallas, Texas. This early May show, organized by Dave Waisman (who also runs the increasingly popular Westward Look Show at Tucson each year) debuted in 2007. It feels in many ways like an enlarged Westward Look show, dominated as it is by high-end mineral dealers, mostly American although with French, Germans, Italians, Brazilians, Indians, Chinese and Australians showing their respective flags as well. There are a few fossil, gem and lapidary-materials merchants on hand, and Dave is publicizing the Show with a view to attracting the general public, but basically this is a show for serious mineral collectors. Early in the proceedings this year the aforesaid "general public" was but thinly represented, and sometimes it seemed as though dealers outnumbered customers, but traffic picked up significantly later on, with hopeful signs for the future, e.g. plenty of children, teenagers and docent-like parents or teachers venturing into the rooms and, after a time, coming out happily cradling specimen boxes. Of course, to survive in the long run the Show *must* attract thicker crowds, but the general feeling was that its prospects look good.

The unusual venue itself ought to prove a good draw, being all at once cushy, convenient, and profoundly comfortable. Coming in at the hotel's main entrance and seeing at once a giant quartz

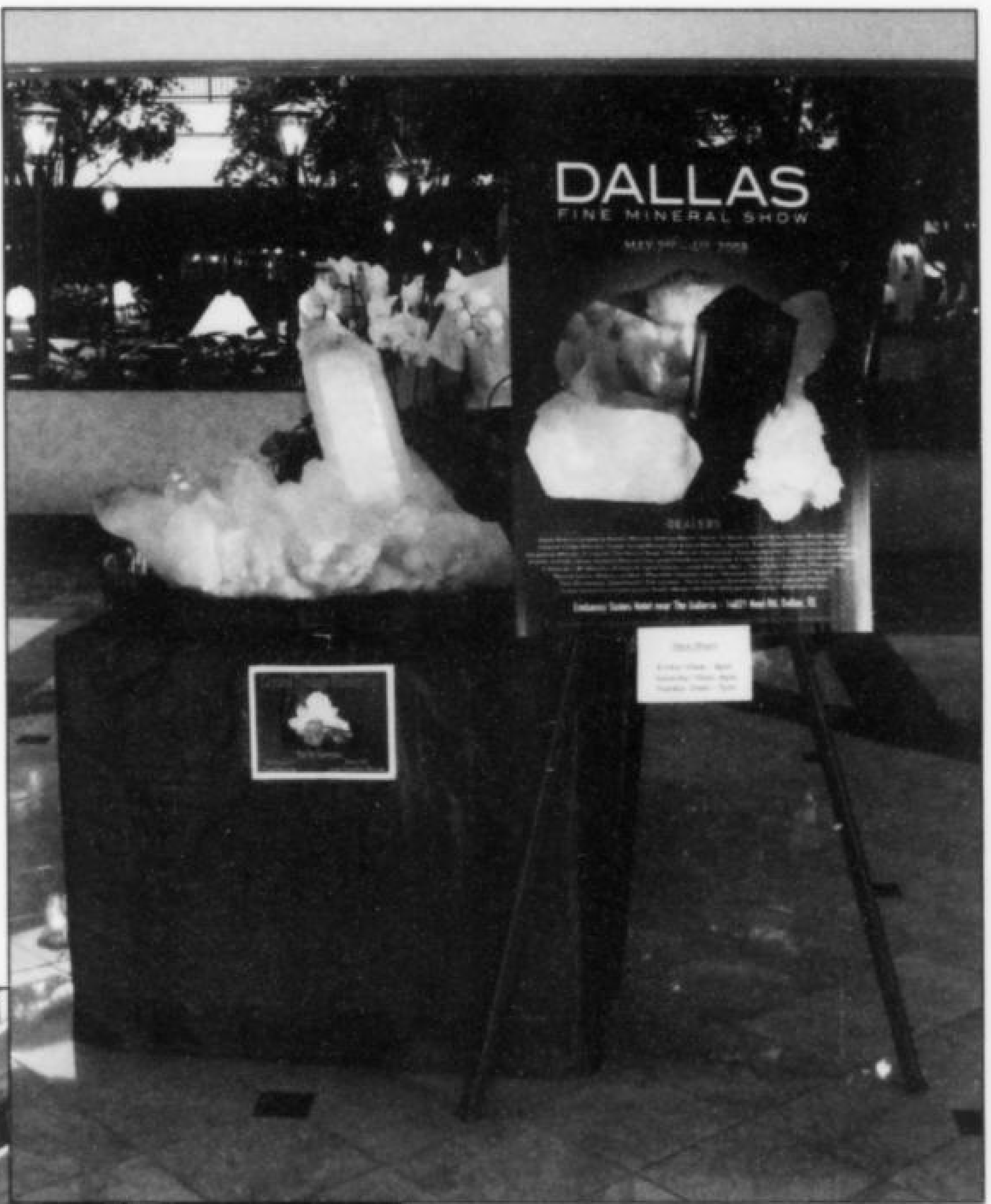

Figure 1. **The Embassy Suites Hotel in Dallas; dealer rooms overlook the atrium. Tom Moore photo.**

crystal group up on a pedestal, one passes the placards, pamphlets on tables and other show paraphernalia to the elevators that go up to the dealer rooms. On the way, however, one is likely to pause at the deep, luxurious atrium where many clusters of couches invite relaxed conversation, and two huge white swans ply the reflecting pool. At the atrium's far end there is a small bar where drinks are served free to patrons after 5:30 p.m., and there is a grill where substantial breakfasts are cooked to order, likewise free for guests each morning. Rising for six stories above visitors' heads and curving around on three sides, a tower of hotel-room entrances beckons, and this year Dave had succeeded in peopling almost all of the rooms on the second and third floors with dealers. From below, each room may be quickly identified from the sign over its door, and one can tell who's "at home" and who's not. The dealers stretching their legs on the encircling walkways outside the rooms may be beckoned and called to, implored to stay put just a minute, "hey, I'll be right up." It's a wholly sensible, shopper-friendly and browser-convenient arrangement, and will remain so in the same way if (when) Dave succeeds in filling more floors with dealers to augment the fifty-odd who signed up for 2008.

