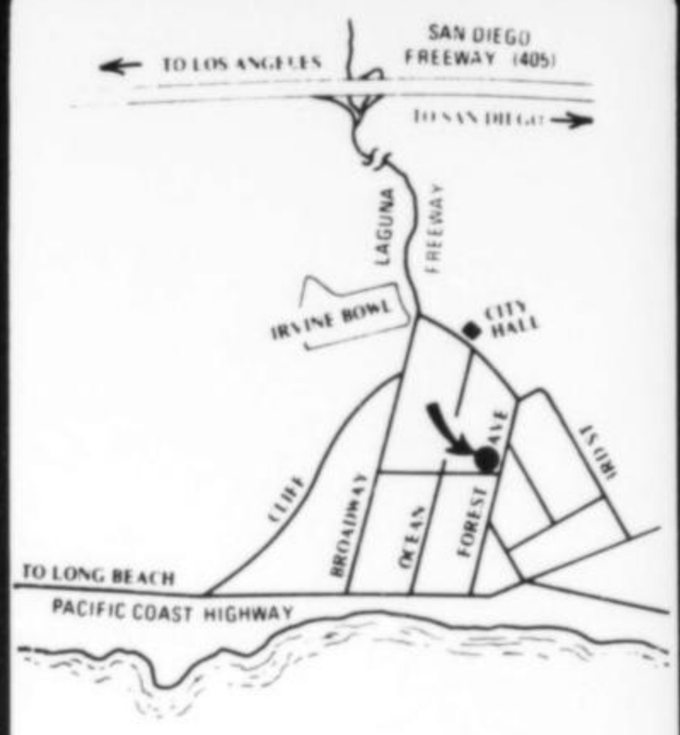
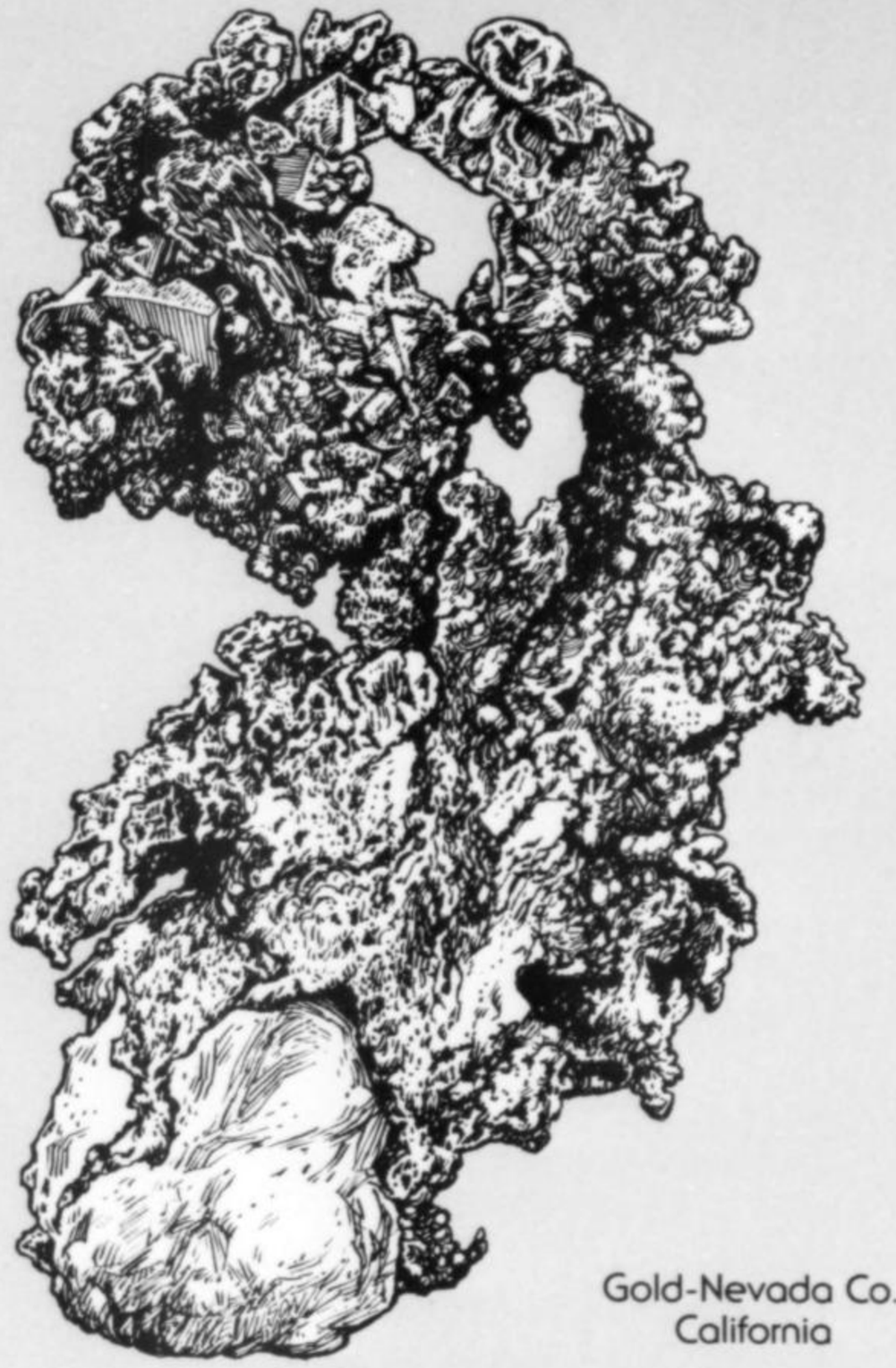
the Mineralogical Record

Volume Ten, Number Four
July–August 1979 $3





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(USPS 887-700)

Volume Ten, Number Four
July–August 1979

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Departments

COVER:
AURICHALCITE from the 79 mine, Gila County, Arizona. Photo (first place winner in Tucson Show slide competition) by Alexis Berset.

address
The Mineralogical Record
P.O. Box 783
Bowie, Maryland 20715

published
bimonthly by the Mineralogical Record Inc.

subscriptions
$13 per year, domestic and foreign. Personal checks in foreign currency accepted, but equivalent of $3 extra must be included to cover exchange charges.

foreign payments
remittance may be made in local currency, without surcharge, to the following people:

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Contributed articles and news items are welcome. Acceptance is subject to the approval of the editor.

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notes from the EDITOR

MEMORIALS

My apologies to the friends and admirers of Neal Yedlin for the seemingly interminable delay in producing a memorial suitable for publication. We chose the concept of a group authorship for Neal's sketch and it took far longer than anticipated to orchestrate that into completion. It appears in this issue.

I usually prefer to publish personality sketches of people while they are still living; for one thing, the person is available to correct errors himself, and to provide answers to questions that may come up during the writing of the piece. For another, the piece can be more upbeat and less mournful. Thus far in the *Record* we have published only two types of personality pieces: sketches written by someone other than the subject, either while the subject is living or posthumously, and personal interviews with the subject. In this issue we have a rare third type: the memoir. Fred Cassirer died recently at the age of 90, but shortly before doing so he spent several months writing his mineral memoirs for publication. I had a chance to read them over and question Fred on a number of points before he passed away. Surely this is the best type of memorial, straight from the person himself.

CIRCULATION HISTORY OF THE RECORD

Judging from conversations with collectors, and from the letters received, it appears that people enjoy the occasional look behind the scenes provided in *Notes from the Editor*. That being the case, I shall continue to provide such glimpses from time to time, until readers begin to indicate that I'm boring them.

As the publisher will no doubt attest, I have a mania for graphs, and the graph shown here, I think, is particularly interesting. It shows the plotted circulation of the *Record* since its beginning with volume 1 in 1970. The volume numbers are indicated along the trace of the graph, and the downward jogs which represent the renewal period each year (incredibly, some people fail to renew!) serve to separate the volumes.

The first interesting thing to note is that the increase in the subscription rate from $6 to $10 at the end of volume 5, produced no discernible perturbation of the circulation. It appears safe to conclude that those 3500 or so subscribers are hard-core supporters of the *Record*, willing to stand such price increases.

The plateau represented by volumes 4, 5 and 6 is also interesting. Beginning with the middle of volume 7, we began our first serious advertising campaign to gain new subscribers . . . before that, all new subscribers were gained by word-of-mouth advertising from our existing readers and supporters. The advertising campaign, coupled with a slightly modified editorial approach, was extremely successful in gaining us new subscribers . . . up to a point. That point came with the beginning of volume 9, coincidentally also the time of a rate increase from $10 to $13.

My favorite interpretation of this (highly speculative, I admit) is that we were not fully tapping the potential market with only word-of-mouth advertising. We commonly heard from astonished, new subscribers during those years that they had never heard of the *Record* until recently and would have subscribed much earlier had they known of it before. I think that perhaps the circulation growth curve would instead have followed the dashed line (indicated with a question mark) if regular advertising had been employed since the beginning. If this is true, the

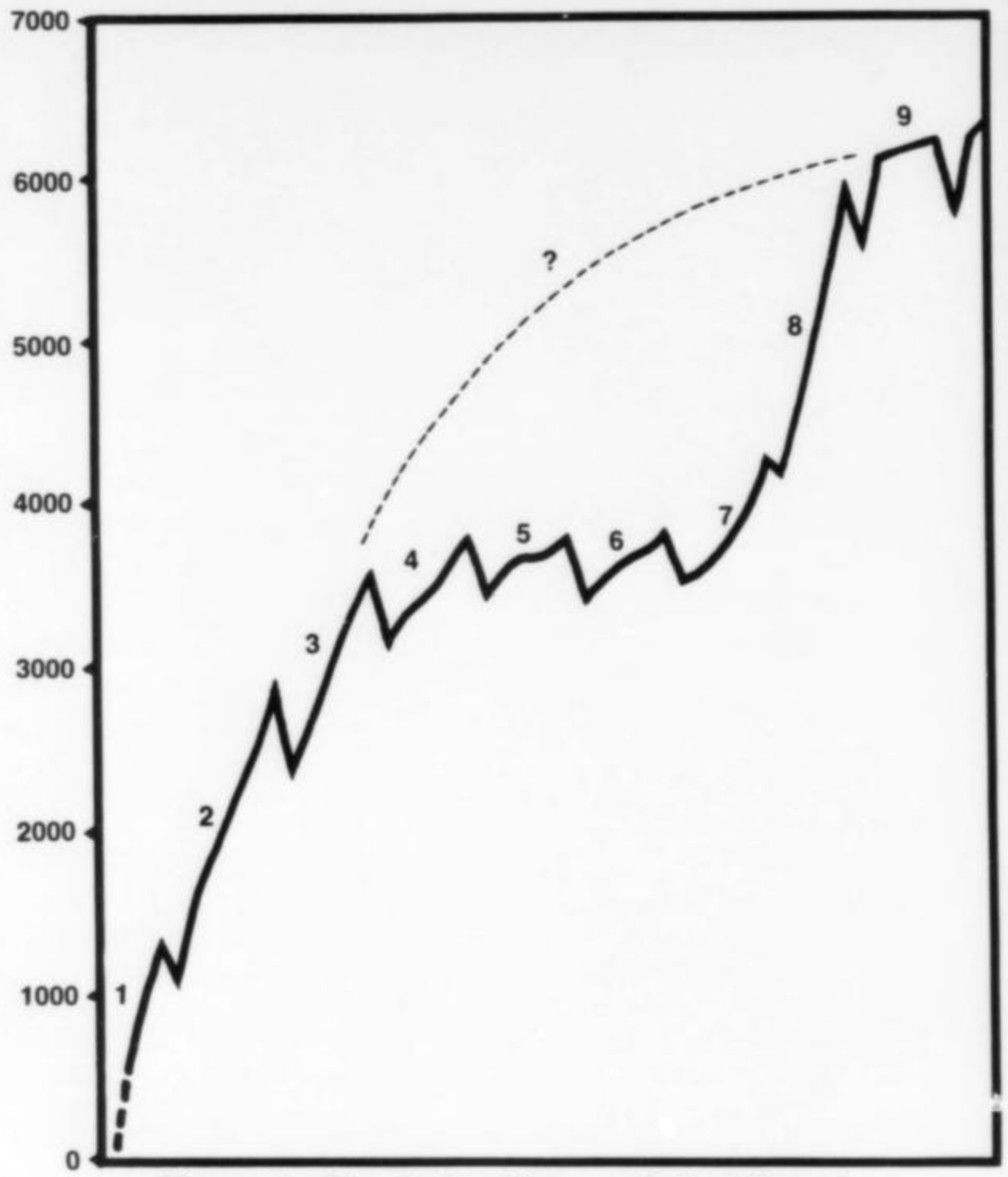

Figure 1. **Circulation history of the *Mineralogical Record* from 1970 (volume 1) through the present. Volume numbers are indicated along the trace of the graph; number of subscribers are indicated at the left.**

graph suggests that we are now very close to saturating the market for our particular type of publication. I see indications of this at our table at the Detroit and Tucson Shows, where we now enlist far fewer new subscribers than we used to.

A circulation of about 6500 subscribers, including over-the-counter sales, is the break even point for us these days and we should all be happy that the *Record* is (albeit precariously) secure, barring galloping inflation, runaway recession and other destabilizing influences. But it hurts a little to be so close to real prosperity. For every additional 1000 subscribers at this point we could afford to add 16 pages of full color to some issue every year. All other things remaining equal, if our circulation were at 10,000 today we would be publishing every issue in color!

The graph notwithstanding, I still feel there are quite a few potential new subscribers left out there who don't know about the *Record* yet, or who have not yet felt ready to make the mental leap from calcite and fluorite to the other 2500 and some species (see William Frechette's letter in this issue), or who are still debating whether they should try to learn anything at all about their hobby or not. Those latter folks stand at the borderline between collecting like mindless packrats or thinking human beings, and they may require only a little encouragement from friends to make that most noble transition.

So what is the outlook for the *Record* . . . bare survival indefinitely? Not necessarily. We have yet to utilize our non-profit status to its full potential for gaining outright donations and grants. We're hampered by a lack of time and experience in this area, but perhaps the situation can be forced to improve in future years. A number of possible approaches are currently under consideration and, although such things move with exasperating slowness, we hope they will eventually raise the *Record* from a subsistence level to a level of real prosperity. In the meantime, every new subscriber helps, and we need a steady flow of new subscribers to counterbalance the dropouts. I am happy to say, however, that the dropout rate for the *Record* is *remarkably* low in comparison to that for most other magazines. So thank you, readers, for all your support.

"LAWS" OF COLLECTING

In the Record Bookshelf a few issues ago there was a short review of a book entitled *Murphy's Law and Other Reasons Why Things Go Wrong!* Everyone knows Murphy's Law . . . "if anything can go wrong it will." The book contains over 400 other such "laws" and observations of varying profundity, none of which, however, seem to have been composed with collectors *directly* in mind. In order to fill this cryng need, I offer here a few observations relative to collecting.

LAWS OF COLLECTING

1. Specimens become more expensive faster than you become more affluent.

2. A specimen being trimmed tends to break through the largest crystal.

3. Untrained observers always wish to touch the most fragile specimen.

4. The one specimen you like best in a collection is the one which the owner is least inclined to part with.

5. Every specimen is dinged; the dings are just smaller on some.

6. In the field, the best crystals are always found on the largest, hardest rock.

7. In the field, the greatest discoveries are always made the day before you arrive, or the day after you leave.

8. During hard times, mineral dealers keep alive by selling to each other.

9. The best specimens on a dealer's mailing list will already be sold by the time you receive the list.

10. Specimens and money tend to repel each other.

Corollary #1. The specimen you have been waiting years to buy becomes available when you have the least money.

Corollary #2. When you have extra money to spend on specimens, nothing worthwhile will be available.

Corollary #3. Specimens of a given type will stop appreciating, and will begin to depreciate, as soon as you buy one.

Corollary #4. When you wish to sell a specimen, no one will have the money available to buy it from you.

11. If you immediately buy a specimen from a new discovery, better ones will shortly be found and sold for less. If you delay in buying, no more will ever be found, and prices will immediately rise drastically.

12. If you wish to sell a specimen, no one wants it. If you wish to keep it, everyone wants it.

Corollary #1. If you buy a specimen from a dealer he will continue to tell you how marvelous it is until the moment you offer to sell it back to him.

13. A repaired specimen is worth less only when owned by someone else.

14. Mineral localities remain open as long as mineral collectors do not visit them.

15. A specimen which you are contemplating buying will remain unsold until *just before* you decide to buy it (regardless of how long you delay), at which time it will be bought by someone else.

BROOKSTONE

I came across a mail-order catalog recently that readers might find interesting: Brookstone's catalog of "hard-to-find tools and other fine things" (Brookstone Company, 127 Vose Farm Road, Peterborough, New Hampshire 03458). A few of the items worth noting:

1. Hand lenses (10X) (one with *built-in* illumination!)
2. Knee-pads (for working on your knees while collecting)
3. Rubber stamp kit with moveable type for creating your own message (nice for labeling slides)
4. Shadow boxes (for display of minerals or mining memorabilia)
5. Three-hour photochemical light tubes (for emergency use underground)
6. Portable headlamp and battery case (for D-cells) suitable for use on a hardhat underground
7. Appliance plug converter kit (so your electrical stuff will work when you travel to foreign countries)
8. Brass replica of Welsh miner's safety lamp ($72.50 plus $4.95 shipping and another $2.95 for airmail)
9. Chain ladders (15 ft or 25 ft long) possibly useful underground
10. Wide assortment of vises, tweezers, picks, files and other small tools useable by micromounters
11. Rust-inhibiting paper (gives off ammine nitrite vapor) which *may* be useful for wrapping pyrite and marcasite for storage and preservation from decomposition
12. Large light designed to work from a car battery (of possible use underground)
13. Hand-formable clay-like epoxy putty useful for mounting or bracing those really big and heavy cabinet specimens
14. And a very large variety of other fascinating and useful items.

The catalog is free for the asking. Write for one, or call their customer service department (603-924-7181) and have them send you one.

FOOD FOR THOUGHT

Readers who have been fortunate enough to visit the Royal Ontario Museum in Toronto know what an outstanding collection of mineralogical and geological exhibits may be seen there. The mineralogy wing is considered by those who know minerals to be of major significance among the public collections in North America.

Unfortunately the upper administration of the ROM is not fully aware of this. Current plans call for the mineralogy and geology wings to be entirely dismantled and put into storage for an indeterminate period of time. Plans also call for them to be reassembled at some later date in a different part of the museum, but funding is not now available for the reconstruction, and it could be many years before the ROM again has mineralogy and geology exhibits.

What incredible coup of acquisition could prompt the replacement of these fine exhibits? Well . . . a restaurant. And a space for changing exhibits of various random kinds. Toronto already has more than its fair share of fine restaurants (within walking distance of the ROM), and it seems there *must* be some other place temporary exhibits could be housed. The stormy controversy has recently burst into the Toronto press, and the museum administration appears to be unyielding in the face of criticism. The curators, staff and mineral-appreciating public of Toronto are becoming very concerned about this, and so should readers of the *Record*.

Feedback is needed and *Record* readers can help. The dismemberment is not scheduled to start for a while yet, and there is still time to influence the decision. Write a letter of protest! Letters, *many* of them, from outside of Canada will let those in power know how widespread is the admiration for that which they propose to tear down. I have checked with curator J. A. Mandarino, and he suggests readers write directly to:

William Davis
Premier of Toronto
Parliament Buildings
Toronto, Canada

Letter-writing *can* make a difference. (It did, after all, keep the *Mineralogical Record* from changing its name!) Don't be one who stands quietly by. A letter from *each* of the *Record's* 6000-and-some subscribers could very well turn the situation around. Do it now, before reading the rest of this issue.

Chañarcillo
Chile

by
Robert B. Cook
Department of Geology
Auburn University
Auburn, Alabama 36830

No other district of similar size in the western hemisphere has produced the variety, quantity, and quality of silver minerals, especially proustite and native silver, as Chañarcillo, Chile. Although the mines and once booming town of Juan Godoy now lie in ruin, the tradition of Chañarcillo silver lives on for collectors and curators.

INTRODUCTION

This article is intended to generally acquaint the reader with Chañarcillo[1] and to present pertinent facts about the district and its minerals, particularly those that the reader is most likely to encounter in museums, systematic collections, and dealer stocks. Much of the information contained herein has been compiled from scant professional articles and is augmented by the author's observations at Chañarcillo in December, 1976.

LOCATION

The Chañarcillo district is located in the Atacama Desert of northern Chile, approximately 50 km south of Copiapo and about 10 km east of the Pan American Highway at south latitude 27° 48.6′ and west longitude 70° 75.6′ (Figure 1). Relief in the district is approximately 750 m and most mines lie at approximately 1,000 m above sea level. Chañarcillo boasts an unusually arid climate and little or no vegetation.

Access to Chañarcillo is difficult, primarily due to the lack of rental transportation in the nearest city, Copiapo. Copiapo is serviced weekly by a commercial airline and is easily accessible by major highways. A mineralogical museum located in the Mining University at Copiapo is well worth a visit. Although an exceptional suite of Chañarcillo specimens was once on display here, an unfortunate robbery several years ago resulted in the loss of virtually all of these specimens. The thief was apprehended only after the specimens had been reduced and sold as bullion.

HISTORY

The early history of Chañarcillo was nicely capsulized by Browne in 1868, and is worth quoting here in full:

The nearest water—at least the most convenient of access—is 10 miles off, and it is sold at the mines at 16 gallons for $1, but it is fit only for brutes, and the water for the men is brought further, and paid for at a higher price.

The first mine of Chañarcello was discovered on the 18th of May, 1832, by a muleteer named Juan Godoi, who, while out hunting, got tired of chasing a guanaco and sat down on a stone to rest. Happening to examine the rock, he saw that it was very rich silver ore, and he managed to break off enough to load his two donkeys, with which he went to Copiapo, where he asked the assistance and counsel of Juan Callejas, his friend and an old miner. They obtained a title to the mine, and Callejas, in recog-

Figure 1. **Index map of Chile showing the location of Chañarcillo (from Park and MacDiarmid, 1964).**

[1] Pronounced "Chan-yar-see-́oh."

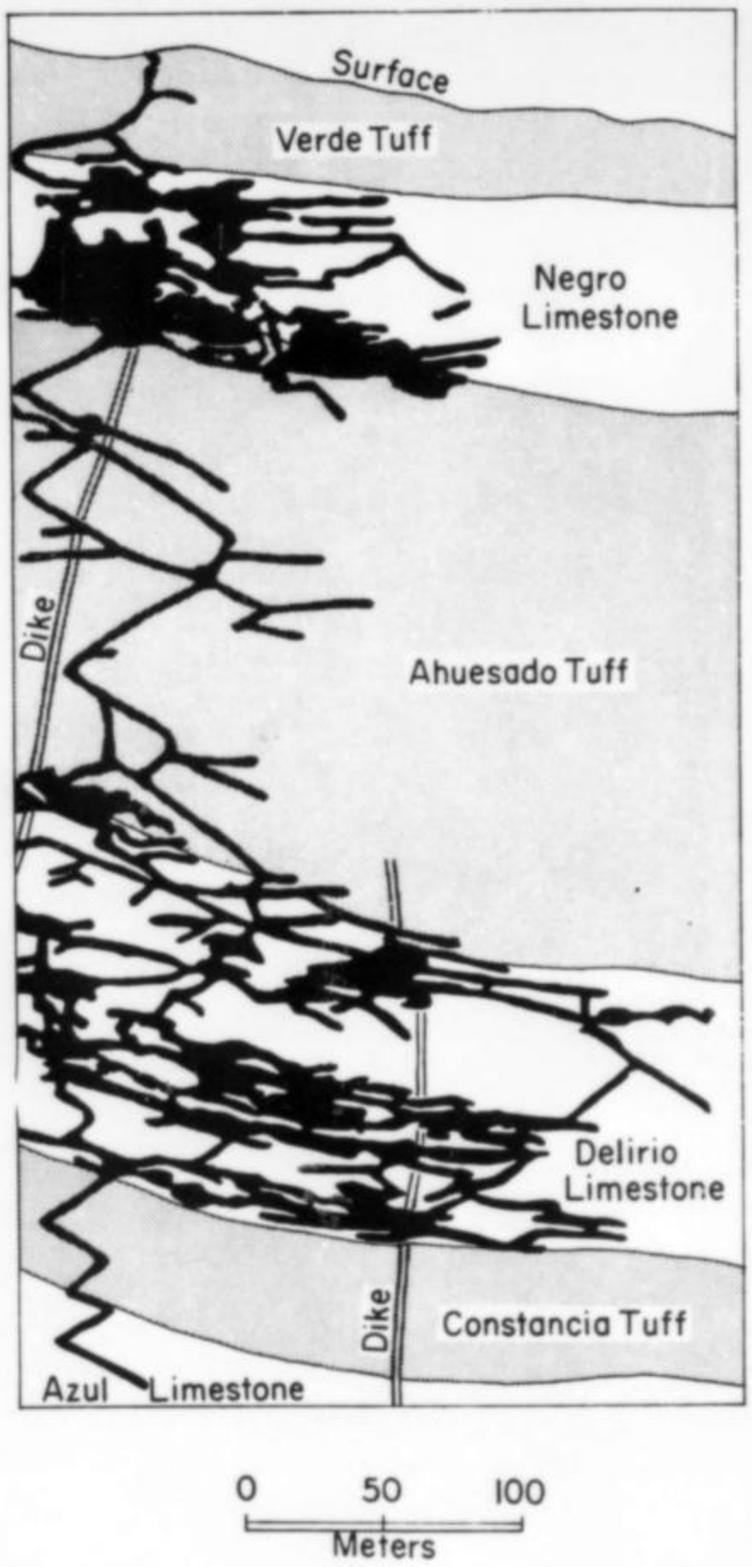

Figure 2. **Cross section through the Constancia mine at Chañarcillo, showing ore concentrations (black) preferentially invading limestone strata parallel to the bedding (from Park and MacDiarmid, after Whitehead, 1919).**

nition of many favors, transferred his share (one-third) to Don Miguel Gallo, who became one of the wealthiest men of Chili. The mine proved very productive, and Godoi, who had been a very reputable muleteer, became a low debauchee. He spent all his immense wealth, and was reduced to beggary. He had not even a donkey. Gallo took pity on him and gave him a little mine, which he sold for $14,000, and on that sum the discoverer of Chañarcello lived in moderation and quiet.

A mine called Bolados was richer than the pioneer claim, to which it was very near. It yielded $3,000,000 to four owners, and, though all were married and had children, not one of them left a cent to his heirs. All had wasted their money in riotous living. The largest piece of native silver on record was found in this mine; it weighed 6,000 pounds, and was worth $150,000. One lump of it cut out with chisels—for it could not be drilled for blasting—weighed a ton and a half.

In 1850 there were 1,750 miners in the Chañarcello district, two-thirds of them Chilenos, and the remainder foreigners, mostly from other Spanish American States. The barreteros or miners who break down the ore, received $25 per month and 20 ounces of bread, a pound of boiled beans, six ounces of wheat, and 24 figs daily, the food being supposed to be enough for an average family. The apires, or men who carry the ore upon their backs to the surface, the usual load being from 250 to 375 pounds, receive $12 per month and the same rations.

Figure 3. **Recent photograph (1976) showing the remains of Chañarcillo's old mining camp, Juan Godoy.**

Figure 4. **Recent photograph (1976) of open stopes and dumps along one of the major Chañarcillo vein systems.**

At the mouth of the mine the ore is broken with hammers into pieces of half a cubic inch and assorted. Everything that will not yield at the rate of $50 per ton was thrown to one side as not rich enough to pay for working, and of this rejected material there were piles at Chañarcello, in 1850, estimated to contain $20,000,000 of silver.

The pulverization is effected in arrastras, and the amalgamation in wooden tubs with iron bottoms. The stirring is done by four crooked iron arms fastened on a vertical shaft which revolves in the centre of the tub. There is no muller or grinding of the ore in the tub. The process requires six or eight hours.

In 1850 there were in the province of Atacama 75 productive silver mines, 198 unproductive, and 2,914 persons employed. The amount of ore extracted was 15,398,996 pounds, of which 10,480,000 were credited to Chañarcello and 3,000,000 to Tres Puntas.

At Chañarcello there were 18 productive mines and 97 that had been opened and had not paid expenses. The total yield of the 10,480,000 pounds of ore obtained at Chañarcello was $2,700,000 of which $2,100,000 was net profit.

It would appear from this statement that the ores extracted yield on average more than $5,000 per ton. The total yield of the Chañarcello district from 1832 to 1860 is estimated at $80,000,000. The value of the silver exported from Chili was $59,931 in 1830; $761,406 in 1835; $1,381,030 in 1845; $3,555,045 in 1850.

The ores responsible for Chañarcillo's amazing production were, of course, quite high grade due to the processes of supergene enrichment and oxidation. For the year 1856, the average ore grade was 466 ounces of silver per ton of hand-sorted ore and the total production was 115,656 ounces (Davies, 1888). Primary vein mineralization contained between 60 and 150 "ounces" of silver per ton (Whitehead, 1919)[2] while enriched upper portions of the deposits contained zones in which silver was measured in percent. Phenomenally high grade masses were encountered. One piece of nearly pure native silver weighed over 91 kg. A mass of embolite with native silver weighed 20,450 kg and contained 75% silver.

Today, little remains of these once great mines and the bustling community of Juan Godoy. Not a single building stands although the foundations and streets are still quite evident (Figure 2). The dumps have been picked over time and again for high grade ore and mineral specimens (Figure 3). A few of the mines can still be entered, but at great risk. Superficial attempts are currently under way to reclaim small portions of the dumps for primary mineralization discarded years ago due to its lower grade.

GEOLOGY

The general geology of the Chañarcillo district has been presented time and again as the classic example of enriched, bonanza-type silver ores (Moesta, 1870; Davies, 1888; Echegaray, 1905; Beck, 1909; Whitehead, 1919 and 1942; and Park and MacDiarmid, 1964). A revised, modern approach to the regional geology of Chañarcillo by Segerstrom (1962), coupled with the interpretative ore paragenesis of Whitehead (1919), form the basis of the following paragraphs of this section.

Chañarcillo is only one of a series of silver districts that form a linear belt parallel to the Pacific coast and the Andes Mountains. This belt,

[2] Ounces should in all likelihood be read as grams since other ore grade data in this paper are given in grams of silver per ton.

which corresponds generally to the Andean Geosyncline, is bounded on the west by basement rocks of Paleozoic and possibly Precambrian age. The oldest geosynclinal units are clastic beds of Triassic age. These are overlain by marine sediments of early Jurassic age and volcanics of probable Jurassic age. The stratigraphically higher Chañarcillo group and Bandurrias formation of Cretaceous age crop out extensively. These two units interfinger and rocks within this zone of apparent facies change host the Chañarcillo deposits (Segerstrom, 1962). The overlying Cerrillos and Hornitos formations of late Cretaceous volcanic and sedimentary rocks also host silver deposits within the general belt. All units comprising the geosynclinal sequence have been intruded by igneous rocks of intermediate composition.

The most important structural features of the silver-producing belt are folds, domes, and faults. Chañarcillo is on the south flank of an open dome underlain by a granodiorite stock and characterized by ore-bearing radial fractures and a northwest-striking fault system.

Primary veins vary in width from about 3 cm to 1 m. Hypogene minerals include pyrite, sphalerite, chalcopyrite, galena, arsenopyrite, cobalt arsenides, pearceite, tetrahedrite, proustite, polybasite, and pyrargyrite in a gangue consisting of varying quantities of calcite, barite, quartz, and siderite. The veins extend to the greatest depth explored (about 1,000 m). Ores are preferentially developed in the major limestone units of the Chañarcillo group, the Negro and Delirio formations. Major veins are generally aligned along the axes of the dome and there appears to be a correlation between proximity to the crest of this feature and continuity or richness of the parallel veins. Irregular ore zones are also located at vein intersections and where veins intersect fissures and dikes.

Well-developed oxidation and supergene sulfide enrichment zones yielded most of the ore for which the district is famous. A late period of faulting, reflected by a normal fault with about 50 m of displacement that generally divides the district into northern and southern parts, shattered the veins, thus permitting subsequent erosion and weathering to redistribute the silver minerals in near-surface parts of the veins and adjacent wall rocks.

Supergene sulfide enrichment is generally restricted to ores within the lower Delirio limestone. Descending meteoric waters precipitated their dissolved silver content upon reaching primary ore beneath the water table. Accordingly, upper parts of the supergene sulfide zones were selectively enriched with ore grade diminishing from the top to the bottom of the limestone bed. Zones of supergene sulfide enrichment range in thickness from a minimum of approximately 40 m in the northern part of the district to a maximum of approximately 150 m in the south (Whitehead, 1942). Supergene minerals characteristic of these bonanza zones include stephanite, acanthite, dyscrasite, stromeyerite, pearceite, polybasite, and native silver. The general enrichment process was by replacement of primary sulfides, antimonides, and native silver. The most intense enrichment was represented by veins of massive dyscrasite.

Above the zone of supergene sulfide enrichment, and separated from it by a rather thick bed of volcanic rock, is the second bed of limestone (Negro limestone), characterized by unusual oxidation of the veins. Within this zone, abnormal thickening of the veins to as much as 10 m was characteristic. Oxidation processes developed silver halides which were arranged zonally according to relative solubilities. Oxide zone minerals include chlorargyrite, iodian bromargyrite, bromargyrite, embolite, iodargyrite, mercuroan bromyrite, and tocornalite.

As a complicating factor, fluctuations of the ground water level caused the oxide zone to encroach on the supergene sulfide enriched ores. Thus, portions of the supergene sulfide ores are, in part, replaced by silver halides. After the halides were formed, there followed a short period during which the oxidation processes were reversed and native silver and small amounts of argentite coated, transected, and partially replaced some of the previously formed silver halides (Whitehead, 1919).

MINERALOGY

Although most descriptive mineralogy texts refer to Chañarcillo, detailed literature concerning this district and its mineralogy are almost entirely lacking. Several articles by Moesta (1870 and 1928) describe Chañarcillo from a geologic standpoint and present some details of the occurrence of silver halides in the oxide zone. An excellent article by Whitehead (1919) gives details of the microscopic relationships between major ore minerals, but reveals little descriptive information relative to the more exotic mineral occurrences.

Table 1 lists minerals described from Chañarcillo. Based simply on the geology and prevailing climate of the occurrence, this list is assumed to be incomplete, particularly with respect to non-silver-bearing species of the enriched zones. Today, it appears that only a small amount of early Chañarcillo specimens (other than proustite) remain for detailed study by modern techniques and that new research into the mineralogy of this district will not be forthcoming.

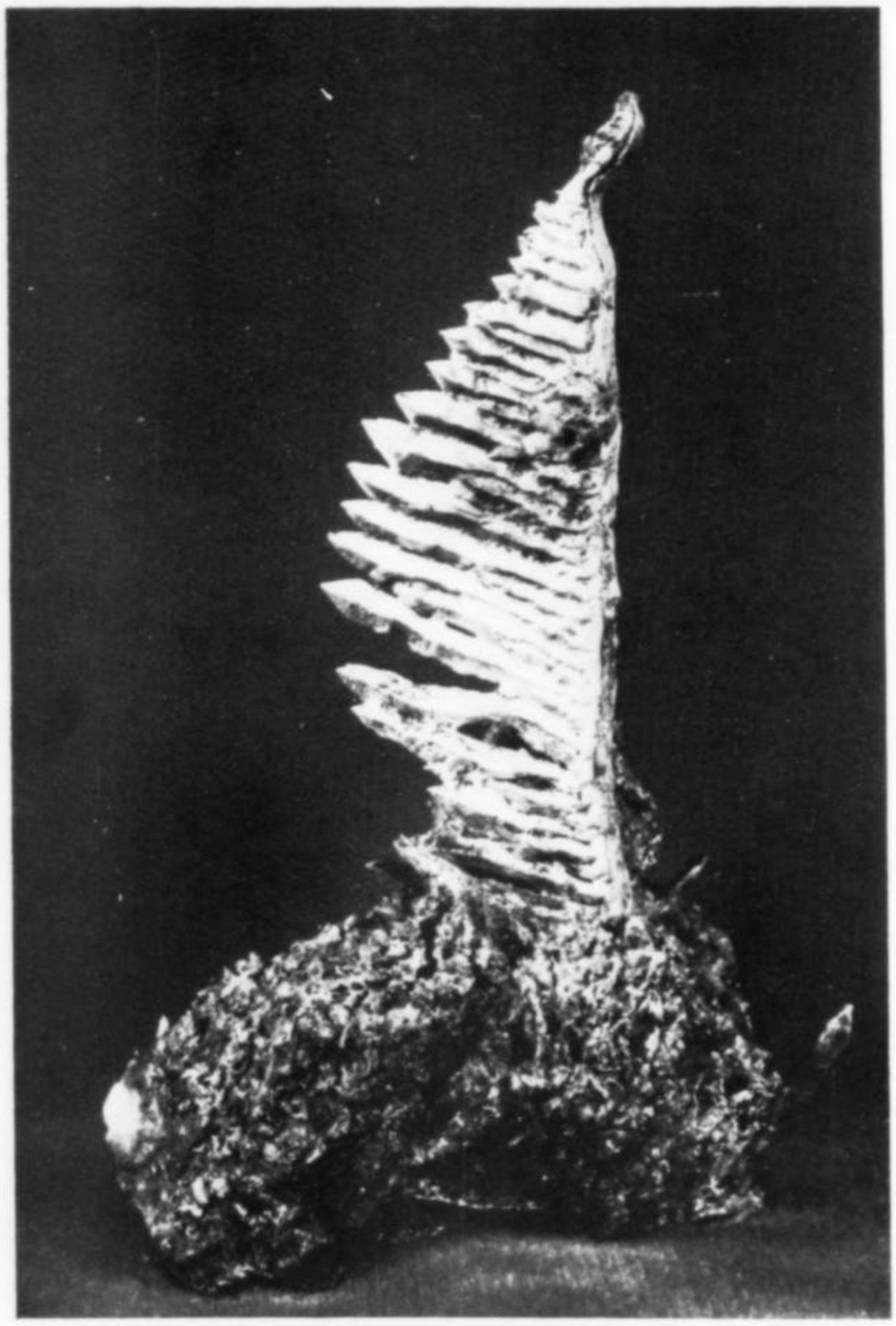

Figure 5. **Arborescent native silver from Chañarcillo. The specimen is about 5 cm tall; Harvard collection. Photo by Bob Jones.**

Elements

Exceptional samples of native silver were recovered from Chañarcillo. Although rarely encountered today, the few observed by the author rival those from Kongsberg, Norway. Much of the silver occurred as thick wiry masses after silver sulfides in calcite. An exceptional example seen in the Copiapo area consisted of a single bent wire approximately 8 cm long by 1.5 cm in diameter bounded by poorly developed crystal faces. Native copper, occurring in the oxidized portions of veins containing relatively abundant primary copper minerals, is commonly replaced in part by native silver, resulting in small half-

Figure 6. **Native wire silver from Chañarcillo. The specimen is about 5 cm tall; Harvard collection. Photo by Cornelius Hurlbut.**

breeds reminiscent of some Michigan material.

Perhaps the most unusual mineral occurring at Chañarcillo is moschellandsbergite. This compound of silver and mercury occurs in silver-white metallic cubes of rather small size. The presence of this and other mercury-bearing secondary minerals at Chañarcillo has not been adequately explained with respect to the mineralogy of the primary veins that in all likelihood were the ultimate source of the mercury.

Oxides

The oxide minerals of Chañarcillo are of academic interest only. Powdery goethite masses in coarsely crystalline barite or calcite generally signals the presence of microcrystalline silver halides, and may be used as a guide in examining old ore specimens from Chañarcillo for these particular minerals. Rather drab cuprite was locally common in the oxide zones of veins whose deeper portions are relatively rich in primary copper sulfides.

Sulfides

Most sulfides occurring in Chañarcillo ores are of primary origin and are of academic mineralogical interest only. Arsenopyrite is exceptionally common and frequently occurs as euhedral crystals up to 1 cm in greatest dimension. Massive cobalt arsenides were encountered during deep exploration of primary vein mineralization, but have not been studied in sufficient detail for species identification. Pyrite, generally in small and uninteresting crystals, is a prevalent mineral in both the primary ore and wall rock. Sphalerite is characteristic of much of the primary ore and is typically light in color and of rather small grain size.

Sulfides of the enrichment zone occasionally occurred in spectacular specimens. Dyscrasite occurred as dendritic masses replacing pyrargyrite and proustite, and in many instances was intimately associated with abundant native silver. Intense enrichment resulted in almost pure veins of massive dyscrasite and native silver. Occasionally, small dyscrasite crystals were found within cavities in pink calcite or as feathery aggregates along calcite cleavage planes.

Exceptional crystalline specimens of argentite (acanthite) were apparently characteristic in the supergene sulfide zone. Better specimens consist of single crystals and groups on calcite. Individual crystals commonly exceed 1 cm in diameter and are characterized by octahedral forms with minor cubic modifications.

Figure 7. **Argentite from Chañarcillo. This illustration is from Reinhard Brauns' *Das Mineralreich* (1912, plate 8).**

Sulfosalts

The silver sulfosalts are well represented at Chañarcillo. High quality crystalline aggregates of polybasite, pearceite, stephanite and miargyrite were infrequently encountered in both the primary veins and sulfide enrichment zones. Little of this material was preserved even though quality appears to have rivaled that of the classic German occurrences.

Exceptional pyrargyrite specimens characterized by crystals exhibiting highly developed scalenohedral forms were recovered from the Dolores mine. Individual crystals frequently exceeded 1 cm in length and occurred as groups on crystalline, white to pink calcite.

The most exquisitely developed and highly sought Chañarcillo mineral is proustite. Few museums cannot boast at least one of these old-timers. The beauty and desirability of these specimens have made them perhaps the ultimate in collector minerals with prices more than reflecting this circumstance.

Proustites of unrivaled quality were produced from the Dolores and adjacent mines in the mid-nineteenth century. Chañarcillo proustite crystals in many instances are characterized by strongly developed scalenohedral forms with a perceptible lightening of color toward the termination. Individual crystals to 10 cm in length are known. Matrix specimens normally consist of crystal groups on coarsely crystalline calcite, crystalline argentite, or aggregates of calcite and wall rock

Figure 8. **Magnificent, transparent spear of deep red proustite from Chañarcillo. The crystal is 6.4 cm tall (2.5 inches), very near the maximum length of 3 inches reported for Chañarcillo. Smithsonian collection; USNM# 121831.**

silicates. Occasionally, proustite crystals were found coated by a soft, asbestiform silicate mineral. Many of the finest existing specimens are of this type and have been carefully cleaned of this material. A description of Chañarcillo proustite in the Bement collection of the American Museum of Natural History is worthy of note: "The proustite from Chile will be seen in long fluted crystals with projecting spikes of smaller

Figure 9. **A group of scalenohedral proustite crystals from Chañarcillo. The specimen measures 3.9 cm tall; Smithsonian collection, USNM# 121830. The crystals are brilliant red and transparent. The strong double refraction of proustite causes some of the internal reflections to appear doubled.**

crystals, like a Hercules club; often acute and obtuse rhombohedrons of a deep cochineal transparent tint; also in deeply channeled prisms" (Gratacap, 1912). See, for example, the color photo of channeled prisms previously published in the *Record* (vol. 9, no. 3, p. 182).

Today, Chañarcillo proustites are rarely available and then only from old accumulations and collections. The value of Chañarcillo proustite is well known in Copiapo and the surrounding vicinity. Well crystallized proustite is rarely if ever found on the dumps and even massive broken fragments are erroneously thought to be worth substantial sums.

Halides

The silver halides, occasionally in exceptional crystal aggregates, were developed to an unusual degree within the oxide zones of the Chañarcillo deposits. Species described here and given in Table 1 are consistent with the most recent revisions of silver halide terminology (Notices, *American Mineralogist*, **49**, 224 (1964)). Inasmuch as most literature dealing with Chañarcillo reflects old, imprecise, and at times vague terminology, both presently accepted and older species names will be used (obsolete terminology in parenthesis).

In general, the silver halides were formed by replacement of dyscrasite and native silver, or were formed as euhedral crystals in pockets and cavities in massive calcite or barite. The halide species attributed to Chañarcillo are chlorargyrite (cerargyrite), bromargyrite (bromyrite), iodargyrite (iodyrite), iodian bromargyrite (iodobromite), mercuroan bromargyrite (mercuroan bromyrite), embolite, and tocornalite. The characteristic occurrence of these minerals is in waxy, colorless to light

Figure 10. **Spectacular cruciform crystal of proustite from Chañarcillo. The crystal as seen (brilliant dark red) measures 6.6 cm in height, although another crystal is attached at the back, the termation just visible on the lower left, which extends downward 3 more cm. Smithsonian specimen, USNM# 121829.**

yellow masses or ill-defined crystalline aggregates. Distinction between the species is difficult. Most individual crystals are quite small (less than 1 mm), and suitable for micromounting purposes. Handsome specimens consisting of yellowish aggregates of various silver halide minerals in crude crystals approaching 1 cm and associated with wire silver and dyscrasite were occasionally recovered in the early days of mining.

Rather drab examples of the silver halide minerals may still be collected on the dumps of Chañarcillo, although the minerals cannot normally be recognized without the aid of magnification. Samples collected by the author consist of coarsely crystalline carbonaceous calcite and white barite containing small iron-oxide-filled cavities and granular masses of embolite and bromargyrite. Minute, perfectly developed, colorless iodargyrite crystals exhibiting typical hemimorphic

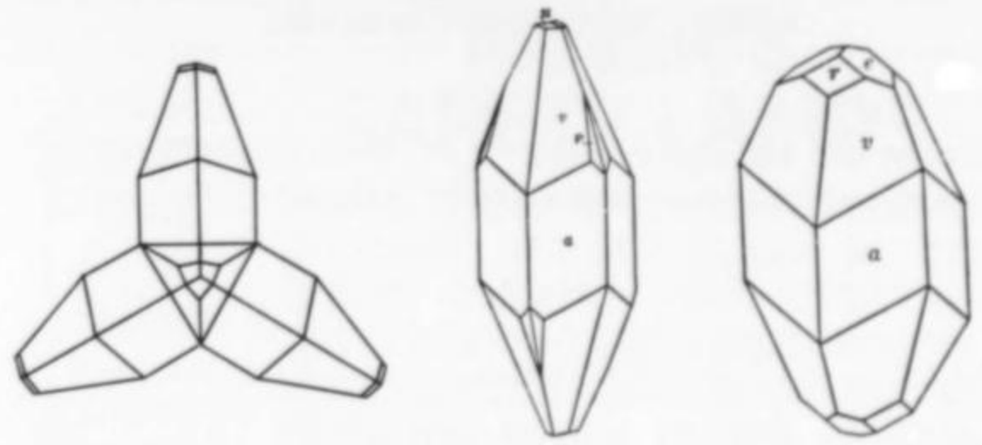

Figure 11. **Crystal drawings showing the forms and habits of Chañarcillo proustite. The single crystal drawings are from Palache, *et al.* (1944). The trilling twin drawing is from Goldschmidt's *Atlas der Krystallformen* (1922).**

development were found coating flesh-colored calcite in small vugs.

Although not observed by the author in any specimen or existing collection, Chañarcillo is the type locality for the mineral tocornalite, an ill-defined silver mercury iodide first described by Domeyko (1867) and later found with other silver halides in the Proprietary Mine, Broken Hill, New South Wales, Australia. The mineral is quite nondescript, occurring in pale yellow granular masses.

Carbonates

The predominant gangue mineral of the Chañarcillo veins is calcite. Coarsely crystalline masses of pink to gray calcite litter the dumps. Although the material is quite vuggy, cavity filling by silver minerals is extremely rare in material exposed today. Richer portions of the dumps appear to be characterized by darker gray, organic-rich calcite associated with abundant coarsely-crystalline barite. Minor coatings of earthy malachite are locally present.

Sulfates

Coarsely crystalline white barite is the dominant sulfate mineral at Chañarcillo. In most instances it is intimately associated with calcite. Rather uninspiring specimens of terminated crystals can be collected. Gypsum occurs as minute crystals with iron oxides in ore from the oxide zones.

Silicates

The silicate minerals of Chañarcillo (Table 1) are those characteristic of the country rocks and weakly altered wall rocks of the veins. Contact metamorphic minerals developed around the margins of the Chañarcillo stock include coarsely crystalline garnet locally affording good specimens, diopside, augite, epidote and wollastonite.

CONCLUSIONS

The future of Chañarcillo as a viable mining district as well as a source of new specimen material is uncertain at best. Although rather superficial reworking of the dumps is in progress, it appears that ores characteristic of the enriched zones are sparse if not entirely absent within the area and at the depth of these operations. There are persistent rumors of a major undertaking to dewater the mines for the exploitation of the deep primary ores. Even should this take place, old records indicate that the occurrence of specimen grade material equivalent to that of the past would be unlikely. Although the mines are easily identified and some can be entered, the accessible portions have been examined in minute detail over the years for any indication of quality specimen materiai and that material has been removed. For these reasons, a trip to the mines is certainly not worth the cost or the effort, and Chañarcillo specimens, particularly proustite, will remain both expensive and difficult to acquire.

ACKNOWLEDGMENTS

The author wishes to express his appreciation to the editorial board of the *Mineralogical Record* for its careful review of this manuscript and the resultant revisions and additions. A visit to Chañarcillo was one stop in a collecting trip sponsored by Marvin Boote of Excelsior, Minnesota.

Table 1. Minerals of Chañarcillo

A = Country and wall rock minerals B = Oxide zone minerals
C = Supergene sulfide zone minerals D = Primary vein minerals

NAME	FORMULA	CHARACTERISTIC OCCURRENCE
Elements		
Arsenic	As	B, C
Silver	Ag	B, C, D
Copper	Au	B
Moschellandsbergite	Ag_2Hg_3	C
Sulfides		
A_3X Type		
Dyscrasite	Ag_3Sb	C
A_2X Type		
Acanthite (argentite)	Ag_2S	B, C
Chalcocite	Cu_2S	C
Stromeyerite	AgCuS	C
A_3X_2 Type		
Bornite	Cu_5FeS_4	D
AX Type		
Galena	PbS	D
Sphalerite	ZnS	D
Chalcopyrite	$CuFeS_2$	D
AX_2 Type		
Pyrite	FeS_2	D
Arsenopyrite	FeAsS	D
Cobalt Arsenides		D
Sulfosalts		
AmBnXp Type		
Polybasite	$(Ag,Cu)_{16}Sb_2S_{11}$	C, D
Pearceite	$Ag_{16}As_2S_{11}$	C, D
Stephanite	Ag_5SbS_4	C
A_3BX_3 Type		
Pyrargyrite	Ag_3SbS_3	D
Proustite	Ag_3AsS_3	D
Freibergite	$(Ag,Cu)_{12}(Sb,As)_4S_{13}$	
Xanthoconite	Ag_3AsS_3	
ABX_2 Type		
Miargyrite	$AgSbS_2$	D
Oxides		
A_2X Type		
Cuprite	Cu_2O	B
A_2X_3 Type		
Hematite (specularite)	Fe_2O_3	D (?)
AX_2 Type		
Pyrolusite	MnO_2	B
Hydroxides		
Goethite	FeO(OH)	B
Halides		
AX Type		
Chlorargyrite (cerargyrite)	AgCl	B
Bromargyrite (bromyrite)	AgBr	B
Embolite	Ag(Cl,Br)	
Iodian Bromargyrite (iodobromite)	Ag(Br,Cl,I)	B
Mercuroan Bromargyrite	(Ag,Hg)Br	B
Iodargite (iodyrite)	AgI	B
Tocornalite	silver mercury iodide	B
Carbonates		
$A(XO_3)$ Type		
Calcite	$CaCO_3$	D
Siderite	$FeCO_3$	D
$Am(XO_3)pZp$ Type		
Malachite	$Cu_2(CO_3)(OH)_2$	B
Sulfates		
AXO_4 Type		
Barite	$BaSO_4$	D
$A(XO_4)\cdot xH_2O$ Type		
Gypsum	$CaSO_4\cdot 2H_2O$	B
Silicates		
Quartz	SiO_2	A, D
Plagioclase (undifferentiated)	$(Na,Ca)Al(Al,Si)Si_2O_8$	A
Orthoclase	$KAlSi_3O_8$	A
Muscovite	$KAl_2(AlSi_3)O_{10}(OH)_2$	A
Biotite	$K(Mg,Fe)_3(Al,Fe)Si_3O_{10}(OH,F)_2$	A
Chlorite (undifferentiated)		A
Actinolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$	A
Tourmaline (undifferentiated)		A
Epidote	$Ca_2(Al,Fe)_3Si_3O_{12}(OH)$	A
Garnet (undifferentiated)		A
Diopside	$CaMgSi_2O_6$	A
Augite	$(Ca,Na)(Mg,Fe,Al,Ti)(Si,Al)_2O_6$	A
Wollastonite	$CaSiO_3$	A

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Quartz Geodes

from near the Sierra Gallego Area Chihuahua, Mexico

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For almost two decades large numbers of quartz-lined geodes have been produced from a small deposit near Sierra Gallego in north-central Chihuahua, Mexico. The geodes, or "coconuts" as they are commonly called, have found their way into many collections around the world. They are a geologic oddity to the hobbyist and an enigma to the professional.

INTRODUCTION

Characteristically, the geodes from Sierra Gallego (Fig. 1) are round to sub-round hollow nodules ranging from 2.5 to 30 cm or more in diameter. They possess a chalcedony rind that grades inward into well-defined megacrystalline quartz (Fig. 2). The megacrystalline quartz is locally amethystine or smoky. Finally, within the typical geode, there is the complex late-stage sequence of minerals that was studied in great detail by Finkelman *et al.* (1972, 1974) and by Finkelman (1974, 1975). These studies examined about 500 geodes and determined the presence of 18 different mineral species. Seven of these species are manganese oxides, some of which are generally considered quite rare. In thin section, the chalcedony in the geodes is the optically "length-slow" variety known as "quartzine," with the crystallographic *c* axis paralleling the length of the chalcedony fiber. "Quartzine" has been described in some detail by Folk and Pittman (1971). Recently, Frondel (1978) examined the fibrous nature of chalcedony from geode deposits in great detail. Until very recently, however, very little was known about the provenance of these geodes. This article seeks to fill the void by describing their occurrence and developing a model for their origin.

LOCATION AND ACCESS

The geode deposit is located approximately 120 km north of Chihuahua City and about 35 km east of Laguna Encinillas, a large playa lake on the south end of Sierra Gallego which is visible on the east side of Mexican National Highway 45 (Fig. 3). The area consists primarily of large cattle ranches; the only population centers are the small villages of Sueco, Gallego, Ojo Laguna, and Ejido Esperanza. With its population of approximately 200, Ejido Esperanza is the largest of these villages.

The Sierra Gallego region can be reached easily via Mexican National Highway 45, a major highway linking Chihuahua City with Juarez/El Paso. Access from the highway to the deposits, approximately 35 km to the east, is considerably more difficult. The most direct route is via the Rancho Gregoria road, an unimproved dirt road leading eastward to Ejido Esperanza. In addition, a large locked gate blocks the road just beyond the ejido en route to the deposits some 5 km south. During the rainy season, which usually lasts from June through August, access is further complicated by torrential rains which flood all low areas and render the roads impassable.

The Sierra Gallego area is situated on Mexico's high central plateau and is part of the Chihuahua Desert; consequently it has a climate and vegetation typical of the high deserts. Rainfall is almost totally limited to the torrential storms that occur during the summer months. The area supports widespread grasses as well as a great variety of succulents and cacti. Oak is common at higher elevations. The mild temperatures, absence of rain, and hibernation of rattlesnakes during winter make the field work most desirable during the period from October through May.

Figure 1. **The view looking northwest over the geode locality. The area appears on aerial photographs as a white scar because of the large piles of mine debris. This debris consists of volcanic glass that has been almost totally altered to bentonite.**

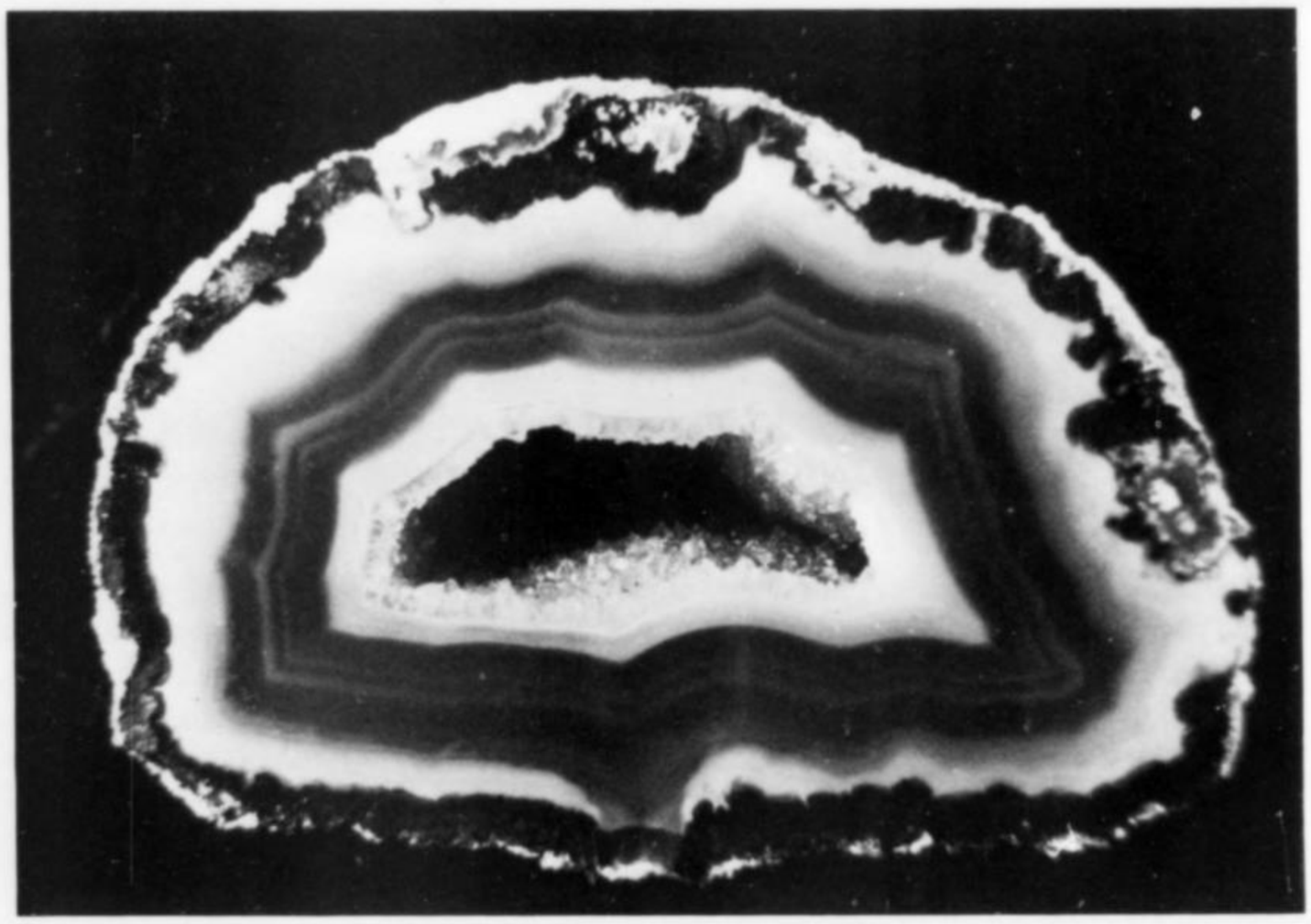


Figure 2. **A typical quartz geode exhibiting a finely banded chalcedony rind grading inward to megacrystalline quartz. This geode is approximately 12 cm in diameter.**

GEOLOGY

In the Sierra Gallego region, more than 1,000 m of volcanic rocks lie unconformably over Lower Cretaceous limestones of the Chihuahua tectonic belt. The volcanic rocks represent the almost continuous volcanic activity in the area from 44 to 28 million years ago (Keller, 1977). Approximately 44 to 38 m.y. ago, the area was blanketed by thin, widespread rhyolitic ash-flow tuffs of the Liebres formation. The geode-bearing unit, informally called the geode tuff, is one of the oldest members of the Liebres formation, its age determined by potassium-argon dating to be 43.7 ± 0.8 m.y. These thin ash flows were closely followed by about 300 m of andesitic lava flows, representing the Rancho El Agate andesite. It is worth noting here that the Rancho El Agate andesite is the unit responsible for producing the famous Laguna, Coyamito, Agua Nueva, and Gallego agate nodules. The andesite lavas were followed about 37 m.y. ago by approximatey 150 m of the Gallego dacite, an extraordinarily thick lava flow. About 35 m.y. ago, the region underwent extensive rhyolite doming accompanied by lava flows. The rhyolite domes and flows are represented by the Mesteño, Agua Nueva, and Carneros formations. It is believed that this doming had a significant effect on the geode formation, which I will discuss in greater detail below. A period of relative quiescence followed this doming until approximately 29 m.y. ago, when a final surge of volcanic activity produced the bimodal Milagro basalt and rhyolite flows. About 20 m.y. ago the region was subjected to typical basin-and-range normal faulting, which resulted in a series of large, parallel fault block ranges, with intervening basins, that dominate the terrain today.

The geodes occur as irregular to spherical lithophysal cavity fillings

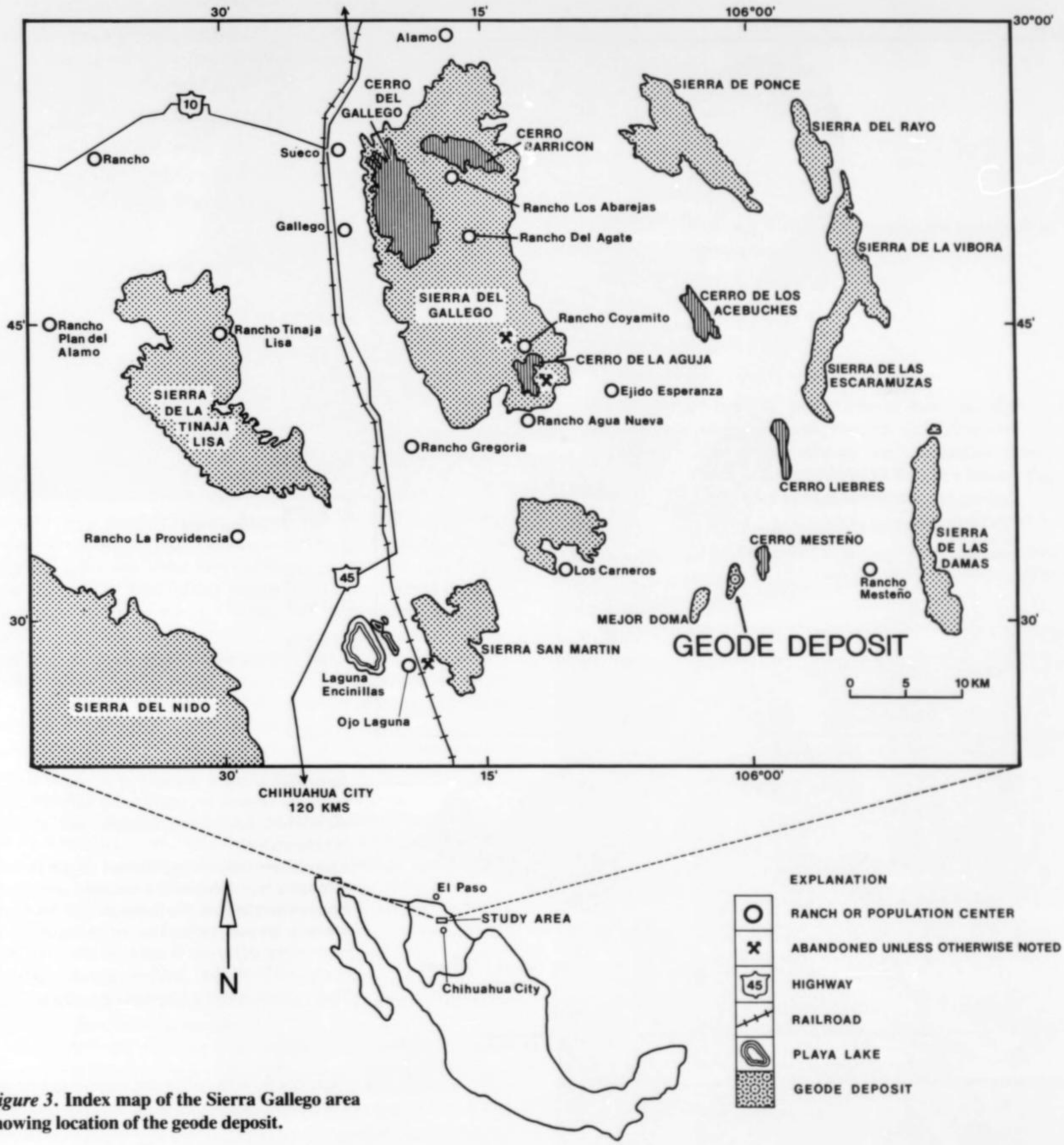


Figure 3. **Index map of the Sierra Gallego area showing location of the geode deposit.**

in the intensely altered basal vitrophyre of a lower member of the Liebres rhyolite that is informally designated the "geode tuff" (Fig. 4). Regional geologic mapping of about 2,000 square kilometers revealed that the geode tuff is exposed only in the area where the geodes are presently mined. Either the unit was deposited very locally or, more likely, was deposited more widely and subsequently stripped by erosion. The geode-producing basal vitrophyre portion of the unit has been intensely altered to bentonite. Close field examination of this phenomenon revealed that the vitrophyre was altered inward from partings that were well developed above and below it. This inward alteration left only local patches of fresh black glass in the center. The partings apparently acted as channelways for the corrosive alkaline solutions that were introduced. In a typical section cut, the vitrophyre, or "productive zone," exhibits a 1.5 m top of white clay (altered glass) that the miners refer to as "caliche," underneath which is a 0.6 m section of remnant fresh black vitrophyre, and then a base of about 2 m of white altered glass.

A MODEL FOR THE FORMATION OF THE CHIHUAHUA GEODES

Any model for the origin of geodes has to account for at least two events: (1) formation of the cavity or open space in which secondary minerals develop, and (2) secondary mineralization that produces the cavity lining. In sedimentary rocks, the open space in which geodes form is usually accounted for by the solution of nodules of minerals such as gypsum or anhydrite, or by the decay of organic material. Explaining the formation of the round open space, or lithophysal cavity, in a volcanic rock is more involved.