Figure 2. **Scorodite crystals to 1.8 cm, with pyrite, from a small prospect pit near the town of Hezhou, near the eastern border of Guangxi Zhuang Autonomous Region, southern China. Marcus Origlieri (Mineral Zone) photo and specimen, now in the Cal and Kerith Graeber collection.**

Most exciting and promising, surely, among the what's-new items from this year's Dallas Show is a find of superb **scorodite** in what is said to be a small prospect pit near the town of Hezhou, near the eastern border of Guangxi Zhuang Autonomous Region, southern China. About a dozen fine scorodite specimens from this occurrence were on hand in the Embassy Suites room of Marcus Origlieri's new dealership, *Mineral Zone* (www.mineralzone.com), and a like number were only just being prepared for market at Rob Lavinsky's nearby *Arkenstone* (www.irocks.com) shop. The glassy, blocky to thick-tabular scorodite crystals are quite sharp and reach a remarkable 3 cm across. The larger crystals are rendered dark by inclusions, but even some of these have thin outer zones which, when backlit, are seen to be transparent and blue; smaller scorodite crystals which rise from matrix are indeed gemmy blue or purple (depending on the incident light) throughout their volumes. The dark matrix consists of massive scorodite and (probably) other phosphates shot through with earthy brown "limonite" gossan and with massive, microcrystallized pyrite: the specimens, it would appear, came from pyrite pods in the gossan, and some of the scorodite crystals show surfaces peppered with tiny subhedral pyrite crystals. Scorodite may form druse coverages, interrupted by larger crystals, on surfaces to 15 cm across; most of the specimens are of cabinet dimensions. Thumbnailers need not despair, however, for when the specimens came in from China some of the large matrix chunks proved to have individual scorodite crystals and small crystal clusters of thumbnail size glued on; these are easily detachable by dissolving the glue. In any event these are important specimens, with scorodite crystals that, while remaining quite sharp, sport sizes matching or exceeding those of the older-known crystals from Tsumeb, Nambia; the El Cobre mine, Zacatecas, Mexico; and the Ojuela mine, Durango, Mexico.