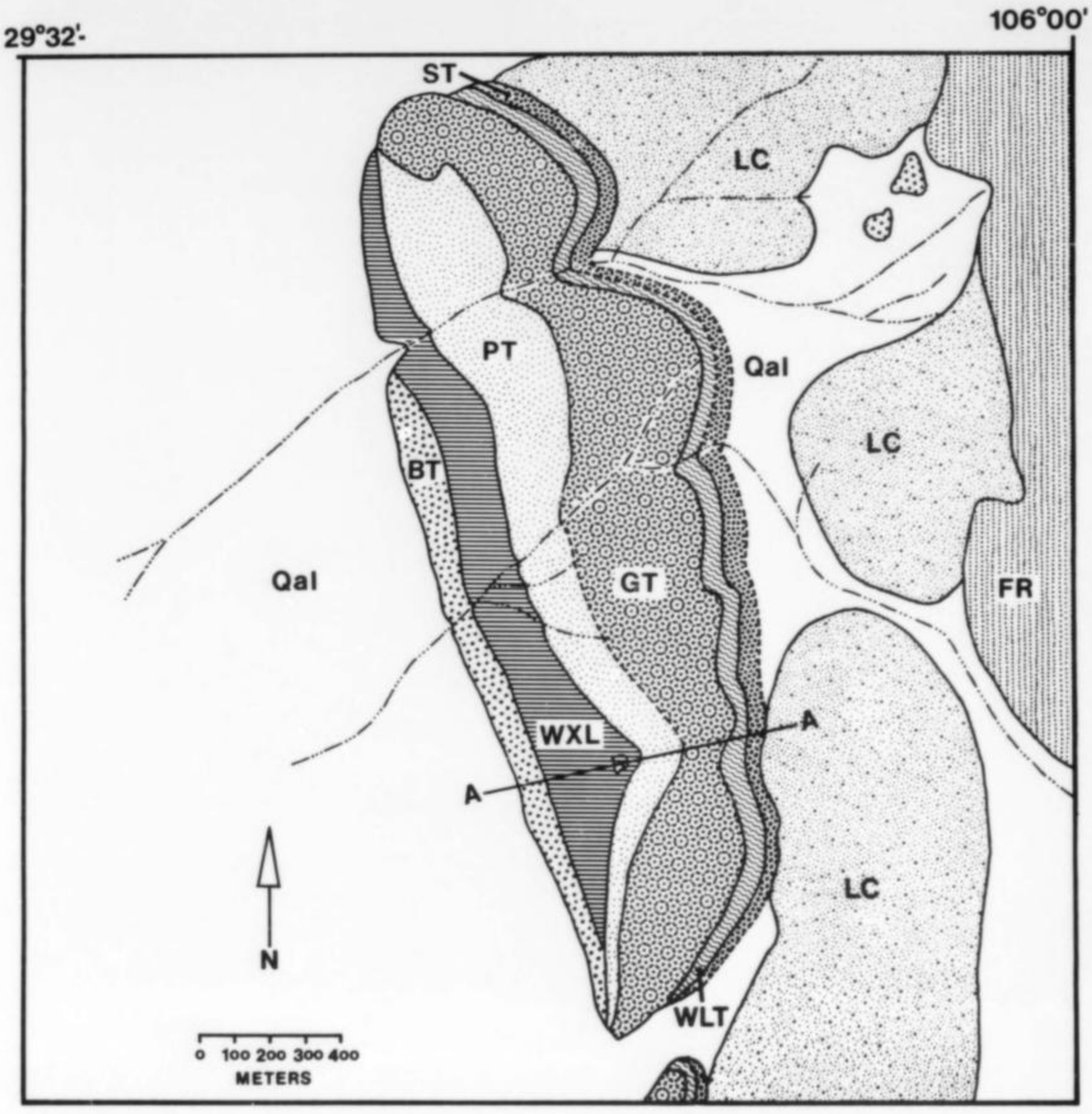


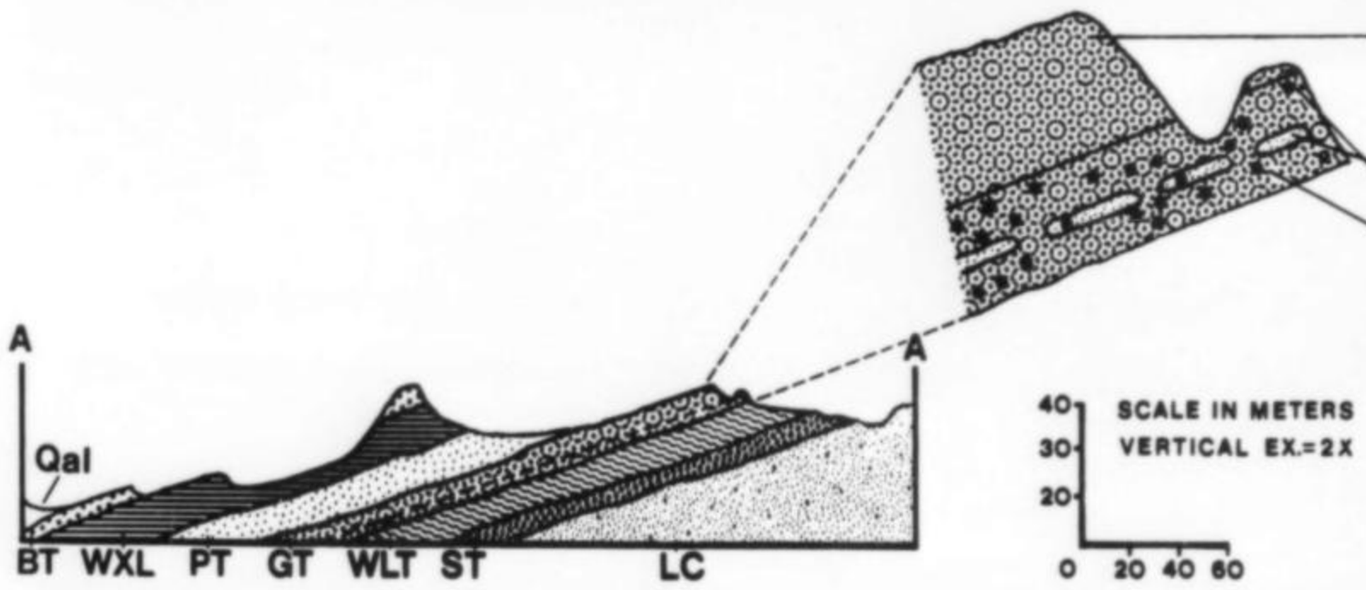
Figure 4. **Geologic sketch map and cross section showing the occurrence of the geodes.**

EXPLANATION

- Qal — Quaternary Alluviun
- FR — Mesteño Rhyolitic Flows & Domes

TERTIARY LEIBRES RHYOLITE

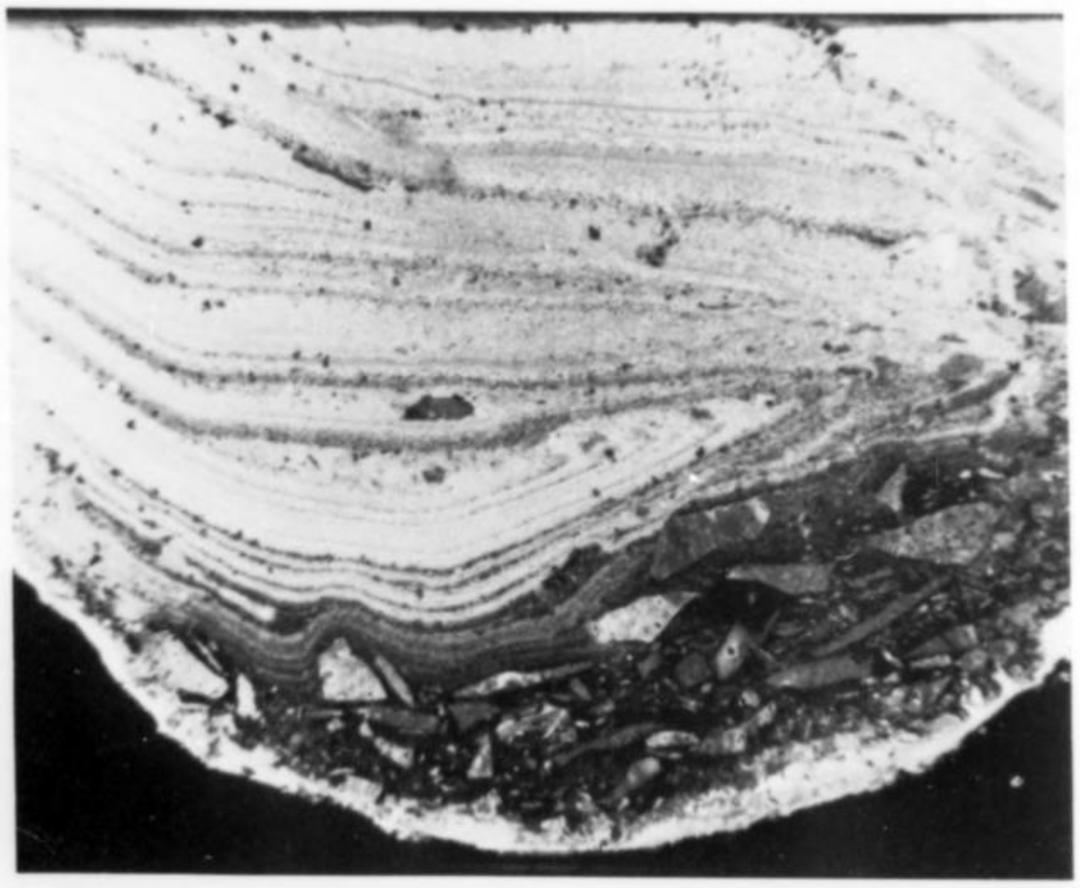
- BT — Gray-Brown to Purple Tuff
- WXL — White Crystal Tuff
- PT — Pink Tuff
- GT — Geode Tuff
- WLT — White Lithic Tuff
- ST — Soft Varicolored Tuff
- LC — Limestone Cobble Conglomerate



Approximately 6 meters of densely welded reddish brown crystal-lithic tuff. Alteration increases downward. Geodes not present in this zone.

Approximately .6 meters of remnant basal vitrophyre. Geodes present.

Approximately 2 meters above and 1.5 meters below remnant vitrophyre is the intensely altered basal vitrophyre which is called "caliche" by the geode miners. This is the geode producing zone.



An ash-flow tuff or ignimbrite, such as the one represented by the geode tuff, is very hot and plastic when emplaced. The basal portion, having come in contact with the relatively cold ground, chills so rapidly that it forms a glass, or basal vitrophyre. This vitrophyre is generally very homogeneous and highly gas-charged. With cooling, the metastable glass devitrifies (crystallizes) into fine-grained, round, radial aggregates of alkali feldspar and cristobalite, known as spherulites (Lofgren, 1971). As crystallization of the glass proceeds, the gas held in solution in the glass exsolves and collects around centers of crystallization, that is, within the spherulites. Commonly, very small amounts of gas are released and the spherulites remain intact. If, however, somewhat more gas is released and concentrated in the interior of the

Figure 5. **A geode exhibiting the finely laminated silt that was deposited by circulating groundwater prior to the secondary quartz. This geode section is approximately 15 cm in diameter.**

Figure 6. **Geode mining near the surface at the updip edge of the deposit.**

Figure 7. **Geode mining downdip where it is necessary to dig through up to 10 m of overburden before striking the "productive zone." A man is lowered into the hole in a bucket that is then used to haul out debris and geodes.**

spherulite as a growing bubble, the spherulite expands and the fine-grained devitrification products are thinned around the periphery. Semi-expanded spherulites from Oregon, known as "thunder eggs," have been described by Ross (1941), Brown (1957), and Staples (1965). If this process is carried one step further, and large amounts of gas are released, expansion of the spherulite becomes extreme and the devitrification products are thinned so drastically that they form an exceedingly thin rind that is easily broken down and lost. The resulting void in the now-solid basal vitrophyre is called a lithophysal cavity. It was in lithophysal cavities of this type that silica deposition subsequently occurred to form the Chihuahua geodes. A similar occurrence was described by Ingerson (1953) in andesitic rocks in the Southern Quitman Mountains of Texas.

Before the secondary silica was introduced into the lithophysal cavities, however, a period of time elapsed (probably several million years) during which vadose groundwater circulated through the relatively permeable volcanic tuff and deposited silt in many of the lithophysal cavities. This resulted in various sedimentary structures, including graded bedding, cross-bedding, and slump structures, all of which have been observed in many of the geodes (Fig. 5). Some of the "geodes" collected consisted entirely of finely laminated silt, which indicates that in some instances the lithophysal cavities were filled totally before the secondary silica could be introduced.

Vadose sedimentation may have continued until the Mesteño rhyolite domes were intruded into the region. Potassium-argon age determinations demonstrate that the Mesteño domes were intruded about 35.7 m.y. ago, 8 m.y. after the geode tuff was emplaced (Keller, 1977). The heat from the Mesteño intrusions caused the groundwater to warm up and a convective cycle to start. Groundwater circulated particularly along the partings above and below the basal vitrophyre of the geode tuff. During the circulation process, the heated groundwater became alkaline as a result of the breakdown of the alkali feldspars in the geode tuff, causing the alteration of the siliceous glass of the basal vitrophyre and the leaching of its silica. Silica solubility increases significantly at a pH above 9.5 (Krauskopf, 1956). Because the heated groundwater was circulating above and below the basal vitrophyre, leaching took place from the outside inward. Silica saturation promotes rapid crystallization and the formation of chalcedony (Folk and Pittman, 1971). Therefore, when the groundwater became supersaturated with silica, chalcedony was deposited inside the lithophysal cavities. We commonly see this development as the outer rind of Chihuahua geodes. The cause of precipitation of the silica is uncertain. It may have been due to a lowering of the pH by fresh rainwater, or it may result from evaporation of the silica-rich water, as is believed to have produced the agates found 30 km to the west. This chalcedony does not exhibit the vivid colors found in the agates, however, probably because rhyolite tuffs such as the geode tuff do not have the iron content necessary to provide the pigmentation that an andesite or basalt can contribute.

With time, the groundwater was depleted of silica, the rate of crystallization slowed and megaquartz, rather than chalcedony, formed on the interior surfaces of the lithophysal cavities. The amethystine nature of some of the megaquartz is probably the result of a combination of ferric iron impurities and natural irradiation (Cohen and Hassan, 1974).

One of the most perplexing questions about the formation of the geodes has been the temperature at which the chalcedony and quartz were deposited. Oxygen isotope studies provide an excellent geother-

Figure 8. **The geodes are stockpiled at central collection points where they are "graded" and put into 100-lb lots for export.**

mometer, and such studies were undertaken by Keller (1977) to determine the temperatures of silica deposition.

These studies revealed that the chalcedony rinds of the geodes were deposited at temperatures ranging from 48° to 59° C, and the megaquartz on the interior of the geodes formed at somewhat higher temperatures, between about 69° and 79° C. These results suggest that the groundwaters were heating up during mineralization and depletion of silica. Futhermore, according to White and others (1961), the formation of megaquartz is favored at higher temperatures. The continued heating of the groundwater led to the final stage in the development of the Chihuahua geodes: the crystallization of calcite and of numerous iron and manganese oxides. These late-stage minerals are commonly found perched on top of quartz crystals lining the interior of the geode.

MINING AND PRODUCTION OF THE CHIHUAHUA GEODES

The altered glass containing the geodes weathers easily; initially the resistant geodes had collected on the surface after surrounding material had weathered away, and were retrieved readily by inhabitants of the region as curiosities. Around 1962, the first claims were filed and serious mining began. Today, six claims, each measuring 300 m by 300 m are active: La Otra Estrella, La Animosa, El San Antonio, La Morenita, La Paty, and El Mesteño.

The claims are all situated on the dip slope of the Liebres rhyolite tuffs, which dip about 10° to the west (Fig. 4). At the updip edge of the tuffs, where the geode tuff intersects the surface, the geodes are easily dug with a pick from very shallow trenches (Fig. 6). Farther down dip, however, the depth to the basal vitrophyre, or "productive zone," of the geode tuff increases to a maximum shaft depth of about 10 m. At the greater depths, the miners dig vertical shafts to the productive zone, and then dig laterally as far as they feel they can safely go (Fig. 7).

A pulley system, with a bucket tied to the end of the rope, is used to lower the miners into the hole and then to haul up debris and geodes. The geodes are sold to the claim manager who, in turn, grades them into three lots: hollows, semi-hollows, and solids (Fig. 8). This grading is done by a very crude "hefting" to check their density. Once graded, the geodes are sacked into 100-pound lots and, in most cases, trucked to Juarez where they are marketed to wholesalers in the United States.

Current mining of the geodes is a large-scale operation. Jack Young, an El Paso dealer, estimates that since 1962 production has averaged over 34,000 kg (75,000 lbs) per year from all the active claims. Unfortunately, accurate production records have never been kept. At this time it is difficult to imagine the total exhaustion of the deposit and an end to the geode supply. Much of the deposit has yet to be worked and mining techniques are primitive, resulting in very slow production. Even so, the total deposit appears to be rather limited in size and, if demand remains high, depletion in the next decade is a possibility.

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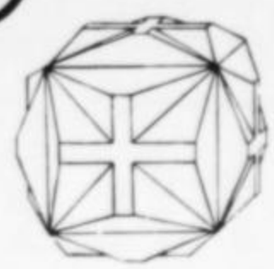

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Notes on Recent Underground Collecting at Långban

by **Stig G. Adolfsson**
Ryktarevägen 9
77200 Grängesberg, Sweden

Figure 1. **A drift near the *Rämsorten* on the 130-meter level of the Långban mine. Photo by Roland Eriksson, Filipstad.**

"Långban, in the Swedish province of Värmland, is the most remarkable mineral locality on earth." So began Paul Moore's article in the *Mineralogical Record* (1970) on the mineralogy and chemistry of Långban-type deposits. Of approximately 200 species found there, 40 have been found nowhere else, and the locality is justly famous among mineralogists and collectors of rare minerals.

Most research was done during the years 1910 to 1935, and in recent years Moore has published systematic studies of the peculiar mineralogy. His studies have culminated in the descriptions of a large number of new species from Långban.

The Långban mines were worked for iron and manganese oxide ores during their most productive years. One interesting feature of the ores was that the iron and the manganese oxides occurred in layered contact with each other but never intermixed. The great majority of the rare minerals were found in the manganese-rich domains of the ore.

Due to the decreasing grade of the ore, metal mining ceased in the mid-1950's when the ore grade was running at about 3% Mn. Extensive diamond drilling failed to locate additional ore bodies. Underground mining for dolomite continued until around 1972, but the mine finally closed and the water pumps were turned off in November of that year. Today the water level is within 10 or 15 meters of the surface.

Through the courtesy of the late mine manager, Gösta Breitholtz, I had the privilege of collecting underground in the old famous stopes. Of these stopes, the *Amerika* stope is probably the biggest, and could easily contain a large church. Remnants of the ore could be found in most of the workings; by careful search of the underground dumps such minerals as native lead, kentrolite, blixite and several others were found. The following is a description of the occurrence of some recently collected species.

Native Lead Pb

All of the lead I found was in the form of plates and veinlets in hausmannite/braunite ore associated with hydrocerussite. Generally these plates were thin, but thicker plates were found in the *Bulgarien* stope on the 130-meter level. **Litharge,** PbO, occurred there too, possibly formed by the action of humid mine air on native lead. A few of the lead specimens exhibit cubic and octahedral crystal faces.

Magnetoplumbite $Pb(Fe^{3+},Mn^{3+})_{12}O_{19}$

Well-formed, striated, doubly terminated crystals were found in the upper *Bolivia* stope on the 185-meter level. The mineral occurred with melanotekite and hedyphane in lean manganese ore. The crystals are 5 to 8 mm long and metallic black in color; only a few such specimens were recovered.

Blixite $Pb_2Cl(O,OH)_2$

Blixite was found only in the upper *Bolivia* stope, where it occurred as pale green fissure coatings and as veins in manganese ore. In some cases microscopic plates of native lead were found in the blixite. The blixite-containing fissures were commonly 1 to 3 mm in width.

Mendipite $Pb_3Cl_2O_2$

Mendipite, always associated with a manganoan biotite (*manganophyllite*), was found only in the skarn ore. It occurred as light yellow-green veins and fissure coatings commonly associated with calcite.

Figure 2. **The *Storfors* stope on the 85-meter level of the Långban mine. Photo by Roland Eriksson.**

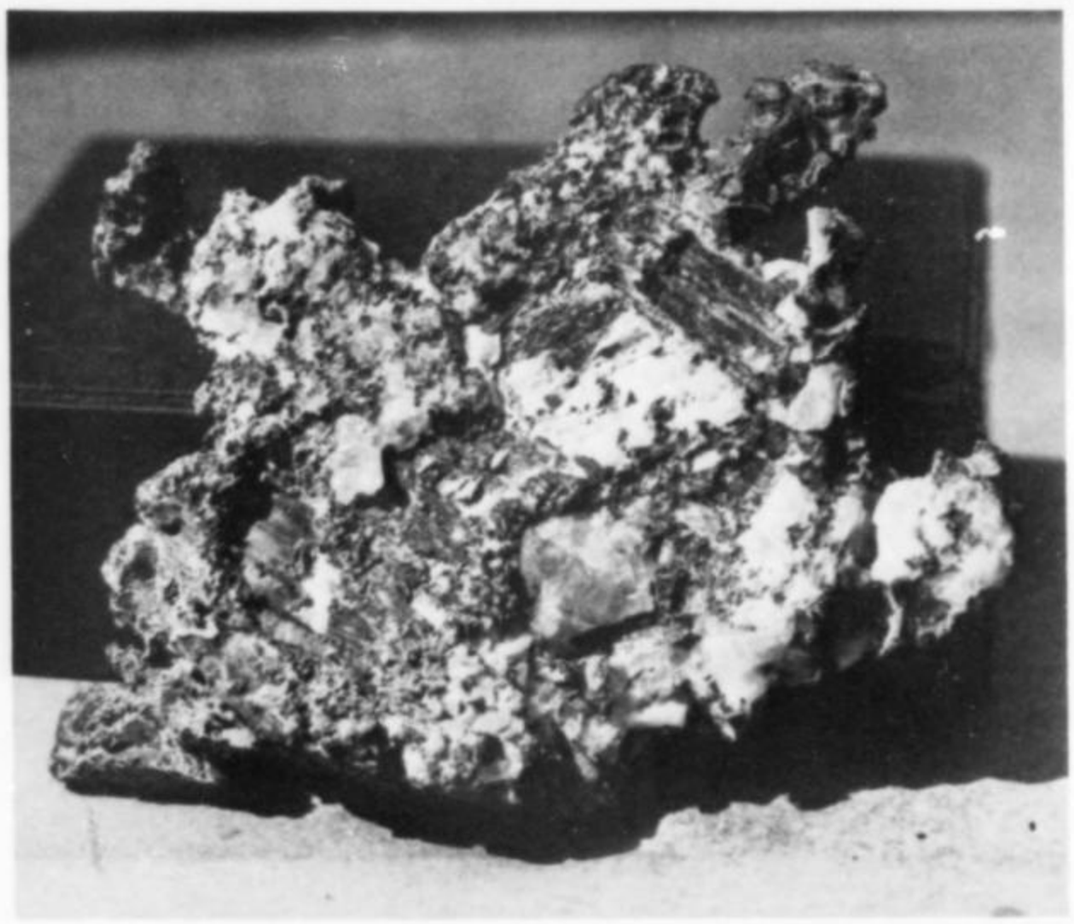

Figure 3. **A specimen of native lead from Långban showing crystal faces. Photo by Stig Adolfsson.**

Kentrolite $Pb_2Mn^{3+}_2Si_2O_9$

Crude, barrel-shaped crystals of kentrolite were found in the *Bolivia* stope, comprising some magnificent specimens. The kentrolite, occurring on a braunite/hausmannite matrix, was not associated with any other lead silicates. The crystals are 5 to 6 mm long and shiny steel-gray.

Margarosanite $Pb(Ca,Mn)_2Si_3O_9$

Margarosanite was found as thin, radiating, silky white crystals lining fissures in hausmannite ore in the *Bolivia* stope.

Melanotekite $Pb_2Fe^{3+}_2Si_2O_9$

Material on the surface dump yielded specimens of melanotekite associated with Ba-feldspars (hyalophane and banalsite), hedyphane, manganophyllite and **cymrite,** $Ba_2Al_5Si_5O_{19}(OH)\cdot 3H_2O$. Cymrite has not previously been reported from Långban; a detailed description will be published by the Swedish Museum of Natural Histoty, Stockholm. Cymrite is easily identified by its greenish white fluorescence under ultraviolet light.

Långbanite $(Mn^{2+},Ca)_4(Mn^{3+},Fe^{3+})_9SbSi_2O_{24}$

Small, spear-shaped, shiny black crystals of långbanite were found in braunite ore associated with calcite and **caryinite,** $(Na,Ca,Pb)_2(Mn,Mg,Fe^{3+})_3(AsO_4)_3$(?). All specimens of this assemblage were found at a drawpoint with several tons of ore from the *Skottland-Irland* stope on the 165-meter level, where fine crystals of spessartine were also found.

Black Mn-As-Cu-B Unknown

Near the above-mentioned drawpoint, three specimens of an unknown mineral were found in ore probably from the *England* stope. The mineral occurs as radiating, dull black crystals 5 to 8 mm in length. The crystals are brittle, have a hardness of 3, a light nut-brown streak, and *d*-values from X-ray diffraction analysis which do not correspond to any known mineral. Spectrographic analysis indicates major Mn and As with very minor Cu and B. The unknown is associated with **hoernesite,** $Mg_3(AsO_4)_2\cdot 8H_2O$, which occurs as white tufts, and with manganese hydroxides, all in thin fissures in lean manganese ore composed of hausmannite and dolomite.

Berzeliite $(Ca,Na)_3(Mg,Mn)_2(AsO_4)_3$

Berzeliite is probably the most common arsenate at Långban, occurring generously as small grains in manganese ore, sometimes forming

yellowish red masses. Beautiful massive specimens were collected in the old *Collegiegruvan* stope near the 100-meter level. Here the mineral occurred as lumps in dolomite, the berzeliite sometimes colored nearly black by manganese oxide inclusions and impurities.

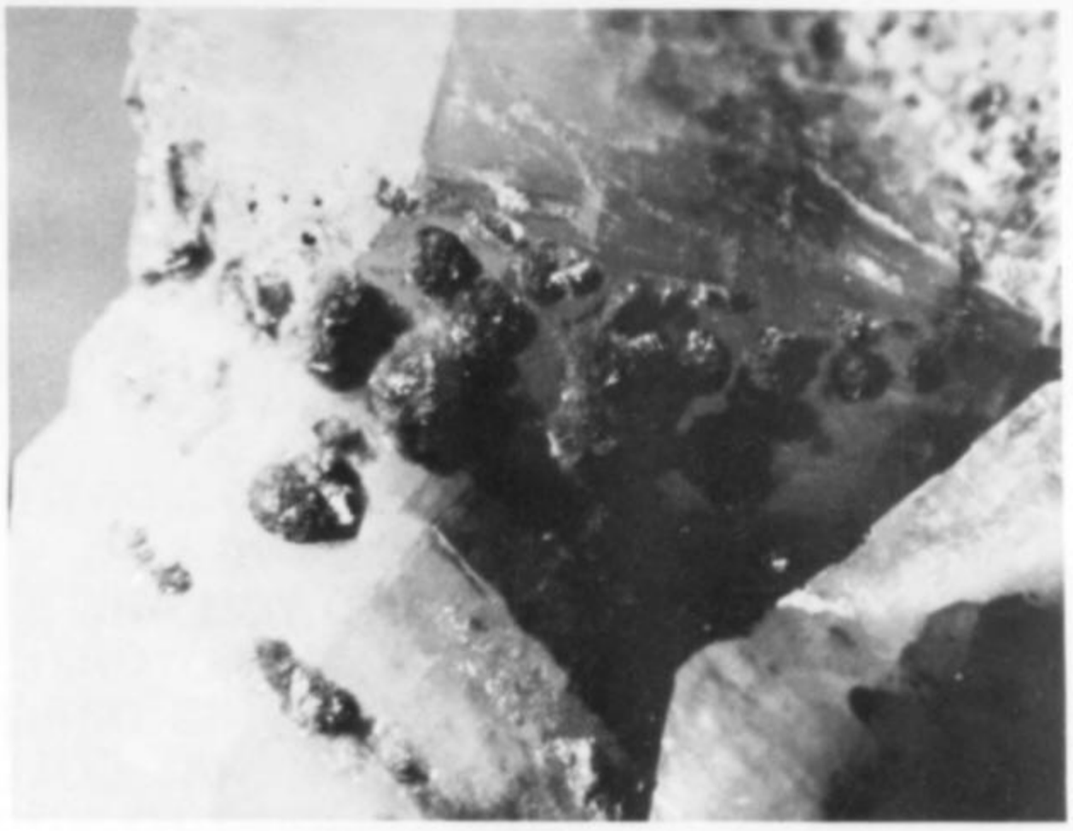

Figure 5. **Spheres of wermlandite on calcite from the 220-meter level of the Långban mine. Photo by Stig Adolfsson.**

Figure 4. **Unknown Mn-arsenate recently found at the Långban mine, associated with white hoernesite, from the 165-meter level. Photo by Stig Adolfsson.**

Adelite $CaMg(AsO_4)(OH)$

Adelite was found in association with Mn-berzeliite and very minor långbanite, as sharp, pale red micro crystals in calcite pockets in ore from the *Skottland* stope.

Wermlandite $Ca_2Mg_{14}(Al,Fe)_4(SO_4)(OH)_{42}\cdot 29H_2O$

In one of the dolomite workings on the 220-meter level, beautiful samples of wermlandite were found in a pocket 1 meter square and about 10 cm thick. The wermlandite is associated with small sharp octahedrons of magnetite and bladed calcite crystals. Miners recovered about 20 hand-size specimens as well as several smaller pieces and sold them. One or two years later a similar mineral was found on the dumps, and subsequently sold and traded by many Swedish collectors. Later X-ray work indicated, however, that the dump mineral was **pyroaurite,** $Mg_6Fe_2^{3+}(CO_3)(OH)_{16}\cdot 4H_2O$, which is also uncommon, especially in pale bluish green crystals such as these.

A couple of years ago the dumps at Långban were fenced off and mineral collecting forbidden. This step was taken after people from other countries each year loaded tons of material into cars and buses for transport out of the country. In order the save the remains of this remarkable mineral deposit, the Swedish government in cooperation with the former owner of the mine closed the area to the public. The mine is, of course, open to scientific investigators, and even though many species have disintegrated out in the open over the years, many interesting features can still be observed *in situ*.

ACKNOWLEDGMENTS

The author wishes to thank O. Gabrielson, former curator of the Swedish Museum of Natural History in Stockholm, Bengt Lindqvist, former Professor at the University of Uppsala, and Svend V. Sölver, former lecturer at the Bergskolan School of Mines, Filipstad, for their generous help and rewarding discussions. Also, my heartfelt thanks to Gösta Brietholtz, the late mine manager, who made my underground visits possible.

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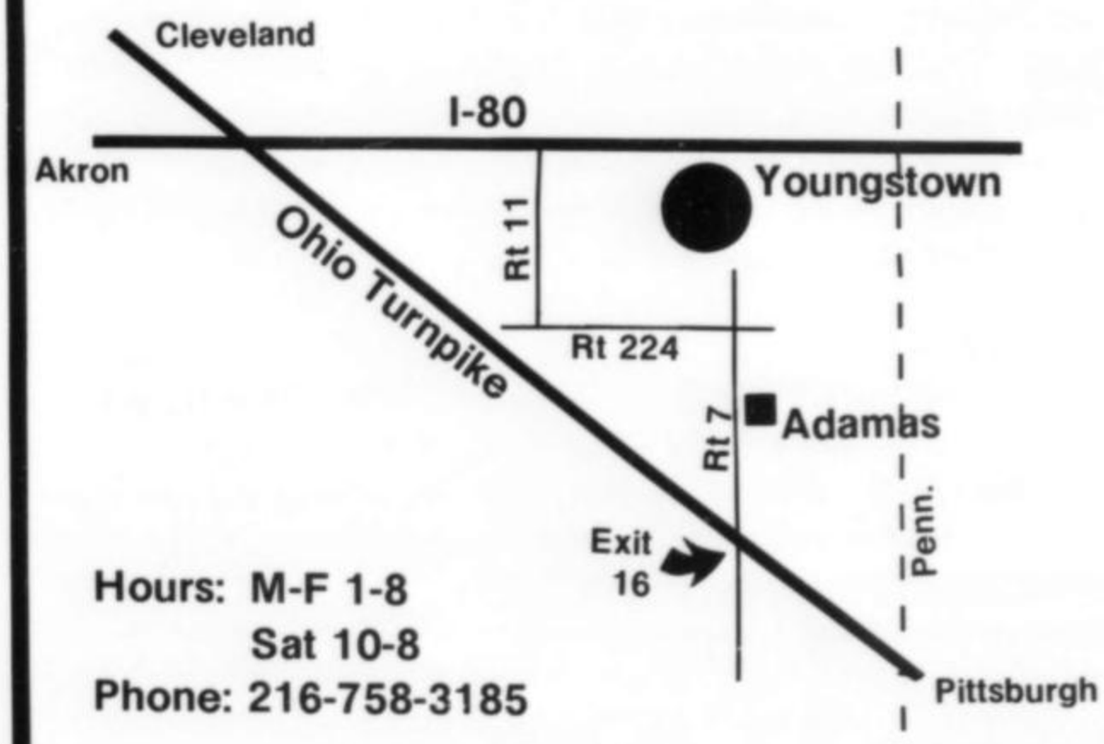

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Curetonite
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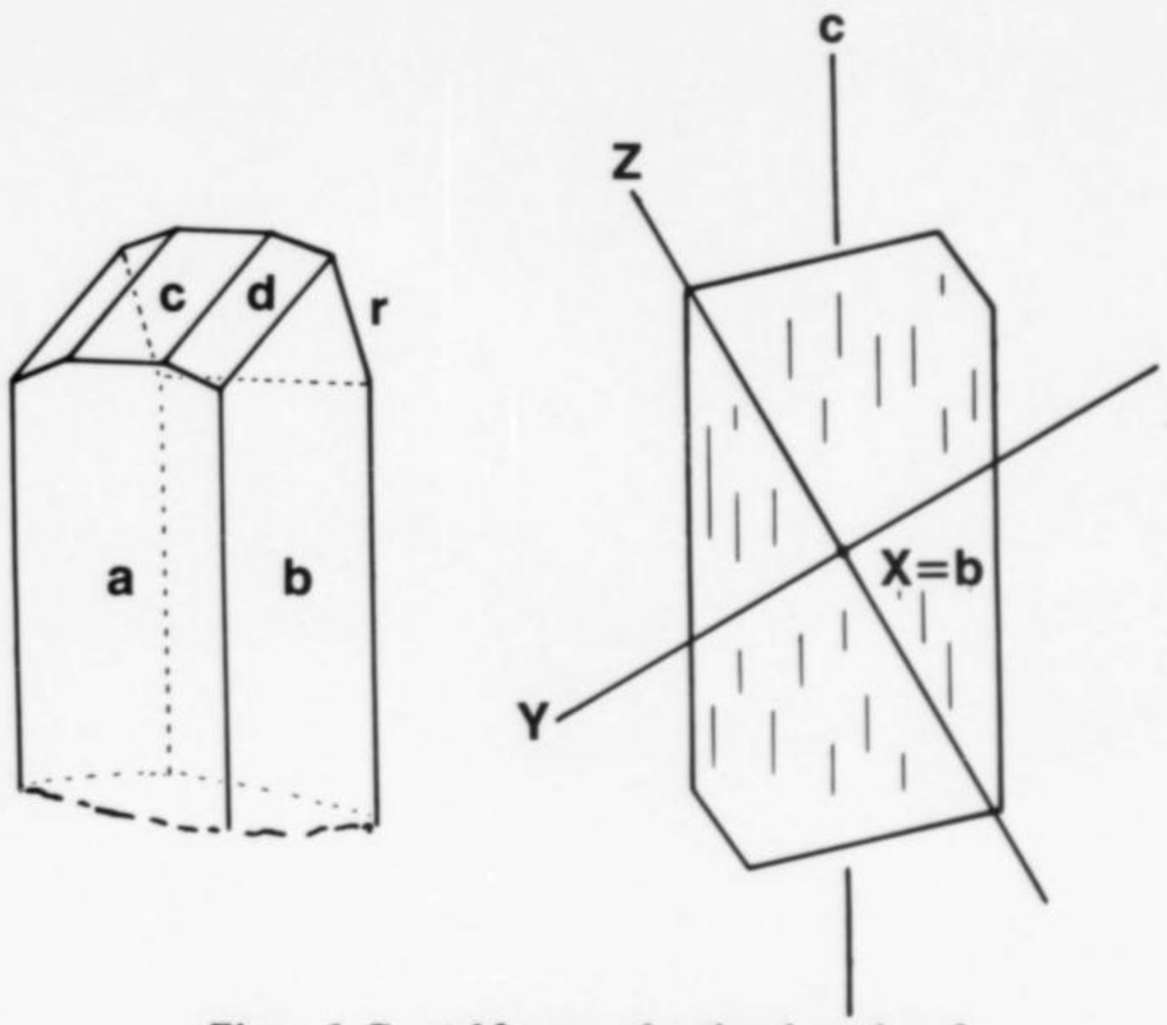

Figure 1. **Crystal forms and optic orientation of curetonite; *a*{100}, *b*{010}, *c*{001}, *d*{011}, *r*{$\bar{2}$01}.**

ABSTRACT

Curetonite was found by Forrest and Michael Cureton at a barite prospect near Golconda, Nevada. It occurs in veins in cherts and shales that have been replaced by barite; associated species include adularia, barite, and variscite. Color yellow-green, Mohs hardness = 3.5, specific gravity = 4.42 (4.31 calc).

Crystals are monoclinic $P2_1/m$, a=6.957, b=12.55, c=5.22, β=102°; Z=1. Strongest lines are 4.290(5), 3.286(8), 3.230(10), 2.991(6), 2.816(6), 2.251(6), 2.199(6), 1.686(7). Biaxial +, 2V=60°; α=1.676, β=1.680, γ=1.693. Chemical analysis indicates $Ba_4Al_3Ti(PO_4)_4(O,OH)_6$ for the ideal formula.

INTRODUCTION

The new mineral curetonite described herein was found by Forrest Cureton II and Michael Cureton, and is named for both. The type locality is a barite mine in Sec. 12 (T37N, R41E) near Golconda, Nevada.

The rocks at the locality are cherts and shales of the Comus formation (Hotz and Willden, 1964) that have been extensively replaced by barite. Deposits of this nature are common in Nevada and more detailed studies of them elsewhere in the state have been reported by Ketner (1975) and by Shawe *et al*. (1969).

At the type occurrence barite replaces sericitic, phosphatic, and black organic cherts and shales that locally carry fossil trash. The replacement begins along thin veinlets cutting the cherts. These veins have a central barite core and walls of chalcedonic quartz. Stippling of the chert with lacy barite crystalloblasts appears to be the next step in a process leading eventually to massive barite rock.

The massive barite is then sometimes cut by veins of coarse-grained barite and perfectly euhedral adularia crystals. It is these veins that carry curetonite. Crystals up to 3 mm in maximum size may be found attached to the vein walls or floating as inclusions in larger adularia crystals. When occurring in adularia the curetonite crystals may actually be an aggregate of optically aligned islands whose distribution outlines one large euhedron. Crystals lining veins are frequently corroded and coated by a mantle of finely fibrous barite.

Following crystallization of curetonite was an episode of deformation. Both curetonite and adularia may be strained and show pronounced curvature. By contrast the barite seems to have relieved itself of strain by recrystallization. Fracturing associated with the deformation is frequently healed by veining. Species such as opal, an amorphous phosphate gel (perhaps evansite), variscite, montgomeryite, and hisingerite occur in these veins. Two unknown phosphates were also noted here; both are replacement products of curetonite.

PHYSICAL PROPERTIES

Curetonite is readily visible in its gangue because of its green color. Usually it is bright yellow-green (Royal Horticultural Society 138D) but in some samples is nickel green (R.H.S. 130C). The streak is invariably white. The Mohs hardness is 3.5 and crystals are brittle, yielding easily to white powder under pressure. No fluorescence was noted in long or short wavelength ultraviolet light although several of the late fracture vein minerals fluoresce and phosphoresce strongly. There is good cleavage following *d*{011} and a pronounced parting on *b*{010}.

The specific gravity was determined as 4.42 ± 0.05 using measured adamite and barite as bracketing standards. This value is about 2.5% high, possibly due to unseen bubbles adhering to standard grains.

CHEMISTRY

The chemical analysis was a nightmare consuming several months time. A preliminary spectrographic analysis showed P, Mg, V, Ti, Ca, Al, Ba, Sr, and Si. The Mg, Sr, Si, and Ca were subsequently found to be trace constituents.

Water was found by the Penfield method and is readily released before the mineral fuses to a grey, intumescent slag. Microchemical tests showed no halogens, and sulfate was shown to be absent by

Table 1. **Chemical Analysis of Curetonite**

	Meas.	*R*	*Theory*[7]
BaO^1	53.09%	.346	53.01
$Al_2O_3^2$	12.81	.126	13.22
TiO_2^3	6.84	.085	6.91
$P_2O_5^4$	23.39	.165	24.53
$V_2O_5^5$	1.27	.007	
H_2O^6	2.46	.137	2.33
	99.86		100.00

1.) avg. of 52.53, 52.75, 53.99 by electron probe; benitoite standard
2.) avg. of 13.43, 13.43, 14.31 by electron probe (anorthite standard), 11.15 and 11.71 by wet methods
3.) by wet methods following NaOH fusion
4.) average of 22.70, 23.98, 23.48 by electron probe, apatite standard
5.) average of 1.25, 1.29 by wet chemistry and emission spark spectroscopy
6.) Penfield method
7.) for $Ba_4Al_3Ti(PO_4)_4(O,OH)_6$ OH:O = 1:1

electron microprobe. Despite the easy fusibility of curetonite it resists attack by all acids tried and is digested only by fusion methods.

The results of the chemical analysis are summarized in Table 1 with footnotes explaining the method used. A particularly nettlesome problem was presented by titanium. Interference with barium gave high values on the electron microprobe. Early analysis following pyrosulfate fusion gave low values due to precipitation of some TiO_2; the low values at first seemed especially believable because they were determined both by A.C. spark spectroscopy and by wet methods with excellent agreement. Fusion by NaOH finally provided reliable results.

OPTICS AND MORPHOLOGY

In thin section curetonite bears a close resemblance to jagowerite and might also be confused with axinite. Viewed along the *b* axis, crystals are broad and may be crudely composited on {100} and show the following recognizable forms: *b*{010}, *c*{001}, *a*{100}, *d*{011}, and *r*{$\bar{2}$01}. Viewed along the *a* axis the crystals assume a wedge-shaped habit owing to curved vicinal forms produced by combinations of *d* and *b*.

Polysynthetic twinning is common on *a*{100} resembling that seen in jagowerite. Lamellae are broad and composition planes imperfect.

Although crystals may be colorless in thin section, they may also show splotchy pleochroism in yellow, a color closely resembling that of chondrodite. When pleochroic the formula is X >> Y = Z. The most

***Figure 2*. Pale nickel-green crystals of curetonite to about 1 mm in size on matrix.**

***Figure 3*. Pale nickel-green crystalline mass of curetonite about 5 mm across showing parting.**

Table 2. **X-Ray Powder Date for Curetonite, 114 mm Camera, CrKα**

I/I₀ est.	*d meas.*	*d calc.*	*hkl*	*I/I₀ est.*	*d meas.*
1	6.252	6.275	020	2	2.500
1	4.565	4.565	$10\bar{1}$	1	2.394
5	4.290	4.290	$11\bar{1}$	2	2.352
1	3.956	3.960	021	6	2.251
2	3.692	3.692	$12\bar{1}$	3	2.223
4	3.568	3.574	111	6	2.199
		3.564	130	3	2.130
3	3.400	3.402	200	2	2.107
8	3.286	3.284	210	5	1.998
10	3.230	3.236	031	2	1.963
3	3.084	3.084	$13\bar{1}$	1	1.931
3	3.055	3.055	$21\bar{1}$	2	1.846
6	2.991	2.991	220	1	1.823
5	2.848	2.849	140	2	1.802
6	2.816	2.815	$22\bar{1}$	2	1.786
4	2.779	2.783	131	1	1.736
2	2.587	2.586	$14\bar{1}$	7	1.686
4B	2.544	2.553	002	2	1.668
		2.540	211	4	1.616

deeply colored patches show weak dispersion of the optic axes $v > \rho$, and strong inclined dispersion.

Indices determined for NaD are $\alpha = 1.676$, $\beta = 1.680$, $\gamma = 1.693$. The $2V_Z$ was measured as 60° (it is 58.4 calculated) for NaD and varies little with λ. The optic orientation is $X = b$, $Z \wedge c = +30°$ (in β).

An idealized crystal is shown in Figure 1 alongside an optic orientation diagram. Because of the crystal habit all crystal sections show length slow character whether or not extinction is inclined or parallel.

X-RAY STUDY

Curetonite produces a complex X-ray powder pattern with numerous closely spaced lines showing little contrast in intensity. The data provided in Table 2 were used to refine single crystal results to give the following cell: $a = 6.957$Å, $b = 12.55$Å, $c = 5.220$Å, $\beta = 102° 0.2'$. The cell volume is thus 445.8Å^3, giving a calculated density of 4.31 g/cm^3 for $Z = 1$.

Rotation and Weissenberg level photographs taken around [b] and [c] establish the likely space group as $P2_1/m$.

ADDITIONAL COMMENTS

Curetonite owes its existence to the presence of collophane-bearing laminae in the rocks that have been replaced by barite. It probably formed at mildly elevated temperatures under severely reducing conditions.

A number of specimens comprising several grams of the mineral were found at the type locality. Type material will be provided to the British Museum (Natural History) and the U.S. National Museum.

ACKNOWLEDGMENTS

I am grateful to Robert W. Schafer for his invaluable assistance in the analysis (electron microprobe) and to Marjorie Duggan and Lance Talley for the chemical and spectographic analyses. Forrest Cureton provided a suite of research specimens and information on the locality.

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Memoirs of a Mineral Collector

by
Fred W. Cassirer
with the assistance of Amanda Martin

Photo by Lotta Jacobi

Fred W. Cassirer (1888–1979)

The First of Three Parts

On February 15 of this year, Fred Cassirer passed away at the age of 90. Before doing so, however, he was able to put down, for publication in the Record, *many of the mineralogical memories he had accumulated over his long and interesting life.*

Although his most active years as a collector and dealer took place before many of the readers of this magazine were born, he was well known to several generations of mineralogists, and he continued to collect and cherish minerals until the day of his death. His life was devoted to business affairs but his interest in minerals was never far away. He knew, collected for, dealt with or exchanged with all of the principal museums and collectors of the first half of this century. His life was filled with drama and narrow escapes, through the course of which he lost several fine collections.

To his friends Fred will be remembered for his twinkling eye, his acerbic wit, his kind and gentle nature, and his ready willingness to help someone in need. We are indeed fortunate to have these reminiscences, in his own words, to remember him by.

Richard V. Gaines

Life Begins at Eight

It is often difficult to pinpoint the precise moment when a life-long interest is born; minerals have been a passion with me for most of my 90 years. But it probably happened in Germany when, in 1896, at the age of eight I got into my hands, just by chance, a small cube of a stone. I did not know what it was (a small broken piece of galena).

We were vacationing in the Harz Mountains and I was being taken care of by a tutor, probably a young fellow—in my memory a grown man. We were on a walk. There appeared one of those wayside souvenir stores. I stopped at the window display—nothing special for the little boy . . . but among all the trivial objects was a small stone, dark black with a delicate luster. It was interestingly proportioned, and it was the first time in my life that I had seen a mineral specimen. I didn't think of it as being half-broken; I felt that something was absolutely right and complete. All I immediately knew was that I had to have this stone. I entered the boutique.

The proprietor took it out of the window, put it in my hand, cool and somewhat strange it lay in my hot palm. I did not ask for a price, at least I don't remember that I did. I dug into my pocket, scooped up the few loose coins—they came to three *groschen*. I held them out to him. Was it enough? The man saw a little boy filled with longing. He smiled, took the money and wrapped the stone. I put the small package into my pocket and felt enormously happy. What I did not know was that this purchase marked the beginning of a lasting power in my life, a passionate occupation and contact with Nature, a life-long fulfilling love affair with minerals.

When I left the booth sober reality descended on me like a cold shower. My tutor was nowhere in sight! Accustomed to having me trot along or fall slightly behind he had walked on, lost in thought. I ran a few yards to a fork in the road, I called out, but all to no account. What was I to do? The little money I had was spent. I did not think I could find my way back home alone. I did not know what to do. Perhaps I even cried a little for someone noticed my distress. It was the man who ran the inn opposite the booth. Standing in the door, he called me in, quite aware that food solves many a childhood grief. He gave me a glass of

milk and a sandwich. I confided my problem to him and told him the name of the hotel where my family was staying. He showed me where I could get the little excursion train that would take me to my family and lent me the fare.

When I reached home, whatever parental joy there may have been at my safe return was expressed in a sound spanking. Then I was sent off to bed. But all this was of no real importance to me. I had my stone! And I had it all to myself, for I had neither shown nor mentioned it to my father or to my tutor. It was my first; my cherished secret.

As soon as school began in Berlin I took my stone with me, ran after my science teacher when class was over and asked him what it was. He told me that it was galena, so now my treasure at last had a name. I felt a lively curiosity to know more about it, and overflowed with questions: What was its origin? Whence its irregular-regular shape? Where to find more? Why such weight? How to make use of it? . . . Some of them impossible to answer. I asked them then, and now after seven or eight decades I am still asking and still learning. But today at almost ninety, I know that there are many questions which still cannot be answered. Up to this point in school I had learned what I was supposed to learn and not a jot more. Now the desire to learn came out of my innermost self. My teacher sensed this, took me with him where the mineral specimens for instruction were kept and showed me a miniature collection of minerals. After this first visit I was allowed to help him take care of this collection. I became his "assistant" as it were.

During those early years I had few aids to work with. Some time later a friendly soul helped me get a copy of *Elemente der Mineralogie* by Naumann-Zirkel (first edition, 1870; my own, 1890). It became my "Bible" later on, as Dana is today. All this, however, was yet to come when, at the age of thirteen I first saw a large collection of minerals in a museum. This was in the Naturkunde Museum in the Invalidenstrasse in Berlin, at the other end of town from where my parents lived. It was on a Sunday. I should have been in Sunday School. Instead I took a horse-cab and entered a building which seemed to me a veritable house of wonders. I walked straight into the department of mineralogy—my amazement and delight were unbounded. I had no idea that the guard was watching me as I looked at piece after piece with the utmost intensity, nor did I see the guard leave the room. It was only when he returned and approached me that I became aware of him. "There," he said to me, and put something into my hand. It was a small stone perfectly shaped on all sides. I was struck by the regularity of shape and marveled that earth could hold and produce such geometric perfection.

When I got home from this first museum excursion I identified my new possession in my mineral guide, a little booklet from my science teacher. I had been given an exemplary sample of a doubly terminated, complete, hexagonal quartz crystal.

A little later a friend of my father's gave me a third specimen, an excellent example of crystallized pyrite from the world-famous mines on the island of Elba.

Now I owned three pieces already. How fortunate had I been, and how fortunate on the human level: There was the owner of the roadside store in the Harz Mountains, the science teacher at my school, the museum guard (a complete stranger), and a family friend. All of them must have watched me and certainly must have shared their love of minerals with me. And for the first time I became aware of something different, something outside the pleasure of crystals, something very satisfying and profound which I was to experience many more times: the warm comaraderie and kinship between persons who have strong and like interests, a kinship independent of race, age or nationality that unites those who feel it in a universal "brotherhood."

I did not know then that quartz, pyrite and galena were of great

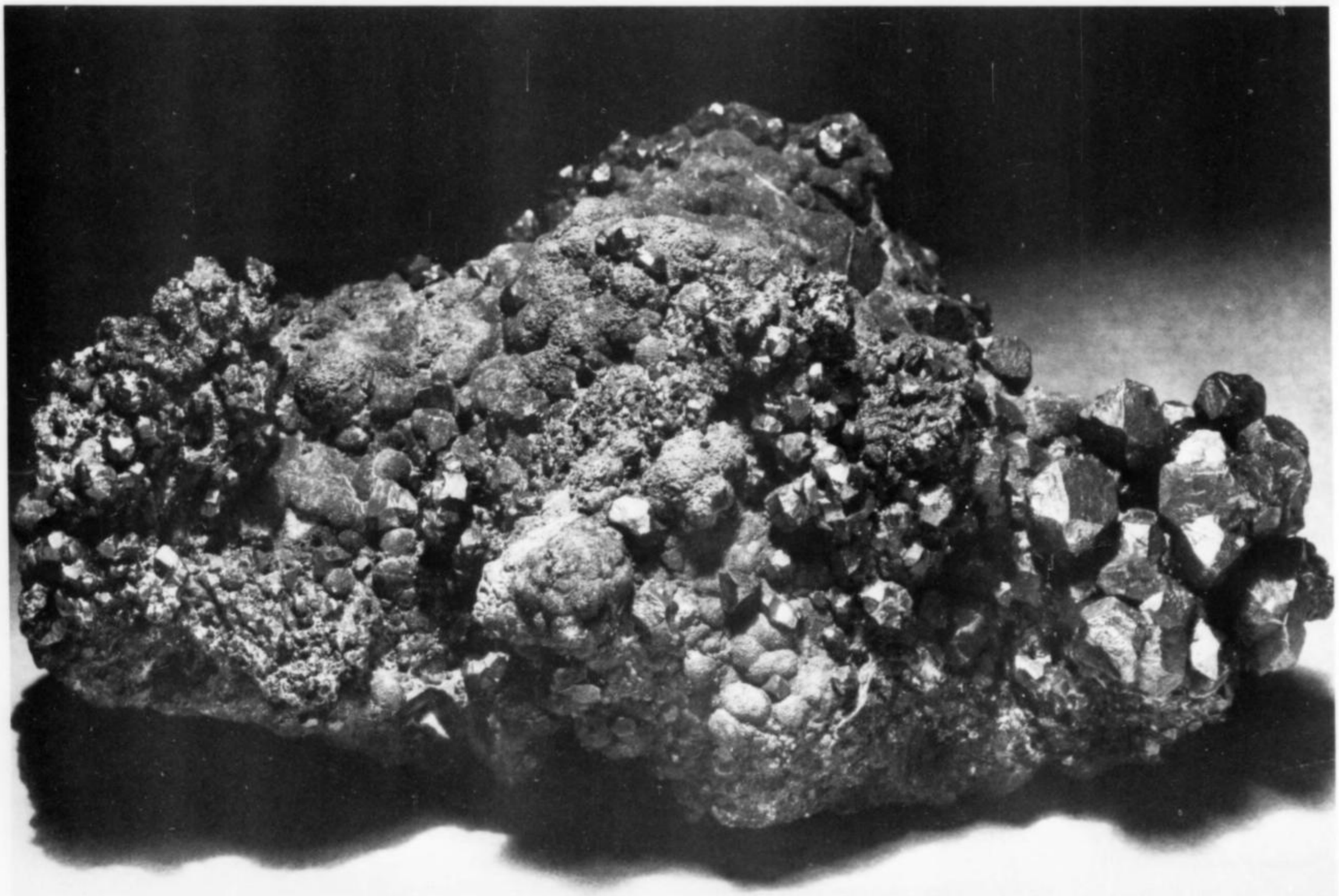


Figure 1. **Argentite (acanthite) crystals on a matrix 11 cm long from Freiberg, Saxony. Cassirer collection; photo by Henry Janson.**

importance to our economy, and were to play a part in my own daily life later on. For I was to work in my father's pulp and paper mills, where gelena was needed as well as pyrite because of their high sulfur content: sulfur is needed to purify wood before it is made into pulp. Nowadays galena is mined in the famous Rio Tinto mines in Portugal. In those days it was imported from Sicily. Quartz crystals, on the other hand, became indispensable in war for the manufacture of a small and sensitive wafer essential to radio transmission (in the walky-talky). For one short period in the odyssey of my life I was a dealer in quartz crystals, but no quartz crystal kept as fresh in my mind as the one I was given at the age of thirteen.

Nor did I know then that, as Goethe said: "Die Natur mich umgeben und umschlungen hatte—unvermögend auszutreten und unvermögend tiefer in sie hineinzukommen." (that Nature had surrounded and encircled me making me incapable of withdrawing from her and yet incapable of penetrating her more deeply.)

These brief data on the use of minerals in war and peace hail of course, from my adult life with its ever increasing cognitions and experiences. When life began at eight and continued to grow more and more interesting and intense in my teens; such practical application had not entered a mind filled with wonder and pleasure in the beauty and rightness and the strange mystery of stones.

Out of School and Into the World

My interest in minerals deepened and played a more and more important part in my daily life. It made me cut classes at the *Gymnasium* (High School) and kept me wholly away from Sunday school. It took me to the mineral collection in the museum and sneaked me into lectures at the university where, at my age, I had no business to be. My school teachers were outraged when they heard of this, but one of them encouraged these precocious enterprises: my science teacher, of course. I ventured out further; I went on trips exploring the mineral deposits in the neighborhood of Berlin and thus visited Ruedersdorf, and its enormous pit in a large deposit of gypsum, sand and limestone. And later, a bit farther away from Berlin, I went to Freiberg in Saxony, where in time to come I was often a continuous guest for several weeks at the famous *Berg-Akademie* (School of Mines).

The mines in the Freiberg area, now partly belonging to Czechoslovakia, date back at least to the 15th century. They were built without the help of any modern technology, often only with axe and hammer. Straw baskets dangling on hand-made ropes were used to get down into the mine, as I still remember from my early visits to Freiberg.

In 1904, when I was sixteen, my parents stayed in Dresden for a few weeks and I went along with them. They gave me permission to go off to Freiberg by myself and visit the Berg-Akademie and the mines in that area. It was my daily routine to get up early and watch the miners go to work at 6 in the morning. Half an hour after the miners had gone down the baskets started to come up the shafts filled with mined ores. These were not just crude lumps of ore; they were beautifully crystallized specimens still contained in their native rock or matrix—exceptional pieces, if we found them nowadays when, with the technological advance of blast mining, such pieces are hardly likely to reach the surface whole.

The pieces were spread out on the ground and hand-sorted with the best ore going to the smelter and the rejects thrown on discard piles. After a few days I ventured forth to the actual work area, greeted the foreman, stood quietly where I was not in the way, and continued to watch. The foreman finally understood that I was fascinated, and saw that I did not make a nuisance of myself; he allowed me to have my pick from the reject pile. I filled my pockets with all kinds of crystals, filled my knapsack too, and eventually covered my room with all manner of finely crystallized Freiberg ore minerals. In return I offered a drink at the local tavern and soon I had the miners themselves bringing me finds from their digs underground. My personal collection grew by leaps and bounds from that time on. At that early period I had already made friends at the Berg-Akademie, friendships which still continue; only a few years ago I received a wonderful shipment of rare Erzgebirge specimens from Dr. F. Hofmann, Mineral Curator at Freiberg.

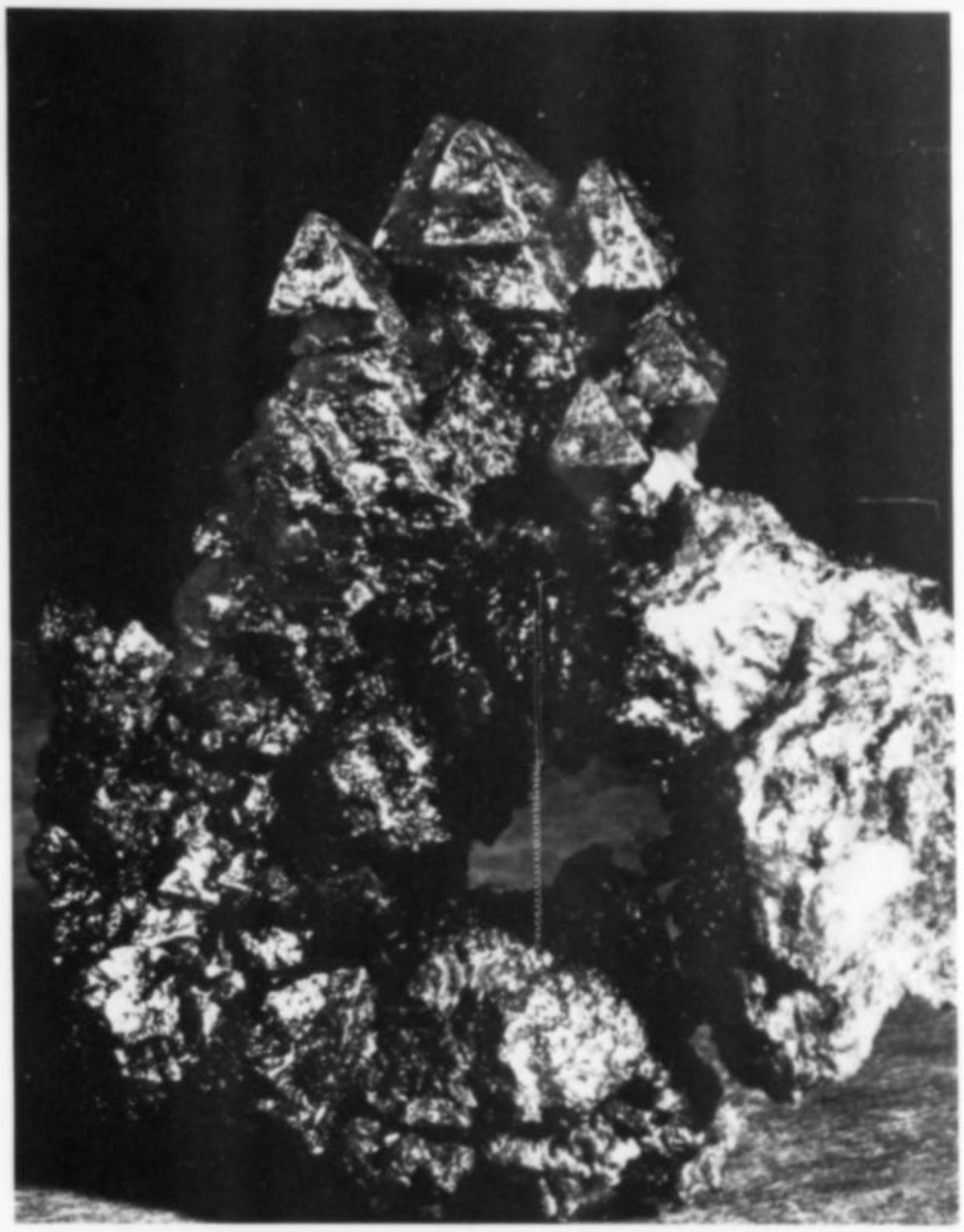


Figure 2. **Black argentite (acanthite) crystals on a 6-cm matrix from Freiberg, Saxony. Cassirer collection; photo by Henry Janson.**

In the course of their mining history, Freiberg and nearby Klausthal became known especially for silver and silver compounds like proustite, argentite, zinnwaldite, scheelite, eulite and manganite, every piece embedded in matrix, in large or small crystals. The areas where these ores were found reach as far as Transylvania, whose mines I visited and whose specimens I collected. And very comprehensive collections they had been, lost after the first World War, as I lost almost half a dozen more collections during the course of my life. Political situations forced me again and again to change countries across Europe until I got to the United States, having held four different passports in succession. These frequent compulsory movements, I must admit, did help to increase my mineralogical experiences, but they did not increase my collections; on the contrary, as I said before, they were assembled and then lost again, lost without a trace. This happened when Hitler came to power and I, together with my little boy had to leave Germany overnight—all this at a secret hint by the Berlin police commissioner, and again before German troops marched into Prague, and again when they entered Paris and came to the South of France. But my experience has been that what lasts is mining and minerals, not politics and persecution. Many years later the mines of Freiberg were still there and even some of my old friends, who helped me to regain some old familiar specimens in an exchange for specimens which I had in the meantime collected in North America.

I finished the *Gymnasium* in due time. I did my required year of military service and tried to discover what I really wanted to do. "Es war nicht nur Unentschiedenheit des Berufszieles," (It was not only the indecision about my professional goal) as Fritz Kraus says in the introduction to Alexander von Humboldt's *Kosmos und Humanität* when he tells about Humboldt's very gradual development and extremely diversified interests. What was the decision going to be? On the one hand there was my great desire to take courses in mineralogy,

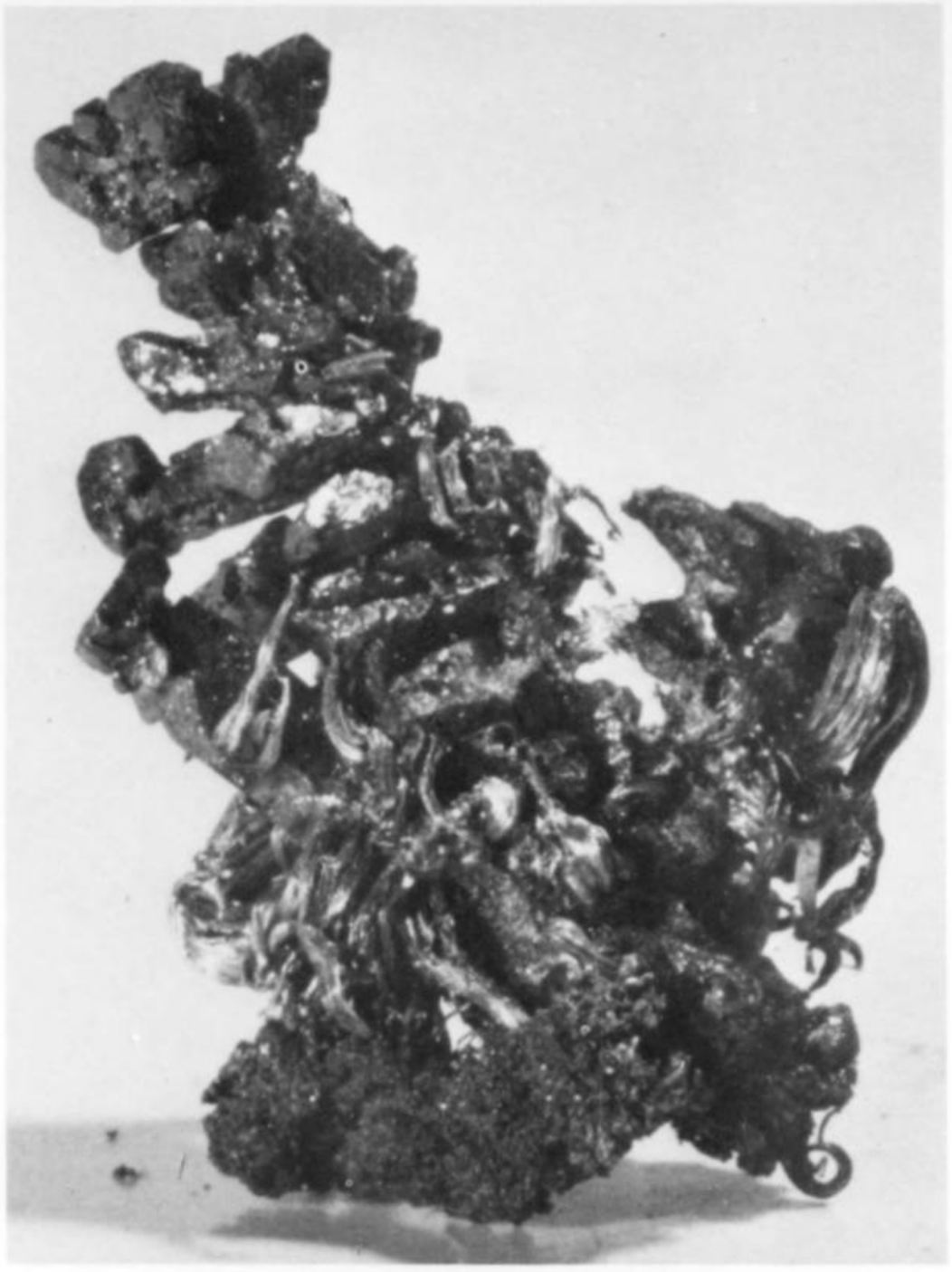


Figure 3. **Black argentite (acanthite) on native wire silver about 5 cm tall from the Schneeberg-Freiberg area, Saxony. Cassirer collection; photo by Henry Janson.**

chemistry, geology—all those sciences which would teach me something about "stones." On the other hand there were technical and practical pressures and considerations coming from our family's business. I often think of Humboldt. My interest and love for this great researcher into the wonders of nature have never subsided. I feel an even greater affinity with this man today. He had an uneven cast of mind and personality when young, and so had I been. For years he had difficulties giving his life a firm outline. He was not interested in specialization and the study of only details. He was driven by the idea of unity of the mind, of unity of nature and he believed in an all-embracing knowledge, not in the knowledge of some isolated facts. He acquired his intellectual knowledge in a highly personal manner, one could say in spite of his university attendance. He could be called a graduate of self-teaching and self-discipline as well as of practical life-experience and his time spent at the Berg-Akademie played no small part in his early development. With this unusual development and this independence of mind Humboldt will always remain a great example to me.