With Marcus Origlieri in the *Mineral Zone* room there were also a dozen excellent loose crystals of **scheelite**, all about 3 cm on edge, from the polymetallic, fluorite-rich Xianghualing mine in southern Hunan Province, China. Of late (see my 2006 Sainte-Marie-aux-Mines Show report in September–October 2006), this locality has been producing increasing numbers of these impressive scheelite crystals, which are razor-sharp, slightly elongated pseudo-octahedrons, with medium to high luster and an unusual, distinctive purplish brown color. Marcus's examples are among the best I've seen yet.

Madagascar's minerals also played starring roles at the Dallas Show, thanks largely to some fine things brought in by Emanuele Marini of the Italian dealership *Demineralia* (www.demineralia.com). Emanuele's showcase boasted about 20 miniature-size specimens of a new polychromatic **liddicoatite** from (another!) new find, this one at Ambarafa, Ampandramaika, Fianarantsoa Province, Madagascar. The loose, lustrous, well-terminated prisms and parallel groups of prisms, to 12 cm, are translucent in medium-pink, and some show faint *blue* zones near their tips. The next shelf down in the showcase was filled with bright, gemmy, yellow to yellow-green groups of **chrysoberyl** crystals from a pocket opened in April 2008 in a pegmatite at Ambatondrazaka: the thumbnail and miniature-size specimens are groups of twinned chrysoberyl crystals with individuals to about 3.5 cm, some groups being complete, 360-degree cyclic-twinned aggregates.

But the most unusual—if also the only ugly—Madagascar items at *Demineralia* were some just-found loose crystals, to 6 cm, of the niobium-rich variety of rutile which has long been called ***"strüverite."*** If you have a copy of the monograph on Madagascar minerals which is No. 1 in the *ExtraLapis English* series, see page 37 for a description and photo of Nb-rich rutile crystals as found and described by Alfred Lacroix in 1922, and see also page 42, where there is a picture of an 8-cm Nb-rich rutile crystal from the Andravory Massif, near the northern end of the island. Like these old-time crystals, Emanuele's new ones are very sharp, blocky to short-prismatic, dull brownish black singles to 6 cm—certainly among the world's best known specimens of this rutile variety. However, whereas the earlier crystals described by the French scientists came from other sites, these new pieces are from near Antsirabé, near the dead center of Madagascar; specifically they are from Ialamitana, just south of Antsirabé and very near Manandona and Vorondolo. If these latter place names sound familiar, it's because they are the localities given for some outstanding specimens of **almandine** which appeared first at the 1996 Denver Show (see that report in January-February 1997). Yes! some of the new specimens from Ialamitana show sharp trapezohedral almandine crystals, of low luster but a nice red-brown color, reaching 5 cm, associated with Nb-rich rutile; one miniature has a 3-cm garnet crystal resting on the flat face of a dark brown Nb-rich rutile plate measuring 5 cm across.

At a show like this you'd expect, of course, a new thing or two from the Himalayan mountain system—and Rob Lavinsky of *The Arkenstone* was glad to oblige. He had some beautiful cabinet-size specimens newly won from a pegmatite near Bulochi, Diamar district, Northern Areas, Pakistan. Gemmy lime-green **fluorite** forms slightly rough dodecahedral crystals to 5 cm on glittering matrix composed of snowy white crests of parallel albite ("cleavelandite") crystals shot through with sleek, striated crystals of jet-black schorl; on other pieces, translucent pink **apatite-(CaF)** (formerly known as **fluorapatite**) forms lustrous tabular crystals to 7 cm, in parallel aggregates resting lightly on the same albite/schorl matrix.