After Germany's victory in the war of 1871 my father's family had moved from Silesia to Berlin. Their business had always been a family concern and my father wanted me to prepare for the take-over, but because of my reluctance and uncertainty he decided that it would be best for me to see foreign countries, to "find myself" as the phrase goes. This was in the old German tradition of travel years, *Wanderjahre*, before settling down.

Thus I went to Paris in 1905, where I lived with friends who had a fanatical interest in modern literature and who owned more quantities of books than space to live in. Our friends in London were book-lovers as well and were musicians. At the time of my visit they were involved head over heels with George Bernard Shaw and Oscar Wilde. During these visits I absorbed two cultures and advanced my knowledge of foreign languages which I had already studied at the *Gymnasium*.

When I returned to Berlin I began to take courses in chemistry, mathematics and the production of iron, subjects essential to a grasp of industry at the Chemical Institute and the Technological University. But the problem of what I was really going to do with my life was still unsolved. It was not the multiplicity of choices which made it difficult, the problem so many gifted young people are faced with today. My situation was simple: my father wanted me to take over the family business and I wanted to devote myself to the study of the natural sciences, especially geology and mineralogy for which I felt I had a vocation. What happened finally was that I succeeded in combining two apparently conflicting callings: I yielded to my father's wish and still managed to have ample time to follow my obsessive interest in mineralogy—a pattern which I adopted for decades to come.

I completed the traditional three years' business apprenticeship in one. After that came the practical training in the technical process of paper and pulp manufacture in plants in Germany and Polish Russia. France and England I visited again, this time to study different production patterns in a number of plants manufacturing quite different items in our field. It was then that I embarked on what proved to be my life-style. After finishing everything I was supposed to do in the London and Paris business, I stayed on for a month or two, a time which I devoted to my own interests. In London I paid daily visits to the Department of Mineralogy in the British Museum, the Natural History Museum in South Kensington, and when in Paris to the Department of Mineralogy of the Museum in the Jardin des Plantes. My first visit to the Naturkunde Museum in the Invalidenstrasse in Berlin as a boy and, as a young man, to the Berg-Akademie, had set the tone for the rest of my life. For when in Prague I became a frequent visitor of the Narodny Museum (The State Museum of Natural History), in Moscow of the Academy of Sciences, and in New York of the American Museum of Natural History, and also in between, in Budapest or Athens—every time I found my way to the respective Department of Mineralogy.

One year my father took me along to England to act as his interpreter in negotiating for one of the modern paper-and-pulp machines for our new plant in Polish Russia. When the business part of the trip was over he invited me to the Derby races with him, but I preferred going to Cumberland and Cornwall to visit the famous mines where calcites of rare beauty were mined as well as zinc, copper, beryl and fluorite.

Figure 4. **A group of black manganite crystals 5.5 by 7.5 cm from Ilfeld, Harz Mountains, Germany. Cassirer collection; photo by Henry Janson.**

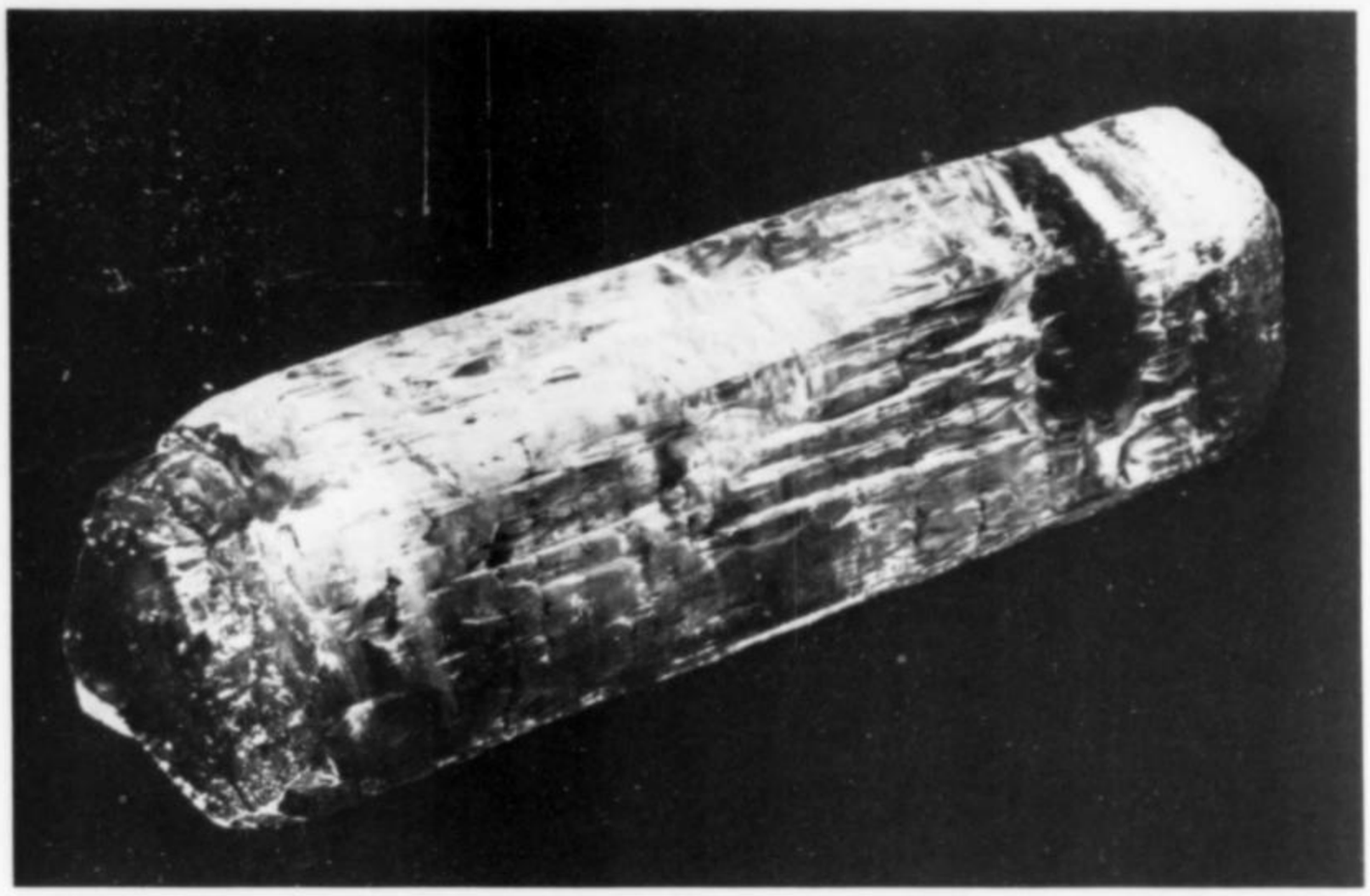


Figure 5. **A green beryl crystal about 10 cm long from Adunchilon, Ural Mountains, Russia. Cassirer collection; photo by Henry Janson.**

My finest pieces from these classic locations were a calcite twin group, a big calcite butterfly from Frizington, a large crystal group from Derbyshire, a hematite with different crystal formations, and a blue barite crystal group.

I have been visiting these mines repeatedly, as early as 1912, working there myself with pick-axe, hammer and chisel, trying to discover specimens of the above quality. The calcites are my preferred minerals still and I have kept a fine calcite collection. No longer can one find such specimens in those mines. The mines are closed now. Besides, mining by the blasting process has changed the whole picture.

Our manufacturing plants were rapidly growing. We needed modern machinery. The most modern was made in the United States. It was decided that I was to go there to study what was being done then. This was in 1911. We, for example, were still using separate motors for production energy, whereas in the U.S. they had gone on to the single large transmission principle for driving the entire producing machine.

Soon after I arrived in New York I went to the Museum of Natural History, to the Department of Mineralogy in particular, and was dumbfounded and delighted at the same time by the quality of their mineral collection. I made friends with the curator. Just when I was starting on a trip through the country, which General Motors had mapped out for me, the curator phoned me, asking me to help him with a German professor who had come to spend a large amount of money on American minerals for the museum in Berlin. We arranged to go to the leading Tri-state mining area where I had heard of a man by the name of Boodle Lane, a miner in the area.

When we arrived, Boodle Lane told us of a situation most interesting to us: "I have just bought this place. The man who owned it before had nothing but flower-beds with rocks around them. What I want to do is plant vegetables. You are welcome guests and you may stay as long as it takes you to cart away these detestable stones." There were about 300 of them, oustanding specimens, mostly fine crystals which had been picked up from the surrounding dumps: calcite, large crystals of galena, sphalerite and dolomite.

Almost thirty years later, in 1937, after not hearing from him during all that time, I wrote Boodle Lane from Paris: "I have just run away from the Germans. Can I get some specimens?" Boodle Lane did not answer in writing, instead he shipped me *two tons* of very carefully selected specimens with a brief note saying: "To my old friend." Overnight I was back on my feet.

In Prague

When I had settled in Prague in 1933 I already knew Professor Slavek, Chief of the Department of Mineralogy at the National Museum of Prague. One evening in 1935 the Professor called me on the phone, asking me whether I had the time and inclination to meet a mineral collector who had come from the South of Prague.

The man I met was an engineer by profession, about 45 years old. On

Figure 6. **Galena crystals on a 10-cm matrix from the Joplin area, Missouri. Cassirer collection; photo by Henry Janson.**

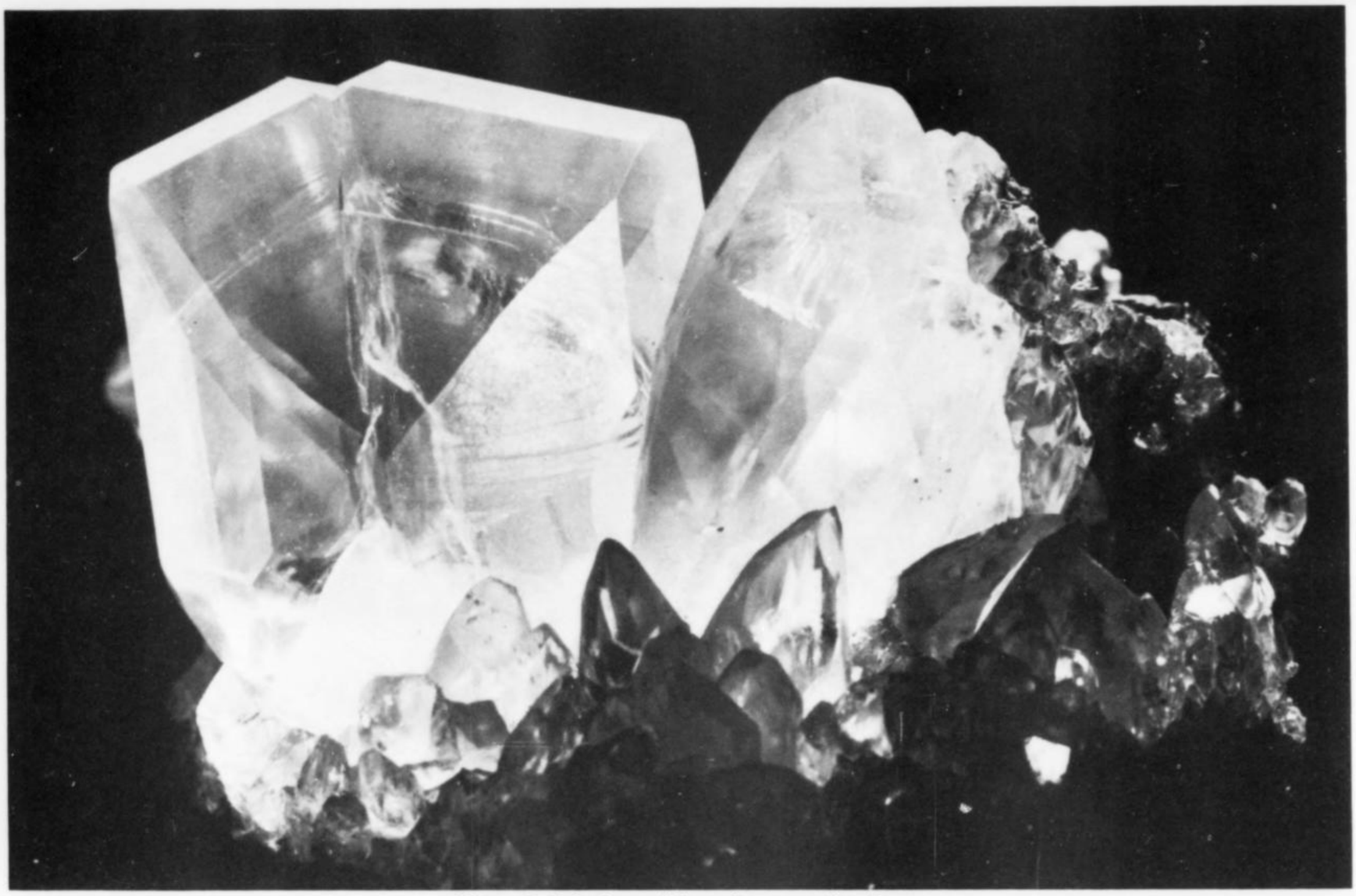


Figure 7. **Colorless calcite twin on matrix, about actual size, from Biggrig, Cumberland, England. Cassirer collection; photo by Henry Janson.**

greeting me he said: "I don't really know quite myself what had suddenly come over me that I started to collect stones. I am struck by a feeling completely unknown to me previously: I want to see more and more stones. I want to own more, I want to read and learn about them all I can." He did not know that he had struck an all too familiar chord in me, and I told him that I had gone through a similar stage before, and that I understood his feelings. "And what will help you more than anything else," I told him "is to collect stones yourself." But he was sure he did not have a chance to do so since, as he explained, he lived in an area South of Prague which was completely barren of mineral finds.

I offered him duplicates from my own collection from different parts of the world. I had been trading quite a bit at the time. My visitor pulled the drawers open, looking over each piece carefully and taking out many, leaving hardly any behind. I was fascinated to watch him because he did not select according to the beauty or the dazzling color of the pieces nor did he select according to crystallization. I pointed this out to him, but he hardly listened. Perhaps, I wondered, this is another case of collector's mania as I had witnessed it before on other occasions. But I was not sure.

"Can I call my wife now," he turned to me "and ask her to come here?" I now walked over to my own wife, informing her that there was a mineral collector in the house who was about to buy my whole collection, that he was calling his wife at that moment to join him here. "We know what she'll do," I whispered to my wife; "she'll figure out the number of dresses she can buy with the money her husband wants to spend on minerals."

As it happens often in life, things turned out quite differently. There appeared on the doorstep a dwarfish little woman whom I immediately recognized to be her husband's emotional impetus; she, too, joined the situation on account of an indefinite feeling she had but did not fully understand. "Is that all that is for sale?" she asked. I nodded and said that the rest was my private collection. Impressed or, perhaps disappointed, she looked at me saying: "What a pity, I feel limited."

"There exists still another possibility to get specimens," I started. "I know of a big and very fine mineral collection which is for sale. The catalog is right here," and I handed her the catalog of a collection. Its owner was a big wheel in the Kattowitz coal industry, Professor Karabaczek, whose collection I knew was of excellent quality. The Harvard Mineralogical Museum in Cambridge had just bought a large part of it. But they had not bought according to quality and beauty of the pieces. The pieces were selected in order to build up and complete as much as possible their mineral collection. I told my guests that I was about to buy the other half of the collection or whatever there was left of it, but that I had difficulties financing the purchase.

"Maybe I could finance it," the engineer said to me.

"Then let me make the following proposition," I said. "What we could do is this: we buy together whatever is available. I shall pay you off in monthly rates which we will discuss and since you are financing it, you can have first choice."

"This sounds very efficient, but how can I buy what I haven't even seen?" answered my prospective partner.

"I am completely sure of the quality of the collection," I assured him. "And as I know it in detail, I will not only take on my half but also those pieces of your half which you do not want." And so it happened that after clarifying the price and other details I got a large stock of first-class selling material without investing money into it directly. My mineral selling business blossomed and once again it had come to the rescue of my financial situation.

The finest piece which I kept from the Karabaczek collection—a high point in my whole collecting activity—has never left me during the odysseys of my life. It stands, at this moment, on my working desk: a pegmatite matrix of about 10 by 10 cm carrying one main hexagonal

prism of fine blue-green beryl, an aquamarine of cutting quality, and a terminated crystal with a 12 mm radius and 96 mm in length along with countless more aquamarine crystals. It is a piece from Adunchilon in the Ural Mountains in Russia. I have no idea why this piece always came along with me, for my entire Prague collection was lost when we fled from Prague in 1937.

The story which I have just told you represents only one little incident among many of a kind which took place while I was living in Prague. Events had been such that I had made Prague my second home. In the clear-thinking circles of Berlin we had already predicted at an early date that Hitler meant a terrifying end for Germany, but, at the same time, we were convinced that the Hitler action would be over within a couple of months. Whatever the predictions, the mood was uncomfortable.

On my business trips to Paris and London in the early thirties I had already made several attempts to join a cellulose and paper plant abroad. I held no hopes for high employment, but assumed that the new ideas we had developed in this area might be of interest to foreign manufacturers. Also, I was personally acquainted with a number of leading people in the field, and had first-class references—but all my efforts remained fruitless.

A few days after the *Reichstagsbrand* in 1933 one of my colleagues had been picked up by the Hitler gang and jailed overnight. They let him go again the next morning, all without investigation or any kind of explanation. In the wake of this event and after extensive consultations with my friends and my family it was decided that I should go to Prague and there assist in the publication of an anti-Hitler newspaper. At this time I had an opportunity to discuss this plan and, more broadly, the general situation, with a high official in the Berlin Police headquarters. He locked and bolted all doors while I was in his office, took me aside, and said: "See to it, my old friend, that you get out of Germany as fast as possible." This was enough warning for me and that very evening my little boy and I boarded the night-train to Prague. To my great surprise the police entered our compartment in the night, demanded my passport, established that we were Jews and escorted us out of the train to the so-called Hitler camp where we spent the rest of the night. The following morning brought a still bigger surprise: Just as in the case of my colleague, we were set free, without investigation or explanation, and told to continue our travels. If I had ever harbored any doubts when I decided to leave my country, to leave my family and my friends, to give up my work, and last but not least my mineral collection, this experience in Dresden made me two hundred percent certain that I had to change the ground I was standing on. Once more I returned to Berlin to catch the night-train to Prague, once more I said good-bye to my family and replied to their objections to my hurried departure (which proved to be dead right later on) that if I could help them at all, it could only be from the "outside," never from the "inside."

We reached Prague the next morning according the plan and without incident. I immediately went to the newspaper office to discuss our former ideas and to meet my future partners, but came away with a feeling of doubt. The following day I set out for the Mineralogical Department of the Narodny Museum in order to meet Professor Slavek, the curator of the department, and an old acquaintance of mine. He was not at all pessimistic about the new turn in my life, encouraged me to follow my mineralogical interests and, as a first undertaking, to visit the quarries near Aussig. Maybe I could discover and bring back some interesting specimens. His words were all I needed to get back to my old love. I promptly went to the quarries. They were the supply sources of the raw material for road construction, but contained unusual mineralogical treasures: marvelously crystallized zeolites of all kinds: natrolite, scolecite, thomsonite, analcime, laumonite, and mordenite as well as ordinary aragonite and calcite which workers and foremen alike helped me find and extract from the rocks. Two days later I returned to Prague with a beautiful selection of specimens and asked Dr. Slavek to come and see me at my hotel. He was impressed by the results of my trip and made me an offer to become a freelance buyer for the museum. In this way I would get full support and any needed help even though I was not formally employed. While I was buying for the museum I was also in a position to buy any amount of material for my own use. I knew the important mining areas in Czechoslovakia and, with the added help of the museum, success was around the corner. In a very short time I was back on my feet doing flourishing business in Prague and (why not?) also in Germany with my former contacts in Klausthal and Freiberg.

(To be continued)

Neal Yedlin — A Memorial

by Ron Bentley and a few of Neal's many friends

"Finds tongues in trees, books in the running brooks, sermons in stones and good in everything."

(*As You Like It* Act II Scene I)

Never until I began the real if somewhat perfunctory study of minerals did I appreciate the profound significance of those lines. W.C.S.

These lines are from an inscription inside a copy of Dana's *Descriptive Mineralogy*. They were written in 1909 by Walter Cyrus Sherman, a mineral collector. They might also have been written by another more contemporary mineral collector who also came to appreciate their profound significance. In fact, had Walter Sherman only known, he might have been present a year earlier on March 20, 1908, at the birth in New York City of that other mineral collector, a mineral collector who would have a great impact on mineralogy especially micromounting: Neal Yedlin.

Many of us who collect, research, deal or otherwise have some interest in minerals, knew Neal Yedlin. Many of us had come to accept his presence at mineral shows around the nation, always ready with a smile and a new joke to tell. We knew him as a lecturer, a collector, a friend. And it was as such that we mourned his death on October 8, 1977. But, while many of us knew Neal, few of us *really* knew him. The more material I gathered about Neal for this memorial, the more I realized that he was much more than we saw on the surface, and that many of us saw different sides of him. For this reason I thought it would be selfish to only offer the side I saw, so I asked five others to contribute their impressions of Neal.

Neal was born Leo Neal Yedlin to Morris and Celia Shapiro Yedlin of New York City. The first biographical information I have picks up his life attending Boy's High School in Brooklyn, but his earlier upbringing must have been more than satisfactory for his accomplishments in high school go on and on. Leo (he didn't start using Neal until the late 1940's) was president of the general student body, a member of Arista, an active athlete participating in baseball, archery, soccer, lacrosse, football, swimming and about any other sport you could name. He was named Outstanding School Athlete in football and was captain of the lacrosse team, as well as recipient of several school awards. Following high school, Leo attended Columbia University for two years and graduated from the Brooklyn Law School of St. Lawrence University in 1929. He passed his bar exams in march of 1930 and practiced law until his move to Maine in 1937. In addition to his academic studies, he also found time to serve as counselor and director at a boys' summer camp for the 15 years between 1927 and 1942. Since I wasn't able to get much information on Neal during this period I was very grateful to receive the following contribution from perhaps his closest acquaintance. Neal's oft spoken motto was, "you can't choose your relatives so choose your friends well." He chose a real gem of a friend in Lou Perloff.

Painting by Jules Bernhardt

Neal Yedlin (1908–1977)

"When I was about five years old, my family moved from the east side of Manhattan to Howard Avenue in Brooklyn. Having assured myself that my own treasures had survived the shipping intact, I headed for the street to see what the neighborhood had in the way of kids my own age. I didn't have to go far. Right outside the door was a fellow who lived a few doors down the street—that was Neal.

"In the age-old manner of boys at first encounter, we made a wary appraisal of each other, asked the first few questions and exchanged

names. He showed me where he lived and we decided we could get along together. That simplified things for our mothers because finding two kids was easier than finding one. From that time on we attended school together and were virtually inseparable.

"Geologically, Brooklyn is a heap of glacial till, as attractive to a mineralogist as the southern tip of Florida. Whereas Brooklyn was heavily populated in certain areas, the West and South were relatively open, with streets laid out in checkerboard fashion, some of them cut through hills of glacial rubble two or three stories high. There were blocks where houses had been built only on land nearest the intersections, leaving raw hillsides deeply eroded by rain that were to become our hunting grounds. Those gullied hillsides within a few blocks of home became our first mineral haunts. Why we both developed an interest in minerals simultaneously I can't say. Perhaps it was just because we had grown so accustomed to doing everything together. We knew nothing about minerals at that time. We only knew that there were pretty things to be found in the hillsides, and we squirreled them away in boxes and drawers. We had no conception of crystals and had never found anything but glacially polished pebbles of quartz in all shapes and colors, plus the occasional stray pebble of hematite, pyrite or other "exotic" minerals which became treasured bragging pieces.

"We first began to learn about minerals when we discovered the Brooklyn Children's Museum around the age of 12. We were well along in Public School No. 144 and had taken some science courses by the time someone told us about the museum. And imagine, it was only about a mile from where we lived! We ran there that afternoon, after school let out (kids walk only when forced out on errands). The museum was in an old mansion in a block-square park. There were many wonders inside the door, but most of them had to wait until later; we homed in on the mineral room. For the first time in our lives we knew the enchantment of a real mineral collection. It was quite a good one, filling glass and wooden cases which lined the wall of one room. As we learned later, many of the specimens came from the Brooklyn Museum when it had removed minerals to make room for other things that were to become its specialties.

"A game was in progress in the mineral room when we entered. A handsome lady, Mrs. Seldner, was handing out cards with questions typed on them. You took a card and scurried around the room until you located a specimen and label that provided the answer, then you rushed back and called out your answer (earning a check mark by your name), and took another card. It was a day of triumph for both of us; we beat the regulars who lived nearby and had played the game before. As prizes I received a chunk of pumice and Neal received something more colorful (but I've forgotten what it was).

"That first sight of a room full of minerals, most of them well crystallized, was an eye-opener for us both and we were hooked from that day on. We went to the museum anytime we didn't have errands at home or a heavy load of homework. Saturdays were the best of all. We were usually there before the doors opened, prepared to spend the whole day among the mineral wonders. The museum contained a good deal more than the exhibit rooms; the real treasures were in storage in the basement. Down there were drawers full of minerals that we could handle, and break, and scratch, and weigh. There were hammers and streak plates, magnets and balances, and, best of all, there was Jack Boyle.

"Jack came to the museum a year or two after we discovered it. We had been learning about minerals (and trees, shells, butterflies, etc.) from a group of wonderfully dedicated women who were wise enough to introduce us to knowledge as if we were adults, not kids. Jack was a Philadelphia Irishman whose knowledge and wit were, to us at least, dazzling. Learning about minerals from him and being gloriously entertained at the same time was an experience to be treasured forever. There was so much sheer fun in having him for a teacher that we sopped up knowledge at a rate that would have staggered our teachers back at P.S. 144 and later at Boy's High School. (Neal and I attended both schools,

Graduation

in the same classes most of the time, and got our law degrees from Brooklyn Law School in the same year.)

"Before meeting Jack we had gone on occasional field trips to places like the Palisades or the limestone caves of upper Manhattan. But with Jack we really began to hit the collecting localities around New York. We had a copy of Manchester's *Minerals of New York and its Environs* (1931) which contained a map showing the localities within a 50 mile radius of the Battery of Manhattan (that map was reproduced in the *Record*, vol. 9, p. 157). Neal and I collected at every locality indicated on the map, many of them dozens of times in the years before and after the war. In New York there were Valhalla, Tilly Foster, Mahopac, the Kinkel and Baylis quarries at Bedford, Glen Cove and Staten Island. In New Jersey there were the Arlington copper mine, the trap rock quarries of Paterson, Snake Hill, Bound Brook, Great Notch, Summit and Sommerville, as well as limestones of the Franklin-Sparta area. In Connecticut there were Haddam, Portland, Trumbull, Roxbury, Redding and Danbury and, as we grew older, the upper New England localities.

"One of Jack Boyle's maxims was, 'never take no for an answer.' Of course those were simpler times and there were far fewer collectors to drive quarry operators crazy. But there were rules and restrictions on collecting even then. Many such restrictions were in force at the Lower New Street quarry, the source of more zeolites of spectacular quality than have ever been found in any other American quarry. Individual collecting was forbidden at New Street. Periodically there were group visits by the New York and Newark mineral clubs, but those always brought out mobs to rival those in the notions department at Macy's just before Christmas; not the best of collecting conditions. Neal and I were in our late teens when we decided to test the rule at New Street. We set out for the quarry one Saturday afternoon in the fall. Bob Mercer, the

quarry manager, was alone in his office at the roadside listening to a football game on the radio. We had come prepared to be turned down, and Mercer said the expected words: 'Sorry fellows, I'd like to say yes. But if I let you in today I'll have half of New York here by next Saturday.' We looked a little disappointed, said nothing. Neal, who knew a good deal about football, both as a player and a fan, sensed that the football game on the radio might be the key. Lowering our eyes bashfully and scraping one foot behind the other, we asked Mercer if he minded if we stayed around and listened to the game. He said he was glad to have us. It took only a few plays, with Neal's correct guesses about what would happen next, to impress Mercer. (I limited myself to noncommital comments that wouldn't reveal my ignorance, such as 'Wow!' and 'Whee!') Before the game was over we were in solid! It was dusk by then and there was no time left for collecting that day, but Bob opened up drawers in his desk that were filled with choice pieces and invited us to take what we wanted. Even better, the two of us could come and collect whenever we wanted as long as we didn't tell anybody! It was a privilege we had until the quarry ceased operations well into the 1930's. The surrounding area had become too thickly settled and blasting was finally outlawed. But during those years, even when Neal and I were serving our clerkships in the same law office in Manhattan, Bob would sometimes call Neal to tell him about a blast that was going to be set off. Many times we would grab some legal envelopes in which to put specimens (Bob had the tools) and set off for New Street.

"Franklin, New Jersey, was a tougher nut to crack. There were no club trips to the picking table where all the ore of the mine was hoisted to and laid out. You had to be a Very Important Person or a close friend of the chief chemist, Bauer, in order to have a whiff of a chance of getting an invitation to visit the picking table. For several years Neal had been head counselor at a camp near Bear Mountain Park, not far from Franklin. One day he composed a letter to the Franklin mine manager that, for lucid persuasiveness, Metternichian guile and consummate chutzpah would have done credit to Henry Kissinger! Neal laid great stress on how such a visit to the fabled mine would assist him in imparting to his charges the great mining history of the region. We discussed the phrasing in detail, fearful that some of it might sound a bit fulsome. But the letter worked! Very shortly after sending the letter we received an invitation. As Neal's colleague I was, of course, to accompany him. Not wanting to be hogs, we invited Jack Boyle, Ivan Lee, and Mary Whelleck. There was one sticky moment at the gate when it seemed that someone objected to letting a woman into the mine, but then the gates opened and the picking table was before us.

"In the early 1930's Neal and I became members of the New York Mineralogical Club. In those years the club had an awesome membership composed of some of the best amateur and professional mineralogists in the country, men such as Ashby, Stanton, Manchester, Hoadly, Morton, Trainer, Carlson, Harry Lee, Ivan Lee, Hawkins, Holmes, Weidhass, Whitlock and others. Their mineralogical knowledge was deep, their opinions strong, and all were fiercely disputatious. Neal and I eagerly looked forward to the monthly meetings, for each meeting was certain to see its share of verbal fireworks. We soon realized that these mineralogical Donnybrooks had an almost ritual quality in which the contestants welcomed the verbal testing of themselves and each other. Over the years we became friends with many of them.

"Neal moved to Maine in the late 1930's and we didn't meet again until after the war. Both of us were out of uniform at the end of 1945 and Neal had returned to New York. His stored mineral collection had been left in Maine at the home of a friend. At once we were gripped by the fever to get out into the field again and see the old collecting sites. The fever, as we found out, was pandemic among mineralogists and collectors after the war. The crowds at club trips were enormous. It was at this time that our interest in micromounts began to develop. Jack Boyle had introduced us to the microscope many years earlier, and we had

seen some of John Grenzig's mounts in his home. But it was during the post-war sessions with a microscope in Ivan Lee's home in Jersey City that we were sold on micromounting as the True Faith. We had never seen anything to match Ivan's suite of uranium minerals from Shinkolobwe. We began to think seriously of converting entirely to micromounting.