Rob Sielecki of *Ausrox* (rob@crystaluniverse.com.au) had two intriguing miniature-size matrix pieces—having recently obtained ten of the same kind, he said—showing extraordinary **uvarovite** crystals partially embedded in veins of slightly smoky, massive quartz in gneissic matrix. The world's only comparably good uvarovite specimens are the classic examples from Outokumpu, Finland—but Rob's, from an undisclosed locale somewhere in Pakistan, are just as fine as the best from Finland, with deep green, sharp, lustrous, dodecahedral uvarovite crystals to 1.5 cm displaying almost mirror-smooth faces. Rob, of course, has asked his supplier for further locality details concerning the find, but so far without success. It is a matter of high interest whether more specimens as good as these will emerge.

Turning now to domestic news . . . Adam Sotomayor of *Adam's Mountain Minerals* (www.coloradominerals.net) was on hand in Dallas with some pretty specimens of "red" **fluorite** from a large pocket system which he is presently working near Lake George, Park County, Colorado. The sharp cubic fluorite crystals reach 3 cm on edge, and rest on matrix plates composed of intergrown, chalk-white microcline crystals and gemmy smoky quartz crystals, both of the latter reaching 5 cm. Complexly color-zoned, the fluorite crystals are outwardly gray-brown and fairly dull-lustered, but are translucent enough for good lighting to show offset inner zones which are purplish red to almost cherry-red. These miarolitic cavities in the Pikes Peak granite get up to 4.5 meters deep, and one great microcline/quartz crystal plate in Adam's room measures about 20 × 60 cm; however, the prettiest pieces are miniature-size single crystals and tightly intergrown crystal clusters of fluorite, a few with shining, golden brown sprays and fans of acicular **goethite** crystals to 5 cm clinging onto their sides. Adam calls the occurrence the Mother Load [*sic*: his mother has loaded him up, as it were, with support] Pocket Complex, and his development of it is ongoing.

In 2002 Stan Esbenshade showed up at Tucson with about 50 exceptional specimens of **native copper** which he'd collected during the previous summer from dumps at the Chino mine, Bayard, Grant County, New Mexico (see the Tucson Show report in May-June 2002). This year in Dallas, Don Olson (P.O. Box 858, Bonsall, CA 92003) offered about 25 newly collected, almost as fine (just not quite as lustrous) copper specimens found recently on the 5100 bench of the East Pit of the same mine: they are loose, twisting, stalactiform groups of sharp spinel-law-twinned copper crystals with individual, sharp-edged twins to 1 cm, in groups ranging from 5 to 15 cm long.

Finally, a place called Bosque Draw, north of Acme and northeast of Roswell, Chaves County, New Mexico, gave up, late last year, a number of vaguely extraterrestrial-looking **pyrite** specimens, mostly of small-cabinet size. The specimens are sinuous concretions—dull black, rounded, and burrow-shaped—to 20 cm long, studded with subparallel clusters of cubic pyrite crystals. The pyrite crystals are a slightly tarnished brassy yellow, with individual cubes to 3 cm on edge. These specimens were brought to Dallas by a most friendly Chinese lady, MiaoYang, who has started a new dealership called *Crystal Monster* (www.crystalmonster.com), and here's hoping for her success in the venture.

So that's the story from Dallas. This elite yet highly visitor-friendly show deserves the support of all—come and savor the action, and check out those swans, next year. As the full-page ad in March-April 2008 points out, you may contact Dave Waisman for more information at 509-458-2331; or you might visit his website at www.DallasFineMineralShow.com.

Legal Nuggets

Francis M. Allegra
Judge, United States Court of Federal Claims
Adjunct Professor, Georgetown University Law Center
717 Madison Place, NW
Washington, DC 20005

The Tax Man Cometh

In 1900, when J. P. Morgan, at George Kunz's behest, purchased the Bement collection and promptly donated it to the American Museum of Natural History, he likely was unconcerned about the amount of the income tax deduction generated by his contribution. That was because the modern income tax was not passed until after the Sixteenth Amendment to the Constitution was ratified in 1913.

Since 1917, every version of the income tax code has included a section authorizing a deduction for contributions or gifts to entities organized and operated exclusively for religious, charitable, scientific, literary or educational purposes. Currently, that provision is found in section 170 of the Internal Revenue Code. If you contribute property, the amount of your deduction under this section is "generally" equal to the "fair market value" of the property.

Now, if you ever hear a lawyer, let alone a ***tax*** lawyer, utter the word "generally," take note, as that is a sure-fire indication that there is ***at least*** one exception to the general rule lurking. In the case of section 170 of the Code, there are more than a few. For those donating minerals, one of the more important ones is found in section 170(e), which essentially caps the amount of the deduction in the case of property which is not "capital gain property." Under this rule, if a mineral specimen is inventory in a trade or business, the amount of the charitable deduction is set at the cost incurred in acquiring the specimen. The same is true if the specimen is not inventory in a trade or business, but has been held for a year or less before the time of the donation. So, if a specimen is not used in inventory in a trade or business and has appreciated, you must hold it for more than year before you donate it in order to deduct the full appreciated fair market value. Alas, this rule does not work both ways; if the fair market value of the specimen decreases from your cost, it is that diminished value at the time of the donation, and not the cost of purchase, that sets the amount of the deduction.

This begs the question: what is "fair market value?" Under IRS regulations, that value is "the price at which the property would change hands between a willing buyer and a willing seller, neither being under any compulsion to buy or sell and both having reasonable knowledge of relevant facts."[1] (A slightly different formulation applies if the donated property was held as inventory.) IRS Publication 561, entitled "Determining the Value of Donated Property" (available at www.irs.gov), indicates that "[t]he cost of the property to you . . . may be the best indication of its [fair market value]." It adds that "because conditions in the market change, the cost or selling price of property may have less weight if the property was not bought or sold reasonably close to the date of the contribution." The law thus anticipates that as time passes, it is more likely that the value of the property will differ from its acquisition price.

Publication 561 provides additional guidance for valuing "hobby collections," including "natural history items." It cautions taxpayers not to rely too much on published prices, noting that "a dealer may sell an item for much less than is shown on a price list, particularly after the item has remained unsold for a long time." (Shocking news, no doubt.) Other helpful hints on how to value minerals may be drawn, by analogy, from the guide's discussion of valuing jewelry. As to such items, the IRS encourages donors to get appraisals that consider the "coloring, weight . . . brilliance and flaws" in the specimen. The guide notes that while "sentimental personal value" has no effect on fair market value, "if the jewelry was owned by a famous person, its value might increase." In other words, provenance matters, as, undoubtedly, do such traditional indicia of mineral value as the size, associations and locality of the find.

So, in auditing returns, does the IRS actually focus on this valuation issue? Who knows? But, rest assured, the IRS's audit-selection formulae are more sensitive to ***large*** deductions than ***small*** ones. Evidence that this issue has periodically arisen in audits may be found in court cases involving the value of contributed minerals and gems. These cases provide us with additional guidance on how to value mineral specimens in calculating a charitable deduction.

One of them, *Chiu v. Commissioner of Internal Revenue,* 84 T.C. 722 (1985), involved an all-star cast from the mineral world, with key testimony being provided by none other than Paul Desautels, fresh off his 25-year tour as the distinguished Curator of Gems and Minerals at the Smithsonian Institution. Desautels, in fact, was still the Curator when the taxpayers in question donated a variety of specimens to the Smithsonian, among them, a sinhalite, a cat's-eye rubellite tourmaline, a couple of euclase crystals, several cerussite specimens, some wulfenite specimens and a few anglesite crystals.

The taxpayers claimed that they had acquired these specimens at significant discounts and that their values as of the time of the donation were much higher. Their claim was supported by two appraisers, as well as testimony from Desautels. As quoted in the court's opinion, Desautels testified that the mineral market was "chaotic" and that establishing actual sale prices was complicated by the fact that selling "fine mineral specimens is a very secretive business" in which "[d]ealers don't tell you" the final sales price.

[1] 26 C.F.R. §1.170A-1.