"Around this time we had met a young priest who lived in a room behind a church in Times Square. In his small room there was a large grand piano for his work with sacred music, a workbench where he worked on stained glass window panels, and a table for his microscope and micromount collection. His collection, which seemed enormous to us, was in about 1000 rakestraw boxes. Loose micromount material overflowed the space below the table and every odd corner of the room. A small cot occupied one side, so that one had to move sideways to get through. It was evident that something would have to go. Reluctantly, our friend decided that it would have to be the minerals in order to leave room for his more vital religious activities. When he told us of his decision, I bought his microscope. Neal, who already had a microscope, bought the boxed micromounts which were to form the nucleus of his collection. We happily hauled away and shared the mounds of loose micromount material from the room. We were in the micromount business at last."

Lou Perloff

As I mentioned, Neal moved to Maine during 1937 and set up a law practice at Cedar Grove near West Dresden. During this period Neal was very active in minerals and on February 28, 1942, he was elected president of the New England Federation of Mineral Societies at its first meeting in Cambridge, Massachusetts. He was an incorporator and member of the board of directors of the prestigious New York Mineral Club, Inc. as well as vice president of the Maine Mineralogical and Geological Association. Neal ceased his activities in Maine with his return to New York and subsequent enlistment in the Army on June 27,

1942. In the short four years Neal was in the service, he also excelled. Among his jobs, he served as a courts-martial investigator and legal advisor, and, later, on the separations board, as counselor, tax and legal advisor and claims officer. Neal was discharged as a Lieutenant-Air Corps in 1946.

Another of Neal's close friends and comrades was Carl Krotki. Himself an avid collector of minerals, books and labels, Carl affords us another view of Neal.

"It was a rainy evening on November 16, 1961, at the Faculty Club of Columbia University. The occasion was the seventy-fifth anniversary dinner of the New York Mineralogical Club, and the minutes of the fiftieth anniversary meeting had just been read. Someone made a motion that the minutes be read every twenty-five years. The motion was carried, and Neal Yedlin, who was then president of the club and toastmaster for the evening, mentioned that he would like to be president again the next time the minutes would be read—at the hundredth anniversary in 1986. It was not to be, since Neal died on October 8, 1977.

"Neal will be missed at the New York Club, where he had twice served as president and where he had spent countless years on the Board of Directors.

"He will be missed at the Eastern Federation meetings where his wise and quiet counseling and sound judgment helped the members through many turbulent moments; at the micromount symposia in Baltimore and Canada and California, where he was recognized as a giant in the field; in Tucson and at all the other great mineral meetings; and at the late night sessions that are so much a part of mineral conventions. Many of us used to enjoy sitting for hours looking at the superlative slides that Neal had taken. His supply of good stories was inexhaustible.

"At club meetings, when Neal himself was not the speaker, he was often called upon to introduce lecturers, a task he thoroughly enjoyed. Neal always did his homework, and many times his introductions proved more entertaining and informative than the lectures themselves.

"Neal was a generous, loving man. He was never too busy to identify a specimen for a collector, to advise a dealer, or to explain something to a junior club member.

"Once when Neal was serving as auctioneer at a club sale, he noticed a boy sitting in the front row, fingering a dollar and licking his lips anxiously as specimen after specimen was bid up beyond his reach. The first time the boy opened his mouth to bid fifty cents on a crystal group, Neal slammed down his hammer and called robustly, '*Sold* to the young man in the front row.' No one would dare argue.

"If it had not been for Neal and his expert guidance, my attraction to mineralogy might have passed. He led me through the labyrinth of the chemistry and crystallography of minerals and introduced me to many of the thousands of collectors he considered his friends. He told me about localities across the country and around the world—we were planning a trip to Larium together for next summer. Best of all, Neal shared with me his love for books. I remember his amazement when he saw my floor-to-ceiling shelves stocked with mineral books. He laughed and said he never thought his 'buy and use a good mineral book' slogan would lead to that.

"I will remember Neal as the great Renaissance man of the mineral world, a collector, a micromounter, an author, a photographer, a counselor, a teacher, a speaker and a charming raconteur. However, Neal's knowledge extended far beyond the perimeters of mineralogical circles. Professionally, he was a lawyer and a builder. But he was able to match wits with the best when discussing topics as diverse as music, African violets, silver, football, children's summer camps, fine furniture, and Jewish humor. My son-in-law sought his advice on building techniques and materials as readily as my daughter asked Neal about the design of a piece of jewelry.

In the service.

"Neal and Helen usually joined the rest of my family for celebrations and holiday dinners. On these noisy, joyous occasions, I always had difficulty getting any point across or finishing any story without being interrupted several times. Neal never had this difficulty. When he had a story to tell or something to say, the twenty-or-so adults and children at the table immediately fell silent. When I complained about this to my sister-in-law, she answered very sensibly, 'Well, of course, Neal's a brilliant man.' Well, of course, he was. Neal's stories were always worth listening to, and you didn't have to be a mineralogist to know that.

"Last Friday I bought one copy of a newly published mineral book. On another day I would have bought one for Neal also, and had he found it first he would have bought one for me. Sometimes we ended up with two each. A week earlier I bought one block of a mineral stamp. The salesperson reminded me that I usually asked for two, and I had to tell her that that would no longer be.

"Neal and I had it all worked out. At the hundredth anniversary of the New York Mineralogical Club, he would be president and I would still be treasurer. It would be the culmination of his long career as a guiding force in the mineral world. I find it most difficult to believe that he won't be there. Neal was not related to me but he was a member of my family. He was my brother and an uncle to my children and my grandchildren. He was a friend to all my friends. He will always be my president."

Carl Krotki

Following Neal's discharge, he resettled in New York and remained there, practicing law and working in real estate construction until 1950. This was a very important period for Neal since he met, courted, and, in 1947, married a very engaging, talented and beautiful concert pianist by the name of Helen Rosenberg.

He actively pursued his 'new' hobby of micromounting, also serving as legal advisor to the Eastern Federation of Mineral Societies, lecturer, and contributor to *Rocks and Minerals* magazine, with a column called

The Micromounter in 1948. As with other avenues he followed, Neal's quest for knowledge should be an inspiration to us all. As his knowledge grew, so did his ability to bridge that psychological gap lying between the amateur and professional mineralogist. He was welcome and at home among many of the museums across the country. Clifford Frondel treated this aspect of Neal in the following note.

"Neal Yedlin was always a very welcome visitor to the Harvard Mineralogical Laboratories, as he was at the many other museums and universities that he visited. Part of it, of course, was the pleasure of talking to him, for he was a person of good humor and many anecdotes, and always a source of up-to-the-minute information about mineral collecting and mineral club activities. But he was also valued highly for sound comment at the scientific level. One of Neal's abilities was that he was an exceptionally keen observer of minerals, sensitive to the many subleties of crystal form, physical properties and mineral association. This faculty, taken in hand with a thorough knowledge of descriptive mineralogy, gained not just from books but from years of working on reference collections, and from field collecting as well, made his opinions valuable over a wide range of mineralogical problems. These would include such matters as the probable source of a specimen unlabeled as to locality, or the period when a specimen had been collected, or more importantly, whether a given specimen was perhaps a significant variety of some known species or a new species. Knowing how to utilize modern mineralogical equipment is one thing, and the skill is not too difficult to acquire given the opportunity, but a more fundamental matter is to recognize a mineralogical problem worthy of detailed study. Neal had this ability and the science of mineralogy is indebted to him for it."

Clifford Frondel

Neal's popularity increased greatly during these and later years, especially after his move to 129 Englewood Drive in New Haven, Connecticut, in May of 1950. Here he had a spacious basement waiting to accept his already large micromount and Franklin collections. Just about anyone who met Neal remembers him for his ease with people, his ability to make you feel one of the group and to give you any help or information he could. He always had a new group of jokes he was ready to tell; in fact it is this very aspect of Neal that Joe Mandarino expresses so well.

"When I was asked to write a few words for Neal Yedlin's memorial, I decided to try to write something that Neal would have liked to have seen if he was around to read his memorial. This paradoxical statement in itself would have appealed to Neal and, I hope, it would have amused him. I can almost see the small laugh starting deep within that massive frame and spreading upward to form that infectious grin. I guess to me that's what a memorial is all about—remembering a person as they were.

"It is difficult for me to believe that when I go to certain mineral shows or meetings of certain clubs, Neal isn't going to be walking towards me with that wonderful smile and that huge outstretched hand, saying (as if we hadn't seen each other for a couple of days, rather than a couple of months) "Did you hear the one about . . . ?" We remember Neal in many ways: his extraordinary ability to identify numerous species through the 'scope; his devotion to his wonderful wife, Helen; his and Helen's boundless generosity and hospitality; and most of all, at least to me, his sense of humour. Over the years that I knew Neal we swapped many stories. Indeed, our all too infrequent meetings were 90% joke-trading with a strong "can you top this," element. My day

With Lou Perloff at the Tilly Foster mine, 1947.

was made, of course, if I told him a joke he hadn't heard. But even better was the real pleasure I received when he would tell me a "new" joke that turned out to be one which I had told him on a previous encounter!

"What would Neal have liked to read in his memorial? I think it would have been a joke. One of his favorites was the one about the bunch of people who got together so often to tell the same jokes that they decided to give numbers to all the jokes to save time. One person would say "eighty-seven!" and the rest would roar. "Twenty-three" would be followed with gales of laughter. One day, a newcomer said "Ninety-eight!" which was followed by an embarrassed silence. One of the regulars drew the fellow aside and said "We don't tell that kind of joke when ladies are present." Well, I know Neal would enjoy the following jokes: sixty-five, seventeen and thirty."

J. A. Mandarino

The period in New Haven before his retirement in 1973 was also an active one for Neal. His column on micromounting began in the first issue of the *Record* in 1973, and continued almost without interruption until his stroke. Still actively engaged in the construction end of real estate, he and Helen were on the go all the time, whether on the job or visiting mineral shows and meetings. Tucson was a natural during the winter months and they both enjoyed themselves tremendously. Often-

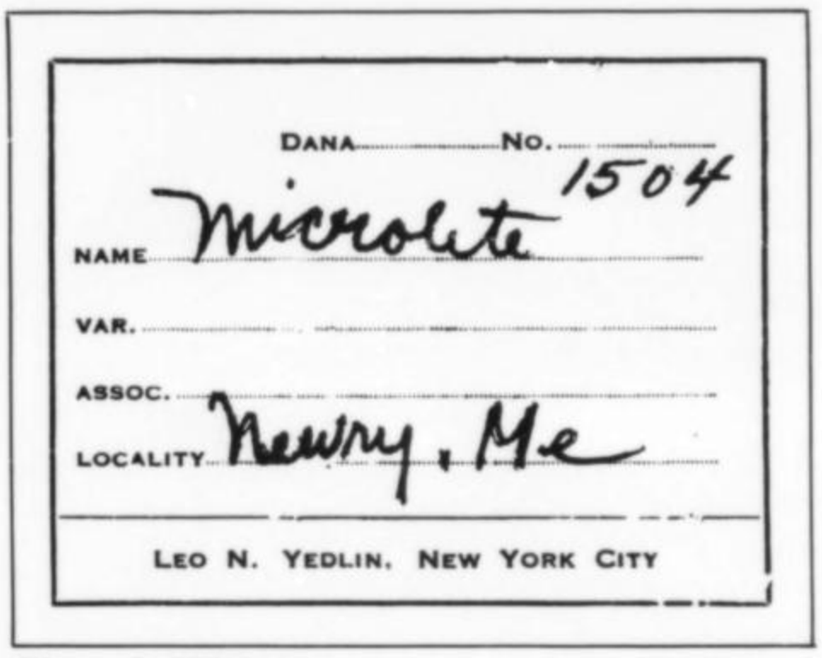
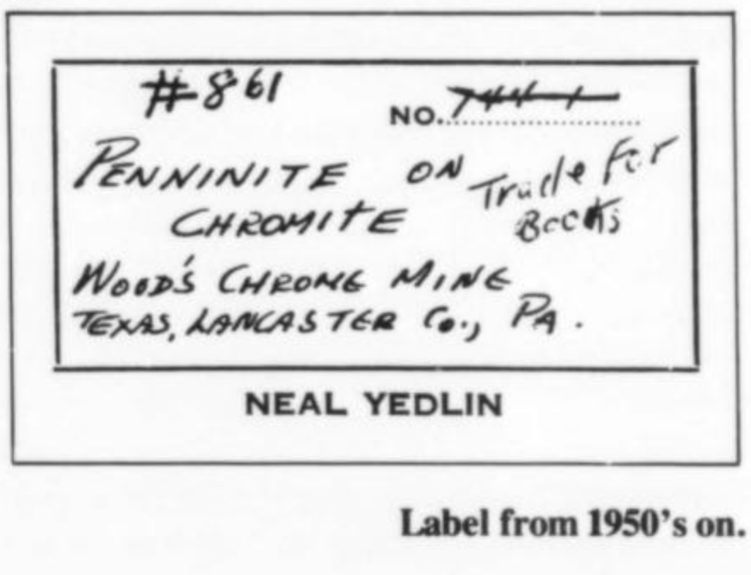


Figure 7. **1940's label.**



Label from 1950's on.

times Neal would complain he had been so busy talking, joking and visiting that he hadn't had time to see the show. It was during this period that I first met Neal. It was in the winter, during one of my pilgrimages to the Schortmann's in Easthampton, Massachusetts. When I went downstairs to visit Alvin, there was this large man, selecting bits of rocks from a tray and looking at them under a "mike." As others have said before me, Neal was delighted to show some of the mounts he had brought with him and share in his knowledge. The material he was going through would play an important role for Neal, for it was from among these tiny pieces from the Mammoth Mine, Tiger, Arizona, that he showed me a very, very minute cranberry-red crystal he had nicknamed "cranberryite." Neal submitted this strange crystal for more work in 1967 and was rewarded when the November–December 1974 issue of the *American Mineralogist* reported the occurrence of a new mineral from Tiger, Arizona, named yedlinite. Since that first meeting, Neal was a frequent visitor, always willing to help identify or to trade a "new" old label or book. Much of my interest in the historical aspects of our hobby is due to his encouragement. I am not alone when I say he will be missed.

Neal was preparing for the Rochester Symposium in April 1977 when he suffered a paralyzing stroke. From the time of his stroke to his death in October, he and Helen received prayers, cards, letters, and tapes from all over the world. I'm sure if Helen were still alive she would ask that her and Neal's thanks be expressed to their many friends. At the time of his stroke Neal was working on a manuscript for a book on micromounting to be published by Van Nostrand. While nearly completed, there were still finishing touches needed before publication, and very graciously, the task has been taken on by Paul Desautels. The book will cover the history and practice of micromounting, its contributions to mineralogy, and many of Neal's personal experiences. The book is expected in print sometime in 1980. Don't miss it.

Even if this memorial could be alotted an entire issue, I could still use more room. Neal was truly a Renaissance man; his interests so wide and varied that I could go on and on. And there are many among you who knew Neal and could have just as well contributed were it not for limited space. We have tried to show here something of Neal, his life and his contribution to our field. Had I not had a fifth contributor, I would have had a very difficult time finishing this memorial. As luck would have it, my fifth contributor says it all. I refrain from mentioning him as he wishes to remain anonymous. His feelings I'm sure are reflected by all who knew Neal.

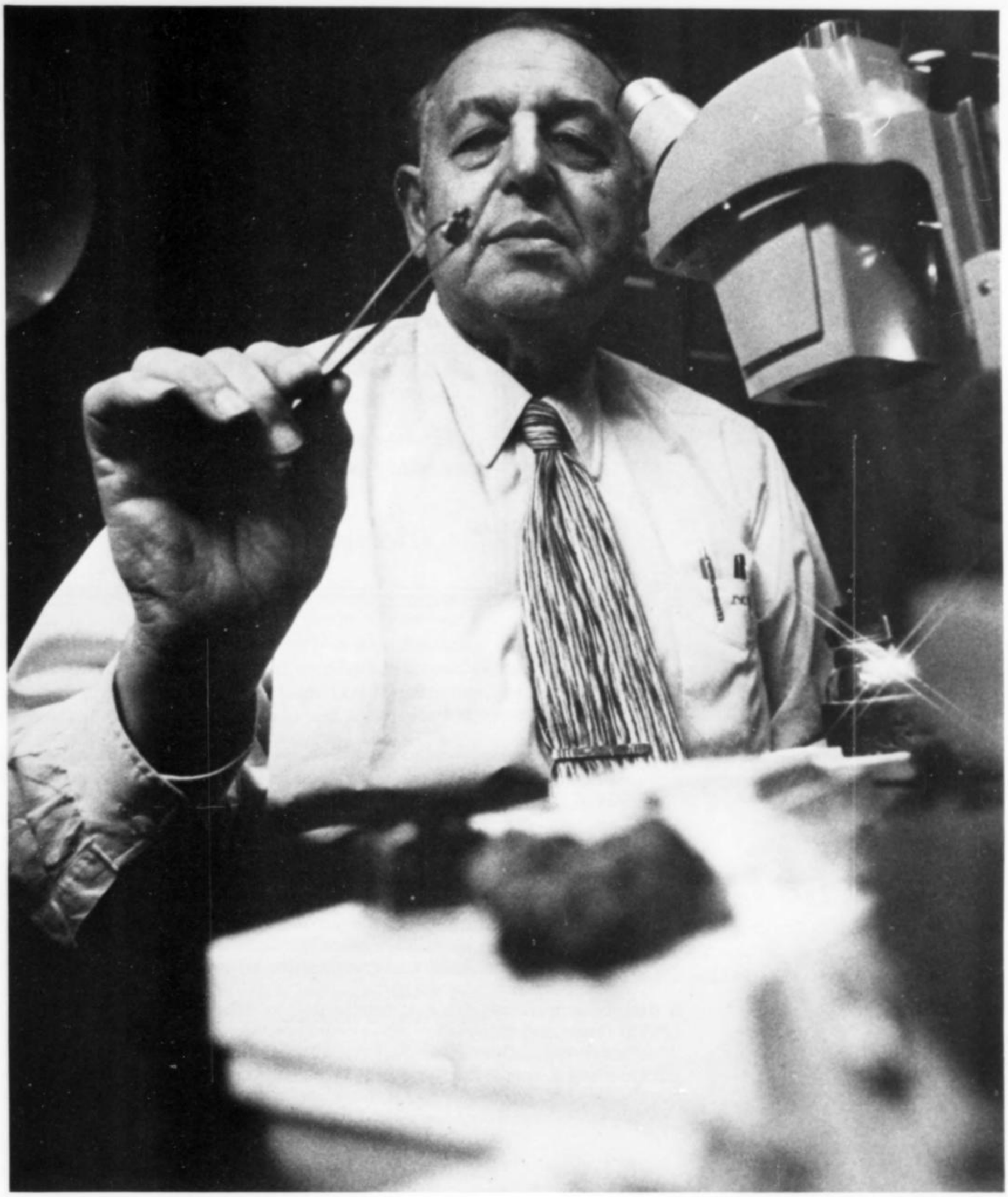


Photo by Peter R. Hvizdak

"One measure of the worth of a man is the legacy he leaves behind in the minds of those who were influenced by his actions, words and thoughts. It is no small coincidence that the legacy of Neal Yedlin will be felt, in hundreds of different ways, by thousands of collectors, for many years after his passing.

A part of his richness of personality was the knowledge he shared so openly with those who sought it. Knowledge for Neal was a type of nourishment, and he really believed in spreading it around with all the gusto he could muster! The warmth of the man was legendary; he would open his arms and embrace the newest novice collector as warmly as he would happily renew old acquaintances. It is as if he were saying: *"Come one and come all and take richness from the mineral kingdom and mingle with one another, give of yourselves and have a ball while you are doing it; for such is the nature of good mineral people"*

A measure of his significance, and the richness which pervaded every place he went, was felt, in a negative sense, at the Rochester Symposium in 1977, which was held just a few weeks after Neal had suffered a stroke. The news of his illness had spread rapidly, and there was a distinctly perceptible drop in enthusiasm, enjoyment and happiness. What a pleasure it was, at any mineral show, to see Neal Yedlin coming down one of the aisles. One knew, immediately, that the next minutes would be fun ones, full of joy, plenty of laughter, a story of two, and a feeling of *fellow-well-met*.

Neal was peaceful in his final months. Happy in the knowledge that he had his joys and contributed to those of others. When I look back at the times I spent with Neal, they are good memories; the kind of memories that make one tingle a bit, wish for more, and in the end, thank the Creator that you were fortunate enough to be a friend of Neal Yedlin. He gave so much to so many. I think it fitting that we might try, in our way, to honor Neal by "passing it on."

Thank you Neal, for allowing us to walk a little closer to this earth of ours, to see it in a different way through your insights, and for making the experience a most enjoyable one. I miss you."

an American mineralogist

Microminerals

Editor's note: In this column Vi Anderson welcomes another guest columnist, William A. Henderson, Jr. Bill is a Senior Research Chemist for American Cyanimid in Stamford, Connecticut. He earned a BA in chemistry at Harvard (where he studied mineralogy under Frondel and Hurlbut), and an MS and PhD at Yale. While still a student at Yale 20 years ago, he was introduced to micromounting by Neal Yedlin and has been at it ever since (eventually expanding his collecting interests to larger sizes as well). Bill has taught geology at Fairfield University (Fairfield, Connecticut), lectured on mineralogy at schools and mineral clubs, and written several articles for the Record.

Thomaston Dam, Connecticut

Since this is my first appearance as a guest writer in Vi Anderson's *Microminerals* column, I would like to talk about Thomaston Dam, my first good micromounting locality. Besides being a source for several interesting microminerals, Thomaston Dam holds fond memories for me, since it was there that I went on my first date with my wife. When I found she was willing to kneel in the spring thaw mud holding a big chisel while I swung at it with the long handled sledge, I knew she was the one.

The dam, in Thomaston, Connecticut, was built by the Army Engineers in the late 1950's for flood control purposes. In the process, they relocated some railroad tracks through a new cut, and it was there that most of the interesting minerals were found.

The country rock is part of the Harland formation, composed of schist and gneiss locally injected with granitic material. The sulfide mineralization at Thomaston Dam is found in or near quartz or quartz/fluorite stringers or veins running through the schist and gneiss. Some two dozen of the 60–70 minerals found in the area occur in good micro crystals. Of these, the most interesting are wurtzite and harmotome.

In 1959, Paul Desautels described the wurtzite from Thomaston as the best he had seen from the United States. At that time, he ran X-ray studies on material such as that shown in Figure 1, and obtained patterns for wurtzite and sphalerite for different crystals. In 1972, using a Gandolfi camera, Pete Dunn was not able to find wurtzite, and got only sphalerite patterns from a number of crystals. Since, on cooling, wurtzite is known to invert to the lower temperature polymorph of zinc sulfide, sphalerite, and since this occurs without any change in outward appearance, it seems that the material from Thomaston should be called wurtzite with the qualification that all or most of it is a pseudomorph of sphalerite after wurtzite.

The wurtzite varies in color from a dark red-brown to almost black, and the luster varies from brilliant to dull. The biggest crystals are perhaps 5 to 7 mm in length, although most are 1 to 2 mm long. Occurring singly and in groups, they often resemble Chinese pagodas, increasing and decreasing markedly in width. None really shows the hemimorphic symmetry for which wurtzite is noted.

The most remarkable wurtzite I have collected, one of a very few of its type, is shown in Figure 2. A sketch is used rather than a photograph since, during preparation for mounting, the group suffered an accident resulting in one of its three legs being severely shortened. Further, it is not possible to show the striations on all three legs at the same time in a photograph. The specimen is composed of three oriented wurtzite crystals growing from three of the tetrahedron faces of a sphalerite. The

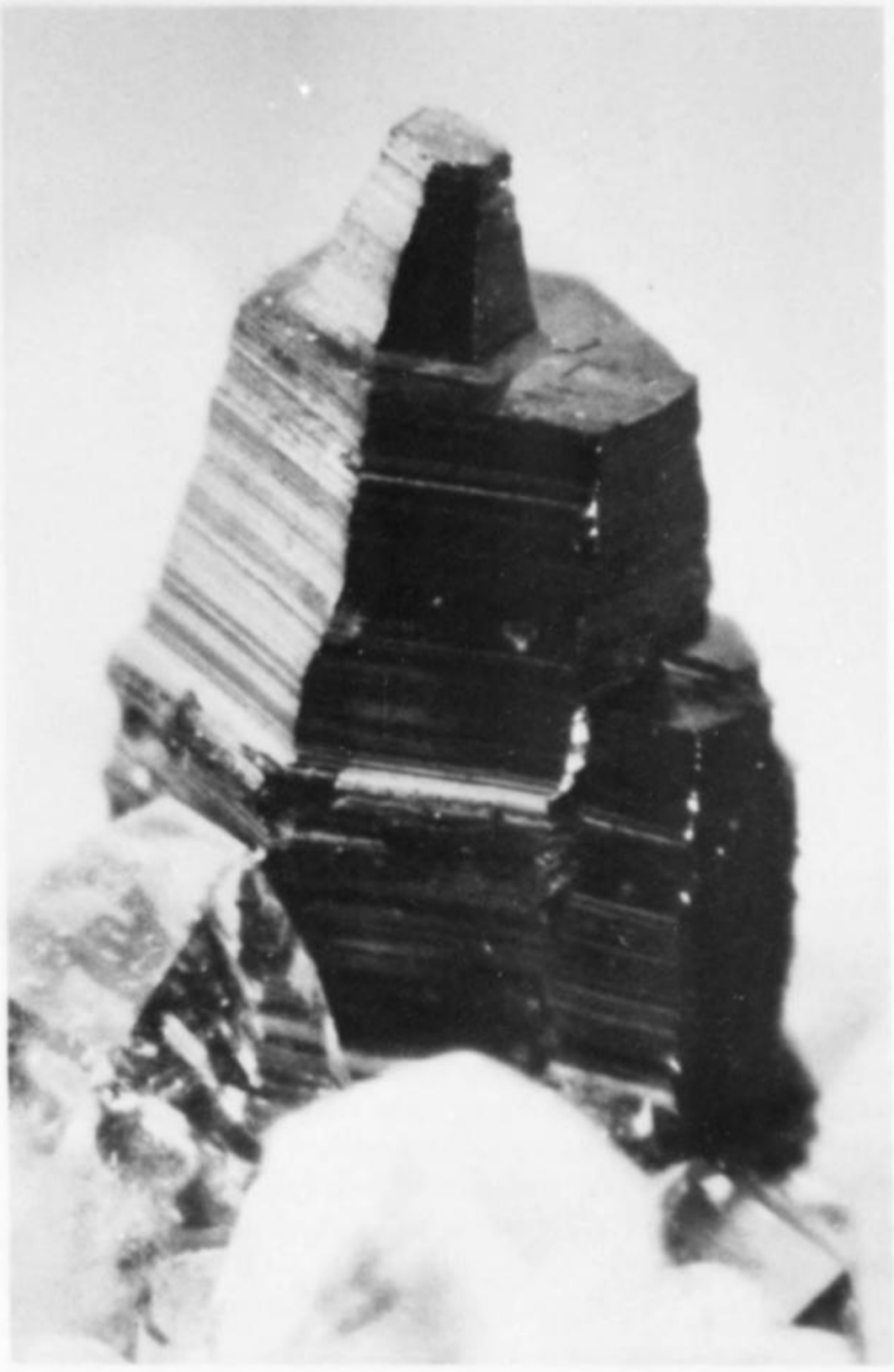


Figure 1. **Dark brown wurtzite crystals in parallel growth on quartz. The large crystal is 3 mm long. (All specimens shown here are from Thomaston Dam.)**

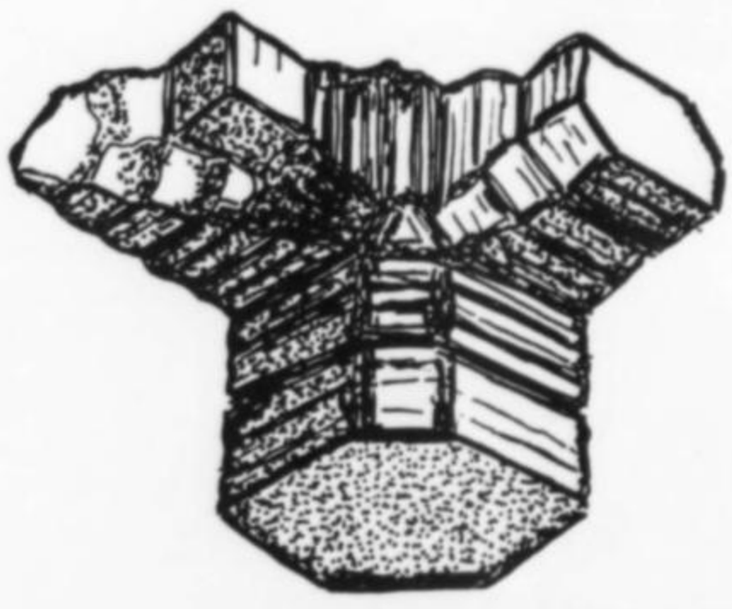


Figure 2. **Epitaxial growth of three wurtzite crystals on the (positive) tetrahedron faces of sphalerite. The view is down the three-fold axis of sphalerite, with a small (negative) tetrahedron face visible in center. Size of group, 4 mm.**

sketch is drawn looking down a three-fold axis of the sphalerite crystal, and a very small face of the negative tetrahedron (assuming the wurtzites are growing from faces of the positive tetrahedron) can be seen in the center. The oriented, epitaxial nature of the group is confirmed by the parallel nature of the twinning striations from one wurtzite crystal to

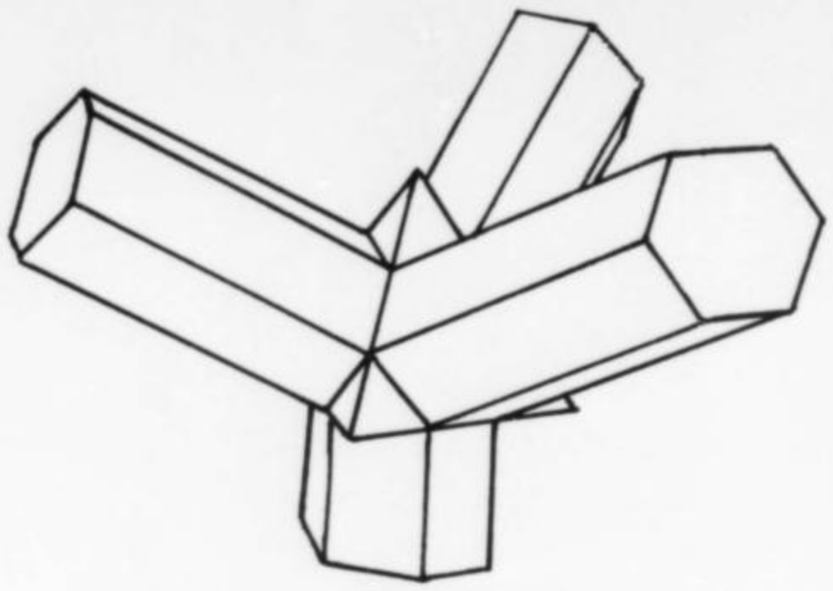


Figure 3. **Epitaxial growth of wurtzite on sphalerite as shown by Mitchell and Corey, showing the relationship between the three-fold axis of sphalerite and the six-fold axis of wurtzite.**

the next. Such epitaxial polymorphs of zinc sulfide were accidentally synthesized by R. S. Mitchell and A. S. Corey (*American Mineralogist,* **39**, 773 [1954]), who obtained wurtzite-sphalerite groups like that shown in Figure 3. They hypothesized that during a synthesis of wurtzite, a momentary temperature drop allowed the formation of sphalerite caps, and a return to higher temperatures caused wurtzite to reform. Interestingly, they were unable to repeat the preparation of such material despite several attempts. As explained in greater detail by Mitchell and Corey, the formation of such epitaxial growths is not surprising since the {111} tetrahedron face of sphalerite is identical in the spacing of the zinc and sulfur atoms to the {0001} pinacoid of wurtzite. This is the first time I have seen such epitaxial polymorphs in nature.

The wurtzite at Thomaston is usually found on quartz, but sometimes on harmotome or sphalerite. Other associates are heulandite, pyrite, galena and fluorite. The sphalerite, too, is interesting in that it often forms rotation or contact twins such as that in Figure 4. Occasionally,

Figure 4. **A very dark brown rotation twin of sphalerite on quartz; size of crystal, 2 mm.**

multiple contact twins are formed, like the wurtzite pagodas but with larger steps. A few wurtzites with their very thin steps are capped by single, large crystals of sphalerite.

Other sulfides and their alteration products are also found at Thomaston. Pyrite occurs in brilliant cuboctahedrons, commonly much elongated. Occasionally, a single elongated crystal will make one or more right-angle bends along its length. A few pyrites show a roughly cubic shape with a few pyritohedral striations, but with a markedly concave appearance like that of hopper halite crystals.

Galena is found in brilliant cubes with minor octahedron faces. Other lead minerals at Thomaston include pyromorphite and wulfenite. These two minerals are not as rare east of the Mississippi as many people think. The pyromorphite is in radiating, deep green prisms, while the associated wulfenite is also elongated in form and a pale orange in color.

Calcite and fluorite from Thomaston are quite variable. The calcite is found in equant to acicular crystals, and occurs in at least seven distinct habits. The most complex of these is shown in Figure 5. Here, a flattened crystal bounded by the hexagonal prism is shown, looking down the *c* axis. The termination is made up of several shallow rhombo-

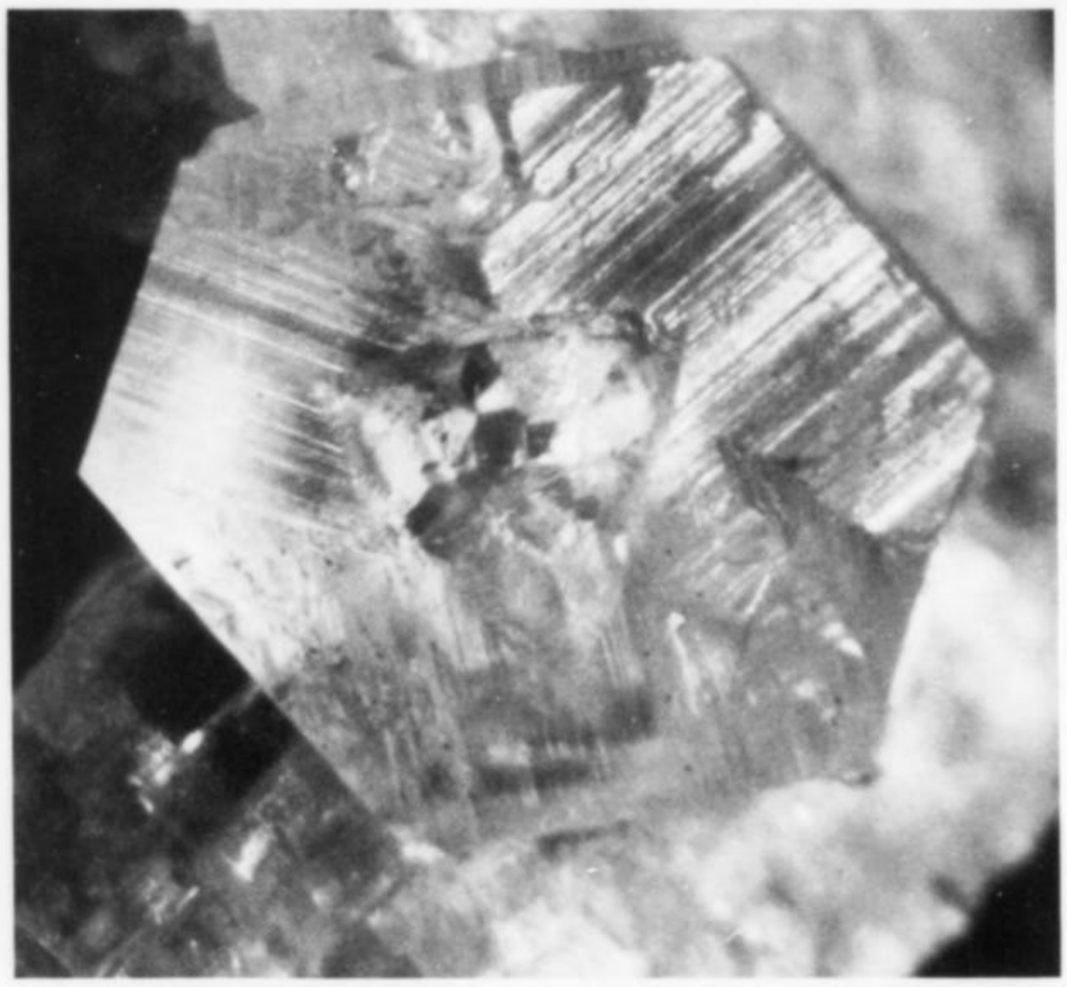


Figure 5. **A colorless calcite crystal, viewed down the *c* axis and showing several shallow rhombohedrons in oscillatory growth; crystal size, 2.5 mm across.**

hedrons in oscillatory growth to give the crystal its heavily striated appearance.

Although several habits of fluorite can be found, the most common is that shown in Figure 6. The subparallel cubes are modified by the dodecahedron (brilliant highlights) and the less common tetrahexahedron (lesser highlights). While this is a small group, far larger aggregates with dimensions of 10 to 20 cm were found. These groups have bulk cleavages and crude outer surfaces roughly paralleling one or more faces of an octahedron, but are made up of hundreds of light green to blue fluorite cubes like those in Figure 6.

The zeolite group and its associates are surprisingly well represented. Of its members, harmotome is the most interesting. For a long time, and despite rumors to the contrary, I had taken this mineral to be the much more common phillipsite. However, microprobe analysis shows the Ba:Si ratio to be 1.2:6, and the amounts of K, Na and Ca to be low. This data fits harmotome perfectly, and is not consistent with either phillipsite or wellsite.

Perhaps half the harmotome crystals are twinned in the typical cross shape form shown in Figure 7. The rest, while twinned, are simpler and not cruciform in shape. A few are heavily corroded or even skeletal.

Figure 6. **Pale blue, slightly zoned fluorite crystals in parallel growth, showing major cube plus dodecahedron (brilliant highlights) and tetrahexahedron (lesser highlights). The size of the group is 5 mm.**

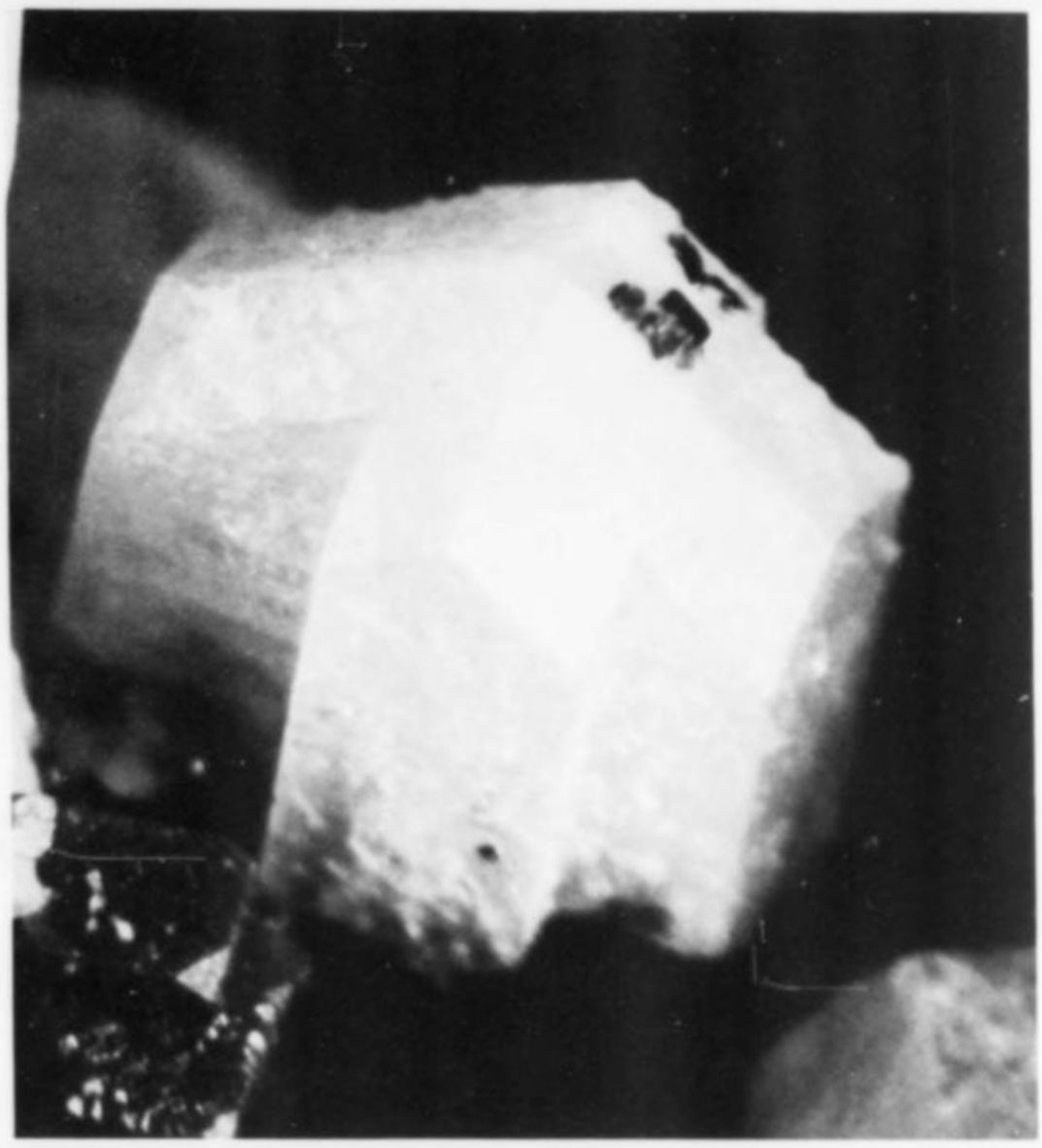


Figure 7. **A twinned crystal of harmotome with pyrite on quartz. Size of harmotome crystal, 4 mm.**

The harmotome appears to be contemporaneous with pyrite and fluorite, and occurrs on quartz.

Other zeolites and associates I have found in good micro crystals at Thomaston include heulandite, chabazite, stilbite and apophyllite. The stilbites occur in two-dimensional fans of flat-topped crystals, remarkably like epistilbite in form. They also are similar to brewsterite which, like harmotome, is a barium-containing zeolite. Since doubts creep in when writing a column like this, I checked the stilbite optically. The indices and sign of elongation rule out epistilbite or brewsterite.

Thomaston Dam thus turned out to be remakrably productive as a micro locality. In fact, it still is. On a recent visit, it was possible with some work to collect all the species I have described and several more. Permission to collect can be obtained at the Army Engineers office at the dam, and the railroad cut is but a short walk from the parking area. For those who like to collect their own, happy hunting!

In closing, I want to thank Vi Anderson for allowing me the use of her column and for taking the photographs in Figures 1, 5 and 7. I thank Norman Colthup for the sketches in Figures 2 and 3.

Bill Henderson
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Stamford, Connecticut 06903

THE HISTORICAL RECORD

by

Ron Bentley
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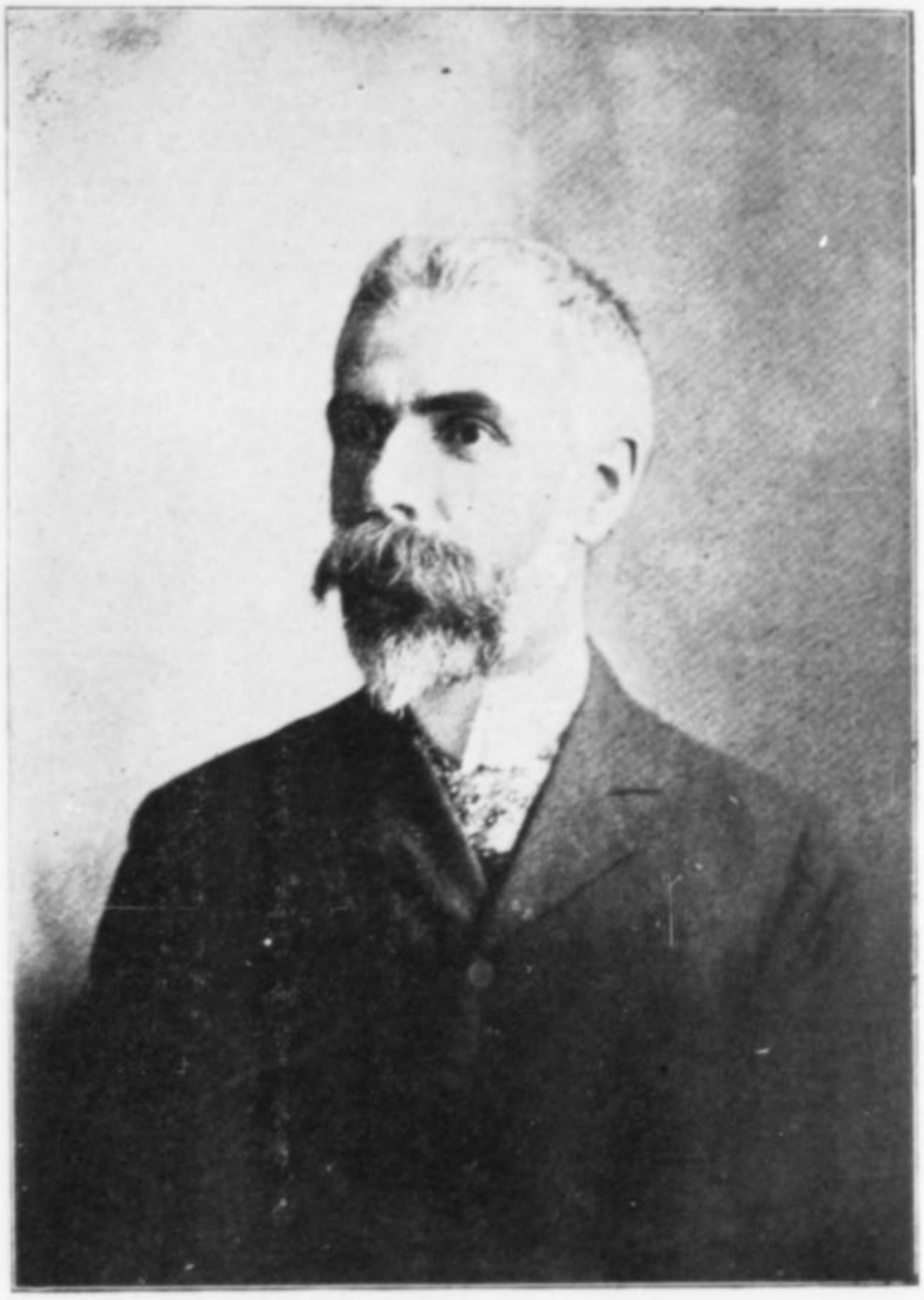
When I first began this column, I made some "campaign promises" as to topics that would be covered. One of those promises was to cover the history of early mineralogists and dealers. So let the record show that this promise is kept with a biography of a most noted mineralogist *and* dealer, George Letchworth English.

For the following information I am indebted to two earlier biographies. *George Letchworth English*, by A. C. Bates (*Mineral Collector*, vol. 12, no. 3, May 1905); and *Memorial of George Letchworth English*, by Robert C. Vance (*American Mineralogist*, vol. 30, nos. 3 and 4, March–April 1945).

George Letchworth English was born June 14, 1864, in Philadelphia. He attended the Friends Central School, graduating in 1881. It was later, between 1881 and 1887, when he was working for a Philadelphia insurance company, that his interest in minerals came to light. His interest became so intense that he left a career in insurance to go into partnership with a Mr. Edwin C. Atkinson and opened up a mineral store at 1512 Chesnut Street, Philadelphia. Because he had collected actively prior to the opening, the new shop had for sale a wonderful assortment of Arizona wulfenite, vanadinite, azurite and malachite, plus some of the finest Franklin fowlerite seen to date. These specimens instantly commanded the attention of collectors and museum people, bringing wide recognition to the new dealership.

Extensive collecting trips in 1887, '88, and '89 to Europe, Canada, northern New York and the West brought forth many, many fine specimens. In late 1891 his extended trip to Greece, Italy (Sicily), Switzerland and other countries resulted in his amassing perhaps the finest collection of European minerals ever seen up to that time. Among the rare lead chlorides which he recovered from Laurium, he discovered a new species, penfieldite. Other specimens he acquired (in addition to the famed collection of the Swiss dealer, Hoseus) included Sicilian sulfur, hauerite, Ala essonite, and quartz crystals in Carrara marble. In the West, English was rewarded with splendid Colorado rhodochrosite, phenakite and bertrandite, rare Utah copper arsenates, New Mexican descloizite, and copper pseudomorphs after azurite. From Mexico came topaz, hyalite opals, rose grossular, and aguilarite. And from the East, the beautiful Tilly Foster chondrodite, brucite and titanite. It was during this time that he sold the famed Kunz collection to Thomas A. Edison, and the Spang collection to the American Museum of Natural History.

In April, 1890, the business was removed to New York City and Mr. William Niven was admitted to the firm of Geo. English and Co. Niven made several trips to Arizona, New Mexico and elsewhere but his association did not prove successful and in December, 1892, George English purchased the interests of both of his partners, continuing the business personally until its sale to Ward's Natural Science Establishment in 1905.



GEORGE LETCHWORTH ENGLISH

Figure 1. **From *The Mineral Collector*, 1905.**

In 1893 he arranged for the World's Columbian Exposition in Chicago. It consisted of a $5000 collection of rough and cut gems, and also a systematic collection of over 650 mineral species filling *thirty-three* large *open* showcases and valued at $15,000. His magnificent display earned him numerous medals and awards.

Up to the time of the sale of his business to Ward's, English continued to make collecting trips throughout the United States and many foreign countries. Between 1903 and 1913, he was retained by the National Light and Thorium Corporation to locate monazite deposits in North and South Carolina. In 1913, he became manager of the mineral department of Ward's and from 1922 until his retirement in 1934 he served as their consulting mineralogist. Some of the collections he obtained during this period are outlined below.

1917—purchase of the 6000-specimen collection of Mrs. Leontine A. Lowe

1918—made arrangements for the owners of the Virgin Valley, Nevada, opal mines to place on the market hundreds of specimens of beautiful opal

1919—secured the 2000-specimen collection of Michael Bradley

1920—purchased the 2500-specimen collection of R. W. Forbes, as well as those of John Graves, England; Otto Vautier, Geneva; K. Broadbent, Broken Hill, Australia

1922—purchased collection of Dr. Robert Herzenberg, Hamburg, Germany; and the G. M. Swindell collection of Bisbee minerals, in addition to importing beautiful Grootfontein descloizite.

1924–25—acquired specimens of beautiful wire silver from Kongsberg as well as specimens from the collections of John Ruskin, Baroness

A CORNER IN MESSRS GEO. L. ENGLISH & CO'S NEW STORE

Figure 2. **From *The Mineral Collector*, 1899.**

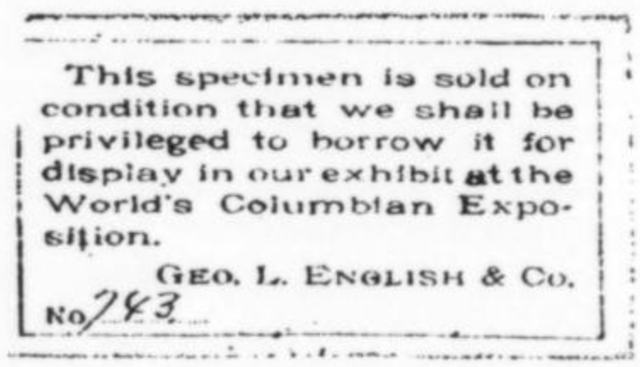


Figure 3. **Exposition label, very scarce.**

Burdett-Coutts, J. H. and Henry F. Collins, Philip Rashleigh and the new Belgian Congo (Katanga Dist.) uranium minerals.

1926—purchased the C. R. Whin collection of Butte, Montana, and the Rochester Collection of Meteorites.

1927—visited Europe, South Africa, Rhodesia, Australia, Tasmania, New Zealand, California, Arizona; in all returning with minerals valued at over $100,000

1933—introduced to museums and collectors the NiCo lamp for producing fluorescence in minerals.

1934—retired to work on his manuscript for a book published later, entitled *Getting Acquainted with Minerals*.

English's contributions and achievements are seemingly endless. He was a lecturer *par excellence*; an associate editor and author of the mineralogy section for the 1904 edition of the *Encyclopedia Americana*; member of the New York Mineralogical Club; Philadelphia Academy of Science; Rocks and Minerals Association; Mineralogical Society of Great Britain and Ireland; Fellow of the American Mineralogical Association—and its vice president in 1927; a life member of the Rochester Academy of Science, and its president from 1919 to 1921.

He first recognized the new minerals penfieldite, graftonite, pyroxmangite and skemmatite, referring them to investigators for detailed descriptions, and was in turn honored by having a rare hydrous phosphate of calcium, potassium, and aluminum from Fairfield, Utah, (englishite) named after him.

It's interesting to note that in 1939 he wrote a book called *Descriptive List of the New Minerals, 1892–1938* which was very similar to our *Glossary of Mineral Species* in giving brief summaries of nearly 2000 minerals.

It was with much heartfelt grief that the friends, business associates and fellow collectors learned of George English's death at his winter

Dana 267. Pyrrhaurite.
Langbanshyttan, Sweden.
GEORGE L. ENGLISH & CO., Mineralogists,
201 East 16th Street, - - - - New York City.

No. Dana. 716. Dolomite 717
Guanajuato, Mexico.
GEO. L. ENGLISH & CO., {1512 Chestnut St., Phila. 739 & 741 Broadway, N.Y.

No. Dana 1892 Ed.,.....; 1868 Ed., 723.
263? SMITHSONITE.
Laurium, - - - Greece.
GEO. L. ENGLISH & CO.
733 and 735 Broadway, New York.

Dana 426.
Tourmaline (Black).
Rhombohedral. $4H_2O.Na_2O.4FeO.3B_2O_3.$ $7Al_2O_3.2SiO_2.$
1601 Tourmaline CONNECTICUT.
GEORGE L. ENGLISH & CO.,
3 and 5 West 18th Street, - - - - New York.

Dana 2392. Franklinite C-1602
Ogdensburgh New Jersey.
Collection of GEORGE L. ENGLISH,
SHELBY, - - - - - North Carolina.

Dana. Epidote, ?
Colorado.
1879.
GEO. L. ENGLISH & CO., 64 East 12th Street, N. Y.

Figure 4. **Various labels and addresses. Addresses on the following labels represent the years indicated: Address on the pyroaurite label, February 1903–January 1905. Dolomite; July 1888–July 1891. Smithsonite; June 1891–January 1892. Tourmaline; March 1901–January 1903. Franklinite; February 1905–April 1914. Epidote; February 1893–January 1899. Quartz; January 1899–February 1901. Fluorite; July 1888.**

***Figure 5.* One of the English ads in *Mineralogists' Monthly*, January 1892.**

home, on January 2, 1944. Robert Vance summarized the person of George English very well in his memorial:

"Mr. English was an enthusiastic collector of unusual skill and ability. He will be remembered as a cultured gentleman, zealous in his efforts to conserve for the scientist minerals that represent the treasures of the earth. A master of his chosen science, he took great delight in conveying to others his love for minerals. The hospitality of his home was known to men in all walks of life including many distinguished scientists. For here he found great delight in exhibiting his remarkable large collection of mineral micromounts. Such a visit inspired many to collect and study minerals, but his great enjoyment was to see a particularly fine mineral specimen that he had procured find its place in a permanent collection."

Until next time, remember, save our history, preserve your labels.

Dana 210. 3472
QUARTZ (Twin.)
Rhombohedral. SiO_2.
810.—DISTRICT OF MIYAMOTO MURA,
PROVINCE OF KAI, JAPAN.
GEORGE L. ENGLISH & CO.,
812 & 814 Greenwich Street, - - - New York.

No. DANA 159. 2501
SPECIES Fluorite.
LOCALITY Weardale,
15 Cumberland, England.
G. L. English & Co. 1512 Chestnut St. Phila.

Abstracts of New Mineral Descriptions

by Wendell E. Wilson

We continue here to present abstracts of the descriptions of new mineral species recently published, which have not previously been included in Fleischer's *Glossary of Mineral Species 1975* or subsequent updates thereto (*Mineralogical Record*, **7**, 91–95; **8**, 398–399; **9**, 371–374).

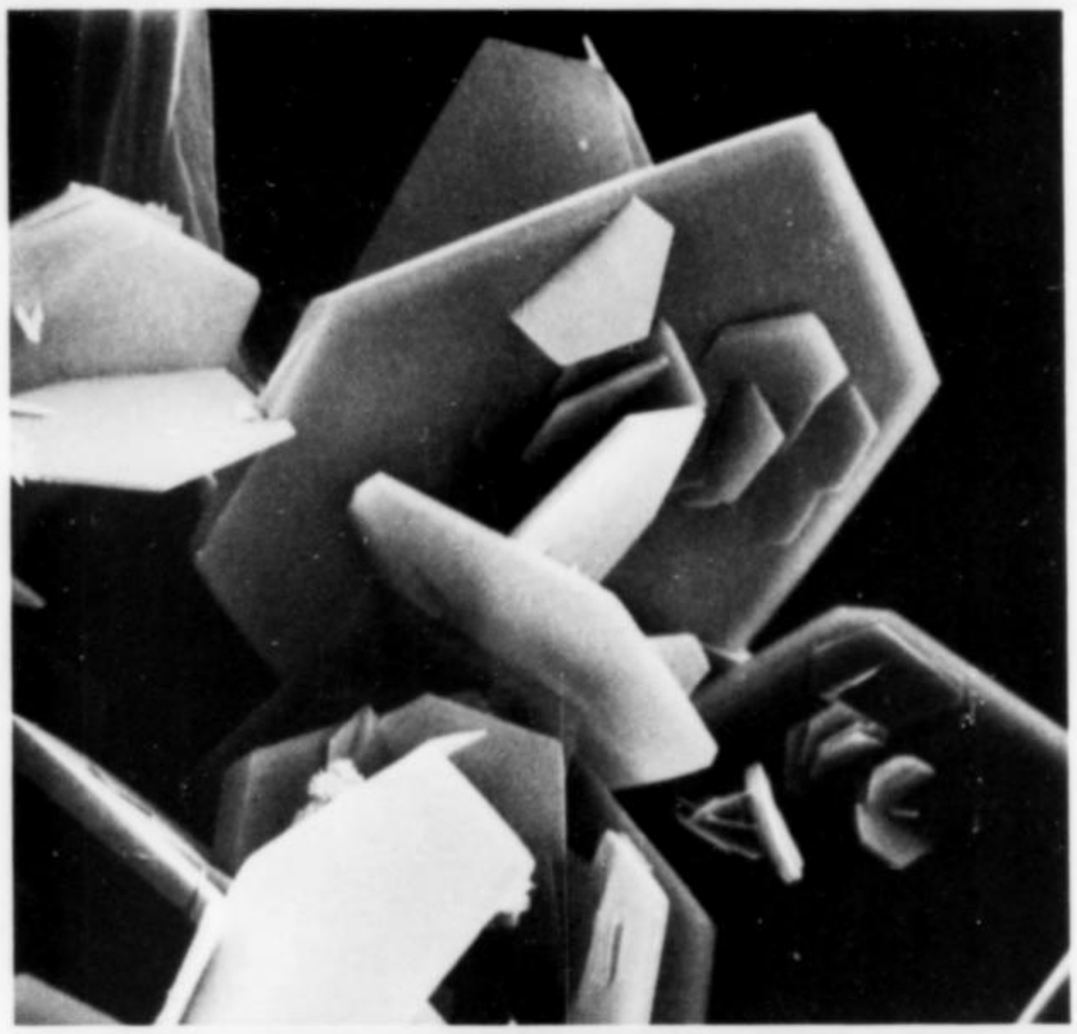


Figure 1. **Desautelsite (840X SEM).**

Desautelsite

$Mg_6Mn^{3+}_6(CO_3)(OH)_{16}\cdot 4H_2O$ Hexagonal

From the Cedar Hill quarry, Lancaster County, Pennsylvania, from the Coalinga asbestos mine, San Benito County, California, from the Herman Akers claim, San Benito County, California, and from an undisclosed locality in Japan; bright orange; Mohs hardness of 2; perfect cleavage on {0001}; transparent; light orange streak; density (calc.) is 2.10, density (meas.) is 2.13 g/cm^3; no fluorescence observed; crystal size rarely exceeds 0.2 mm; forms simple hexagonal plates tabular on [0001]; the only forms observed are {0001} and {10$\bar{1}$0}; occurs in altered serpentines imbedded in colorless brucite and as euhedra in vugs with artinite and talc; desautelsite is the trivalent Mn analog of pyroaurite; it is similar in appearance to coalingite and pyroaurite, but in hand specimens most resembles a thin smear of dried mustard; dissolves with effervescence in HCl; named in honor of Paul E. Desautels, Curator of Gems and Minerals at the National Museum of Natural History (Smithsonian Institution).

DUNN, P. J., PEACOR, D. R., and PALMER, T. D. (1979) Desautelsite, a new mineral of the pyroaurite group. *American Mineralogist*, **64**, 127–130.

Whiteite

$Ca(Fe,Mn)^{2+}Mg_2Al_2(OH)_2(H_2O)_8[PO_4]_4$ Monoclinic

From the Ilha de Taquaral (Lavra da Ilha), Minas Gerais, Brazil (type locality), and also from the Blow River area, Yukon Territory, Canada; pale tan in color (type material), and also chocolate-brown (Ca-poor variant); Mohs hardness 3 to 4; good to perfect cleavage on {001}; specific gravity (tan material) is 2.58, (brown material) 2.69; crystals to 5 mm (tan) and to 1.5 cm (brown); flattened on {001}, warped, canoe-shaped to almond-shaped; forms include $c\{001\}$ and $n\{\bar{1}11\}$; twinning by reflection on {001} (pseudo-orthorhombic); occurs in a moderate temperature hydrothermal vein and pegmatite; associations include childrenite, eosphorite, wardite, rose quartz, albite; whiteite is the Al^{3+} analog of jahnsite ($Al^{3+} > Fe^{3+}$); named in honor of John S. White, Jr., associate curator of minerals at the National Museum of Natural History (Smithsonian Institution), and publisher and former editor of the *Mineralogical Record*, "His liaison between amateur and professional communities has provided many examples of fine specimens for research that otherwise would have passed unnoticed and he has played a major role in the renaissance of mineralogy as an amateur as well as a professional pursuit."

MOORE, P. B., and ITO, J. (1978) I. Whiteite, a new species, and a proposed nomenclature for the jahnsite-whiteite complex series. *Mineralogical Magazine*, **42**, 309–323.

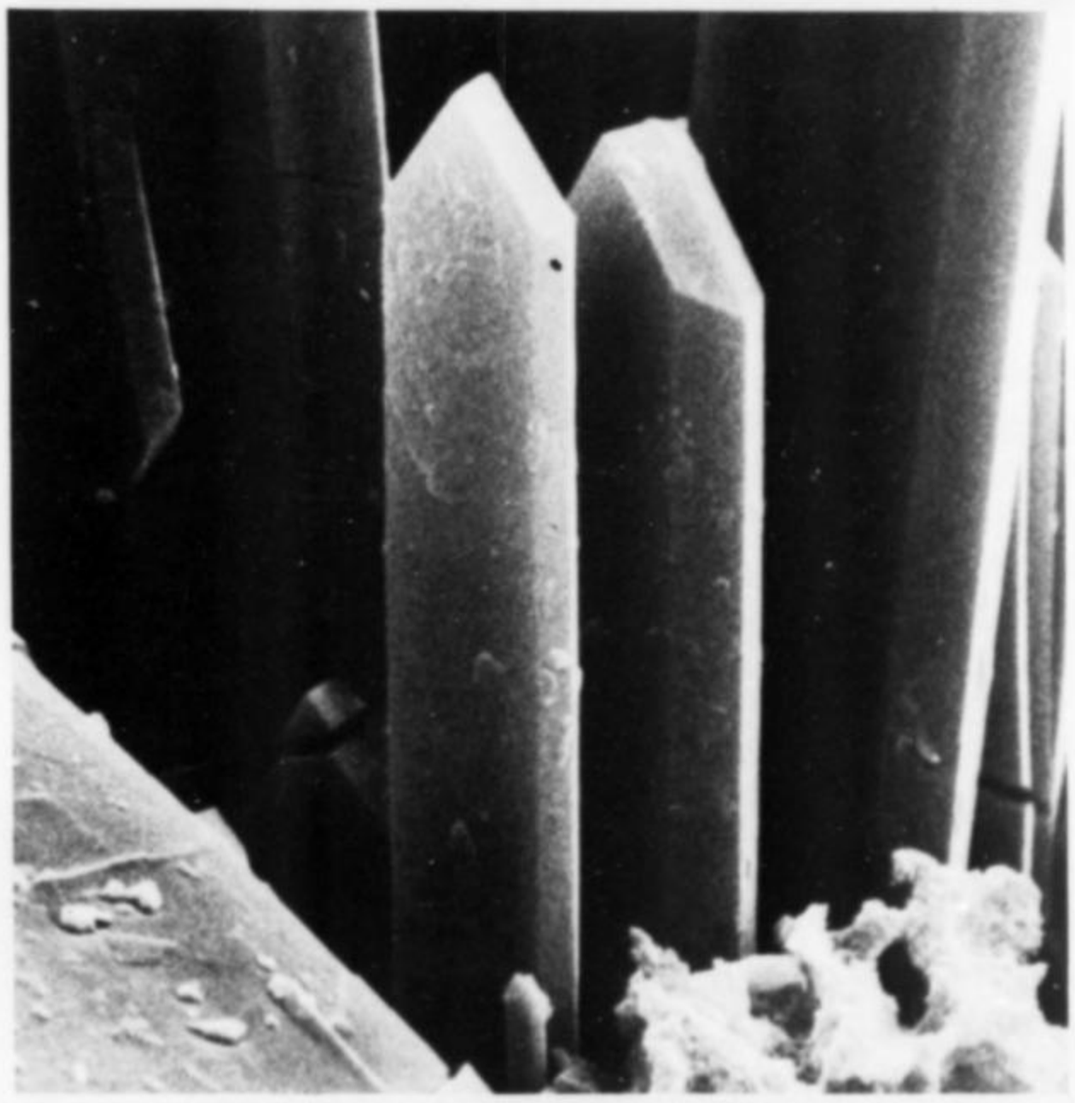


Figure 2. **Mandarinoite (4000X SEM).**

Mandarinoite

$Fe^{3+}_2Se_3O_9\cdot 4H_2O$ Monoclinic

From the Pacajake mine near Hiaco, Colquechaca, Bolivia (type locality), from the Skouriotissa mine, Cyprus, and from the El Plomo mine, Ojojoma district, Tegucigalpa, Honduras; light yellowish green; vitreous to slightly greasy luster; Mohs hardness 2½; no cleavage observed; transparent; very light green streak; density (calc.) is 2.89, density (meas.) is 2.93 g/cm^3; no fluorescence observed; maximum crystal size is 0.5 to 0.7 mm; the crystals are prismatic in habit, elongated on [001], flattened on {100} (from Bolivia and Cyprus), and form 0.2 mm spherules at the Honduras locality; forms include $a\{100\}$, $m\{110\}$, $d\{011\}$, $e\{\bar{1}01\}$; always twinned on (100); occurs in the oxidized zone of an ore vein; associations include native selenium, siderite, penroseite, ahlfeldite, cobaltomenite, chalcomenite, molybdomenite, and quartz at the Bolivian locality, quartz only at the Cyprus locality, and poughite at the Honduras locality; appears to be an alteration product of penroseite; the Honduras material is a tellurian variety of mandarinoite; named "in honor of Dr. Joseph A. Mandarino of the Royal Ontario Museum. His contributions to mineralogy are outstanding; in particular, the insights he has provided into the relationships of the Gladstone-Dale rule are of special merit."