He added that he had never been able to wheedle "a discount greater than 30 percent from the asking price, even at a time when the dealer was under pressure to sell," noting that the "normal discount" he received was "10 percent from the asking price." These last comments actually served to doom the taxpayers, who were arguing that they had acquired their specimens at discounts of 75 to 90 percent. The court rejected the higher values placed on the specimens by Desautels and the other appraisers, choosing instead to set that value at what the taxpayers had paid.

Now, times have changed, but the moral of this story still rings true: courts tend to give more credit to the price fetched on the recent purchase of a donated mineral than on a subsequent appraisal. So, if you intend to argue that you bought your mineral at a super discount price and are now donating it at its "true" value, or that the specimen being donated has exploded in value since its purchase ("yes, the mine really did close"), be prepared to bring in heavy artillery in the form of appraisals and appraisers. Indeed, the IRS publication mentioned above warns that appraisals should carefully document any "unusual circumstances" associated with relatively short-term swings in value.

A word to the wise about appraisals and appraisers. The degree to which you must document the "fair market value" of your specimen for tax purposes hinges on the amount of the deduction claimed. Generally, if the amount claimed for an item or a group of similar items of donated property is under $5,000, an appraisal is helpful, but not required. If it is $5,000 or more, then you must get a qualified appraisal of your specimens made by a qualified appraiser and retain it for your records. And, if your deduction exceeds $500,000, then you must attach that appraisal to your return. For more information on this see IRS Publication 526, "Charitable Contributions," also available at www.irs.gov.

IRS regulations[2] shed light on what is a "qualified" appraisal and who is a "qualified" appraiser. They indicate that where an appraisal is required, it must be performed not more than 60 days before the date of contribution. Care must be taken in setting the appraisal fee; that charge cannot be what the IRS calls a "prohibited appraisal fee." According to the IRS, a "prohibited appraisal fee" is one in which some part of the fee is based on a percentage of the appraised value of the property or the amount of a deduction allowed by the IRS. (By the way, an appraisal fee, even if acceptable, cannot be deducted as a charitable contribution, but may qualify as a "miscellaneous deduction" subject to the 2 percent cap applicable to such deductions.) To be a "qualified appraiser" one must meet a number of requirements in the regulations, principal among which is having verifiable education and experience in valuing the sort of property being appraised. Importantly, an appraiser generally cannot be involved in the transaction in which the donor acquired the property being appraised. (For more information see the segment on "Appraisals" in IRS Publication 561.)

Tax provisions often are complex and section 170 is no exception. Those with particular issues should consult a tax professional—always a good idea given what Will Rogers once said about filling out tax returns: "Even when you make one out on the level you don't know, when it's through, if you are a Crook or a Martyr."

[2] 26 C.F.R. §1.170A-13.

NOTE: ***This column is for educational purposes only and is not legal advice, or a substitute for such advice. Readers who have questions on this topic should consult with a qualified lawyer.***

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Fax: +39 02 8846 3281
E-Mail: Federico.Pezzotta@comune.miland.it
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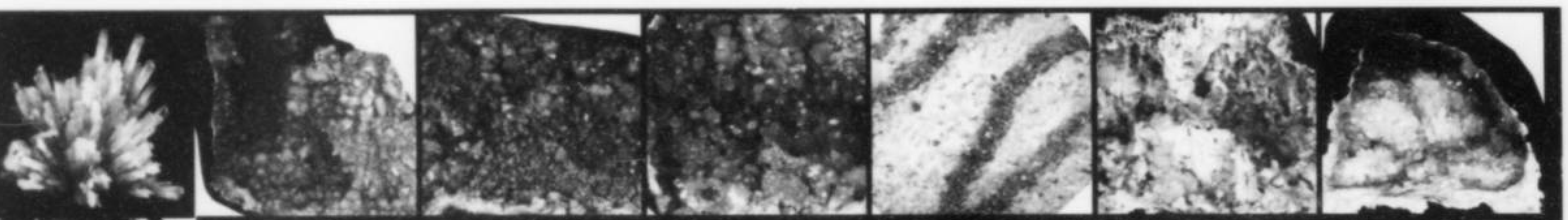

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