DUNN, P. J., PEACOR, D. R., and STURMAN, B. D. (1978) Mandarinoite, a new ferric-iron selenite from Bolivia. *Canadian Mineralogist*, **16**, 605–609.

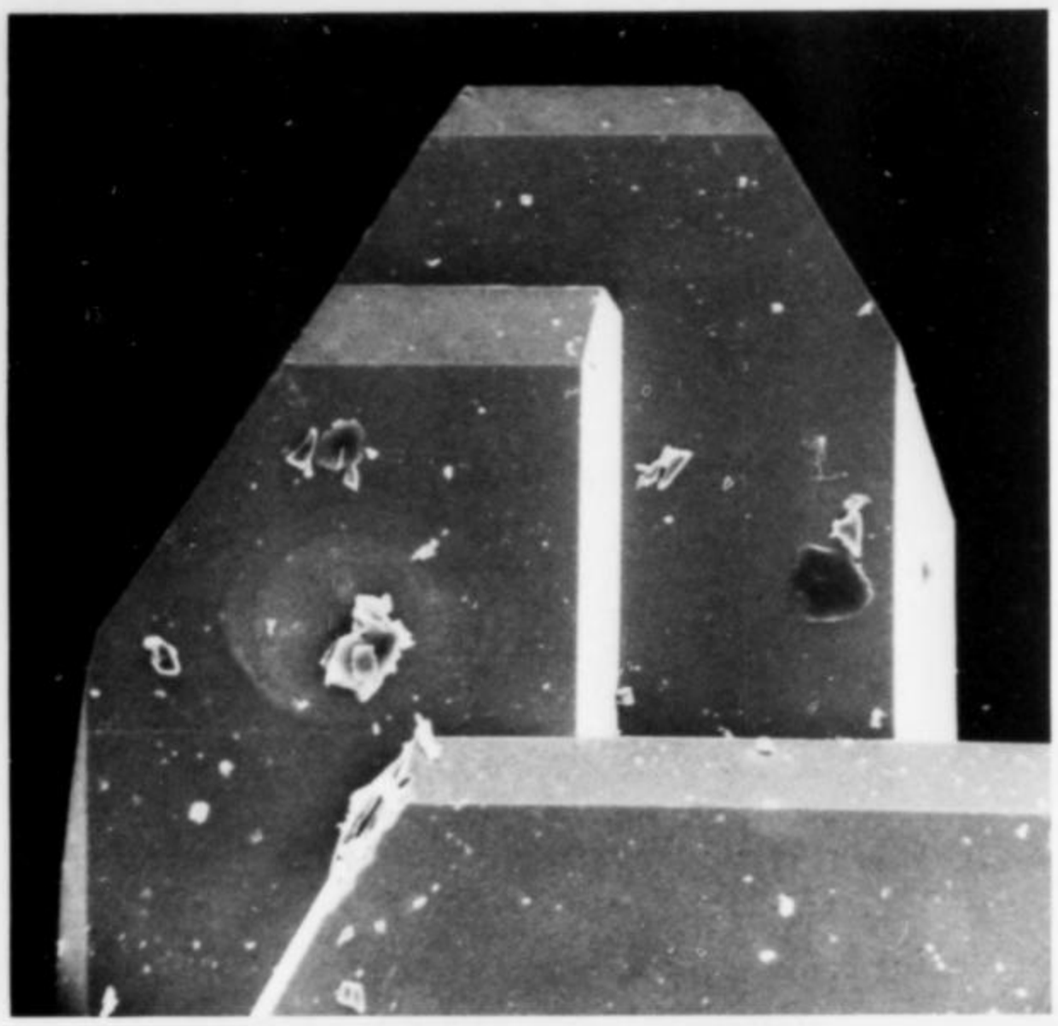


Figure 3. **Paulmooreite (275X SEM).**

Paulmooreite

$Pb_2As_2O_5$ Monoclinic

From Långban, Värmland, Sweden; colorless to light orange; adamantine luster; Mohs hardness 3, very brittle; one perfect cleavage on {001}; colorless streak; density (calc.) is 6.86, density (meas.) is 6.95 g/cm^3; no fluorescence observed; crystals up to 0.5 mm; habit tabular on either {001} or {100}; forms include {100}, {001}, {011}, {102}, {110}, and {111}; occurs on fracture surfaces and in vugs; associated with green andradite, hematite, calcite, magnetite, mimetite; previously known as Flink unknowns #49 and #305; only three specimens known; named in honor of Professor Paul Brian Moore, Department of Geophysical Sciences, University of Chicago.

DUNN, P. J., PEACOR, D. R., and STURMAN, B. D. (1979) Paulmooreite, a new lead arsenite mineral from Långban, Sweden. *American Mineralogist*, **64**, 352–354.

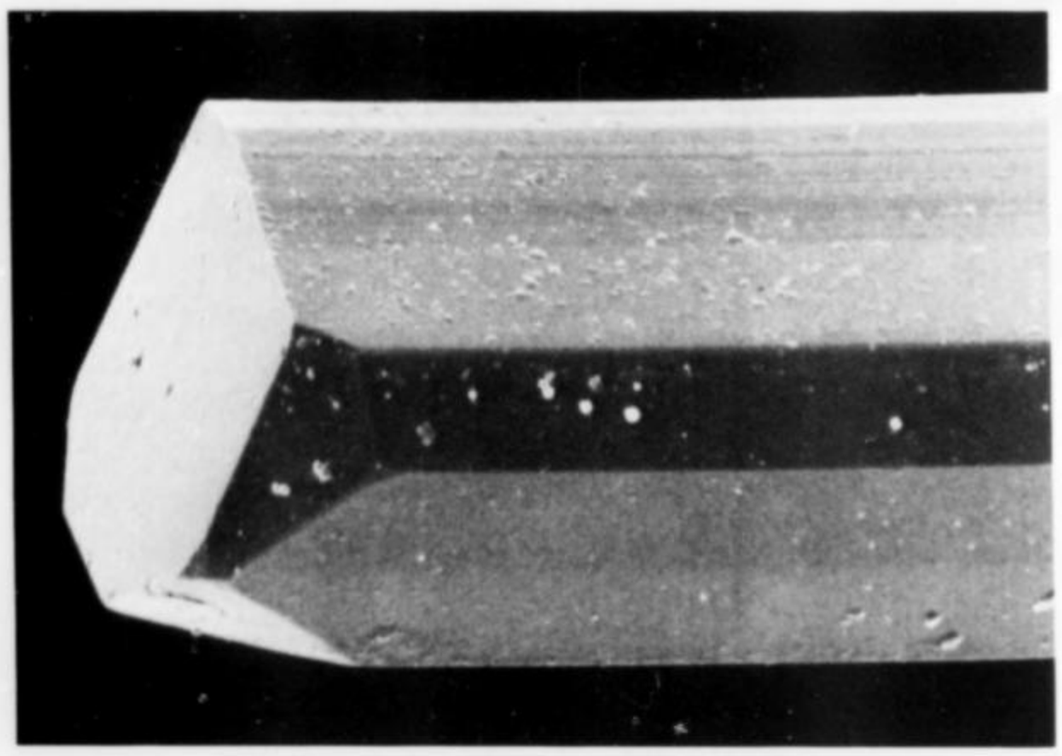


Figure 4. **Prosperite (450X SEM).**

Prosperite

$HCaZn_2(AsO_4)_2(OH)$ Monoclinic

From Tsumeb, Southwest Africa; colorless to white to very faintly blue; brilliant vitreous to silky luster; Mohs hardness 4½; no cleavage observed; streak white; density (calc.) is 4.40, density (meas.) is 4.31 g/cm^3; no fluorescence observed; crystals up to 1 cm in length by 1 mm; occurs as radiating groups of slender crystals elongated on [001]; forms include {100}, {$\bar{1}$01}, {110}, {$\bar{1}$11}, {421}, {540}, {210}, {310}, {301}, {$\bar{1}$12}; no twinning observed; a secondary mineral occurring in cavities in partly altered massive chalcocite; associations include chalcocite, native silver, conichalcite, cuprian austinite, koritnigite, and other as yet undescribed species; prosperite bears no chemical or structural analogy to any other mineral species or synthetic compound; named in honor of Prosper Williams, noted mineral dealer from Toronto, "whose efforts have enriched the Tsumeb collections of many museums, universities and private collectors throughout the world."

GAIT, R. I., STURMAN, B. D., and DUNN, P. J. (1979) Prosperite, $HCaZn_2(AsO_4)_2(OH)$, a new mineral from Tsumeb, South West Africa (Namibia). *Canadian Mineralogist*, **17**, 87–92.

Figure 5. **Marsturite (135X SEM).**

Marsturite

$Mn_3CaNaHSi_5O_{15}$ Triclinic

From Franklin, Sussex County, New Jersey; white to very light pink; frosty luster; Mohs hardness of 6; imperfect cleavage on {100} and {001}; transparent to translucent; density (calc.) is 3.465, density (meas.) is 3.46 g/cm^3; no fluorescence observed; crystals up to 0.5 mm in size; prismatic in habit, elongated on [010], striated on {001} parallel to [100]; forms include {100}, {001}, and {010} (?); associations are rhodonite, manganaxinite, and willemite; known from only one specimen from the Neal Yedlin collection; marsturite is isostructural with nambulite; named in honor of Marion Stuart (Mrs. E. Hadley Stuart) of Bellevue, Idaho, who has given "generous support to the preservation of natural history specimens, most notably in connection with the Maricopa Brea fossil recovery project south of Bakersfield, California, and the La Brea tar-pit fossil recovery program in Los Angeles. In addition she has made substantial contributions to the development of the mineral collections and the new E. Hadley Stuart, Jr. Gem and Mineral Hall of the Los Angeles County Museum of Natural History."

PEACOR, D. R., DUNN, P. J., and STURMAN, B. D. (1978) Marsturite, $Mn_3CaNaHSi_5O_{15}$, a new mineral of the nambulite group from Franklin, New Jersey. *American Mineralogist*, **63**, 1187–1189.

FM friends of mineralogy

by **Peter J. Modreski,** Secretary
Friends of Mineralogy
12113 El Dorado Pl., N.E.
Albuquerque, N.M. 87111

Friends of Mineralogy is an organization dedicated to the furtherance of mineralogical education and research, and to the preservation of specimens and mineral localities. The goals of FM were fully stated in the July-August 1978 issue of the *Mineralogical Record*; we invite you to read them and to consider joining FM if these goals match your own. Here we would like to report on the current activities of the society and of its regional chapters. FM officers elected at the 1979 annual meeting in Tucson for February 1979 through February 1980 are: president, Delbert Oswald (Pittsburgh, Pennsylvania); vice-president, Paul Seel (Bala-Cynwyd, Pennsylvania); treasurer, Arthur Johnstone (Berkley, Michigan); secretary, Peter Modreski (Albuquerque, New Mexico).

The principal national projects of FM currently are the preparation of a register of mineral localities; the study of ways in which mineral localities have been preserved from closure or destruction; and the sponsorship of symposia on mineralogical topics. The Locality Register involves the preparation of a concise listing of the names, locations, and major mineral species found at the more significant mineral localities in the U.S. and, eventually, the rest of the world. The emphasis will be on providing a readily accessible source for accurate information on proper spellings, synonyms and obsolete names of localities, and differentiation between the various mine, district, town, and other geographic names that have been applied to localities. The goal is to publish a small book or booklet, comparable in size to the *Glossary of Mineral Species*, which will be of use to mineral collectors, museum curators, and students of mineralogy. The initial effort will be to cover only localities in the U.S., Canada, and Mexico, and will be limited to approximately a thousand of the most important localities. A preliminary listing has been compiled, and further work is being coordinated by Edward Carper, of the Pennsylvania Chapter, with the help of Delbert Oswald.

Columns about mineral locality preservation appeared in past issues of the *Record* (vol. 7, nos. 3, 4, and 6). The job of surveying the various ways in which localities have been (to one degree or another) preserved appears to be completed, and a summary article for a future FM column is being prepared by Mike Groben, chairman of the committee on locality preservation. FM feels that it will be up to local groups to take the lead in identifying localities where some action is needed and to take that action, but the national organization will be ready to give advice and to help in whatever way possible.

The next joint Friends of Mineralogy-Mineralogical Society of America symposium is tentatively scheduled for February, 1981, in Tucson. The suggested, but not confirmed, topic is "pegmatites."

Four regional chapters of the Friends of Mineralogy presently exist, and about half of the approximately 450 members of FM have chosen to affiliate with one of these chapters. FM members are invited to form new local chapters wherever sufficient interest exists, and the possibility of organizing new chapters in several areas (California, Florida, Texas) has been discussed. The FM secretary can supply information about organizing a regional chapter. The existing chapters, with the names of chapter presidents and persons to contact about membership, are:

Colorado chapter—Jack Murphy, president; Carol Jones, secretary (c/o Denver Museum of Natural History, Geology Department, City Park, Denver, CO 80205); total annual dues **$**10.

Pacific Northwest chapter—Robert J. Smith, president; Sharleen Harvey, secretary (Rt. 4, Box 204B, Hillsboro, OR 97123); total annual dues **$**6.

Pennsylvania chapter—Bryon Brookmeyer, president (Box #19, Blue Ball, PA 17506); total annual dues **$**5.

Southeastern Michigan chapter—Gordon Herron, president; Kathleen Alcorn, membership chairman; (1691 Oak St., Birmingham, MI 48009); total annual dues **$**7, plus **$**5 initiation fee.

The annual dues listed above include the FM national dues of **$**5, of which the local chapter retains a portion for its own activities.

The FM local chapters have been extremely active. The Colorado chapter is working on sponsorship of a 1958–1978 sequel to U.S.G.S. Bulletin 1114, *Minerals of Colorado—a 100 Year Record* by E. B. Eckel, and also on material for a second Colorado issue for the *Mineralogical Record*. The Pennsylvania chapter last year published *The Mineralogy of Pennsylvania 1966–1975* by Robert C. Smith, II, as its Special Publication No. 1. A fall symposium on sulfides was held on November 3–5, 1978, at West Chester State College, and a spring conference ("A Farewell to Cornwall") was held April 21–22, 1979, (jointly with the Mineralogical Society of Pennsylvania) at Cornwall, Pennsylvania. The Michigan chapter was involved in planning for an FM-MSA symposium which was to have been held in conjunction with the 1978 Detroit Show but which had to be cancelled because of an insufficient number of registrants (perhaps another year?). The chapter has otherwise been involved in studying Michigan mineral occurrences, preparing a display for the 1979 Detroit Show, and investigating the possibility of obtaining field trip permits at some "off limits" quarries. The Pacific Northwest chapter held a successful symposium on quartz, September 30–October 1, 1978, in Tualatin, Oregon. Some forthcoming events:

September 14, 1979—Symposium on Colorado Minerals (sponsored by Colorado FM chapter) in conjunction with the Denver Area Mineral Show.

September 28–30—Fifth Annual Northwest Mineral Symposium (sponsored by Pacific Northwest FM chapter), "Sulfides and Sulfosalts," Holiday Inn, Bellevue, Washington.

September 29–30—New Mexico Minerals Symposium (cosponsored by Albuquerque Gem and Mineral Club, University of New Mexico, and local FM members), Albuquerque, New Mexico.

November 2–4—Pennsylvania chapter 7th Symposium, West Chester State College, "A Symposium for all collectors—neophyte as well as professional."

Additional items: a newsletter, more-or-less quarterly, is now being sent to all FM members by the secretary. Carl Francis, of the Harvard University Museum, has been appointed the liaison between FM and the Mineralogical Society of America. If you wish to join the Friends of Mineralogy an application may be obtained from the treasurer, Arthur Johnstone, 996 Larkmoor Blvd., Berkley, Michigan 48072.

Letters

FAN MAIL

Dear sir,

Many sincere thanks for your considerate thoughtfulness in helping me obtain copies of the September–October (1978), November–December (1977) and May–June (1978) issues of the *Mineralogical Record*. Your kind attention to my order and your efficient endeavors to satisfy me are very highly appreciated. All three issues are unusually beautiful and all of them contain papers which find my keen interest, are extremely instructive and beautifully illustrated.

Edward Gübelin
Meggen Lu, Switzerland

Dear sir,

I used to think that reading your magazine required excessive education, but now I see that it just requires some experience. After the passage of a few months in which I buckled down to learn more about the hobby, I found out the mineral world was populated by more than fluorite and calcite. It just took a while to recognize the importance and allure or the rarer minerals. Keep up the good work, for you have one more ardent supporter.

I also wish to congratulate you on the articles themselves, and how they related to actual specimens. Though I don't have a large collection by any means, there is a thrill in acquiring a type of specimen that has been written up in your magazine. I have an old issue about the 79 mine, and have just received a shipment of 79 mine specimens from David Shannon. It is exciting to be able to learn so much about the petrology, mineralogy and history of the material, rather than just looking at the specimen and saying, "boy, this is sharp." Ditto for phenakite from Wausau, Wisconsin, and garnet from the Jeffrey mine, Quebec; in fact, the garnet and your magazine arrived on the same day!

I recently acquired an old specimen of dioptase; the crystal itself is good but I have a question about the locality. The label says it is from Altyn-Tube, Siberia, USSR; exactly where is Altyn-Tube? I've rummaged through more books than I can count trying to locate it.

William Frechette
Greenfield, Wisconsin

The locality of Altyn-Tube (given as "Altyn-Tübe, Kirghese Steppes," in the 6th edition of Dana's ***System of Mineralogy****) is unquestioned as a legitimate locality for dioptase. The locality is represented by numerous specimens in the Smithsonian collection. However, the Record's standard reference atlas,* ***The Times Atlas of the World****, and all of the atlases and gazzeteers in the Smithsonian's Mineral Sciences Department fail to show this locality. According to the Times atlas,* ***tyube*** *means* ***hill****; it is possible that the locality is not a town but a minor geomorphological feature of some type. Our call to the Russian Embassy in Washington for assistance was of no avail. Can any readers shed more light on this locality? Ed.*

BLUE BELL MINE

Dear sir,

Having recently visited some of the sites described in the California Issue (vol. 8, no. 6), I find the descriptions excellent. Upon our arrival at the Blue Bell mine, however, a lack in J. A. Crowley's fine article on that locality became apparent. The mine is in private hands (and has been since before the turn of the century), and is intermittently being worked. We were very hospitably received, and I promised to write to the *Record* asking that when a mine is privately owned, it be mentioned in the article describing it. The owner of the Blue Bell mine, Mr. S. C. Mohony of Inglewood, has never refused a written (or, to my understanding, a verbal) request for permission to collect at the site, but it is reasonable to expect collectors to obtain prior permission to collect at his mine.

J. F. Leising
Half Moon Bay, California

MINERAL MUNDANES

Dear sir,

regarding your request for suggestions as to a term for people who do not, as yet, collect minerals (vol. 9, p. 338), how about *Mincompoops*?

John T. Bent
Rochester, New York

Dear sir,

". . . people who are as yet insufficiently enlightened to be mineral collectors"? *Amorphons*.

G. Robert Ganis
Harrisburg, Pennsylvania

Dear sir,

How about *Lithophobes ("rock fearers")?*

Crandall Smith
Los Angeles, California

Dear sir,

Perhaps we could call them *Antihedrons* (people hostile to crystal forms)?

Charles A. Johnson
New York, New York

TILASITE

Dear sir,

I was interested to read the article by Parker on Tilasite from the Sterling Hill mine, New Jersey (vol. 9, p. 385). Actually this mineral has also been found at two localities in Switzerland (see *Schweizer Strahler*, vol. 4, no. 4, 1976). These locations are Falotta Grisons in colorless to white transparent rods to 2 cm in length, and Binntal where it occurs in the Cherbadung area as pale rose crystals under 1 mm in size. I myself have a cafarsite crystal from Cherbadung found by Giovanni Gaspari, which has two tilasite crystals on it showing the same form and approximate size as those illustrated from Franklin, but of a pale rose color.

F. V. G. Bird
Cabris, France

SETTING THE *RECORD* STRAIGHT

Dear sir,

Richard Kosnar and Hilde Sklar have informed us that the brown "fourlings" described in our paper on hydroxyl-herderite (vol. 10, p. 5–11) are not from the Golconda mine as Smithsonian labels had indicated. According to Kosnar they are from Marilac, about 50 km north of Governador Valadares, Minas Gerais, Brazil. Our thanks to them for setting the record straight.

Pete J. Dunn
Washington, DC

Dear sir,

We should have written previously with a request to set the record straight following the article by Dr. Arthur Roe in the May–June 1978 issue on the Carl Bosch mineral collection. A number of organizations were listed as having contributed funds toward the down payment to allow the Smithsonian to purchase the Bosch collection, and the Tucson Gem and Mineral Society should have been mentioned with them. During 1969 and 1970 our society contributed $300 from show receipts. The amount was small but at that time in our society's history it was a significant part of the budget, and took some persuading of the membership for approval.

Mrs. Mildred F. Schupp
Vice President, TGMS

Dear sir,

In your article by Smith and Cook (Collector's Library, part II, vol. 10, p. 22, under New Jersey) you list *A Rockhound's Guide to Metropolitan New Jersey* (1973) with instructions to order from Jax Products, Renton, Washington. The copyright for this book has been purchased from Jax Products by The Gem Mine, 495 Cedar Lane, Teaneck, New Jersey 07666. The guide is being revised and we hope to have it available by September 1979.

I should mention that I am a staunch supporter of and subscriber to your magazine. I

find the articles interesting, very informative, and (for an amateur like myself) challenging. I think that is the way it should be. One gains nothing by reading material they're already familiar with. Continue the good work.

Lewis D. Bottomly
Teaneck, New Jersey

Dear sir,

In your article by Kearns on the Amity Area (vol. 9, p. 87) you mention that clintonite was discovered in 1828 by Finch, Mather and Horton, and that Mather named the mineral but did not publish it. The name was in honor of DeWitt Clinton who served two terms as governor of New York (1817–1821 and 1825–1828).

Carleton R. Reid
Houston, Texas

Dear sir,

In your article by Smith and Cook (Collector's Library, part II, vol. 10, p. 13) you indicate that *The Minerals of Franklin and Sterling Hill, Sussex County, New Jersey* (1935) by Charles Palache is out of print. This is not so. Although this classic monograph is no longer available from the U.S.G.S., it was privately reprinted in 1974 by the Franklin-Ogdensburg Mineralogical Society and is still available from them at $5.00 softcover and $7.50 hardcover plus 50¢ postage per order. Their address is P.O. Box 146, Franklin, NJ 07416. Quantity discounts to dealers are also available.

Bernard T. Kozykowski
Matamoras, Pennsylvania

Dear sir,

Abraham Rosenzweig brought to our attention the following errors in our paper on the crystal forms of pyrite (vol. 9, p. 219–221). The form identified in Figures 20 and 21 as the trisoctahedron (t) is instead the diploid. It should further be noted that although none of the crystals illustrated in the article show the trapezohedron, it is a well documented form and is probably more frequent in its occurrence than the trisoctahedron.

Robert I. Gait
Toronto, Ontario

EXCHANGES

I have many fine micros (a few larger) from this area for trade for same from other areas.

R. L. Stewart
2304 Fortune Lane
Greensboro, North Carolina 27408

I have some excellent crocoite, chrome cerussite and pyromorphite specimens (from the Kopi and Kosmansky mines, Dundas, Tasmania) for micromounters which I should like to exchange for Tri-State minerals in the miniature size range.

Brian Tod
21 Allen Crescent
Wentworth Falls, NSW 2782, Australia

Well crystallized, showy Tasmanian minerals (e.g. crocoite, dundasite, cerussite, axinite, arsenopyrite, datolite, etc.) available to trade for well crystallized minerals from Trepca, Bisbee, Tsumeb, and other classic American and European localities.

Peter Andersen
48 Athelstan Road
Camberwell, Victoria 3124, Australia

PLEOCHROISM IN AMPHIBOLES

Dear sir,

Less than 100 years ago it was common practice among petrographers to place considerable reliance on the pleochroism of amphiboles as an aid in their identification. With the publication of a new classification system for the amphiboles (*Canadian Mineralogist*, vol. 16, p. 501–520) it has become possible to re-evaluate the use of pleochroism in their identification.

Fifty minerals of this group, using the revisions accepted by the IMA, were compared for similarities in pleochroic colors. Some appear to have color-identification possibilities, especially richterite, ternovskite, magnesioriebeckite and manganoan tremolite, three species and a variety.

Comparison of the pleochroic colors of others was at least interesting, as, for example, with the following related hornblendes:

	X	Y	Z
Hornblende	yellow	olive-green, brown, red-brown	deep green, brown, brownish green
Tschermakistic Hornblende	pale yellow	yellowish-green	green
Hornblende (Fe-poor)	pale blue	pale blue	pale yellow
Tschermakite	pale blue-green	pale violet	pale yellow
Ferro-pargasitic Hornblende	light yellow, light brownish yellow	reddish brown	dark brown, very dark brown

This brief study suggests that pleochroism has doubtful diagnostic value other than suggesting possible identities to be checked by more conventional methods.

Ernest E. Fairbanks
Old Rochard Beach, Maine

I am assembling a comprehensive species and locality collection of silver minerals, and need all types of specimens from good crystals to massive uglies. Of particular interest are specimens of historical importance. In exchange I offer good quality non-silver specimens from micromount to cabinet size, old volumes of the *American Mineralogist*, or mineralogy books of historical interest.

Gerald Kukal
5010 Reno Ct.
Las Vegas, Nevada 89119

I have high quality quartz clusters from Mt. Ida, Arkansas up to 12 by 12 inches; "solution" quartz from the Jeffrey quarry (see M.R. vol. 9, p. 75); "selenite" from Winnipeg, Canada; marcasite from Reims, France. Will trade for quality mineral and crystal specimens.

Daniel Tukel
10321 Dartmouth
Oak Park, Michigan 48237

Have prehnite balls, datolite crystals, mountain leather, and other fine zeolites to trade for good crystals in return.

Kenneth Walling
344 Grosvenor St.
Douglas Mann, New York 11363

My wife and I, keen mineral collectors for 15 years, intend visiting the southwestern U.S. in December 1979 through February 1980. We wish to correspond with other mineral collectors with a view to swapping, seeing other collections, and discussing minerals in general.

Norman Robinson
4, Cronulla St.
East Ballina, NSW 2478, Australia

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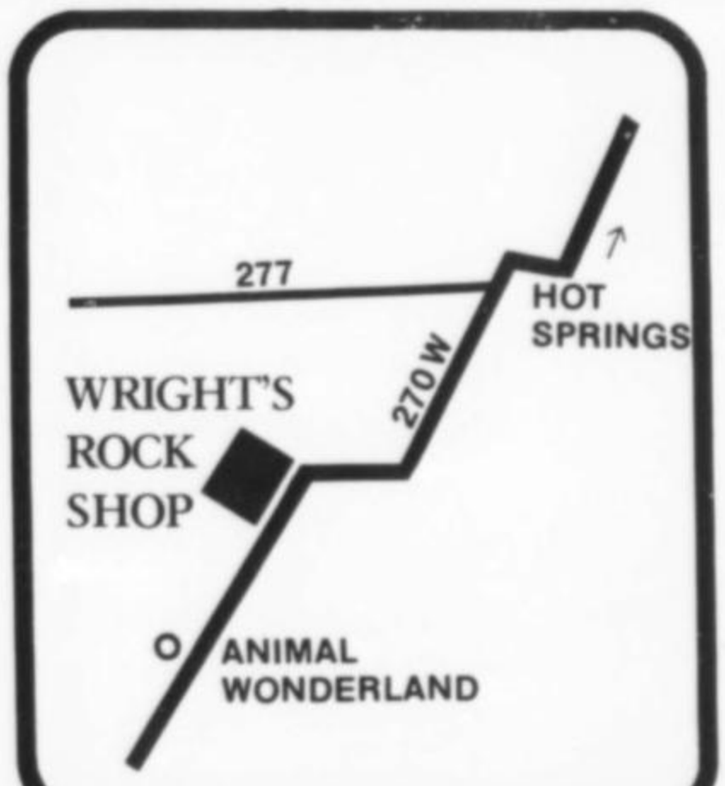

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Mineral World

Amethyst – Las Vigas, state of Vera Cruz, Mexico, 2 x 3 x 2; four large xls. and several smaller ones radiating from a base of drusy quartz and chlorite. Very fine display specimen **$75.00**

Wavellite – near Pencil Bluff, Montgomery County, Arkansas. 3 x 3 x 1½ ; good showing of radiating xls. on exposed seam in brecciated novaculite **$32.00**

Dioptase – Tsumeb, near Otavi, Namibia (South West Africa). Great display material, 1½ x 1½ x ¾ pearly dolomite base covered with small bright green xls. **$47.00**

Dioptase – Tsumeb, near Otavi, Namibia (South West Africa). 2 x 1½ x 1 matrix of white calcite xls. coated with bright green xls. **$47.00**

Dioptase – Tsumeb, near Otavi, Namibia (South West Africa). 2 x 1½ x 1¼ cluster of large showy xls. **$125.00**

Adamite – Ojuela mine, Mapimi, state of Durango, Mexico. 2¾ x 1¾ x ¾; light green xls. on a base of white adamite and limonite **$34.00**

Adamite – Ojuela mine, Mapimi, state of Durango, Mexico. 3¼ x 2½ x 1 matrix of limonite covered with golden brown xls. of various sizes **$65.00**

Adamite – Ojuela mine, Mapimi, state of Durango, Mexico. 2½ x 1¾ x 1¾; blue xls. covering brown adamite xls. on limonite matrix **$100.00**

Gold – Pilgrim's Rest mine, Province of Transvaal, Republic of South Africa. ½ x ½ x ¼ ; twisted mass with no matrix **$120.00**

Gold – Farncomb Hill, near Breckenridge, Summit County, Colorado. 1⅜ x ⅝ x ⅛ thin plate with equilateral triangle markings **$67.00**

Galena – Naica, state of Chihuahua, Mexico. Extremely showy with pale blue fluorite and minor amounts of pyrite, 3 x 3 x 1½; **$92.00**

Galena – Tulsa Quapaw mine, Treece, Cherokee County, Kansas. 2¼ x 1¾ x 1½; two steel grey interlocking xls. **$12.00**

Rock crystal quartz – Idarado-mine, near Ouray, Ouray County, Colorado. 4½ x 4 x 1½ cluster coated grey and dusted with pyrite **$32.00**

Rock crystal quartz – near Charcas, state of San Luis Potosi, Mexico. 5 x 4½ x 3 matrix of large cream colored danburite xls. coated with small brilliant quartz xls. **$400.00**

Smoky quartz – Hot Springs, Garland County, Arkansas. 2¼ x 1½ x 1, showing fine phantom zoning and no matrix on two sharp single attached xls. **$67.00**

Calcite – Egremont, Cumberland County, England. 4 x 2½ x 1¼ group of clear xls. on a grey and white matrix **$180.00**

Calcite – Tsumeb, Namibia (South West Africa). 5 x 4½ x 3½ mass of xls. containing red colored inclusions of hematite **$125.00**

Calcite – San Carlos, state of Chihuahua, Mexico. 2½ x 2½ x 2 bright red xl. cluster containing inclusions of hematite **$67.00**

Aragonite – Krupp Iron mine, Erzberg, near Eisenerz, state of Carinthia, Austria. 5 x 3½ x 2¾ flos-ferri type with no matrix **$40.00**

Copper & silver – Painesdale, Keweenaw Peninsula, Houghton County, Michigan. Half – breed type with no matrix 2 x 1½ 1 **$37.00**

Copper – Emke mine, near Onganja, Namibia (South West Africa). 1¾ x 1 x 1 superb little dendritic specimen with attached calcite xls. **$18.00**

Copper – New Cornelia pit, Ajo, Pima County, Arizona. 3¼ x 2¼ x 1¼ bright, clean specimen with no matrix, fine xl. definition **$32.00**

Amethyst – Denny Mountain, King County, Washington. 1⅞ x ½ x ½ single scepter xl. resting on a single milky quartz xl. **$45.00**

Rose quartz – Island of Lavra da Ilha, Jequitinhonha River, near Taquaral, state of Minas Gerais, Brazil. 1¾ x 1½ x 1⅛ excellent display specimen with no matrix, brilliant xls. **$175.00**

Enargite & pyrite – Quiruvilca mine, near Trujillo, La Libertad Department, Peru. 2¼ x 1½ x 1½ with minor amounts of quartz **$52.00**

Pyrite – region of Tuscany, Italy. 2½ x 2¼ x 1¾; very well xld. show winning type of specimen with no matrix, truly a superb piece **$100.00**

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